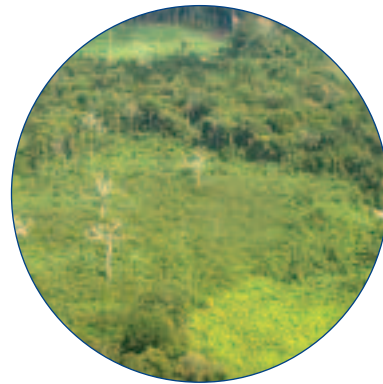
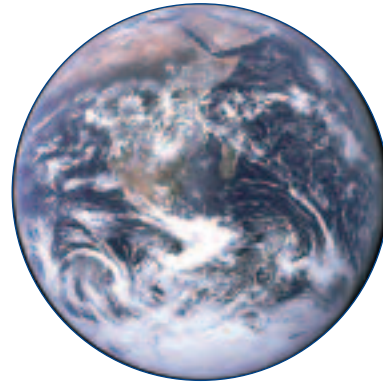




THE STATE OF SÃO PAULO  
RESEARCH FOUNDATION



CONTRIBUTIONS  
TO RESEARCH IN  
SÃO PAULO STATE,  
BRAZIL, INTO  
KNOWLEDGE ON  
CLIMATE CHANGE  
(1992-2008)

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## Understanding and anticipating climate changes

The debate and studies on climate changes are the order of the day, and they are bound to remain so for some considerable time. After all, although there have always been variations and changes in climate, in variable time scales, due to natural causes, over the last century, in addition to those natural causes there has been an onslaught of changes caused by human action. Especially with the releasing into the atmosphere of enormous quantities of greenhouse gases and aerosols and with changes in the land cover – as forests have been transformed into areas of farming and pasture, affecting the natural biogeochemical cycles.

Throughout the world, researchers are studying the many variables involved in global climates changes, their causes and consequences, in addition to drawing up projections of future changes and creating mathematical models of the climatic system. In this way they try to establish possible scenarios and their impact on the natural systems and on the many aspects of life on Earth. In Brazil, particularly, studies on climate change are tremendously important due to the great extension of the country, the significant interdependence of the base economy on renewable natural resources, and its vegetal cover, already greatly altered in the Biomas of the Atlantic Rainforest and Cerrado (tropical savanna) and in the rapid process of replacement in the Amazon Forest, where significant alterations in land use have been witnessed. To this should be added the increase in emissions, resulting from the burning of fossils fuels and agricultural and industrial processes.

In August 2008, the State of São Paulo Research Foundation (FAPESP) launched the FAPESP Program for Research on Global Climate Changes, with the objective of stimulating research on the theme, making the link between the variables resulting from human activity and those resulting from natural causes. Resources in the region of R\$ 100 million have been allocated for this program over the next ten years.

However, even before the creation of this program, a large number of research projects into climate changes and variations have been undertaken over the years in the State of São Paulo, and continue to be undertaken, with support from FAPESP, from the National Council for Scientific and Technological Development (CNPq), and other brazilian and international funding agencies. These research activities were and continue to be carried out within the ambit of specific programs – Biota-FAPESP Program, Large Scale Experiment on the Amazon Biosphere-Atmosphere (LBA) and the Amazon Environmental Modeling project (Geoma) – or in the form of hundreds of individual research projects.

This publication brings together information on 208 Thematic Projects and funding for Regular Research and 399 grants, in the different modalities, supported by FAPESP since 1992 up to July 2008. These research activities range from oceanography to agronomy, from physics to economics, from chemistry to meteorology, including biology and mathematics, among other areas. In isolation, each activity contributes to the advance in knowledge in its specialty. Viewed as an interconnected whole, they provide an important contribution to knowledge on the theme of climate changes.

At the end of this publication there is a compilation of the main articles on the subject published in *Pesquisa FAPESP* magazine.



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## The FAPESP Research on Global Climate Changes Program

Launched in September 2008, the FAPESP Research on Global Climate Changes Program (RGCCP) has the objective of advancing knowledge on the theme. It is hoped that the results of the program will assist in the taking of scientifically informed decisions with respect to risk evaluations and strategies of mitigation and adaptation.

The program has a substantial technological component for the development of the appropriate technologies for the future, not just concerning innovative technologies for the mitigation of emissions, but also technologies for adaptation in all sectors and activities, given that some degree of climate change is now inevitable.

The Program will also develop an observational component, which should involve the recuperation and expansion of regional and paleoclimatic climate observations. This will be obtained in association with other funding mechanisms internal and external to the State of São Paulo. Lastly, it should be noted that the Program includes a research component on the interface of science and climate policy ([www.fapesp.br/mcg](http://www.fapesp.br/mcg)).

The presentation of proposals will be conducted by means of the Call for Research Proposals. The RGCCP will consider research proposals included within the scope of the Program described, including the following areas, the detailed description of which can be found in the reference document available at [www.fapesp.br/mcg/FRPGCC.pdf](http://www.fapesp.br/mcg/FRPGCC.pdf):

- a) Consequences of global climate changes in the functioning of ecosystems, with emphasis on biodiversity and on the water, carbon and nitrogen cycles.
- b) Radiation balance in the atmosphere, aerosols, trace gases and changes of land use.
- c) Global climate changes and agriculture and livestock farming.
- d) Energy and greenhouse effect gases: emissions and mitigation.
- e) Climate changes and effects on human health.
- f) Human dimensions of global climate changes: impacts, vulnerabilities and economic and social responses, including adaptation to the climate changes.

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## FAPESP: in step with social and economic development

The FAPESP strategy for supporting science and technology in the State of São Paulo, Brazil, has three principles: the training of human resources, support for academic research – especially that of a fundamental nature – and support for research undertaken with a view to applications. At the same time, the Foundation has maintained, since the day of its inception, a commitment to promoting the dissemination and application of the results of the investments it makes in research in all areas of knowledge. In this role of inducer and promoter of the applications of science, the Foundation acts in tune with the aspirations of the people of the State of São Paulo, of Brazilian society as a whole, and the country's needs for social and economic development.

To fulfill this mission of training qualified human resources and generating knowledge, FAPESP has different funding lines at its disposal: bursaries, at different levels and in different modalities, awards for regular and thematic research, granted to researchers at doctorate level in institutions of higher education and research in the State of São Paulo.

In research geared to applications, the Foundation supports academic projects geared to specific themes, such as biodiversity, neuroscience, bioenergy and global climate changes, and also the creation of links between academic research and research in businesses or in government, even in research projects in small enterprises.

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# Summary

## AGRARIAN AND VETERINARY, 27

### Thematic Projects

- 1 Environmental impact of the expansion of agriculture in Southwest Amazonia, 29
- 2 Strategies for restoration of degraded pastures in Amazonia examining agronomic, environmental and economic criteria, 29
- 3 Trace gas fluxes associated with land-cover and land-use changes in the Brazilian Amazon Basin, 29

### Support for Regular Research

- 4 Crop-livestock integration in south-western of Goiás: impacts in soil carbon and in the greenhouse gas fluxes, 30
- 5 Loss of carbon from the soil predicted by first order decomposition model: effect of the breaking down of aggregates and the incorporation of the vegetal cover on the emissions induced by the preparation, 30
- 6 Soil sampling for carbon sequestration in a replanted area in São Paulo state, 31
- 7 Evaluation of environmental impact on a hydrographic microbasin using geographic information system, 31
- 8 Evaluation of climatic environment for the rearing of dairy cows in region with high levels of solar radiation, 31
- 9 CO<sub>2</sub> emissions in soils in different positions of the landscape in area cultivated with sugarcane, 32
- 10 Possibility of the occurrence of water deficit in the municipality of Ituverava, São Paulo, 32
- 11 Effect of global climate changes on plant diseases, 32
- 12 Conversion of the Cerrado for agricultural purposes in Amazonia and its impact on climate changes, 33
- 13 Influence of nitrogenated fertilization with biosolid and mineral fertilizer on the fluxes of greenhouse effect gases in the soil in an area under successive forest rotation, 33
- 14 Organic fraction of biosolids and effect of the carbon stock and quality of organic material of a latosol cultivated with eucalyptus, 33
- 15 Models for the forecasting of productive and qualitative responses of *Panicum maximum* Jacq. based on climatic variables, 34
- 16 Integrated analysis of the effects of land use in forest fragments in the river Corumbataí basin, São Paulo (SP), 35
- 17 Ion fluxes in the soil solution in forest and pasture in Rondônia (RO), 35
- 18 Dynamic and stability of the organic matter in areas with potential for carbon sequestration in the soil, 35
- 19 Classification and monitoring of the vegetal cover and use of land using Modis sensor data, 36
- 20 Structure of arbuscular mycorrhizal fungi associated with vegetal species cultivated in agroforest systems in central Amazonia, 36
- 21 Dynamic of soil carbon treated with biosolid in a reforestation with eucalyptus, 36
- 22 The impact of global changes on the productivity of soybean: comparison between the experimental and simulated results, 37
- 23 Quantity and quality of organic material in the soil in forest-pasture succession in Rondônia, 37

- 
- 24 Variation in the chemical and physical properties of the soil and in the organic matter in agroecosystems of Western Amazonia, Amazon region, 37
  - 25 Spatial variability of the properties of the soil in the Brazilian Amazon basin under natural vegetation, 38
  - 26 Modeling with diffuse daily and hourly radiation: application of a computerized system of solar radiation data (Simras), 38
  - 27 Effects of sugarcane harvesting without biomass burning on the dynamic of carbon and properties of the soil, 38
  - 28 Root system and its influence on the flux of gases in forest/pasture succession in Brazilian Amazonia, 39
  - 29 Measurement of CO<sub>2</sub> emission in soils through optical absorption spectroscopy, 39
  - 30 Use of remote sensing in the development of models for estimating canopy temperature and the biological production of sugarcane, 39
  - 31 Classification and monitoring of vegetation through NOAA-AVHRR images, 39
  - 32 Remote sensing for integrated analysis of the vegetation with elements of the physical environment and distribution of phytomass in contact areas of the forest and open countryside in Roraima, 40
  - 33 Modifications in soil properties caused by deforestation and cultivation in different Brazilian bioclimatic systems, 40
  - 34 Geostatistics applied to soils in Amazonia: case of forest-pasture succession in Rondônia, 40
  - 35 Study of the relationship between photosynthetically active radiation absorbed with production of phytomass and yield of grain for the cultivation of wheat under different conditions of hydric stress, 40
  - 36 Spectral characterization of stresses related to water and nutritional deficiencies in *Eucalyptus grandis* seedlings, 41
  - 37 Studies of forest areas in regeneration through Landsat images, 41

- 38 Effect of the use of land on the dynamic of carbon and nitrogen in the soil in the region of Ariquemes, Rondônia (RO): use of a geographical computerized system, 41

#### **Biota-FAPESP Program**

- 39 Distribution of the community of palm trees in the altitudinal gradient of the Atlantic Rainforest in the northeast of the State of São Paulo, 42
- 40 Physiognomic-ecological units associated with remnants of natural vegetal cover, 42

#### **Grants, 42**

### **ARCHITECTURE AND URBANISM, 49**

#### **Support for Regular Research**

- 1 Urban climate computational modeling for medium-size Brazilian cities, 51
- 2 Characterization of the intra-urban thermal field based on homogeneous areas, 51

#### **Biota-FAPESP Program**

- 3 Environmental atlas of the municipality of São Paulo: phase 1 – diagnosis and bases for the definition of public policies on green areas in the municipality of São Paulo, 51

#### **Grants, 51**

### **BIOLOGIES, 55**

#### **Thematic Projects**

- 1 The role of Amazonian fluvial systems in regional and global carbon cycles: CO<sub>2</sub> evasion and land-water interactions, 57
- 2 Alterations in the dynamic of organic matter in micro and meso scale rivers in the state of Rondônia, resulting from changes in land use, 57
- 3 Dynamic of carbon and related elements in the basin of the river Piracicaba, 58

#### **Support for Regular Research**

- 4 Physiological and biochemical responses of three species of tropical legumes to climatic change, 58



- 
- 5 Diversification of Bignoniaceae in the wetland savannas of Central Amazonia, 59
  - 6 Cycle of carbon, nitrogen and soil nutrients in dense ombrophilous forest in the Serra do Mar State Park, in the State of São Paulo, 59
  - 7 Potential production of greenhouse gases in sediments of marginal lagoons, 60
  - 8 Fluxes of gases (CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub>) and alterations in the transformations of the nitrogen in the soil, in basins with forest and pasture cover on the northern coast of the State of São Paulo, 60
  - 9 Microbial diversity in the Central and Oriental Amazonian Anthropogenic Dark Earth: Detection of metanogenic Archaea, their functional role and contribution to the bacterial structure communities in ADE and adjacent sites, 60
  - 10 Vulnerability of organic matter in the soil to temperature increase, 61
  - 11 Methodological procedure for the identification of individual tree species in four forest formations in the State of São Paulo, using orbital images from the Quickbird and Aster sensors, 60
  - 12 Impact of raised concentrations of CO<sub>2</sub> on the physiology and the initial growth of four Brazilian forest species, in a future climatic simulation, 61
  - 13 Stock of carbon and mineral nutrients in cerrado soils: effects of forest cultivation use, 62
  - 14 Dynamic of carbon in the sugarcane agrosystem: mathematical modeling and environmental implications, 62
  - 15 Stocks of carbon and nitrogen in cerrado soils aimed at agricultural sustainability, 62
  - 16 Local management and conservation of natural resources in the Atlantic Rainforest (Vale do Ribeira, São Paulo), 63
  - 17 Comparative ecophysiological analysis between species of macroalgae from lotic environments: temperature and irradiance, 63
  - 18 Acid precipitations and their implications in the biogeochemistry of the basin of the river Piracicaba, 64
  - 19 Effects of air pollution on gas exchanges of young individuals of *Tibouchina pulchra Cogn* (melastomataceae), in the region of Cubatão, São Paulo (SP), 64
  - 20 Thermal comfort in cities: effect of tree-planting on the control of solar radiation, 64
  - 21 Mapping of ground fires in the Emas National Park, Goiás: 1973-1994, 64
  - 22 Adaptation strategies of arboreal species typical of waterlogged ground environments: a morphological, biochemical and ecophysiological approach, 65
  - 23 Changes in land use in Amazonia and dynamic of the organic matter in the soil using carbon isotopes, 65
  - 24 Aspects of the hydrological cycle in the Amazon basin: a temporal and spatial study, 65
- Biota-FAPESP Program**
- 25 Modeling of the dynamic of the organic matter in the soil in the zone of agricultural expansion in southwest Amazonia: basis for research into global climate changes, 66
  - 26 Floristic composition, structure and functioning of the dense ombrophilous forest in the Picinguaba and Santa Virgínia nuclei of the Serra do Mar State Park, 66
  - 27 Environmental Information System of the Biota-FAPESP Program: development of indicators for monitoring, updating the labeling of the cartographic base and improvements to the *Biota Neotrópica* magazine, 66
  - 28 Conservation of the biodiversity in fragmented landscapes on the Atlantic Plateau of São Paulo (Brazil), 66
  - 29 Structure and functioning of hydrographic basins of meso and microscale in the State of São Paulo: bases for generating and sustaining biodiversity, 67
  - 30 Viability of the conservation of the remains of the Cerrado in the State of São Paulo, 68
  - 31 Conservation and sustainable use of the vegetal biodiversity of the Cerrado and the Atlantic Rainforest: the storage of carbohydrates and its role in the adaptation and maintenance of plants in their natural habitat, 68

---

## Young Researchers in Emerging Centers

- 32 Total atmospheric deposition (wet and dry) in Brazil: implications of anthropic activities on the biogeochemical cycles of N and C, 69
- 33 Study of the relationship between the trophic state and the emission of greenhouse effect gases (CH<sub>4</sub>, CO<sub>2</sub> and N<sub>2</sub>O) in reservoirs in the middle Tietê river and evaluation of the capacity to remove carbon, nitrogen..., 69
- 34 Seasonal variations and tolerance to hydric deficiency in seedlings of tropical tree species from different successional groups, 70
- 35 Biogeochemical cycle of carbon in rivers: an integrative approach through analysis without multiscales using multiple tracers, 70

## Grants, 70

## ENGINEERING, 83

### Support for Regular Research

- 1 Concentrations of chemical species released during the combustion of biomasses in the Amazon Forest, 85
- 2 Phytomonitoring and modeling of photosynthesis in *Hymenaea courbaril* (jatobá), 85
- 3 Effects of levels of CO<sub>2</sub> and doses of potassium applied via irrigation water to the melon crop (*Cucumis melo* L.) in protected environment, 85
- 4 Energy efficiency and sustainability: evaluation of the thermal performance of coverings and of the behavior of transparent materials in relation to solar radiation, 85
- 5 Combustion of material of different sizes in ground fires in tropical forests, 86
- 6 Geoenvironmental zoning as an aid to environmental management of hydrographic basins, 86
- 7 Monitoring and characterization of atmospheric particles in the city of São Carlos, central region of the State of São Paulo, Brazil, 86
- 8 Characteristics of the combustion of biomass in tropical forest burnings, 86
- 9 Biomass burning experiments in the Amazon region, 87

## Information Technology in the Development of Advanced Internet (Tidia)

- 10 Research WebLabs in environmental services, 87

## Grants, 87

## PHYSICS, 91

### Thematic Projects

- 1 Physical and chemical interactions between the biosphere and the atmosphere of Amazonia in the LBA experiment, 93

### Support for Regular Research

- 2 Study of natural radiation and characterization in Brazilian soil, 93
- 3 Atmospheric aerosols in Amazonia: measured in long term, transport on large scale and effects on the atmospheric radioactive balance, 93

### Technological Innovation in Small Businesses (PIPE)

- 4 Development of a system to measure pollutant concentrations in the atmosphere with infrared lasers (CO<sub>2</sub> and CO) by photo-acoustic spectroscopy, 94

## Grants, 94

## GEOSCIENCES, 97

### Thematic Projects

- 1 SMCos: System for the Monitoring and Study of Coastal Processes, 99
- 2 Studies on the predictability of extreme meteorological events in the Serra do Mar, 99
- 3 Brazilian component of the South American low level jet east of the Andes field experiment: interaction in Meso and Large scale between the Amazon and La Plata River Basins, 100
- 4 Radiation, cloud and climate interactions in the Amazon during the Dry-To-Wet transition season/LBA, 100
- 5 Organization and hydrobiogeochemical functioning of lateritic coverings in Amazonia, 101
- 6 Meteorology and atmospheric pollution in São Paulo, 102

---

7 Summer rainfall in São Paulo, Brazil, 102

### Support for Regular Research

8 Controls of the Atlantic Rainforest on the local and regional climate, 102

9 The carbon balance over an area of Atlantic Rainforest with micrometeorological and biometrical measurements, 103

10 Study of natural fires in the Cerrado, 103

11 Reconstruction of vegetation and climate since the middle Holocene in Brazil, 103

12 Mapping environmental indicators and remote sensing and GIS techniques applied to coastal regions – study case: Santos/São Vicente estuarine system, São Paulo, 104

13 Study of the influence of aerosol particles emitted by ground fires on photosynthesis in Amazonia, 104

14 Evaluation of air quality for ozone in the metropolitan region of Campinas, 104

15 Prognostic studies of the use of the Aqua satellite in the inference of the concentration of carbon monoxide in the atmosphere, 105

16 The role of mesoscale and submesoscale activity in the Brazil-Malvinas frontal system, 105

17 Implementation and calibration of a Raman Lidar – water vapor and aerosols, 106

18 Investigation of the southern ocean circulation for the 20<sup>th</sup> century – part I: effect of the southern ocean modes of variability on the Weddell sea, 106

19 Reconstruction of paleovegetation and paleoclimate in regions of the southern coast of the State of São Paulo (Serra do Mar State Park – Nucleus of Curucutu and Ilha do Cardoso) in the Late Quaternary, 106

20 Study of the composition of aerosols and the isotopic signature of Pb as tracer of the source of atmospheric pollution in the city of São Paulo, 106

21 Refinement of the description and numerical simulation of the surface and convection processes in the Cptec modeling of the atmosphere, 107

22 An experiment to evaluate the effect of seasonal biomass burnings in central Brazil and the Amazon region on the increase in concentrations of carbon monoxide from tropospheric ozone in Southeast Brazil, 107

23 Variabilities of the South Atlantic. Connections with the thermohaline circulation and the climate in South America (VARIAS 2), 108

24 Study of the influence of atmospheric and geographical factors on the levels of ultraviolet radiation in regions of high population density in the State of São Paulo, 108

25 Study of the dynamics of water circulation between lotic, lentic systems and the floodplain, 108

26 Vertical structure of aerosols and their variations observed by balloon probes, 108

27 Climatic simulations for the summer in the Southeast of the country, 109

28 Study of carboxylic acids and aldehydes in the wet deposition in the metropolitan region of São Paulo, 109

29 Improvements in the description of parameters of surface and vegetation in the Northeast region of Brazil for use in meteorological and hydrological models, 109

30 Paleo-environmental reconstruction (vegetation and climate) in the Late Quaternary based on a multi/interdisciplinary study in the Vale do Ribeira (south of the State of São Paulo), 110

31 Climatic variability on the intrazonal scale in the Southern hemisphere with emphasis on the influences on South America and Southeast Brazil: the behavior of the Cptec/Cola model of global circulation of the atmosphere, 110

32 Survey of the physiognomic structure of the vegetation of the Caatinga, oriented towards the control of techniques of detection in changes, using remote orbital sensing, 110

33 The influence of atmospheric aerosol on the formation of photochemical pollutants, 111

34 Estimate of the effects of aerosol particles on the balance of atmospheric radiation in Amazonia, 111

- 
- 35 Sun-climate relationships studied in tree rings in Chile, 111
  - 36 Measurement of trace gases in regions under the influence of the transport of pollutants from biomass burning, 112
  - 37 Local circulations in the region of Santarém: observations and numerical modeling in the multidisciplinary context of the LBA, 112
  - 38 Investigation of the variability of low frequency in the South Atlantic. Analysis of the results of the ocean-atmosphere coupled model, 112
  - 39 Numerical study of climatic variability in the South Atlantic ocean, 112
  - 40 Study of the spatio-temporal variability of convection in the tropical region of South America, 113
  - 41 Simultaneous observations of the CO and O<sub>3</sub> minority gases in the lower atmosphere, 113
  - 42 Paleoenvironmental dynamic of vegetation and climate in the recent Quaternary in domains of Atlantic Rainforest, semi-arid heathland and north-eastern Cerrado, using carbon isotopes of the soil organic matter (SOM), 114
  - 43 Applications of meteorological satellites, 114
  - 44 Structure of radar echoes in the summer in Amazonia, 114
  - 45 Dynamic study of the impact of El Niño/south oscillation on the climate of the Americas, 114
  - 46 Transport of atmospheric pollutants in the atmosphere-soil interface in natural and urban areas in the State of São Paulo, 114
  - 47 Studies of greenhouse effect gases, 115
  - 48 Climatology of the South-Southeast coastal region of Brazil, 115
  - 49 Study of the surface boundary layer of Pantanal in south Mato Grosso, 115
  - 50 Effects of biomass burning on the lower atmosphere in transition Cerrado-forest ecosystems, 116
  - 51 Monitoring of bioclimatic variabilities and their impact on agricultural production in Brazil through NOAA AVHRR data, 116
  - 52 Mesoscale interactions between biosphere and atmosphere in Amazonia, 117
  - 53 Observations on the ozone layer in Punta Arenas, Chile, 117
  - 54 Information system and modeling of solar radiation (Simras), 117
  - 55 Evaluation of orbital radar images in the study of natural aquatic environments and environments of anthropic origin in: Monte Alegre's Lago Grande and the reservoir of the Tucuruí hydroelectric plant, 118
  - 56 South American cooperative on modeling of ocean, coastal and estuary processes related to global changes, 118
  - 57 Regular sounding of the stratosphere – SRS, 118
  - 58 The use of carbon isotopes in charcoals and humin in the soils. An indispensable tool to evaluate systematically the velocity of biological turnover and of paleoclimatic events, 118
  - 59 Atmospheric teleconnections via data from the Total Ozone Mapping Spectrometer, 118
  - 60 Modeling and observation of the biosphere-atmosphere interaction in the State of São Paulo, 119
  - 61 Experiment on the boundary layer in Rondônia (RBLE), 119
  - 62 Dynamic of waters of the continental platform and of the slope in the bay of Santos (Dabas), 119
  - 63 Carbon isotopes in soils in the tropical region of Brazil and relationships with the cerrado-natural forest sequence of vegetations, 119
  - 64 Measurements of the ozone layer and ultraviolet radiation, 120
  - 65 Experiment on the boundary layer in Rondônia (RBLE), 120
  - 66 Research into temporal variation of the neutrally charged particles and intensity of ozone and electric field in the stratosphere, 120
  - 67 Monitoring of ozone together with meteorological soundings, 120

- 
- 68 Monitoring system of biomass burnings and electronic dissemination of the information, 121
  - 69 Investigation into the application of wavelet transform in the study of turbulent exchanges in the surface boundary layer of the atmosphere, 121
  - 70 The influence of the Atlantic Ocean on global climate variation, 121
  - 71 Experiment on the boundary-layer in Rondônia, 122
  - 72 Measurement of greenhouse effect gases in natural Brazilian ecosystems, 122
  - 73 Numerical study of the circulation of the tropical Atlantic with model of isopicnal coordinates (Nustrac), 122

#### **Biota-FAPESP Program**

- 74 Biosphere-atmosphere interaction phase 2: cerrados and changes of land use, 122
- 75 Biosphere-atmosphere interaction in natural ecosystems and agroecosystems: a monitoring of sugarcane and Cerrado, 123
- 76 Environmental study in the estuary of the river Itanhaém, southern coast of the State of São Paulo, 123

#### **Young Researchers in Emerging Centers**

- 77 Late quaternary paleoclimate in Brazil from oxygen and carbon isotope ratios on speleothems, 124
- 78 An integrated seasonal forecasting system for South America, 124
- 79 Atmospheric aerosols and climatic changes on regional scale based on radiometers in satellites, 124
- 80 Development of an integrator of information acquired by pluviometers, satellites, lightning networks and meteorological radars and analysis of precipitant systems in Brazil – Precibra, 125
- 81 Space technology center for study of dynamic processes and oceanic fluxes on global scale, 125
- 82 Numerical modeling of the transformation and transport of atmospheric aerosol particles in the Amazon region. An evaluation of their climatic impact, 125

- 83 Numerical modeling of the transport and of atmospheric processes acting on gases and aerosols from biomass burnings in South America, 126
- 84 Simple hydrological model to estimate humidity of soil and runoff in macro-scale bays, 126

#### **First Projects**

- 85 Evaluation of the air quality for ozone in the Metropolitan Region of Campinas, 126
- 86 Contributions of solar variability and geophysical events in the climate of South America: study of the Sun-climate relationships in growth rings of trees, 127
- 87 The role of aerosols in the formation of severe storms in the Metropolitan Region of São Paulo, 127

#### **Technological Innovation in Small Businesses (PIPE)**

- 88 Generation of digital models of elevation through radargrametry with Radarsat-1 satellite images, 128

#### **Partnership for Technological Innovation Program (PITE)**

- 89 A research program on earth system science with special emphasis on global climate change, 128

#### **Public Policies Research Program**

- 90 Implementation of the air quality model for the Metropolitan Region of São Paulo, 128

#### **Grants, 128**

### **HUMAN AND SOCIAL, 145**

#### **Thematic Projects**

- 1 Socio-environmental dynamics, local development and sustainability on the São Paulo–Paraná–Mato Grosso do Sul frontier, 147
- 2 Intrametropolitan dynamic and socio-demographic vulnerability in the metropolises in the interior of the State of São Paulo: Campinas and Santos, 147

#### **Support for Regular Research**

- 3 Study of the socio-environmental impacts motivated by the advance of the agricultural frontier along the BR-163, 148
- 4 Urban restructuring and the environment: the case of São Paulo, 149

- 
- 5 Social actors in the deforestation in the Serra do Mar, São Paulo: conflicts of interest between preservation and regional development, 149
  - 6 Evaluating international scientific collaboration in Amazonia, 149

## Grants, 149

## CHEMISTRY, 153

### Thematic Projects

- 1 Mercury fluxes in the Rio Negro Basin, Amazon, 155

### Support for Regular Research

- 2 Determination of polycyclic aromatic derivatives in atmospheric aerosols, 155
- 3 Organic compounds indicators of natural and anthropic emissions, 155
- 4 Studies of nitrogen compounds present in the atmosphere in the central region of the State of São Paulo, 156
- 5 Use of diffuse reflectance spectrophotometry for verifying the detailed history of the whitening of marine coral samples, 156
- 6 Biogeochemistry of metals in aquatic environments and in the atmosphere. Part I: chemical speciation of metals in rainwater, 156
- 7 Development of methods *in situ* close to real time for atmospheric trace gases, 157
- 8 Study of the contribution of sugarcane burning to atmospheric contamination by PAHs and nitro PAH. Evaluation of the occupational exposure of sugarcane cutters to PAHs, 157
- 9 Aquatic chemistry of mercury in the river Negro: importance of sunlight in the redox process, 157
- 10 Study of the paleoclimatic alterations in central Amazonia, through the use of <sup>14</sup>C dating and isotopic reason <sup>13</sup>C/<sup>12</sup>C, 157
- 11 Determination of partial pressure of CO<sub>2</sub> in the ocean mixed layer, 157
- 12 Characterization of atmospheric particulate matter: II. Identification and quantification of polar organic compounds, 158

## Grants, 158

## HEALTH, 161

### Thematic Projects

- 1 The impact of intra-uterine exposures and in the initial phases of the development to atmospheric pollutants in the development of adverse alterations in adult life, 163
- 2 Atmospheric pollution in the metropolitan region of São Paulo: impacts on health of the population and proposition of remedial measures, 163

### Support for Regular Research

- 3 Analysis of the chemical signatures of particulate material emitted by different diesel/biodiesel concentrations and their toxic effects in biological systems, 163
- 4 An analysis of the bioaerosols in the atmosphere of the metropolitan region of the city of São Paulo, 164
- 5 Pulmonary and cardiovascular alterations induced by inhalation of concentrated particulate material from the atmosphere of São Paulo, 164
- 6 Effect of air pollution in the carcinogenesis of mice, 164

### Public Policies Research Program – SUS

- 7 Analysis of morbidity and mortality associated with climate variation in the municipality of São Paulo, 165

## Grants, 165

## INTERDISCIPLINARY AND GRANTS FOR OTHER AREAS, 169

### Public Policies Research Program

- 1 Development of technology for ozone forecasting in the lower atmosphere, 171

## Grants, 171

## SELECTION OF REPORTS ON CLIMATE CHANGE – PESQUISA FAPESP MAGAZINE, 173

---

# Summary by modality

## THEMATIC PROJECTS

---

### **Agrarian and Veterinary, 27**

- 1 Environmental impact of the expansion of agriculture in Southwest Amazonia, 29
- 2 Strategies for restoration of degraded pastures in Amazonia examining agronomic, environmental and economic criteria, 29
- 3 Trace gas fluxes associated with land-cover and land-use changes in the Brazilian Amazon Basin, 29

### **Biologies, 55**

- 1 The role of Amazonian fluvial systems in regional and global carbon cycles: CO<sub>2</sub> evasion and land-water interactions, 57
- 2 Alterations in the dynamic of organic matter in micro and meso scale rivers in the state of Rondônia, resulting from changes in land use, 57
- 3 Dynamic of carbon and related elements in the basin of the river Piracicaba, 58

### **Physics, 91**

- 1 Physical and chemical interactions between the biosphere and the atmosphere of Amazonia in the LBA experiment, 93

### **Geosciences, 97**

- 1 SMCos: System for the Monitoring and Study of Coastal Processes, 99
- 2 Studies on the predictability of extreme meteorological events in the Serra do Mar, 99
- 3 Brazilian component of the South American low level jet east of the Andes field experiment: interaction in Meso and Large scale between the Amazon and La Plata River Basins, 100
- 4 Radiation, cloud and climate interactions in the Amazon during the Dry-To-Wet transition season/LBA, 100
- 5 Organization and hydrobiogeochemical functioning of lateritic coverings in Amazonia, 101
- 6 Meteorology and atmospheric pollution in São Paulo, 102
- 7 Summer rainfall in São Paulo, Brazil, 102

### **Human and Social, 145**

- 1 Socio-environmental dynamics, local development and sustainability on the São Paulo–Paraná–Mato Grosso do Sul frontier, 147

- 
- 2 Intrametropolitan dynamic and socio-demographic vulnerability in the metropolises in the interior of the State of São Paulo: Campinas and Santos, 147

### **Chemistry, 153**

- 1 Mercury fluxes in the Rio Negro Basin, Amazon, 155

### **Health, 161**

- 1 The impact of intra-uterine exposures and in the initial phases of the development to atmospheric pollutants in the development of adverse alterations in adult life, 163
- 2 Atmospheric pollution in the metropolitan region of São Paulo: impacts on health of the population and proposition of remedial measures, 163

## **SUPPORT FOR REGULAR RESEARCH**

---

### **Agrarian and Veterinary, 27**

- 4 Crop-livestock integration in south-western of Goiás: impacts in soil carbon and in the greenhouse gas fluxes, 30
- 5 Loss of carbon from the soil predicted by first order decomposition model: effect of the breaking down of aggregates and the incorporation of the vegetal cover on the emissions induced by the preparation, 30
- 6 Soil sampling for carbon sequestration in a replanted area in São Paulo state, 31
- 7 Evaluation of environmental impact on a hydrographic microbasin using geographic information system, 31
- 8 Evaluation of climatic environment for the rearing of dairy cows in region with high levels of solar radiation, 31
- 9 CO<sub>2</sub> emissions in soils in different positions of the landscape in area cultivated with sugarcane, 32
- 10 Possibility of the occurrence of water deficit in the municipality of Ituverava, São Paulo, 32
- 11 Effect of global climate changes on plant diseases, 32
- 12 Conversion of the Cerrado for agricultural purposes in Amazonia and its impact on climate changes, 33
- 13 Influence of nitrogenated fertilization with biosolid and mineral fertilizer on the fluxes of greenhouse effect gases in the soil in an area under successive forest rotation, 33
- 14 Organic fraction of biosolids and effect of the carbon stock and quality of organic material of a latosol cultivated with eucalyptus, 33
- 15 Models for the forecasting of productive and qualitative responses of *Panicum maximum* Jacq. based on climatic variables, 34
- 16 Integrated analysis of the effects of land use in forest fragments in the river Corumbataí basin, São Paulo (SP), 35



- 
- 17 Ion fluxes in the soil solution in forest and pasture in Rondônia (RO), 35
  - 18 Dynamic and stability of the organic matter in areas with potential for carbon sequestration in the soil, 35
  - 19 Classification and monitoring of the vegetal cover and use of land using Modis sensor data, 36
  - 20 Structure of arbuscular mycorrhizal fungi associated with vegetal species cultivated in agroforest systems in central Amazonia, 36
  - 21 Dynamic of soil carbon treated with biosolid in a reforestation with eucalyptus, 36
  - 22 The impact of global changes on the productivity of soybean: comparison between the experimental and simulated results, 37
  - 23 Quantity and quality of organic material in the soil in forest-pasture succession in Rondônia, 37
  - 24 Variation in the chemical and physical properties of the soil and in the organic matter in agroecosystems of Western Amazonia, Amazon region, 37
  - 25 Spatial variability of the properties of the soil in the Brazilian Amazon basin under natural vegetation, 38
  - 26 Modeling with diffuse daily and hourly radiation: application of a computerized system of solar radiation data (Simras), 38
  - 27 Effects of sugarcane harvesting without biomass burning on the dynamic of carbon and properties of the soil, 38
  - 28 Root system and its influence on the flux of gases in forest/pasture succession in Brazilian Amazonia, 39
  - 29 Measurement of CO<sub>2</sub> emission in soils through optical absorption spectroscopy, 39
  - 30 Use of remote sensing in the development of models for estimating canopy temperature and the biological production of sugarcane, 39
  - 31 Classification and monitoring of vegetation through NOAA-AVHRR images, 39
  - 32 Remote sensing for integrated analysis of the vegetation with elements of the physical environment and distribution of phytomass in contact areas of the forest and open countryside in Roraima, 40
  - 33 Modifications in soil properties caused by deforestation and cultivation in different Brazilian bioclimatic systems, 40
  - 34 Geostatistics applied to soils in Amazonia: case of forest-pasture succession in Rondônia, 40
  - 35 Study of the relationship between photosynthetically active radiation absorbed with production of phytomass and yield of grain for the cultivation of wheat under different conditions of hydric stress, 40
  - 36 Spectral characterization of stresses related to water and nutritional deficiencies in *Eucalyptus grandis* seedlings, 41
  - 37 Studies of forest areas in regeneration through Landsat images, 41

- 
- 38 Effect of the use of land on the dynamic of carbon and nitrogen in the soil in the region of Ariquemes, Rondônia (RO): use of a geographical computerized system, 41

#### **Architecture and Urbanism, 49**

- 1 Urban climate computational modeling for medium-size Brazilian cities, 51
- 2 Characterization of the intra-urban thermal field based on homogeneous areas, 51

#### **Biologies, 55**

- 4 Physiological and biochemical responses of three species of tropical legumes to climatic change, 58
- 5 Diversification of Bignoniaceae in the wetland savannas of Central Amazonia, 59
- 6 Cycle of carbon, nitrogen and soil nutrients in dense ombrophilous forest in the Serra do Mar State Park, in the State of São Paulo, 59
- 7 Potential production of greenhouse gases in sediments of marginal lagoons, 60
- 8 Fluxes of gases (CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub>) and alterations in the transformations of the nitrogen in the soil, in basins with forest and pasture cover on the northern coast of the State of São Paulo, 60
- 9 Microbial diversity in the Central and Oriental Amazonian Anthropogenic Dark Earth: Detection of methanogenic Archaea, their functional role and contribution to the bacterial structure communities in ADE and adjacent sites, 60
- 10 Vulnerability of organic matter in the soil to temperature increase, 61
- 11 Methodological procedure for the identification of individual tree species in four forest formations in the State of São Paulo, using orbital images from the Quickbird and Aster sensors, 60
- 12 Impact of raised concentrations of CO<sub>2</sub> on the physiology and the initial growth of four Brazilian forest species, in a future climatic simulation, 61
- 13 Stock of carbon and mineral nutrients in cerrado soils: effects of forest cultivation use, 62
- 14 Dynamic of carbon in the sugarcane agrosystem: mathematical modeling and environmental implications, 62
- 15 Stocks of carbon and nitrogen in cerrado soils aimed at agricultural sustainability, 62
- 16 Local management and conservation of natural resources in the Atlantic Rainforest (Vale do Ribeira, São Paulo), 63
- 17 Comparative ecophysiological analysis between species of macroalgae from lotic environments: temperature and irradiance, 63
- 18 Acid precipitations and their implications in the biogeochemistry of the basin of the river Piracicaba, 64
- 19 Effects of air pollution on gas exchanges of young individuals of *Tibouchina pulchra Cogn* (melastomataceae), in the region of Cubatão, São Paulo (SP), 64
- 20 Thermal comfort in cities: effect of tree-planting on the control of solar radiation, 64

- 
- 21 Mapping of ground fires in the Emas National Park, Goiás: 1973-1994, 64
  - 22 Adaptation strategies of arboreal species typical of waterlogged ground environments: a morphological, biochemical and ecophysiological approach, 65
  - 23 Changes in land use in Amazonia and dynamic of the organic matter in the soil using carbon isotopes, 65
  - 24 Aspects of the hydrological cycle in the Amazon basin: a temporal and spatial study, 65

### **Engineering, 83**

- 1 Concentrations of chemical species released during the combustion of biomass in the Amazon Forest, 85
- 2 Phytomonitoring and modeling of photosynthesis in *Hymenaea courbaril* (jatobá), 85
- 3 Effects of levels of CO<sub>2</sub> and doses of potassium applied via irrigation water to the melon crop (*Cucumis melo L.*) in protected environment, 85
- 4 Energy efficiency and sustainability: evaluation of the thermal performance of coverings and of the behavior of transparent materials in relation to solar radiation, 85
- 5 Combustion of material of different sizes in ground fires in tropical forests, 86
- 6 Geoenvironmental zoning as an aid to environmental management of hydrographic basins, 86
- 7 Monitoring and characterization of atmospheric particles in the city of São Carlos, central region of the State of São Paulo, Brazil, 86
- 8 Characteristics of the combustion of biomass in tropical forest burnings, 86
- 9 Biomass burning experiments in the Amazon region, 87

### **Physics, 91**

- 2 Study of natural radiation and characterization in Brazilian soil, 93
- 3 Atmospheric aerosols in Amazonia: measured in long term, transport on large scale and effects on the atmospheric radioactive balance, 93

### **Geosciences, 97**

- 8 Controls of the Atlantic Rainforest on the local and regional climate, 102
- 9 The carbon balance over an area of Atlantic Rainforest with micrometeorological and biometrical measurements, 103
- 10 Study of natural fires in the Cerrado, 103
- 11 Reconstruction of vegetation and climate since the middle Holocene in Brazil, 103
- 12 Mapping environmental indicators and remote sensing and GIS techniques applied to coastal regions – study case: Santos/São Vicente estuarine system, São Paulo, 104
- 13 Study of the influence of aerosol particles emitted by ground fires on photosynthesis in Amazonia, 104

- 
- 14 Evaluation of air quality for ozone in the metropolitan region of Campinas, 104
  - 15 Prognostic studies of the use of the Aqua satellite in the inference of the concentration of carbon monoxide in the atmosphere, 105
  - 16 The role of mesoscale and submesoscale activity in the Brazil-Malvinas frontal system, 105
  - 17 Implementation and calibration of a Raman Lidar – water vapor and aerosols, 105
  - 18 Investigation of the southern ocean circulation for the 20<sup>th</sup> century – part I: effect of the southern ocean modes of variability on the Weddell sea, 106
  - 19 Reconstruction of paleovegetation and paleoclimate in regions of the southern coast of the State of São Paulo (Serra do Mar State Park – Nucleus of Curucutu and Ilha do Cardoso) in the Late Quaternary, 106
  - 20 Study of the composition of aerosols and the isotopic signature of Pb as tracer of the source of atmospheric pollution in the city of São Paulo, 106
  - 21 Refinement of the description and numerical simulation of the surface and convection processes in the Cptec modeling of the atmosphere, 107
  - 22 An experiment to evaluate the effect of seasonal biomass burnings in central Brazil and the Amazon region on the increase in concentrations of carbon monoxide from tropospheric ozone in Southeast Brazil, 107
  - 23 Variabilities of the South Atlantic. Connections with the thermohaline circulation and the climate in South America (VARIAS 2), 108
  - 24 Study of the influence of atmospheric and geographical factors on the levels of ultraviolet radiation in regions of high population density in the State of São Paulo, 108
  - 25 Study of the dynamics of water circulation between lotic, lentic systems and the floodplain, 108
  - 26 Vertical structure of aerosols and their variations observed by balloon probes, 108
  - 27 Climatic simulations for the summer in the Southeast of the country, 109
  - 28 Study of carboxylic acids and aldehydes in the wet deposition in the metropolitan region of São Paulo, 109
  - 29 Improvements in the description of parameters of surface and vegetation in the Northeast region of Brazil for use in meteorological and hydrological models, 109
  - 30 Paleo-environmental reconstruction (vegetation and climate) in the Late Quaternary based on a multi/interdisciplinary study in the Vale do Ribeira (south of the State of São Paulo), 110
  - 31 Climatic variability on the intrazonal scale in the Southern hemisphere with emphasis on the influences on South America and Southeast Brazil: the behavior of the Cptec/Cola model of global circulation of the atmosphere, 110
  - 32 Survey of the physiognomic structure of the vegetation of the Caatinga, oriented towards the control of techniques of detection in changes, using remote orbital sensing, 110

- 
- 33 The influence of atmospheric aerosol on the formation of photochemical pollutants, 111
  - 34 Estimate of the effects of aerosol particles on the balance of atmospheric radiation in Amazonia, 111
  - 35 Sun-climate relationships studied in tree rings in Chile, 111
  - 36 Measurement of trace gases in regions under the influence of the transport of pollutants from biomass burning, 112
  - 37 Local circulations in the region of Santarém: observations and numerical modeling in the multidisciplinary context of the LBA, 112
  - 38 Investigation of the variability of low frequency in the South Atlantic. Analysis of the results of the ocean-atmosphere coupled model, 112
  - 39 Numerical study of climatic variability in the South Atlantic ocean, 112
  - 40 Study of the spatio-temporal variability of convection in the tropical region of South America, 113
  - 41 Simultaneous observations of the CO and O<sub>3</sub> minority gases in the lower atmosphere, 113
  - 42 Paleoenvironmental dynamic of vegetation and climate in the recent Quaternary in domains of Atlantic Rainforest, semi-arid heathland and north-eastern Cerrado, using carbon isotopes of the soil organic matter (SOM), 114
  - 43 Applications of meteorological satellites, 114
  - 44 Structure of radar echoes in the summer in Amazonia, 114
  - 45 Dynamic study of the impact of El Niño/south oscillation on the climate of the Americas, 114
  - 46 Transport of atmospheric pollutants in the atmosphere-soil interface in natural and urban areas in the State of São Paulo, 114
  - 47 Studies of greenhouse effect gases, 115
  - 48 Climatology of the South-Southeast coastal region of Brazil, 115
  - 49 Study of the surface boundary layer of Pantanal in south Mato Grosso, 115
  - 50 Effects of biomass burning on the lower atmosphere in transition Cerrado-forest ecosystems, 116
  - 51 Monitoring of bioclimatic variabilities and their impact on agricultural production in Brazil through NOAA AVHRR data, 116
  - 52 Mesoscale interactions between biosphere and atmosphere in Amazonia, 117
  - 53 Observations on the ozone layer in Punta Arenas, Chile, 117
  - 54 Information system and modeling of solar radiation (Simras), 117
  - 55 Evaluation of orbital radar images in the study of natural aquatic environments and environments of anthropic origin in: Monte Alegre's Lago Grande and the reservoir of the Tucuruí hydroelectric plant, 118

- 
- 56 South American cooperative on modeling of ocean, coastal and estuary processes related to global changes, 118
  - 57 Regular sounding of the stratosphere – SRS, 118
  - 58 The use of carbon isotopes in charcoals and humin in the soils. An indispensable tool to evaluate systematically the velocity of biological turnover and of paleoclimatic events, 118
  - 59 Atmospheric teleconnections via data from the Total Ozone Mapping Spectrometer, 118
  - 60 Modeling and observation of the biosphere-atmosphere interaction in the State of São Paulo, 119
  - 61 Experiment on the boundary layer in Rondônia (RBLE), 119
  - 62 Dynamic of waters of the continental platform and of the slope in the bay of Santos (Dabas), 119
  - 63 Carbon isotopes in soils in the tropical region of Brazil and relationships with the cerrado-natural forest sequence of vegetations, 119
  - 64 Measurements of the ozone layer and ultraviolet radiation, 120
  - 65 Experiment on the boundary layer in Rondônia (RBLE), 120
  - 66 Research into temporal variation of the neutrally charged particles and intensity of ozone and electric field in the stratosphere, 120
  - 67 Monitoring of ozone together with meteorological soundings, 120
  - 68 Monitoring system of biomass burnings and electronic dissemination of the information, 121
  - 69 Investigation into the application of wavelet transform in the study of turbulent exchanges in the surface boundary layer of the atmosphere, 121
  - 70 The influence of the Atlantic Ocean on global climate variation, 121
  - 71 Experiment on the boundary-layer in Rondônia, 122
  - 72 Measurement of greenhouse effect gases in natural Brazilian ecosystems, 122
  - 73 Numerical study of the circulation of the tropical Atlantic with model of isopicnal coordinates (Nustrac), 122

#### **Human and Social, 145**

- 3 Study of the socio-environmental impacts motivated by the advance of the agricultural frontier along the BR-163, 148
- 4 Urban restructuring and the environment: the case of São Paulo, 149
- 5 Social actors in the deforestation in the Serra do Mar, São Paulo: conflicts of interest between preservation and regional development, 149
- 6 Evaluating international scientific collaboration in Amazonia, 149

---

## **Chemistry, 153**

- 2 Determination of polycyclic aromatic derivatives in atmospheric aerosols, 155
- 3 Organic compounds indicators of natural and anthropic emissions, 155
- 4 Studies of nitrogen compounds present in the atmosphere in the central region of the State of São Paulo, 156
- 5 Use of diffuse reflectance spectrophotometry for verifying the detailed history of the whitening of marine coral samples, 156
- 6 Biogeochemistry of metals in aquatic environments and in the atmosphere. Part I: chemical speciation of metals in rainwater, 156
- 7 Development of methods *in situ* close to real time for atmospheric trace gases, 157
- 8 Study of the contribution of sugarcane burning to atmospheric contamination by PAHs and nitro PAH. Evaluation of the occupational exposure of sugarcane cutters to PAHs, 157
- 9 Aquatic chemistry of mercury in the river Negro: importance of sunlight in the redox process, 157
- 10 Study of the paleoclimatic alterations in central Amazonia, through the use of <sup>14</sup>C dating and isotopic reason <sup>13</sup>C/<sup>12</sup>C, 157
- 11 Determination of partial pressure of CO<sub>2</sub> in the ocean mixed layer, 157
- 12 Characterization of atmospheric particulate matter: II. Identification and quantification of polar organic compounds, 158

## **Health, 161**

- 3 Analysis of the chemical signatures of particulate material emitted by different diesel/biodiesel concentrations and their toxic effects in biological systems, 163
- 4 An analysis of the bioaerosols in the atmosphere of the metropolitan region of the city of São Paulo, 164
- 5 Pulmonary and cardiovascular alterations induced by inhalation of concentrated particulate material from the atmosphere of São Paulo, 164
- 6 Effect of air pollution in the carcinogenesis of mice, 164

---

## **BIOTA-FAPESP PROGRAM**

### **Agrarian and Veterinary, 27**

- 39 Distribution of the community of palm trees in the altitudinal gradient of the Atlantic Rainforest in the northeast of the State of São Paulo, 42
- 40 Physiognomic-ecological units associated with remnants of natural vegetal cover, 42

### **Architecture and Urbanism, 49**

- 3 Environmental atlas of the municipality of São Paulo: phase 1 – diagnosis and bases for the definition of public policies on green areas in the municipality of São Paulo, 51

---

**Biologies, 55**

- 25 Modeling of the dynamic of the organic matter in the soil in the zone of agricultural expansion in southwest Amazonia: basis for research into global climate changes, 66
- 26 Floristic composition, structure and functioning of the dense ombrophilous forest in the Picinguaba and Santa Virgínia nuclei of the Serra do Mar State Park, 66
- 27 Environmental Information System of the Biota-FAPESP Program: development of indicators for monitoring, updating the labeling of the cartographic base and improvements to the *Biota Neotrópica* magazine, 66
- 28 Conservation of the biodiversity in fragmented landscapes on the Atlantic Plateau of São Paulo (Brazil), 66
- 29 Structure and functioning of hydrographic basins of meso and microscale in the State of São Paulo: bases for generating and sustaining biodiversity, 67
- 30 Viability of the conservation of the remains of the Cerrado in the State of São Paulo, 68
- 31 Conservation and sustainable use of the vegetal biodiversity of the Cerrado and the Atlantic Rainforest: the storage of carbohydrates and its role in the adaptation and maintenance of plants in their natural habitat, 68

**Geosciences, 97**

- 74 Biosphere-atmosphere interaction phase 2: cerrados and changes of land use, 122
- 75 Biosphere-atmosphere interaction in natural ecosystems and agroecosystems: a monitoring of sugarcane and Cerrado, 123
- 76 Environmental study in the estuary of the river Itanhaém, southern coast of the State of São Paulo, 123

---

**YOUNG RESEARCHERS IN EMERGING CENTERS**

---

**Biologies, 55**

- 32 Total atmospheric deposition (wet and dry) in Brazil: implications of anthropic activities on the biogeochemical cycles of N and C, 69
- 33 Study of the relationship between the trophic state and the emission of greenhouse effect gases (CH<sub>4</sub>, CO<sub>2</sub> and N<sub>2</sub>O) in reservoirs in the middle Tietê river and evaluation of the capacity to remove carbon, nitrogen..., 69
- 34 Seasonal variations and tolerance to hydric deficiency in seedlings of tropical tree species from different successional groups, 70
- 35 Biogeochemical cycle of carbon in rivers: an integrative approach through analysis without multiscales using multiple tracers, 70

**Geosciences, 97**

- 77 Late quaternary paleoclimate in Brazil from oxygen and carbon isotope ratios on speleothems, 124
- 78 An integrated seasonal forecasting system for South America, 124



- 
- 79 Atmospheric aerosols and climatic changes on regional scale based on radiometers in satellites, 124
  - 80 Development of an integrator of information acquired by pluviometers, satellites, lightning networks and meteorological radars and analysis of precipitant systems in Brazil – Precibra, 125
  - 81 Space technology center for study of dynamic processes and oceanic fluxes on global scale, 125
  - 82 Numerical modeling of the transformation and transport of atmospheric aerosol particles in the Amazon region. An evaluation of their climatic impact, 125
  - 83 Numerical modeling of the transport and of atmospheric processes acting on gases and aerosols from biomass burnings in South America, 126
  - 84 Simple hydrological model to estimate humidity of soil and runoff in macro-scale bays, 126

### **FIRST PROJECTS**

---

#### **Geosciences, 97**

- 85 Evaluation of the air quality for ozone in the Metropolitan Region of Campinas, 126
- 86 Contributions of solar variability and geophysical events in the climate of South America: study of the Sun-climate relationships in growth rings of trees, 127
- 87 The role of aerosols in the formation of severe storms in the Metropolitan Region of São Paulo, 127

### **TECHNOLOGICAL INNOVATION IN SMALL BUSINESSES (PIPE)**

---

#### **Physics**

- 4 Development of a system to measure pollutant concentrations in the atmosphere with infrared lasers (CO<sub>2</sub> and CO) by photo-acoustic spectroscopy, 94

#### **Geosciences**

- 88 Generation of digital models of elevation through radargrametry with Radarsat-1 satellite images, 128

### **PARTNERSHIP FOR TECHNOLOGICAL INNOVATION PROGRAM (PITE)**

---

#### **Geosciences**

- 89 A research program on earth system science with special emphasis on global climate change, 128

### **INFORMATION TECHNOLOGY IN THE DEVELOPMENT OF ADVANCED INTERNET (TIDIA)**

---

#### **Engineering**

- 10 Research WebLabs in environmental services, 87

### **PUBLIC POLICIES RESEARCH PROGRAM**

---

#### **Geosciences**

- 90 Implementation of the air quality model for the Metropolitan Region of São Paulo, 128

---

**Health, 153**

- 7 Analysis of morbidity and mortality associated with climate variation in the municipality of São Paulo, 165

**Interdisciplinary, 157**

- 1 Development of technology for ozone forecasting in the lower atmosphere, 171

**GRANTS**

---

**Agrarian and Veterinary, 42**

**Architecture and Urbanism, 51**

**Biologies, 70**

**Engineering, 87**

**Physics, 94**

**Geosciences, 128**

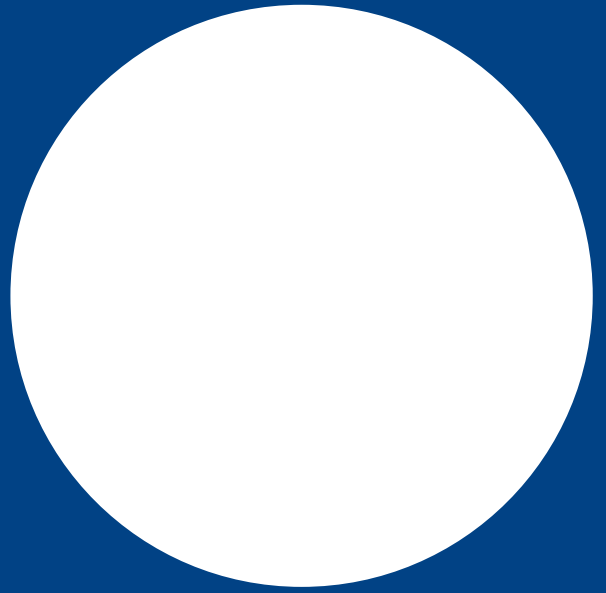
**Human and Social, 149**

**Chemistry, 158**

**Health, 165**

# Agrarian and Veterinary





## THEMATIC PROJECTS

1

**Environmental impact of the expansion of agriculture in Southwest Amazonia**

Carlos Clemente Cerri

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 2005/59012-1

Term: Nov/2006 to Oct/2010

Current global warming is caused by the increase in greenhouse effect gases (GEE) in the atmosphere, emanating from the burning of fossil fuels, agriculture and changes in land use. Brazil is considered one of the largest emitters due to the last two sources. The southwest region of Amazonia, today the largest agricultural frontier in the world, probably contributes significantly to this increase. The research aims to evaluate the environmental impact caused by the use and change of use of the land in the states of Rondônia and Mato Grosso due to emissions of GEE  $\text{CO}_2$ ,  $\text{CH}_4$  and  $\text{N}_2\text{O}$  in the last 30 years and forecast, by means of modeling, future impacts. Complementarily, we will evaluate the soil degradation and the socioeconomic implications due to the agricultural expansion in the region, which, together with the previous objectives, constitute the indispensable elements for the formulation of public policy plans which aim to mitigate global warming without losing sight of the production of foods and the sustainable development of the region.

2

**Strategies for restoration of degraded pastures in Amazonia examining agronomic, environmental and economic criteria**

Carlos Clemente Cerri

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 2000/08239-2

Term: Jul/2001 to Apr/2006

Pastures make up the principal use of cleared land in the Brazilian Amazon. Observations show that after 4 to ten years after they are formed, pastures generally begin a process of degradation that characterized by a decline in grass productivity and an increase in the cover of weeds. For both environmental and economic reasons, development of strategies for reformation and restoration of these existing degraded pastures is preferable to formation of new pastures by traditional slash and burn activities. The objective of this project is to examine strategies for recuperation of degraded pastures in Amazonia examining agronomic, environmental

and economic criteria. To achieve this objective, we will conduct an experiment on an existing 63-ha area of pasture in the process of degradation located at Fazenda Nova Vida, in Ariquemes, Rondônia. To ensure that this experiment will be located on a representative and homogeneous area of this existing pasture, the area will be characterized for topography, soil physical and chemical attributes, production and nutritive value of existing forage plants, weed infestation and botanical composition, using geostatistical and geoprocessing techniques. The experiment will consist of four blocks (replicates) of six pasture reformation techniques: 1) control, 2) herbicide + NPK + micronutrients, 3) disking + NPK + micronutrients, 4) disking + coplanting of *Brachiaria brizantha* + PK + micronutrients, 5) plowing + disking + planting of rice + NPK + micronutrients ("barreirão" system), and 6) plowing + disking + rotation of soybean and corn +PK + micronutrients. Before and during the three years following the initiation of the treatments, they will be evaluated for a number of agronomic, environmental and economic criteria, including, i) plant production, nutrient value and digestibility of forage, ii) distribution of the root system, iii) soil quality, aggregation, resistance to root penetration, stocks and fractions of carbon (C), nitrogen (N), phosphorus (P), cation exchange capacity, acidity, availability of nutrients and toxic elements, macrofauna and microbial biomass, iv) chemical analysis of soil solution, including dissolved organic C and N, potassium, nitrate and ammonium, v) fluxes of trace gases, carbon dioxide ( $\text{CO}_2$ ), nitrous oxide ( $\text{N}_2\text{O}$ ) and nitric oxide (NO), vi) sequestration of C and N, and vii) economic viability. Results will be analyzed by multivariate analysis of variance to determine the treatments that best meet the criteria in each of the three areas and to examine the tradeoffs between these reformation objectives.

3

**Trace gas fluxes associated with land-cover and land-use changes in the Brazilian Amazon Basin**

Carlos Clemente Cerri

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 1997/00446-4

Term: Jun/1997 to Nov/2000

We propose to measure changes in key soil processes and the fluxes of  $\text{CO}_2$ ,  $\text{N}_2\text{O}$  and  $\text{NO}$  associated with the conversion of tropical rainforest to pasture in Rondônia, a state in the southwest Amazon that has experienced rapid deforestation, primarily for cattle ranching, since the late 1970s. In sum, these measure-

ments are intended to provide a comprehensive quantitative picture of the nature of surface soil element stocks, C and nutrient dynamics, and trace gas fluxes between soils and the atmosphere during the entire sequence of land-use change from the initial cutting and burning of native forest, through planting and establishment of pasture grass and ending with very old continuously-pasture land. All of our work is done in cooperation with Brazilian scientists at the Center for Nuclear Energy in Agriculture (Cena) through an extant official bi-lateral agreement between the marine biological laboratory and the University of São Paulo, Cena's parent institution. In this research we will: 1) make field measurements of P stocks and N<sub>2</sub>O and no fluxes along two sequences of forest and pastures established between 1989 and 1911 at a large ranch (Fazenda Nova Vida) that we have been studying for the past five years, 2) conduct field studies of C, N and P stocks and C and N cycling rates in soils, and fluxes of CO<sub>2</sub>, N<sub>2</sub>O and no between the soil and the atmosphere in a pasture that we created in 1994; 3) develop both response-function and process-based models to predict trace gas flux rates; 4) link these models with geographically-referenced information on rates of forest clearing for pasture to begin to predict how these changes affect trace gas flux rates for the entire Brazilian Amazon basin.

#### SUPPORT FOR REGULAR RESEARCH

4

#### **Crop-livestock integration in south-western of Goiás: impacts in soil carbon and in the greenhouse gas fluxes**

Carlos Clemente Cerri

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 2008/00707-9

Term: Jun/2008 to May/2010

Nowadays, there is much discussion about possible environmental damage arising from agricultural activities, due to the expansion of crop farming and pastures in regions of the Cerrado, especially aspects related to the emission of greenhouse effect gases (GEE) and global warming. However, there are sustainable alternatives for the use of natural resources, based on soil conservation, environment and maximization of cattle farming production. The crop-cattle integration system (CCI) proposes a diversification of activities through the strategic incorporation of pastures into agriculture, in a way that benefits both. This modern system is sized to meet the demands of land for agribusiness, the economic perspectives of farmers and cattle breeders,

without causing deforestation and with minimal environmental impact. The objectives of this research will be to evaluate the CCI system under no-till planting and compare it to the other land uses in the southwest region of Goiás, evaluating the impacts on the soil and the environment. Soil and GEE (CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub>) will be sampled. In the soil we will evaluate quantitative and qualitative attributes related to soil carbon. Mathematical modeling will be used to simulate the dynamic of organic material in the soil as a result of adoption of the CCI system.

5

#### **Loss of carbon from the soil predicted by first order decomposition model: effect of the breaking down of aggregates and the incorporation of the vegetal cover on the emissions induced by the preparation**

Newton La Scala Júnior

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São Paulo State University (Unesp)

Process 2007/57650-6

Term: Mar/2008 to 28/2/2010

Preparation of the soil stimulates the loss of carbon (C) through the increase in aeration, improvement in the temperature and humidity conditions of the soil and through the release of a fraction of the labile organic matter (OM) previously protected by aggregates from decomposition. In this work we present the development of a model capable of explaining the emissions of carbon dioxide (CO<sub>2</sub>), or the losses of C via emission of CO<sub>2</sub> (C-CO<sub>2</sub>) after soil preparation, in relation to the emissions from the undisturbed plot added to a correction due to the preparation effect. Our hypothesis is that an additional quantity of labile OM, previously protected by the aggregates, is made available through the soil preparation to microbial activity. The model assumes that the level of carbon (C) present in the labile OM follows a kinetic of reduction of the first order. The emission of C-CO<sub>2</sub> in the plot where the soil preparation is undertaken will be derived, taking into consideration that this plot possesses a higher quantity of labile OM compared to the undisturbed plot and also taking into account additional labile C introduced into the decay process due to the introduction of the mass of hay into the interior of the soil due to the preparation. Based on this hypothesis, the result is two models. Thus, we are proposing to carry out new experiments in the areas of agriculture where a surface density of residues from the previous maize crop (*Zea mays*) will be controlled and incorporated into the soil at the time of preparation. The preparation systems tested will be the disk plowing followed by leveler grid, and the moldboard plow follo-

wed by leveler grid, to an average working depth of 15-20 cm. We believe that we can define the effect of the breaking up of the aggregates on the additional emission of CO<sub>2</sub> after preparation, distinguishing it from the effect of the incorporation of residues in the soil on these emissions.

6

### Soil sampling for carbon sequestration in a replanted area in São Paulo state

Hilton Thadeu Zarate do Couto

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University of São Paulo (USP)

Process 2007/00864-4

Term: Sep/2007 to Aug/2009

The climate changes are a big danger for the environment and the sustainable development of the world. This changes are caused by the increment of the greenhouse effect up of the desired levels, caused by the gases that absorb the sun radiation (SZACÁKS, 2003). With the main objective of decrease the effects caused by the increment of gasses emissions, the United Nations Framework Convention on Climate Change (UNFCCC) talk about the CO<sub>2</sub> sequestration by the skills of biologic absorption of the soils and forest. In 2006 they point the class of pools to be considered for the sequestration: Biomass up and down the soil, dead wood, organic matter and soils. The present project is considered to be executed in forest soils with the precedent that the organic carbon concentration of soils represent the main stock in interaction with the atmosphere, knowing that the vegetation (650 Pg C) and the atmosphere (750 Pg C) has less levels. The main problem is that the methods to evaluate and study the carbon pools in soils are few, and they represent another big difficult, the comparison of the results and the integration in trust databases are impossible in practice, because there are many differences related to the measure ways and the sampling methods. At this moment there are not methodologies ways to measure the sequestration of carbon in agriculture production systems. (ACOSTA 2001, ETCHEVERS 2001). The objective of this work is to develop a soil sampling plan in native forest to know if the carbon used in clean development mechanisms comparing different sampling class used in soils. The applied methodology is the one named at 2006 Intergovernmental Panel of Climate Changes. This is an important research for Brazil, because it has the main forest at world, so we can estimate a big CO<sub>2</sub> sequestration that may turn into big sales of divisas.

7

### Evaluation of environmental impact on a hydrographic microbasin using geographic information system

Teresa Cristina Tarle Pissarra

Jaboticabal School of Agrarian and Veterinary Sciences

São Paulo State University (Unesp)

Process 2005/60758-8

Term: Nov/2006 to Oct/2008

In the present Project, the environmental impact will be evaluated through the interpretation, observation and graphic representation of part of the earth's surface, considering as experimental territorial unit the hydrographic microbasin, and the analysis of the environment, with regard to the data collected on the physical-chemical parameters of the hydric resources, sediment and soil, in accordance with the alterations deriving from human activities, using in juxtaposition the analysis of data and maps elaborated in the Geographical Information System (GIS). Thus, we will evaluate hydrographic microbasins of the first order of magnitude with sources protected by forest, by reforestation in the initial stage and with a preponderance of agricultural activities. The hydrographic microbasin to be studied will be that of the Córrego da Fazenda da Glória, located in the municipality of Taquaritinga (SP). The use/occupation of the soil and the topography will be evaluated and all the information collected will be used in support of environmental planning.

8

### Evaluation of climatic environment for the rearing of dairy cows in region with high levels of solar radiation

Newton La Scala Júnior

Jaboticabal School of Agrarian and Veterinary Sciences

São Paulo State University (Unesp)

Process 2005/58364-1

Term: Feb/2006 to Jan/2008

Measurements are taken of rectal temperature, temperature of the external surface of the body, respiration rate, of the levels of pigmentation of the epidermis and pelage (thickness of coat, average length of hairs, average diameter of hairs, angle of inclination of hairs) in dairy cows from herds in the states of Rio Grande do Norte and Ceará. These measurements are associated with simultaneous measurements of environmental variables (solar irradiance, average radiant temperature, air temperature, air humidity, wind velocity), with the aim of establishing indices of environmental stress. These indices are compared with similar existing for-

mulas found in the literature, choosing the best index to carry out a bioclimatic zoning of the dairy cattle in the states of the northeast.

9

### **CO<sub>2</sub> emissions in soils in different positions of the landscape in area cultivated with sugarcane**

Newton La Scala Júnior

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São Paulo State University (Unesp)

Process 2004/15213-0

Term: Apr/2005 to Jul/2007

The role of greenhouse effect gases in climate change on our planet is reasonably well known, but little is known about the various characteristics of the balance of this gas in the biosphere. Aspects such as temporal and spatial variability, the relationship between soil properties and also how the different practices and strategies used in agriculture affect the emission of this gas are also barely known, especially in tropical environments. In this project we propose to identify the factors that control or are related to the spatial and temporal variability of the emission of soil-atmosphere CO<sub>2</sub>. The identification of these attributes is essential in order to determine forecasting models used in several simulations. Combining the field measurements with the analysis of data in statistical and mathematical models in the laboratory, we will be able to identify the factors which in first approximation will be more closely related to the respiration of soil in the agricultural areas studied. We will consider, in addition to the variation in the form of landscape, variations in physical, chemical, biological and mineralogical attributes of the soil, during a cycle of the cultivation of sugarcane, in an area with a long history of cultivation of this crop. The emissions will be monitored in periods in which the soil will be uncovered and covered by the sugarcane crop, making it possible for us to discover the influence of the various properties on the respiration of the soil on occasions in which microbial activity is the only source of emission (bare soils), but also how much root respiration could be contributing to the emission of CO<sub>2</sub> into the atmosphere.

10

### **Possibility of the occurrence of water deficit in the municipality of Ituverava, São Paulo**

Anice Garcia

Dr. Francisco Maeda Faculty

Ituverava Educational Foundation (FEI)

Process 2004/04375-0

Term: Mar/2005 to Feb/2007

Water, as a common and fundamental consumable for cattle farming activities, is not uniformly distributed either spatially or temporally. Awareness of the probability of the occurrence of water shortage in the region makes it possible to plan for better use of the water resources. The study will be based on daily data of rainfall and evapotranspiration, which will be estimated by the FAO method using daily measurements of meteorological elements. The water deficit will be estimated based on a sequential hydric balance.

11

### **Effect of global climate changes on plant diseases**

Raquel Ghini

Embrapa Environment

Brazilian Agricultural Research Corporation (Embrapa)

Process 2004/01966-7

Term: Dec/2004 to Nov/2007

Climate changes constitute one of the most serious global challenges for humanity. Their adverse effects are now a reality all over the world. Among the alterations predicted, there is unanimity regarding the increase in the concentration of atmospheric carbon gas, which is expected to double by the end of the century, despite efforts to set up international agreements. This environmental alteration could modify the susceptibility of host plants to diseases; the multiplication, the survival and other activities of pathogens; as well as the interaction between host plant and the pathogens. In the Northern hemisphere there is information on the increase of important plant diseases with the increase of atmospheric CO<sub>2</sub>, given, in general, that 60 per cent of the pathosystems studied displayed increases in the incidence of diseases caused by biotrophic and necrotrophic pathogens. However, in Brazilian conditions there is no information, despite it being indispensable for the understanding of what might occur with some diseases of Brazil's strategic crops. Thus, the present project has the objective of evaluating the effect of the increase in the concentration of atmospheric CO<sub>2</sub> on the monocyclic components of coffee and bean rusts, soybean and rice blast, under open-topped greenhouse conditions. Six open-topped greenhouses will be built with circular aluminum structures, sides covered with transparent plastic film and automated control of the concentration of CO<sub>2</sub>. In three greenhouses we will inject CO<sub>2</sub> until it reaches double the environmental concentration, evaluated in the other three greenhouses. The monocyclic components evaluated will be the period of incubation, the latent period, percentage of foliar area injured, frequency of infection, infectious period and sporulation.



12

### Conversion of the Cerrado for agricultural purposes in Amazonia and its impact on climate changes

Carlos Clemente Cerri

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 2004/01230-0

Term: Oct/2004 to Nov/2006

Favorable conditions of topography and climate make the Cerrado (wooded savanna) one of the world's most promising agricultural frontiers. The clearing and burning of the natural vegetation, followed by the cultivation of the soil lead to a decrease in the stock of the soil's organic material (SOM) and increase in the emission of greenhouse effect gases. Conservationist practices, such as the no-till planting system, are efficient strategies for the mitigation of these effects. The general objective of the research will be to evaluate SOM alterations in the process of the conversion of the Cerrado of Amazonia into areas of conventional cultivation and no-till farming. The work will be undertaken at the Fazenda União, in Vilhena (RO), which has been systematically cleared since 1997 for the planting of annual crops, with the current situation being a chronosequence consisting of cerrado, areas with one or two years of conventional cultivation and with one to four years of no-till farming following on from conventional cultivation. We will collect soil and gas samples in a strip of 1 hectare (200m x 50m), subdivided into five plots of 40m x 50m, which will constitute the repetitions. The levels of C and N, associated with the density of the respective layer, will make it possible to calculate the stock, the variation of which through time will indicate an eventual sequestration of C. The flux of the gases will be measured in five static layers in which the samples will be taken at regular intervals (time 0, 5, 10 and 20 minutes) in 20 ml BD syringes and analyzed by gas chromatography. The measurements will be taken twice in a 24-hour period, at the time of minimum and maximum temperature, and at least twice a year, that is, after harrowing in the dry season and during the development of the crop in the wet season. This sequence should provide information on the dynamic of the flux of gases after the preparation of the soil and the fertilization of the crops. The Century model will be applied to simulate the dynamic of C and N in the soil, initially assuming a state of dynamic equilibrium of the soil under native vegetation, followed by simulation of the temporal variations. The results will be compared with the data effectively measured in the field and potential data contained in the literature.

13

### Influence of nitrogenated fertilization with biosolid and mineral fertilizer on the fluxes of greenhouse effect gases in the soil in an area under successive forest rotation

Marisa de Cássia Piccolo

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 2004/01197-3

Term: Jun/2004 to Sep/2006

In areas under successive rotations of forest plantations the deficiency of nitrogen (N) in the soil can become a limiting factor in the production, requiring high doses of nitrogen in the maintenance of the stocks of this element in the soil and nutrition of the plants. The application of biosolid (sewage sludge) is an alternative that has been increasingly studied for fertilization of areas with forest plantation, offering good results in terms of development of the trees, although little is known about the effects of this practice on the fluxes of greenhouse effect gases in the soil and the mineralization of N. The objective of this project is to study in a forest area populated with *Eucalyptus grandis*, after successive rotations (6th rotation): the influence of mineral and organic (biosolid) fertilizer used as sources of N on the fluxes of important soil greenhouse effect gases (CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub>); the availability of mineral N (NH<sub>4</sub><sup>+</sup> and NO<sub>3</sub><sup>-</sup>) and its rate of mineralization; and the stocks of total carbon and nitrogen in the soil during the first 12 months of the development of the trees.

14

### Organic fraction of biosolids and effect of the carbon stock and quality of organic material of a latosol cultivated with eucalyptus

Carlos Clemente Cerri

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 2004/01196-7

Term: Jun/2004 to May/2005

The agricultural use of biosolid has been recommended as a practice for the maintenance or increase in the levels of edaphic organic matter (OM) and to obtain all the benefits associated with OM. However, little is known about the quality of the organic fraction of the biosolids, the dynamic of carbon (C) in soils treated with the residue and real contribution of the organic fraction of the biosolids in the sequestration of

C and capacity for cationic exchange (CCE) in treated areas. The present research plan is proposed with the general objective of studying the degradation of biosolids after application in the soil, correlating it with the initial chemical composition of the organic fraction of the residues and using the carbon  $^{13}\text{C}$  isotope, to determine the effect of the biosolids in the degradation of the original OM in a latosol cultivated with eucalyptus and treated with doses of a biosolid. To this end, it is necessary to reconcile experiments under controlled laboratory conditions with field evaluation (case study). In controlled conditions we will determine the rates of degradation of five biosolids after mixture with samples of a red oxisol of clayish texture. The incubation time will be 70 days. The results of accumulated  $\text{CO}_2$  released, discounted from the control, will be used in adjustments to mono, bi and triphasic equations of first-order kinetics, so as to obtain values of K (speed of degradation constant) and degradation half-life. The organic fraction of biosolids will be characterized by means of the determination of the total levels of OM, MO, C, N, P, C soluble in water, carbohydrates, proteins, lipids, cellulose, lignin, tannins and phenols; levels of C, N and P in organic compounds; and C, N and P in inorganic compounds. These results will be correlated with the rates of biosolids after 70 days of incubation and, if possible, with the rates in each phase of degradation (bi and tri-phasic equations). Using the difference between the values of natural abundance of the stable isotope of  $^{13}\text{C}$  in the oxisol and in three of the biosolids, we will evaluate the real degradation of the biosolids in the soil, measured periodically during the 70 days of incubation, the relative percentage of C deriving from the residues and original C of the soil, in the incubated soil samples and in the respired  $\text{CO}_2$ . This approach will permit the evaluation of the conventional respirometric method (capture and determination of  $\text{CO}_2$ ) with regard to the possibility of over or under estimation of the rates of degradation of biosolids, as well as making it possible to determine the effect of biosolids in the degradation of the original C in the soil (priming effect). In the field, we will determine the levels and stocks of C and N, up to a depth of 60 cm, in a red-yellow oxisol of low fertility, cultivated with *Eucalyptus grandis* and treated with doses of an alkaline biosolid. We will also evaluate possible alterations in the quality of the soil's OM as a result of the application of the residue and, in this case, the indicator variables will be: 1) total levels of carbohydrates, proteins, lipids, cellulose, hemicellulose and lignin; 2) concentrations of carbon in three pools, determined by reason of different degrees of oxidation; and 3) potential values of CCE at pH 7.0 and CCE effective on the natural pH. It should be noted that the study of the field case is complementary to a multidisciplinary project which began

in 1998, the object of which involves the evaluation of silvicultural, agronomical, environmental and economic aspects, related to the use of biosolids in fast-growth forest plantations.

15

### Models for the forecasting of productive and qualitative responses of *Panicum maximum* Jacq. based on climatic variables

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University of São Paulo (USP)

Process 2004/00415-7

Term: Sep/2004 to Aug/2006

Models for forecasting the production of forage plants and of the qualitative characteristics of the forage produced throughout the year can be valuable tools in planning and taking decisions in animal production systems based on pastures, as well as in the study of these responses by means of simulation in research environments. Such models, however, need to be developed and proposed according to proven criteria of validity and applicability to a range of scenarios and, in general, are more solid and inclusive the more they encapsulate the decisive variables of the processes about which one hopes to make deductions. Data on the production and variation of the qualitative characteristics of the forage produced should be generated in simulations in such a way as to be coherent with the real values obtained in field conditions. To this end, the independent variables chosen for the forecasting of these responses should be biologically consistent with the processes on which they have an effect. The objective of the present study is to characterize the principal productive and qualitative responses of five cultivations of *Panicum maximum* (Jacq.), with the objective of creating a database of the agronomic characteristics and the nutritional value of these forages, such as accumulation of forage, morphological and chemical-bromatological composition, digestibility and physical characterization. With this information in hand, we will evaluate forecasting models of productive and qualitative responses against climatic variables such as heat units (degree-days) and heat units modified by the photoperiod (photothermic units). With this, it is hoped to be possible to rationalize the biological processes, detaching them from less consistent procedures, such as the use of chronological scales (calendar) to determine the management of ideal harvest time for these forages. Seasonal variations in the responses measured in the field will be compared against the results simulated by the models for the purpose of evaluating the forecasting power of these models.

16

### Integrated analysis of the effects of land use in forest fragments in the river Corumbataí basin, São Paulo (SP)

Carlos Alberto Vettorazzi

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University of São Paulo (USP)

Process 2003/09108-7

Term: Jun/2004 to Nov/2006

The general objective of this study is to investigate the effects of land use in forest fragments in the basin of the river Corumbataí (SP). We will use methods of remote sensing (by means of classification of satellite images) and geographical information systems on ground cover, structured interviews and research in databases for the collection and organization of data on land use. For this study, the types of cover are related to the materials which occupy the surface of the ground, such as water, forest and plantation. The use of the land is related to socioeconomic factors, which can determine the conservation or degradation of the forest fragments. The analysis of the results will be based on the correlation between a series of variables which represent the variation or not in the conservation of forest fragments and the indicators of land use occurring in the period 1985 to 2000. With this study we hope for discussion and comparison of the systems of production which use advanced technologies, as is the case with sugarcane, and traditional systems, as is the case of slaughter cattle in the region of the study.

17

### Ion fluxes in the soil solution in forest and pasture in Rondônia (RO)

Marisa de Cássia Piccolo

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 2003/06971-6

Term: Sep/2004 to Nov/2006

The concentration of ions in the solution of soil is an important indicator of the functioning of the soil, being essential in evaluations of losses of nutrients through drainage and from the nutritional demand from vegetation. The study of the interferences in the change of the use of land on the characteristics of the soil solution is important in the quantification of the equilibrium of entry and exit of nutrients in the soil and in the evaluation of the effects with the time of alterations of the system on the fertility of the soil. The objective of this work is the evaluation of the effects of the

change of land use on the dynamic of the nutrients in the soil solution in a system of natural forest and pasture of low productivity. The research project will be carried out in the Fazenda Nova Vida (RO), in a natural forest system, in a pasture established in 1983 in the process of degradation (low productivity) and in a managed (harrowed and fertilized) pasture established in 1983. With the help of collectors, we will sample the rain water, leached rain, surface run-off water, the soil solution (tension lysimetry) and the leached soil solution (zero-tension lysimetry) to study the entries and exits of ions and of organic and inorganic carbon dissolved.

18

### Dynamic and stability of the organic matter in areas with potential for carbon sequestration in the soil

Ladislau Martin Neto

Embrapa Agricultural Instrumentation

Brazilian Agricultural Research Corporation (Embrapa)

Process 2003/06084-0

Term: Sep/2003 to May/2006

Throughout the world, scientifically and economically viable solutions have been studied with the view of reducing the emission into the atmosphere of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O gases, responsible for the greenhouse effect. Most notable among them is carbon sequestration (C) by the soil, for which Brazil displays great potential, due to its territorial expanse and agricultural/forestry aptitude. Reforestation and recuperation of degraded areas, with the use of promising gramineous or leguminous plants, are envisaged by the Kyoto protocol as alternatives capable of substantially increasing the sequestration of C. Other notable practices are the rotation of crops (gramineous-leguminous) and the system of no-till planting, the use of which has been increasing in the country and which has provided greater additions of organic matter to the soil compared to the conventional system. However, with the use of these alternatives, there is the need for a better understanding of the dynamic (additions and losses of C) and the stability (sequestration time of C) of the organic material in Brazilian soils, as well as under different vegetation/crop systems of management, guaranteeing at the same time the sustainability of production and the sequestration of C. The present Project proposes to meet that need, aiming for a better understanding of the behavior of organic matter in areas with potential for C sequestration, through the evaluation of the stocks of carbon in the soil and of the use of fractioning techniques followed by spectroscopic techniques.

19

### Classification and monitoring of the vegetal cover and use of land using Modis sensor data

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National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 2003/01727-0

Term: Jul/2003 to Jun/2005

This Project presents a methodological proposal for the Classification and monitoring of forest, cerrado and pantanal ecosystems, and detection of changes due to natural and anthropic causes. In this context, the state of Mato Grosso was chosen as the area for study, as the region possesses several vegetal formations and has been experiencing big changes in the use and cover of the land, due to the entry of agriculture and cattle farming into the regions of the cerrado, as well as the activities of clearing and burning in the region of legal Amazonia, both through natural and anthropic causes. For this purpose, data will be used from the Modis (Moderate Resolution Imaging Spectroradiometer) sensor acquired during the year 2002. This sensor was chosen as it possesses characteristics of spectral and spatial resolution which enable an improvement in the quality of the studies on regional and global scale. The general objectives of this study are: 1) to generate a map of vegetal cover of the region in a spatial resolution intermediary between the maps already produced; 2) to monitor the phenological changes in the use and cover of the land, due to clearings and burnings. To attain these objectives, we will adapt the methodologies developed for the Classification of the vegetal cover using data from the AVHRR (Advanced Very High Resolution Radiometer) and for the detection of changes in use and cover of the land. Among the results expected, we can mention the making available of a map of the vegetal cover in the state of Mato Grosso and of a methodology for the detection of cleared areas and evaluation of the areas of burnings, generated using multispectral and multitemporal information from the Modis sensor. Such information is important as a basis for the planning and management of the natural resources of the region.

20

### Structure of arbuscular mycorrhizal fungi associated with vegetal species cultivated in agroforest systems in central Amazonia

Elke Jurandy Bran Nogueira Cardoso

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University of São Paulo (USP)

Process 2002/07490-9

Term: Nov/2002 to Feb/2005

In the present study it is intended to investigate in field conditions the structure of communities of MA fungi under the effect of pupunha (*Bactris gasipaes*) and cupuassu (*Theobroma grandiflorum*), cultivated in agroforest system and in monoculture, and of leguminosae cover of tropical kudzu (*Pueraria phaseoloides*) present in these cultivation systems, as well as the effect of the different patterns of structure observed in the growth of these species, in greenhouse conditions. The field trial is located in Embrapa Western Amazonia, in the municipality of Manaus (MA). We will carry out two collections of soils and roots during a year (dry and wet season). The soil samples will be evaluated for the diversity and density of spores of MA fungi through the classic method of taxonomy. Subsequently, we will undertake, using molecular methods, the confirmation of the species determined in the previous stage. In the root samples we will evaluate the mycorrhizal colonization and molecularly determine the presence of the different species of mycorrhizal fungi observed within the soil. In a greenhouse trial, we will produce the different patterns of communities observed in the field and evaluate their effects on the growth of cupuassu, pupunha and kudzu tropical. In this trial we will determine the levels of nutrients and the dry matter in the exposed and root parts. In the roots we will evaluate the total colonization and the presence of the different species of MA fungi.

21

### Dynamic of soil carbon treated with biosolid in a reforestation with eucalyptus

Brigitte Josefine Feigl

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 2001/10761-1

Term: May/2002 to Feb/2006

The growing concern over the environment, principally related to depollution of rivers, has led some cities to treat their domestic sewage. The material resulting from the sewage treatment stations, called biosolid, is rich in organic matter and nutrient and could be applied to agricultural and forest soils as substitute for or complement to chemical fertilization, as it offers improvements in the physical, chemical and biological properties of the soil. Since it possesses a large quantity of organic matter, the material offers potential for carbon sequestration. The general objective of the proposal is to evaluate the effect of the biosolid applied in a eucalyptus plantation on the stock of carbon and the productivity of the crop, in addition to determining alterations in the quality of the organic matter in the soil. As specific objectives we propose: a) to quantify

the stock of carbon in the soil before the installation of the experiment to ascertain the spatial variability; b) to periodically quantify the stocks of carbon in the soil to ascertain the rate of mineralization of the biosolid; c) to monitor the emission of gases (CO<sub>2</sub> and CH<sub>4</sub>) from the soil and to compare with the rate of mineralization of the soil incorporated with biosolid; d) to calculate the quantity of C remaining from the previous crop and that introduced through the biosolid by means of the use of isotopic techniques which include <sup>13</sup>C; and) to evaluate the primary liquid production of the areas with eucalyptus which received biosolid in comparison with areas without biosolid.

22

### The impact of global changes on the productivity of soybean: comparison between the experimental and simulated results

Durval Dourado Neto

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University of São Paulo (USP)

Process 2001/06395-0

Term: Sep/2001 to Feb/2003

Soybean [*Glycine max* (L.) Merr.] has been an important source of protein for 5,000 years and, since the 1950s, food industries have extracted protein from soybeans to develop varieties of foods and food ingredients. The impacts of global changes, such as the increase in the concentration of CO<sub>2</sub> and/or increase in temperature, will affect the development and growth of soybean. Complex models of simulations are widely used to predict the impact of these changes in agricultural production. Notable among these models, is the Cropgro-Soybean model of simulation and growth, which has been used to predict the potential of the impacts of Climate changes in the growth, development and yield of soybean. However, experiments are necessary to determine the accuracy of the simulated results in relation to the development, growth and yield of the crop in field conditions. The first objective of this study is to compare the data on yield, biomass and foliar area obtained in experiments in environmentally controlled chambers, in the University of Georgia, USA, with the responses based on simulations using the Cropgro-Soybean model and similar climatic data to that used in the experiments. The second objective, based on the comparisons between the simulated and observed data, is to propose improvements in the process of the model to increase the accuracy of the simulated data, in relation to impacts caused by climate change in the production of soybean. The third objective is to compare and analyze the data observed of the root development of the soybean crop in two different concentrations of

CO<sub>2</sub> (400 and 700 ppm) and three different temperatures (20/15 °C, 25/20 °C and 30/25 °C, day/night).

23

### Quantity and quality of organic material in the soil in forest-pasture succession in Rondônia

Carlos Clemente Cerri

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 2000/12189-0

Term: May/2001 to Jun/2003

The general objective of this research is to study the dynamic of organic matter of the soil (SOM) when typical tropical forest vegetation is replaced with pasture vegetation, from the quantitative and qualitative aspects. Parallel indicators, such as the mineralization of organic carbon (C) in aggregates, intact and after their destruction, and the chemical nature of the vegetal residues deposited will also be investigated. To attain this objective, it is intended to carry out the following specific goals: 1) to quantify the stocks of C and nitrogen (N) and evaluate the relative contribution of C derived from pasture in the different fractions of the SOM, based on the natural abundance of <sup>13</sup>C; 2) to determine the alterations in the quality of SOM through the analysis of its different fractions with chemical and spectroscopic techniques; 3) to estimate the rates of deposition and decomposition of litter in the pasture; 4) to evaluate whether there is a difference in the quality of the vegetal residue (litter and roots) in the forest and in the pastures and what is the influence on the quality of the SOM; 5) to evaluate the existence of a possible physical protection mechanism for the organic matter in soil aggregates in the two ecosystems, through the determination of the inter- and intra-aggregated "light fraction" and the mineralization of C with the incubation of intact and destroyed aggregates. An essential condition for the carrying out of this study will be the use of a chronosequence consisting of a forest and three pastures of different ages, in the same class of soil representative of the Amazon basin.

24

### Variation in the chemical and physical properties of the soil and in the organic matter in agroecosystems of Western Amazonia, Amazon region

Eurípedes Malavolta

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 2000/05810-0

Term: Aug/2000 to Jul/2002

The studies will be carried out in three chronosequences (forest-brushwood-cassava, forest-cupuassu plantation with the use of agricultural tools) found in the region of Manaus, located in Western Amazonia. The objective of this work is to ascertain the effect of deforestation on the dynamic of the organic matter and on the chemical and physical properties of the soil, when substituted by two different types of management (introduction of an annual crop, cassava, and another by a perennial crop, cupuassu plantation). The studies will be undertaken in the experimental stations of Embrapa Western Amazonia and in areas of producers in the region.

25

### **Spatial variability of the properties of the soil in the Brazilian Amazon basin under natural vegetation**

Carlos Clemente Cerri

Center for Nuclear Energy in Agriculture  
University of São Paulo (USP)  
Process 2000/02439-0  
Term: Jul/2000 to Jun/2001

The research proposes to study the spatial variability of the soil properties, with emphasis on organic carbon, in the Brazilian Amazon basin under native vegetation. The study of the spatial variability will be carried out starting with the elaboration, harmonization and updating of a database of georeferenced data on the soils of the Amazon basin. After the harmonization of the database (estimate of missing data such as soil density), the carbon contents will be calculated based on results derived from the total sum of the available values up to a meter in depth and from those derived from the use of an exponential model of vertical variability of carbon. The maps of values and of associated errors will be calculated by the combination of the model of vertical variability and geostatistical techniques (this methodology was previously developed and tested in a 334,000 km<sup>2</sup> region of Amazonia).

26

### **Modeling with diffuse daily and hourly radiation: application of a computerized system of solar radiation data (Simras)**

João Francisco Escobedo

Botucatu School of Agronomical Sciences  
São Paulo State University (Unesp)  
Process 1999/01980-0  
Term: Jul/1999 to Dec/2001

The objective of the Project is to carry out an operational test of a computer program developed in the Botucatu solar radiometry station for the treatment of database with solar radiation. As application of the program, we will carry out modeling studies with diffuse solar radiation, verifying existing models and proposing an estimative model for the city of Botucatu, São Paulo. The database to be used in the study consists of the global and diffuse radiations monitored by two methods (difference and ring-shadow) in the period from June 1994 up to the present time.

27

### **Effects of sugarcane harvesting without biomass burning on the dynamic of carbon and properties of the soil**

Christian Leon Feller

Center for Nuclear Energy in Agriculture  
University of São Paulo (USP)  
Process 1998/12648-3  
Term: Jan/1999 to Jun/2001

In the next few years the practice of burning sugar plantations aimed at facilitating harvest operations will be totally eliminated in the state de São Paulo, as established by State Law Decree n° 42.056. With the method of sugarcane harvest without prior burning of the plantation, a large quantity of organic matter from the exposed part of the crop can be maintained in the system, deposited on the soil, and act positively against agents that cause erosion, provide nutrients for the plants and increase the stock of organic matter in the soil, with consequences for the physical, chemical and biological conditions of the soil and on the sequestration of carbon in the system. The objective in this study is to proceed to an evaluation of the contribution of the method of no-burn sugarcane harvest on the sequestration of the organic matter of the soil and the consequences on its principal attributes. Three factors of influence in the parameters of interest will be studied: the time taken to establish the no-burn method of harvest, the type of soil where the crop was established and the management of the crop residue, with reference to the quality and quantity of material deposited on the soil. The first factor will be studied in a commercial plantation established on an eutrophic dusky-red oxisol, forming a chronosequence which varies from one to five years of establishment of this method of harvest. And the factors of type of soils and management of the organic matter will be studied in agronomic trials established in red latosol, podzolic red-yellow and quartz sand.

28

### Root system and its influence on the flux of gases in forest/pasture succession in Brazilian Amazonia

Brigitte Josefine Feigl

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 1998/09642-3

Term: Jan/1999 to Dec/2000

The introduction of pastures into Brazilian Amazonia, after the felling of the native forest, has provoked alterations in the cycling of carbon (C) and in the flux of carbon dioxide (CO<sub>2</sub>) into the atmosphere. It is known that the quantity of CO<sub>2</sub> evolved from the soil is derived principally from the organic matter in the soil (SOM) and from the respiration of the roots. Considering that, for this region, little or nothing is known about the distribution of roots and their interaction with the attributes of the soil (soil-root interfaces), the present study has the main objectives of ascertaining the existing relationships between the root system of pastures and of native forest and some attributes of the soil, such as the density and porosity, the stock of C and consequently the flux of CO<sub>2</sub> into the atmosphere. Admitting that, for these studies, the methodology for the evaluation of the roots is identified as the main limiting factor and that an adequate evaluation of the root system may require the application of different methodologies, producing discrepant results with significant variability, in this work we will use the methods of monolith, needle board and the method assisted by the processing of digital images. Thus, we have additional specific objectives of ascertaining the existing correlations between the respective results for the different methods and to analyze the effects of spatial and temporal variability associated with these results. As fundamental complement, this study also intends to use the technique of computerized tomography for the evaluation of the roots and of the soil-root interface.

29

### Measurement of CO<sub>2</sub> emission in soils through optical absorption spectroscopy

Newton La Scala Júnior

Jaboticabal School of Agrarian and Veterinary Sciences

São Paulo State University (Unesp)

Process 1997/12009-8

Term: Jan/1998 to Dec/1999

In this work we are presenting a plan which aims to determine the concentration of CO<sub>2</sub> emitted by soils using a portable apparatus with sensitivity in detection

of 0.2 parts per million volume (ppmv). The initial characterization will be carried out in soils planted with five different agricultural crops in the region of Jaboticabal, São Paulo, over two years, aiming to determine the variations in levels of CO<sub>2</sub> emitted as a result of factors such as organic activity, temperature, luminosity and crop planted. The publication of this data will complement the knowledge on the global balance of carbon in the biosphere. It is important to point out also that, in addition to the application of the technique of optical absorption in the emission of soil-air CO<sub>2</sub>, the same technique could be used in the characterization of other systems. An example would be the determination of sweating of animals by simultaneous measurement of water vapor and CO<sub>2</sub>, respectively.

30

### Use of remote sensing in the development of models for estimating canopy temperature and the biological production of sugarcane

Hilton Silveira Pinto

Center for Teaching and Research in Agriculture

Campinas State University (Unicamp)

Process 1997/03394-5

Term: Aug/1997 to Dec/2000

Project to be developed with the cultivation of sugarcane in the region of Guariba (SP), aimed at carrying out field work with the aim of modeling canopy temperature, hydric balance and production of biomass with the use of satellite images from the National Oceanic and Atmospheric Administration (NOAA) series. We will undertake complementary studies to determine surface emissivity and atmospheric correction.

31

### Classification and monitoring of vegetation through NOAA-AVHRR images

Yosio Edemir Shimabukuro

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 1997/01344-0

Term: Jun/1997 to Nov/1998

Knowledge of phenological variations in vegetal cover is today an indispensable aspect for the planning of a coherent and efficient policy of sustainable development, as well as for the understanding and objective evaluation of the co-existence of different ecosystems whether natural, semi natural, agricultural or industrial. The analysis of these variations at regional level and the interconnection with the different components of the geographical environment (climate, soil, relief,

geology, etc.) are part of the necessary information for the understanding of the functioning of ecosystems on a global scale. The monitoring of these variations at regional and global level, today, is only possible due to the development attained in the last 15 years by techniques such as: remote sensing, geoprocessing, satellite global positioning systems, among others. The objective of this project is to undertake the classification and monitoring of the ecosystems of the Center-West region do Brazil (state of Mato Grosso) using a multi-temporal series of images from the Advanced Very High Resolution Radiometer (AVHRR) sensor on board the National Oceanographic and Atmospheric Administration (NOAA-11) satellite in High Resolution Picture Transmission (HRPT) format. Notable among the principal aspects of the methodology is the generation and analysis of the fraction images (vegetation, soil and shade) derived from the linear model of spectral mixture applied to the AVHRR images. Among the principal results that should be obtained are the classification of the vegetation of the area study and its seasonal variations, based on the analysis of the Normalized Difference Vegetation Index (NDVI) and of the fraction images (vegetation, soil and shade) derived from the AVHRR images for the period of September 1992 to August 1994.

32

### **Remote sensing for integrated analysis of the vegetation with elements of the physical environment and distribution of phytomass in contact areas of the forest and open countryside in Roraima**

João Roberto dos Santos

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 1997/00943-8

Term: Nov/1997 to Oct/1998

Amazonia, suffering the impact of accelerated occupation in these last decades, plays an important role in the global climate system, in addition to figuring as a scientific priority in the scenario of global changes. Remote sensing at orbital level, as an auxiliary tool of acquisition of information, has permitted a continuous monitoring of the region. In the context of methodological advances, the present research has the general objective, making use of images from optical sensors and from radar, to establish an integrated analysis of the vegetation with elements of the physical environment and to ascertain the spatial distribution of the phytomass, taking as its area of study the contact areas of forest and open country in Roraima.

33

### **Modifications in soil properties caused by deforestation and cultivation in different Brazilian bioclimatic systems**

Carlos Roberto Espindola

School of Agricultural Engineering

Campinas State University (Unicamp)

Process 1995/04453-0

Term: Mar/1996 to Feb/1997

The Brazilian vegetal cover has suffered appreciable modifications, for some time now, due to successive human interventions. Important ecosystems such as the Atlantic Rainforest, the Amazon forest and the Cerrado, have been losing a good deal of their original covers, with deforestation, making room predominantly for cattle farming activities. It is predictable that the effects of different covers, their removal and cultivation transmit to the soil different effects and problems. In this sense the objective is to evaluate the impacts deriving from the removal of the original covers and their subsequent agricultural use, selecting, for this purpose, different Brazilian bioclimatic regions, such as mentioned above and taking as the primary attributes of analysis the evolution of organic material linked to the modifications to the structure/aggregation of the soils.

34

### **Geostatistics applied to soils in Amazonia: case of forest-pasture succession in Rondônia**

Carlos Clemente Cerri

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 1995/01451-6

Term: Aug/1995 to Jan/1998

The spatial variability of nutrients, principally for carbon, nitrogen and phosphorus, and of some physical-chemical properties of the soil will be studied in the case of a forest-pasture succession in Rondônia. We will use different experimental sampling patterns standards varying from one hundred square meters to dozens of square kilometers for the collection of data. The data will be analyzed by geostatic and statistical treatment in order to obtain a methodology to improve the estimates of stocks of nutrients in the soil and also ideal sampling patterns.

35

### **Study of the relationship between photosynthetically active radiation absorbed with production of phytomass and yield of grain for the cultivation of wheat under different conditions of hydric stress**



Rubens Angulo Filho

Luiz de Queiroz Advanced School of Agriculture

University of São Paulo (USP)

Process 1994/06157-6

Term: May/1995 to Dec/1996

The objective of this research is to study the relationships between absorbed photosynthetic active radiation (APAR) with the production of phytomass and yield of grains for the cultivation of wheat under different conditions of hydric stress. To this end, a field experiment will be set up, in which we will collect radiometric measurements, parameters relative to the soil, to the cultivation and meteorological parameters, during the entire cycle of the wheat cultivation. It is hoped, at the end, to find a correlation between phytomass and APAR, production of grains and APAR and the influence of hydric stress on APAR, phytomass and the production of grains.

36

### Spectral characterization of stresses related to water and nutritional deficiencies in *Eucalyptus grandis* seedlings

Flávio Jorge Ponzoni

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 1994/02780-0

Term: Jan/1995 to Dec/1996

The application of remote sensing techniques in the study and /or evaluation of stresses in vegetation presupposes the knowledge of their effects on the interaction between electromagnetic radiation and the stressed vegetation itself. This knowledge can be acquired by the spectral characterization of these effects, through the analysis of the spectral reflectance of leave, plants and canopies. The objective of this study is to spectrally characterize (between 400 nm and 1.100 nm) the effects of stress related to hydric and nutritional deficiencies in seedlings and in plantations of *Eucalyptus grandis* and evaluate the consequences of this characterization on the application of remote sensing techniques in the study and in the monitoring of these stresses.

37

### Studies of forest areas in regeneration through Landsat images

Getúlio Teixeira Batista

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 1994/02706-5

Term: Sep/1994 to Sep/1996

The change in the use of land involving the conversion of forest into pasture or other agricultural uses implies the emission of greenhouse effect gases, principally CO<sub>2</sub> into the atmosphere. Areas in the process of regeneration contribute to the sequestration of part of the CO<sub>2</sub> by means of the process of photosynthesis. Knowledge of the carbon balance of Amazonia is fairly precarious and we do not know the area and rates of incorporation of carbon for areas in regeneration. This project is aimed at characterizing areas of secondary forest, i.e. areas previously occupied by forest, which were cleared, subsequently abandoned and are currently in the process of regeneration. This project ties in with the long term objective of understanding the contribution of the regrowth of the forest on the carbon balance in the Amazon region. The project will explore the integrated use of several techniques, including the use of satellite images of remote sensing (Landsat), geoprocessing through geographical information systems, geographical positioning by satellite using the Global Positioning System (GPS) and field work to characterize the parameters of the vegetation, including floristic inventory, inventory of volume aimed at estimating biomass through allometric equations and the spectral characterization of areas of regrowth. The results expected from this experiment include the definition of the classes of regrowth characterizable through the satellite data (e.g. areas in regeneration from zero to two years and less than five, areas with more than five years and less than 10 and areas in regeneration with more than 10 years) with calibration of the accuracy obtained by the field verification and the evaluation of the methodology to be tested in other areas aiming, in the future, at a regional estimate of the areas of regrowth and their contribution to the carbon balance in Brazilian Legal Amazonia.

38

### Effect of the use of land on the dynamic of carbon and nitrogen in the soil in the region of Ariquemes, Rondônia (RO): use of a geographical computerized system

Carlos Clemente Cerri

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 1992/00636-4

Term: May/1992 to Apr/1994

Alterations in land use have caused changes in the dynamic of carbon and nitrogen in the soil. Recent studies on organic matter in the soil in pastures in Manaus, MA, indicate that the levels of C can increase after an initial decline (CHONÉ et al., 1987). Also the rate of cycling of N is significantly modified by the elimination

of the natural vegetation. Understanding of the complexity of these processes and their interrelation with the properties of the soil, vegetation, relief and climate, require the use of techniques which enable the manipulation of a large array of information, which today is possible with geoprocessing. The objective of this work is to study the relationships between the changes in land use in a tropical ecosystem and its consequences in the dynamic of C and N, under conditions of native forest and pasture, in the region of Ariquemes (RO). A geographical information system will be developed integrating field data, digitalized maps of the soil, relief, drainage and information from remote sensing.

#### BIOTA-FAPESP PROGRAM

39

#### Distribution of the community of palm trees in the altitudinal gradient of the Atlantic Rainforest in the northeast of the State of São Paulo

Simey Thury Vieira Fisch

Pro-Rectorcy of Research and Post-graduation / University of Taubaté (Unitau)

Process 2001/06023-5

Term: Apr/2002 to Mar/2005

Although the Atlantic Rainforest is better preserved in mountainous areas, the alterations which the altitudinal gradient provokes in the vegetation has received little attention in studies carried out on this bioma. Elevation has been indicated as the cause of the decline in the diversity of palms and for the abundance of one or few species in intermediary altitudes. Based on these premises, this project has the principal aim of correlating the occurrence of palm trees with the altitude factor in the Atlantic Rainforest of the northeast of the State of São Paulo. The studies will be developed in the Conservation Units of the Serra do Mar State Park (Picinguaba Nucleus, Santa Virgínia Nucleus/Natividade da Serra and Bananal Ecological Station), the Forest formations of which occur at altitudes which vary from 0 to 1900 m. In these localities, samples will be taken at every 200 m of altitude (0 m – sea level, 200, 400, 600, 800, ~940, 1200, 1400 and ~1600 m). Morphometric evaluations will be carried out, existing palm trees collected and the physical medium of each sample unit will be characterized. The project will have a multidisciplinary team from the University of Taubaté (academics and teachers) and the collaboration of researchers from the following research institutions: Forestry Institute, Botanical Institute (SP), Prof. Mello Leitão Museum (ES), Botanical Gardens Institute of Rio de Janeiro (RJ).

40

#### Physiognomic-ecological units associated with remnants of natural vegetal cover

João Batista Baitello

Forestry Institute / Ministry of State for the Environmental (SMA-SP)

Process 1999/12329-8

Term: Feb/2001 to Jun/2003

Georeferenced maps will be drawn containing the potential vegetation according to the physiognomic-ecological units (types of vegetation) developed by the RADAMBRASIL project. This survey will be associated with the *São Paulo Forestry Inventory* (1993) developed on the scale 1:50.000, with the mapping and quantification of the remaining natural vegetation and the states of forest cultivation (reforestation), correctly updated using recent orbital images. The phytophysiognomies considered in that opportunity (forest, scrub, wooded savanna, barren land, enclosed countryside, open countryside, cultivated plains, mangrove and sandbank), will be detailed within the concept of the physiognomical-ecological units of the aforementioned Project. In the case of the cultivated forests, it will be possible to undertake studies on the implantation of these forests in spaces previously occupied by natural ecosystems. The updating of the survey of the natural vegetation, based on the *São Paulo Forestry Inventory* (1993) and the elaboration of the respective georeferenced digital base, are already objectives of the Biota-FAPESP Program, specifically FAPESP Project 98/05251-0 (*Viability of Conservation of Remaining Fragments of Cerrado in São Paulo*) and FAPESP 98/05117-1 (*Development of an Environmental Information System for the Biota-FAPESP Program*).

#### GRANTS

#### RESEARCH ABROAD

1

#### Appraisal of knowledge relative to the changes in land use in Amazonia and the consequences on the global carbon cycle

Grant holder: Carlos Clemente Cerri

Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)

Institution abroad: Ohio State University, EUA

Process 1998/05557-1

**POST-DOCTORATE****2****Development of methodology for the analysis of carbon in soil samples using near-infrared spectroscopy**

Grant holder: Sandra Maria Oliveira Sá  
 Supervisor: Carlos Clemente Cerri  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 2003/13742-3

**3****Impact of global changes on the productivity of soybean: comparison between the experimental and simulated results**

Grant holder: Alexandre Bryan Heinemann  
 Supervisor: Durval Dourado Neto  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 2001/00693-9

**4****Quantity and quality of organic matter in the soil in forest-pasture succession in Rondônia**

Grant holder: Maria da Conceição Santana Carvalho  
 Supervisor: Adolpho José Melfi  
 Institution: Pro-Rectory of Research /  
 University of São Paulo (USP)  
 Process 1999/12165-5

**5****Distribution and biogeochemistry of inorganic compounds associated with the conversion of forest into pasture in Rondônia, using multi-elemental analyses**

Grant holder: Uwe Heinz Willi Herpin  
 Supervisor: Carlos Clemente Cerri  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 1999/03098-2

**6****Evaluation of different recuperation strategies of area degraded by mining in the Amazon forest, Rondônia, using the system of geographical information (SIG) and analyses of the soil/substrate and water**

Grant holder: Regina Márcia Longo  
 Institution: Jaboticabal School of Agrarian and Veterinary

Sciences / São Paulo State University (Unesp)  
 Process 1998/13265-0

**7****Spatial variability of the soil properties in the Brazilian Amazon basin under native vegetation and after changes in land use**

Grant holder: Martial Michel Yoric Bernoux  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 1998/10499-0

**8****Root system and its influence on the flux of gases in the forest-pasture succession in the Brazilian Amazon**

Grant holder: Lorival Fante Júnior  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 1997/13198-9

**DOCTORATE****9****Crop-cattle farming integration in the south-west of Amazonia and Goiás: impacts on organic matter in the soil and on the flux of greenhouse effect gases**

Grant holder: João Luís Nunes Carvalho  
 Supervisor: Carlos Clemente Cerri  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 2006/07110-2

**10****Carbon sequestration in reforestation associated with species of Atlantic Rainforest in Botucatu, São Paulo**

Grant holder: Lauro Rodrigues Nogueira Júnior  
 Supervisor: José Leonardo de Moraes Gonçalves  
 Institution: Luiz de Queiroz Advanced School of Agriculture /  
 University of São Paulo (USP)  
 Process 2006/06315-0

**11****CDM forestry projects: potential for carbon sequestration in the soil-litter system in area of reforestation with eucalyptus**

Grant holder: Cindy Silva Moreira Iglesias  
 Supervisor: Carlos Clemente Cerri

Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 2006/06073-6

## 12 Relationship between climatic variables and types of symptoms caused by *Guignardia citricarpa* in citric fruits

Grant holder: Márcia de Holanda Nozaki  
Supervisor: Antônio de Goes  
Institution: Jaboticabal School of Agrarian and Veterinary  
Sciences / São Paulo State University (Unesp)  
Process 2003/06302-7

## 13 Studies of the mechanisms of hydrological flux and influence of the change of land use in eastern Amazonia, Paragominas, Pará

Grant holder: Azeneth Eufrausino Schuler  
Supervisor: Reynaldo Luiz Victoria  
Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 1999/07648-7

## 14 Influence of the management of straw in the decomposition process of crop debris resulting from the no-burn sugarcane harvesting system

Grant holder: Dinailson Correa de Campos  
Supervisor: Carlos Clemente Cerri  
Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 1998/15927-0

## 15 Effects of the no-burn harvesting of sugarcane on the dynamic of carbon and soil properties

Grant holder: Edgar Fernando de Luca  
Supervisor: Carlos Clemente Cerri  
Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 1998/13281-6

## 16 Software for simulation of daily climatic series based on the dynamic parameterization of the distributions of probability with the retro-feeding of data

Grant holder: Jorim Sousa das Virgens Filho  
Supervisor: Angelo Cataneo  
Institution: Botucatu School of Agronomical Sciences /  
São Paulo State University (Unesp)  
Process 1997/14320-2

## 17 Geostatistics applied to soils in Amazonia: case of a forest-pasture succession in Rondônia

Grant holder: Martial Michel Yorice Bernoux  
Supervisor: Carlos Clemente Cerri  
Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 1994/06046-0

## 18 Effect of land use on the carbon and nitrogen dynamic in the soil of the region of Ariquemes, Rondônia: use of a geographic information system

Grant holder: Jener Fernando Leite de Moraes  
Supervisor: Carlos Clemente Cerri  
Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 1992/00635-8

### MASTERS

## 19 Response of photosynthesis to variation of temperature in the root system of Valencia-orange

Grant holder: José Rodrigues Magalhães Filho  
Supervisor: Eduardo Caruso Machado  
Institution: Campinas Institute of Agronomy / São Paulo State  
Ministry of Agriculture and Supplies  
Process 2007/53520-0

## 20 Fixation of carbon in soils in a native forest and in eucalyptus plantations

Grant holder: Ana Maria Martins Rufino  
Supervisor: Irae Amaral Guerrini  
Institution: Botucatu School of Agronomical Sciences /  
São Paulo State University (Unesp)  
Process 2006/59254-8

21

**Physiological and sanitary qualities of castor-oil seeds (*Ricinus communis* L.) in relation to climatic conditions and type of harvest**

Grant holder: Sheila Fanan  
 Supervisor: Marcelo Bento Paes de Camargo  
 Institution: Campinas Institute of Agronomy / São Paulo State Ministry of Agriculture and Supplies  
 Process 2006/54614-6

22

**Relationship of soil-water-vegetation in a toposequence located in the Assis Ecological Station, São Paulo**

Grant holder: Carlos Eduardo Pinto Juhasz  
 Supervisor: Miguel Cooper  
 Institution: Luiz de Queiroz Advanced School of Agriculture / University of São Paulo (USP)  
 Process 2004/04799-4

23

**Variation and quantification of soils determined by orbital and terrestrial sensors**

Grant holder: José Geraldo de Abreu Sousa Júnior  
 Supervisor: José Alexandre Melo Dematte  
 Institution: Luiz de Queiroz Advanced School of Agriculture / University of São Paulo (USP)  
 Process 2004/04728-0

24

**Luminous relationships, architecture and assimilation of carbon by canopies of xaraes grass [*Brachiaria brizantha* (hochst ex a. Richi.) Stapf] in response to grazing strategies, under intermittent occupation**

Grant holder: Bruno Carneiro and Pedreira  
 Supervisor: Carlos Guilherme Silveira Pedreira  
 Institution: Luiz de Queiroz Advanced School of Agriculture / University of São Paulo (USP)  
 Process 2004/04717-8

25

**Decomposition of crop residues and emission of greenhouse effect gases in soil management systems in Ponta Grossa, Paraná**

Grant holder: Mariana Addison Pavei  
 Supervisor: Marisa de Cássia Piccolo  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2003/04582-2

## SCIENTIFIC INITIATION

26

**Base-temperature, thermal units of growth and effects of meteorological variables on the productivity of peanut cultivation (*Arachis hypogaeae* L.)**

Grant holder: Nilceu Piffer Cardozo  
 Supervisor: Clóvis Alberto Volpe  
 Institution: Jaboticabal School of Agrarian and Veterinary Sciences / São Paulo State University (Unesp)  
 Process 2006/60284-9

27

**CO<sub>2</sub> emission in a latosol deprived of vegetation and its relationship with characteristics linked to CO<sub>2</sub> production and transport in soils**

Grant holder: Daniel de Bortoli Teixeira  
 Supervisor: Newton La Scala Júnior  
 Institution: Jaboticabal School of Agrarian and Veterinary Sciences / São Paulo State University (Unesp)  
 Process 2006/57777-3

28

**Variational analysis of hourly long wave radiation**

Grant holder: Thomas José Justo Miorini  
 Supervisor: João Francisco Escobedo  
 Institution: Botucatu School of Agronomical Sciences / São Paulo State University (Unesp)  
 Process 2006/57525-4

29

**UV, Par and IV solar fractions on the earth surface: temporal series of the average monthly hours and Liu and Jordan estimated equations**

Grant holder: Felipe Luís Petrini  
 Supervisor: João Francisco Escobedo  
 Institution: Botucatu School of Agronomical Sciences / São Paulo State University (Unesp)  
 Process 2006/52839-0

30

**Correlations of ultraviolet, photosynthetically active and infrared radiations with global radiation on the earth's surface**

Grant holder: Erick Roberto Peterlevitz  
 Supervisor: João Francisco Escobedo  
 Institution: Botucatu School of Agronomical Sciences /

São Paulo State University (Unesp)  
Process 2005/51477-5

### **31 Long wave atmospheric radiation: daily and annual temporal series**

Grant holder: Carlos Roberto Furlan Júnior  
Supervisor: João Francisco Escobedo  
Institution: Botucatu School of Agronomical Sciences /  
São Paulo State University (Unesp)  
Process 2004/10765-5

### **32 Determination of CO<sub>2</sub> emission from the soil after scarification of agricultural areas**

Grant holder: Luís Gustavo Teixeira  
Supervisor: Newton La Scala Júnior  
Institution: Jaboticabal School of Agrarian and Veterinary  
Sciences / São Paulo State University (Unesp)  
Process 2004/06698-0

### **33 Determination of attenuation of direct radiation**

Grant holder: Luciana Mara Gonçalves Telles  
Supervisor: João Francisco Escobedo  
Institution: Botucatu School of Agronomical Sciences /  
São Paulo State University (Unesp)  
Process 2003/10851-6

### **34 Estimating models of direct radiation in the incidence and horizontal from global radiation**

Grant holder: Priscila de Oliveira  
Supervisor: João Francisco Escobedo  
Institution: Botucatu School of Agronomical Sciences /  
São Paulo State University (Unesp)  
Process 2003/10467-1

### **35 Anisotropic correction factor for diffuse solar radiation measured by shadow ring**

Grant holder: André Tadeu Gasparoto  
Supervisor: João Francisco Escobedo  
Institution: Botucatu School of Agronomical Sciences /  
São Paulo State University (Unesp)  
Process 2003/09151-0

### **36 Evaluation of microbial biomass of the soil and of the root system in pasture under agricultural management in Rondônia**

Grant holder: Vitor Drummond Sampaio Corrêa Mariani  
Supervisor: Marisa de Cássia Piccolo  
Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 2003/07033-0

### **37 Characteristics and modeling of forest combustible materials**

Grant holder: Ana Cristina Silva Amoroso Anastácio  
Supervisor: Paulo Torres Fenner  
Institution: Botucatu School of Agronomical Sciences /  
São Paulo State University (Unesp)  
Process 2000/08933-6

### **38 Evaporation of surface of free water: comparison of automatic and conventional measurement systems, types of evaporimeter and relationships of measurements with climatic elements**

Grant holder: Fábio Schwingel  
Supervisor: Luiz Roberto Angelocci  
Institution: Luiz de Queiroz Advanced School of Agriculture /  
University of São Paulo (USP)  
Process 1999/05541-0

### **39 Appraisal of a data information system for solar radiation: modeling of direct and diffuse global radiations on sloping surfaces**

Grant holder: André Stefanini Jim  
Supervisor: João Francisco Escobedo  
Institution: Botucatu School of Agronomical Sciences /  
São Paulo State University (Unesp)  
Process 1999/01011-7

### **40 Alteration in the cycle of nitrogen, carbon and phosphorus resulting from changes in land use in the Brazilian Amazon basin**

Grant holder: Andrea Varsone  
Supervisor: Marisa de Cássia Piccolo  
Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 1998/07445-6

**41** Use of thermal amplitude for adjustment of Thornthwaite equation for estimating potential or reference evapotranspiration, in arid climate conditions

Grant holder: Fábio Ricardo Marin

Supervisor: Ângelo Paes de Camargo

Institution: Campinas Institute of Agronomy / São Paulo State  
Ministry of Agriculture and Supplies

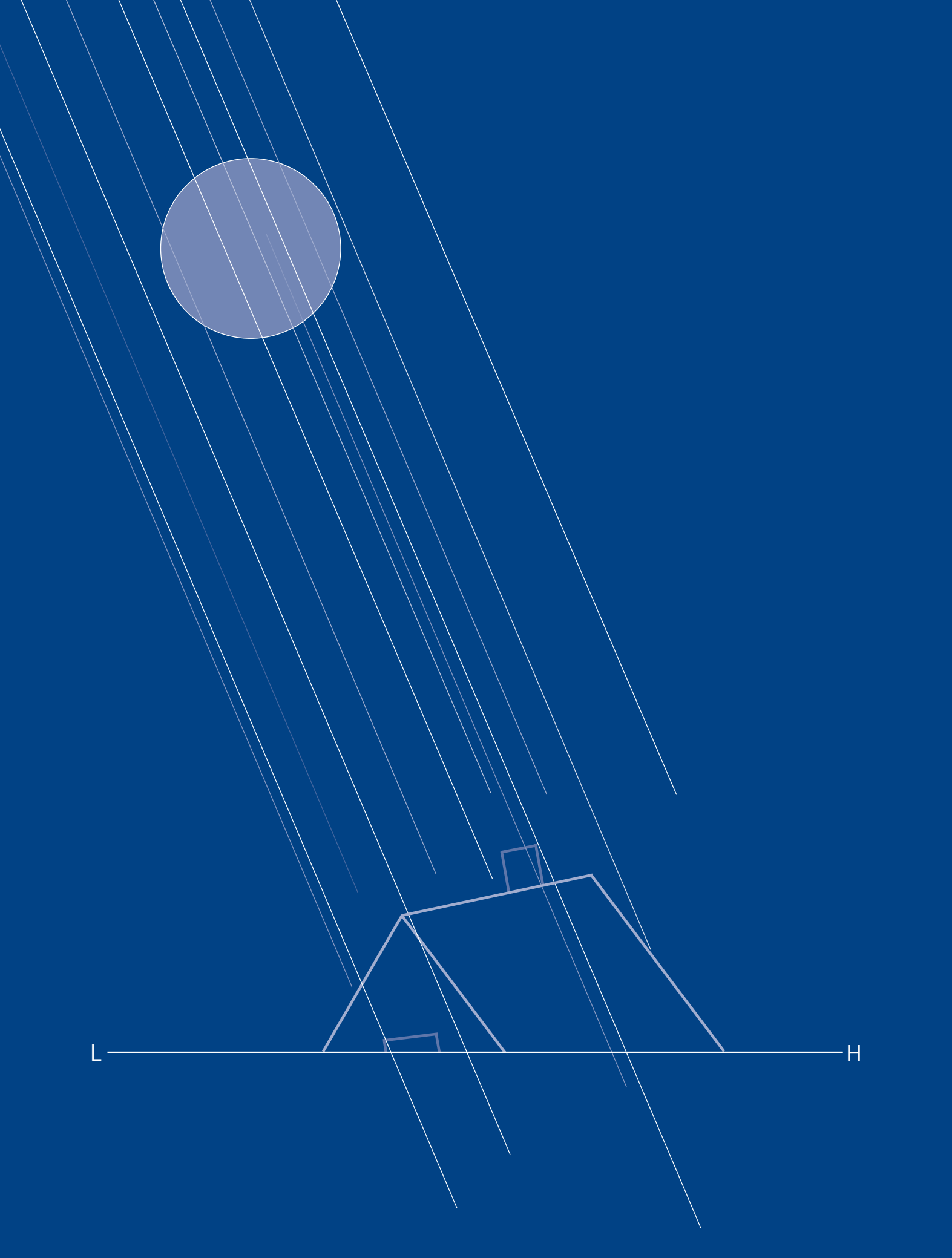
Process 1996/09724-4





# Architecture and Urbanism





## SUPPORT FOR REGULAR RESEARCH

1

### Urban climate computational modeling for medium-size Brazilian cities

João Roberto Gomes de Faria

Bauru School of Architecture, Arts and Communication /  
São Paulo State University (Unesp)

Process 2007/08097-2

Term: Mar/2008 to Feb/2010

This research gives the continuity to the previous works developed by this professor in the periods from 1995 to 1997, from 2001 to 2003 and in 2005. In the first one the winds field in the urban-canopy layer was studied; in the second one the possibility of relating air temperatures data in the urban-canopy layer with attributes of homogeneous areas classified by GIS from a satellite set of images was analyzed; in the last one a model of one-dimensional energy balance for local scale was elaborated, with a surface base assembled by GIS. In this aspect, the urban climate is studied in an evolutionary way, where each new work tries better explain the relations between it and the urban morphology. The aim of the present research is to incorporate to the previous studies the results of recent works, raised from bibliography. More specifically, the aim is to improve the performance of the previously generated model by incorporating surface data from satellite images treated with techniques of multi-spectral analysis and parameters obtained from relations between city morphologic standards and the respective locally modified climates. The expectative is to generate a model with a friendly interface, a set of input data easily obtained, and the establishment of a routine for use of the model together with satellite images and a SIG, with the final objective of to facilitate its use for not academic people.

2

### Characterization of the intra-urban thermal field based on homogeneous areas

João Roberto Gomes de Faria

Bauru School of Architecture, Arts and Communication /  
São Paulo State University (Unesp)

Process 2001/08125-0

Term: Nov/2001 to Oct/2003

In this research we will investigate the possibility of using areas that are homogeneous in terms of their parameters of urbanization to simplify the characterization of intra-urban thermal fields. The urban area of the city of Bauru, São Paulo, the object of the research, will initially be characterized according to urbanistic indices. Subsequently, it will be divided into homogeneous

regions according to those indices, and within these, surveys of temperature and air humidity will be carried out, taking as reference data for these variables measured in a weather station, located outside the urban area. The results of the measurements taken in areas with urban characteristics will be compared, to verify the validity of the proposed method. The positive evaluation of the method will mean a substantial saving in the thermal characterization of the urban environment, which could be inferred based on its structure of use and occupation of the ground.

## BIOTA-FAPESP PROGRAM

3

### Environmental atlas of the municipality of São Paulo: phase 1 – diagnosis and bases for the definition of public policies on green areas in the municipality of São Paulo

Harmi Takiya

Municipal Ministry for Green Affairs and the Environment  
Processo 1999/10955-9

Term: Sep/2000 to Jul/2002

Entitled *Diagnoses and bases for the definition of public policies on green areas in the municipality of São Paulo*, the present project constitutes the first phase of the Environmental Atlas of the Municipality of São Paulo, a cartographic product of the Environmental Information System, to be implanted in the São Paulo Town Hall, in the medium term. It is intended, through the time-honored techniques of cartography, remote sensing and geographical information system, to obtain a diagnosis for the entire municipality, on a regional scale, of the existing vegetal covering associated with socio-economic aspects, of the use and occupation of the land, and the characteristics of the physical environment, with detailing of areas of greatest interest, with the aim of supporting public policies for the expansion and conservation of green areas. By way of product it is hoped to obtain a set of thematic maps and explanatory text, associated with the database in digital form.

## GRANTS

### RESEARCH ABROAD

1

### Cartographic analysis of the urban climate: considerations of method

Grant-holder: Magda Adelaide Lombardo

Institution: Rio Claro Institute of Geosciences and Exact

Sciences / São Paulo State University (Unesp)  
 Institution abroad: Universität Gesamthochschule Kassel,  
 Germany  
 Process 1997/00599-5

## POST-DOCTORATE

2

**Socio-environmental vulnerability in the São Paulo metropolis: an analysis of the situations of spatial superposition of problems and social and environmental risks through indicators**

Grant-holder: Humberto Prates da Fonseca Alves  
 Supervisor: Antônio Miguel Vieira Monteiro  
 Institution: Brazilian Center for Analysis and Planning (Cebrap)  
 Process 2004/02457-9

## DOCTORATE

3

**The use of passive systems in coverings as a tool to aid energy efficiency in buildings**

Grant-holder: Carla Fernanda Barbosa Teixeira  
 Supervisor: Lucila Chebel Labaki  
 Institution: School of Civil Engineering , Architecture and Urbanism / Campinas State University (Unicamp)  
 Process 2007/08221-5

4

**Spatial urban interactions and environmental needs: bases for the incorporation of thermal, luminous and energy phenomena in urban planning**

Grant-holder: Rafael Silva Brandão  
 Supervisor: Márcia Peinado Alucci  
 Institution: School of Architecture and Urbanism / University of São Paulo (USP)  
 Process 2005/02568-8

## DIRECT DOCTORATE

5

**Predictive modeling of thermal comfort: quantification of relationships between microclimatic variables and of thermal sensation for evaluation and design of urban spaces in the city of São Paulo**

Grant-holder: Leonardo Marques Monteiro  
 Supervisor: Márcia Peinado Alucci

Institution: School of Architecture and Urbanism / University of São Paulo (USP)  
 Process 2006/53148-1

## MASTERS

6

**Climate and urban environmental quality in the municipality of Ribeirão Preto: an aid to the elaboration of public policies in medium sized cities**

Grant-holder: Danúbia Caporusso  
 Supervisor: Magda Adelaide Lombardo  
 Institution: Institute of Geosciences and Exact Sciences / São Paulo State University (Unesp)  
 Process 2007/06396-2

7

**Analysis of the characteristics of the urban thermal field in small and medium sized cities: a methodological proposal**

Grant-holder: Joyce Lima de Sousa  
 Supervisor: Magda Adelaide Lombardo  
 Institution: Rio Claro Institute of Geosciences and Exact Sciences / São Paulo State University (Unesp)  
 Process 2005/04250-5

8

**Application of method of bioclimatic analysis as a tool for intervention in historic centers: case studies in the Ribeira neighborhood in Natal, Rio Grande do Norte**

Grant-holder: Bianca Carla Dantas de Araújo  
 Supervisor: Rosana Maria Caram de Assis  
 Institution: São Carlos School of Engineering / University of São Paulo (USP)  
 Process 2002/11470-3

## SCIENTIFIC INITIATION

9

**Estimate of carbon storage in ipê trees (*Tabebuia impetiginosa*) in the Parque do Povo in Presidente Prudente, São Paulo**

Grant-holder: Tatiane Carvalho da Silva  
 Supervisor: José Tadeu Garcia Tommaselli  
 Institution: Presidente Prudente School of Science and Technology / São Paulo State University (Unesp)  
 Process 2006/03927-4

**10** Use of techniques of geo-processing  
and remote sensing in the study  
of urban heat islands in the metropolitan  
region of São Paulo

Grant-holder: Juliano César Rodrigues Vale

Supervisor: Magda Adelaide Lombardo

Institution: Institute of Geosciences and Exact

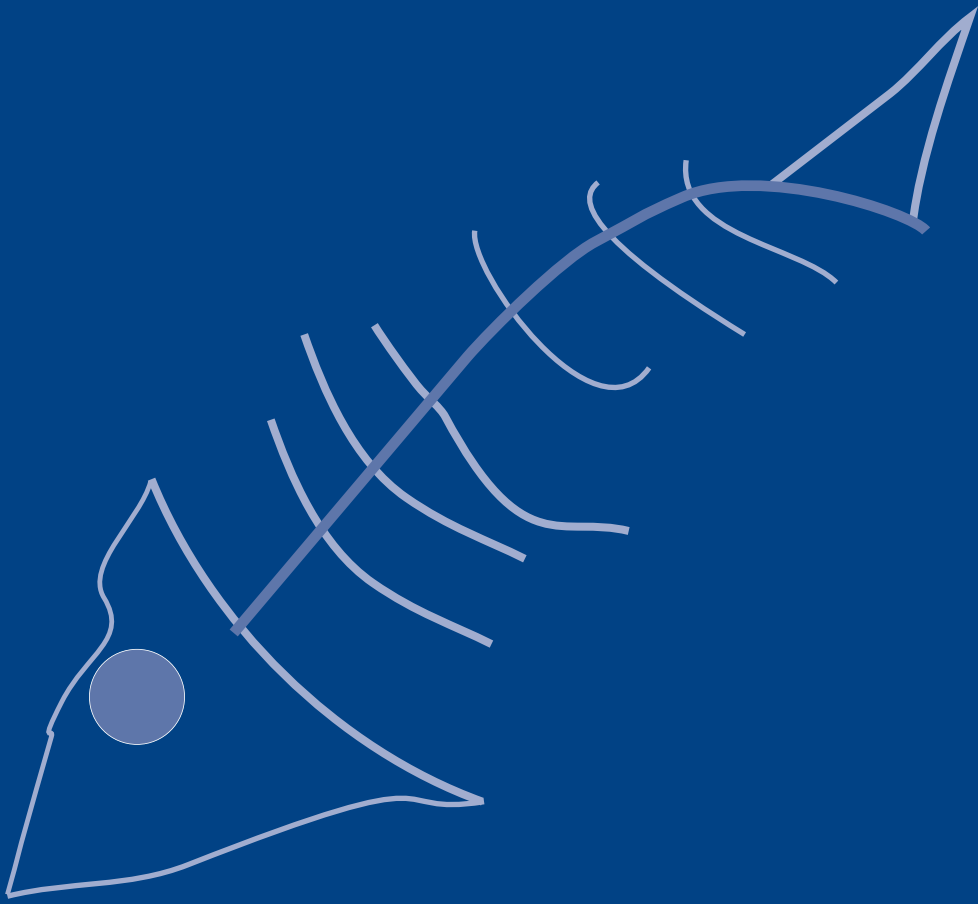
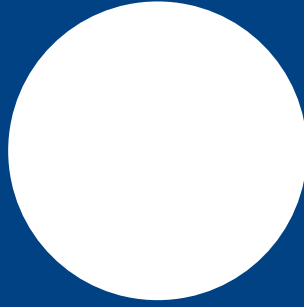
Sciences of Rio Claro / São Paulo State University (Unesp)

Process 2002/00637-4



# Biologies







## THEMATIC PROJECTS

1

### The role of Amazonian fluvial systems in regional and global carbon cycles: CO<sub>2</sub> evasion and land-water interactions

Reynaldo Luiz Victoria  
Center for Nuclear Energy in Agriculture  
University of São Paulo (USP)  
Process 2003/13172-2  
Term: Oct/2004 to Jan/2009

The humid tropics play an important but ambiguous role in the global carbon cycle. While deforestation has been estimated to release about 1.6 Gt C y<sup>-1</sup> (HOUGHTON, 2000), mature Amazon rainforests appear to sequester carbon (act as a sink), but of an uncertain magnitude. Current estimates of sequestration have wide variation between different types of measurements, 1,3 MgC/hectares/year based on the accumulation of biomass and soils (PHILLIPS *et al.*, 1998; CHAMBERS *et al.*, 2001; TRUMBORE, 2000) to 1.0 to > 5.9 MgC/hectares/year based on eddy covariance measurements (FAN *et al.* 1990; GRACE *et al.* 1995; MALHI *et al.* 1998). However, recent calculations from global atmospheric inverse modeling imply that the net carbon exchange of the tropics with the atmosphere is about zero (SCHIMMEL *et al.* 2001). Discrepancies between these estimates of carbon sequestration rates may be due in part to methodological issues and integration times of methods. However, it is also possible that at least part of the carbon fixed in the upland could be “exported” in fluxes not yet quantified. In fact, preliminary results (RICHEY *et al.*, 2002) show that evasive fluxes of CO<sub>2</sub> from aquatic systems of the Amazon can account for as much as the lower estimate of carbon sequestration by “terra firme” forests in the central part of the basin. In this project we hypothesize that “CO<sub>2</sub> evasion returns as much carbon to the atmosphere as is sequestered in upland forests on an interannual basis and the export of organic material from upland forests to fluvial environments is the primary source of carbon that is eventually respired in rivers and evaded as CO<sub>2</sub>”. To test it, we intend to: 1) conduct fieldwork in characteristic sub basins to obtain an extensive suite of pCO<sub>2</sub> distribution measurements over the hydrologic regime; 2) use proven geochemical techniques (gas flux measurements, isotopic tracers, demineralization rates) to quantify the rates of the lateral transfer and cycling of water and bioactive organic matter from the land, through riparian environments and to the river system and; 3) use a terrestrial source/river transport and reaction model to synthesize and extrapolate the site-specific CO<sub>2</sub> evasion rate measurements to a basin-wide estimate of CO<sub>2</sub> evasion rate. This project consolidates and

extends the scientific and educational activities of this group in fluvial systems of the Amazon, started 20 years ago with a successful cooperation between Center for Nuclear Energy in Agriculture, Instituto Nacional de Pesquisas da Amazonia and University of Washington, Seattle, USA, and which was followed by the thematic project *Changes in organic matter dynamics in micro and meso-scale rivers of Rondônia, as a function of changes in land cover*. Its feasibility is also assured by various cooperation within LBA (NASA), with the University of Washington and the Marine Biological Laboratory (Woods Hole, MA, USA) and within the Millennium Institute (CNPq), with several research institutions in the Amazon.

2

### Alterations in the dynamic of organic matter in micro and meso scale rivers in the state of Rondônia, resulting from changes in land use

Reynaldo Luiz Victoria  
Center for Nuclear Energy in Agriculture (Cena)  
University of São Paulo (USP)  
Process 1999/01159-4  
Term: Mar/2000 to Apr/2004

Little is known about the biogeochemistry of small and medium sized rivers in the Amazon basin. Still less is known about the possible alterations due to replacement of forests with pastures, which is the most common change observed in the ground cover. This being so, the main objective of this proposal is to discover how the conversion of forests into pastures alters the distribution of carbon and nutrients (nitrogen and phosphorus), the primary production and its limiting factors and the biodiversity in small and medium sized tropical rivers. Based on this objective, the main questions to be answered in this project will be: question 1) How the composition and quantity of organic matter and nutrients that enter and are processed in a river are altered when the forest is replaced with pasture? Question 2) How the primary production and its limiting factors are altered when forest is replaced with pasture and what is the role of this alteration in the dynamic of the organic matter? Question 3) How the fauna of benthonic macroinvertebrates in small rivers is altered when the forest is replaced with pasture? Question 4) What are the identifiable and persistent changes in the stocks and fluxes of organic matter, nutrients and associated elements, as they continue to evolve in the direction of successively larger basins, in relation to the changes in use and cover of the soil? To respond to these questions we propose the comparison of basins where the original forests predominate with basins or

areas that have been cleared and today are predominantly covered with pastures. We propose this type of comparison in two scales: working in small basins (10 km<sup>2</sup>) situated in the Nova Vida Farm and along the basin of the river Ji-Paraná (104 km<sup>2</sup>), which is considered a basin of mesoscale by the standards of the Amazon region. The emphasis of this project will be given to the spatial and temporal distribution of carbon, nitrogen and phosphorus. As for the limnological processes, we will examine changes in the primary production due to replacement of forests with pastures and also the limiting factors of this process, both abiotic (light) and nutritional (nitrogen and phosphorus). As for the biodiversity, we will analyze the alterations in the populations of macroinvertebrates along the gradients of use of the soil. Finally, the biogeochemical patterns or signs will be tracked along these scales (micro and meso-scales), to evaluate their spatio-temporal alterations. Bearing in mind that the water cycle constitutes one of the most important vectors of the biogeochemistry of drainage basins, in parallel to the processes above, we will generate detailed information on the hydrology of the areas of study. With the development of this project it is hoped to obtain: a) a georeferenced database on the structural attributes of the hydrographic basins studied; b) knowledge about the biogeochemistry of small and medium sized tropical rivers and alterations due to the replacement of forests with pastures; c) knowledge about the fauna of macroinvertebrates and changes due to alterations in the use of the land; d) knowledge about the propagation of the signal emitted by deforestation throughout the hydrographic network (scaling-up); e) additional information on the hydrology of the areas of study.

## 3

### Dynamic of carbon and related elements in the basin of the river Piracicaba

Luiz Antônio Martinelli

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 1994/00529-9

Term: Dec/1994 to Jun/1998

The Piracicaba river basin is a subtropical watershed located in the southeastern region of Brazil. With an area of 12400 km<sup>2</sup>, its main rivers are: Piracicaba, Atibaia and Jaguari. The climate is subtropical (type C in the Koeppen classification). The annual average temperature is 20°C. The annual average rainfall is 1400 mm, or a grand total of 1.76 x 10<sup>10</sup> m<sup>3</sup> of water for the basin. The final annual average discharge is equal to 165 m<sup>3</sup>.s<sup>-1</sup> or 0.52 x 10<sup>10</sup> m<sup>3</sup>.year<sup>-1</sup>. The basin is a typical example of the new landscape resulting from development in tropi-

cal and sub-tropical regions. Establishment of intensive industrial and agricultural process were followed by a significant population growth. The population in the basin is estimated in approximately 3 million people, with a growth rate of almost 6% per year. This fact is imposing increases in both the water consumption and the urban sewage load. Almost 80% of the population is served by sewage systems, but only 5% of the generated load is treated before dumping in the rivers. As a consequence, the estimated load due to urban sewage increased from 50 tons of BOD/day in 1960 to 200 tons of BOD/day in 1990. The Piracicaba River basin, is one of the most intensively cropped area in Brazil. Sugar cane is the main crop; its cropped area increased dramatically, from 62,000 ha in 1975 to almost 270,000 ha in 1988. There are small watersheds in the basin almost 100% covered with sugar cane. During the last decade the rivers in the basin were subjected to acute pollution problems due to urban sewage and sugar cane industry residues. The later may be of two main types: nonpoint sources linked to the transport of sugar cane material with the runoff, and a point-source due to the direct dumping of the industry waste water and residues in the river. For 1977, the impact of the point source alone was estimated to be equivalent to the organic pollution generated by a city of 3 millions habitants. This accelerated populational and industrial growth had led to a significant increase in the water demand. If nothing is be changed, by the year 2000 there will not be enough water supply to cities and industries. Therefore, the futures scenario for the basin is critical. Progressively less water availability, coupled with progressively poor water quality is foreseen. In this scenario, we propose a two years project to study the basic working mechanism of the basin as a natural entity. We will assume the rivers as natural integrator of the process which occur in their drainage system. The rivers will be divided in a series of linked sectors, and mass balances of water and materials for each one of this sectors will be det.

### SUPPORT FOR REGULAR RESEARCH

## 4

### Physiological and biochemical responses of three species of tropical legumes to climatic change

Marcos Silveira Buckeridge

Institute of Biosciences

University of São Paulo (USP)

Process 2007/59708-1

Term: May/2008 to Apr/2010

Alterations in temperature and in the pluvial regime related to the emission of gases that cause the gree-

thouse effect represent a new threat to global biodiversity. Legumes are one of the most important families in the domain of the Atlantic and tropical forests, both for the number of species and individually in the structure of Atlantic forest. Studying five species of legumes, our group observed that the pattern of physiological performance of each species is related to the position occupied by the plant in the process of ecological succession. This data indicates that the successional process could be influenced by the management of the water absorbed by each species. Since the end of the decade of the 1980s, studies have shown that plants respond to the increase in concentrations of CO<sub>2</sub> in the atmosphere with a reduction in the number of stomata. Analyses of increase or decrease in the number of stomata in a leaf are carried out by calculating the stomata index or density, and the results are taken by the literature as an indication that the plants have been responding to these alterations. This knowledge is widely disseminated throughout the scientific community, but to-date very little is known about the responses of the species of tropical ecosystems to growing increases in this gas. In the present proposal we will use an intraphyletic approach, which seeks to conduct studies in greater depth into the physiological (photosynthetic and morphological) and anatomical responses of the species of legumes of different successional groups: *Sesbania virgata* (pioneer), *Schyzolobium parayba* (initial secondary) and *Hymenaea courbaril* (late secondary) to climatic changes, through the study of the combined effects of raised CO<sub>2</sub> and temperature. For this purpose, the plants will be cultivated in conditions and concentrations of CO<sub>2</sub> and temperature expected in the second half of the XXI century. Measurements will be taken of the allocation and accumulation of biomass, of photosynthetic behavior, measurements of C/N relationship, analyses of structural and non-structural sugars and analyses of stomata index. With the results obtained it is intended to examine in greater depth and improve the precision of models of behavior of different species of legumes, so as to predict with greater precision the responses to climate changes occurring on the planet.

## 5

### Diversification of Bignoniaceae in the wetland savannas of Central Amazonia

Lúcia Garcez Lohmann  
Institute of Biosciences  
University of São Paulo (USP)  
Process 2007/54903-0  
Term: Mar/2008 to Feb/2010

The processes responsible for the origin of the diversity of plants in Amazonia remain for the most part unknown. Furthermore, few studies seek to understand the establishment of reproductive isolation between taxa, principally with focus on the patterns of intraspecific variation and/or variation between closely related species. In Amazonia, we find an environment with great potential for the study of mechanisms responsible for speciation in plants: prairies / savannas, which display an insular spatial distribution and an endemic flora. In this project we propose to describe the patterns of morphological, ecological and genetic variation in data endemic to the prairies and savannas belonging to the Bignoniaceae (Bignoniaceae) tribe, aiming to understand the processes involved in the diversification of this group of plants in this system of islands. The present project includes questions related to the influence of the spatial distribution as well as the type of habitat in the isolation and differentiation of populations and species in this clade. In addition to this, broader questions related to the biogeography of Amazonia as a whole will also be tackled.

## 6

### Cycle of carbon, nitrogen and soil nutrients in dense ombrophilous forest in the Serra do Mar State Park, in the State of São Paulo

Marisa de Cássia Piccolo  
Center for Nuclear Energy in Agriculture  
University of São Paulo (USP)  
Process 2007/52482-8  
Term: Aug/2007 to Jul/2009

The Atlantic Rainforest originally occupied an area of 1.3 million square kilometers, though barely around 7.6 per cent of its original expanse has not been modified. It is still possible to find patches of the forest in the Serra do Mar and in the Serra da Mantiqueira, in the South-east of Brazil. Due to the scarcity of information on the structure and functioning of the dense ombrophilous Atlantic Forest along a longitudinal gradient, this research project has as its objective the tracing of the dynamic of C, N and other nutrients in the soil in areas of sandbank woodlands (5 to 20m in altitude), dense ombrophilous lowland forest (50 to 100m), dense ombrophilous submontane forest (300 to 600m in altitude) and dense ombrophilous mountain forest (around 1,000m in altitude). The study will be carried out in the nucleus of Santa Virgínia and Picinguaba (23° 17' to 23° 24' S and 45° 03' and 45° 11' W) with characterization of the soil by means of pedological classification, chemical and physical analyses and isotopic variation of C (13C/12C) and of N (15N/14N).

7

### Potential production of greenhouse gases in sediments of marginal lagoons

Irineu Bianchini Júnior

Center for Biological Sciences and Health  
Federal University of São Carlos (UFSCar)

Process 2007/08602-9

Term: May/2008 to Apr/2010

This research project aims to describe and to discuss the carbon cycling in sediments of marginal lagoons. The temporal cellulolytic activity and the productions of methane and of carbon dioxide will be investigated in different deeps of the sediments. Monthly, samples of sediments will be in the Ecological Station of Jataí (Luiz Antonio, São Paulo); belonging to the Mogí-Guaçu river floodplain. At the first year, the samples will be taken in Óleo Lake. From the second year, the researches will be extended to the other marginal lagoons, aiming to estimate its annual gases productions. The deep of collected layers will be made considering the data obtained from the first year experiments. The investigated processes should contribute to the understanding of the metabolism of river-floodplain systems, besides supply relevant information in scope of greenhouse gases generation from those environments.

8

### Fluxes of gases (CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub>) and alterations in the transformations of the nitrogen in the soil, in basins with forest and pasture cover on the northern coast of the State of São Paulo

Jean Pierre Henry Balbaud Ometto

Center for Nuclear Energy in Agriculture  
University of São Paulo (USP)

Process 2006/57063-0

Term: Feb/2007 to Jan/2009

The Atlantic Rainforest, one of the most threatened ecosystems on the planet, today is considered as one of the priority biomas for the implementation of conservation policies. Its forest area, currently reduced to less than 8 per cent of its original cover, requires special attention in terms of understanding how it functions so as to better support its conservation. Despite the growing interest in environmental studies in this region, the emission of greenhouse effect gases and attributes correlated to these emissions have hardly been studied, including changes in the vegetal cover from forest to pasture, which are very common in this region. The present proposal has the principal objective of carrying out an integrated and comparative study of the dynamic of carbon and nitrogen, in addition to fluxes of

N<sub>2</sub>O, CO<sub>2</sub> and CH<sub>4</sub> (greenhouse effect gases – GEG), in two areas of the Serra do Mar with differing cover and land use. The study will be carried out in two basins, one with forest vegetal cover located in the Serra do Mar State Park, Santa Virginia nucleus, and one with pasture in the neighboring region.

9

### Microbial diversity in the Central and Oriental Amazonian Anthropogenic Dark Earth: Detection of metanogenic Archaea, their functional role and contribution to the bacterial structure communities in ADE and adjacent sites

Siu Mui Tsai

Center for Nuclear Energy in Agriculture  
University of São Paulo (USP)

Process 2006/06700-0

Term: Aug/2007 to Jul/2009

Biodiversity and biological activity are related to functions and essential characteristics for the maintenance of the productive capacity of soils. The microorganisms are responsible for several essential activities for the functioning of the ecosystems, such as the fragmentation and decomposition of organic matter, the making available of soil nutrients, the aggregation of particles of soil, among others (Moreira & Siqueira, 2002). Biological structures and their functions are affected by the alterations and disturbances in the properties of the soil. Furthermore, the presence of stable organic material and large biological activity indicate that soils with high content of organic material can be places of high microbial diversity, constituting sources of microbial germplasm. There is a lack of detailed and organized information on this biodiversity, such as studies on the effect and management of these soils in their biodiversity and which characterizes the specific function of biodiversity in the development of their sustainable fertility.

10

### Vulnerability of organic matter in the soil to temperature increase

Carlos Clemente Cerri

Center for Nuclear Energy in Agriculture  
University of São Paulo (USP)

Process 2005/59585-1

Term: Apr/2006 to Sep/2008

During the process of decomposition of organic matter in the soil (OMS) greenhouse effect gases are formed which are released into the atmosphere, contri-

buting to global warming. It is believed that this global warming may affect retroactively the rate of decomposition of the OMS potentiating the release of carbon (C) from the soil and the mineralization of nitrogen (N). The OMS is compartmentalized in fractions with different sensitivities to temperature. Earlier research has suggested that the oldest fraction of AC is more recalcitrant and less sensitive to temperature. In addition to this, some mechanisms of physical, chemical and biochemical protection may act to reduce the sensitivity of the OMS to the increase in temperature. Possible modifications in the structure of the microbiological community, caused by the increase in temperature, may interfere in the process of decomposition of the OMS by means of alterations in its protection mechanisms. And the conversion of the original (forest) vegetation into pasture promotes modification in the ground, enabling an indication of what is the origin and quantity of C released in the form of CO<sub>2</sub>. With the objective of evaluating the dynamic of the decomposition of the OMS we will carry out incubations (for 660 days) of clay and sandy soils, under forest and pasture, at three temperatures: 25°, 35° and 45°C. We will evaluate the relationship between the texture x OMS, the origin of the C released, the sensitivity of the labile-C x recalcitrant-C and how the possible alterations to the protection mechanisms of the OMS may contribute to the release of CO<sub>2</sub> into the atmosphere and in the rate of mineralization of N.

11

### Methodological procedure for the identification of individual tree species in four forest formations in the State of São Paulo, using orbital images from the Quickbird and Aster sensors

Marcos César Ferreira

Institute of Geosciences

Campinas State University (Unicamp)

Process 2005/56757-6

Term: May/2006 to Apr/2008

The emergence of sensors with extremely high spatial resolution has made it possible for the level of detail on satellite images to reach the point at which studies of forest ecology can be undertaken based on information of forest individuals. The combination of images of high spectral, radiometric and temporal resolution increase the efficiency of these studies, given that it makes available far more information about the object under analysis. Such a research theme is a promising field, since the possibility of remotely studying individuals in a forest can contribute to greater agility and lower cost of forest management, minimizing field

work to a large extent. This study proposes to investigate the potential of images from the Quickbird satellite, combined with the images from the Aster satellite, in the identification of tree individuals in four forest formations in the State of São Paulo. To achieve this, the study is linked to the thematic project *Biota – diversity, dynamic and conservation in forest in the State of São Paulo: 40 ha of permanent plots*, which already have field information on all the tree species in the plots studied, with all the individuals already marked and georeferenced. Immediately a database will be set up with spectral signatures of the canopy tree species studied in the four formations, which could assist in the identification of these species in other similar geographical locations, through satellite images. In addition to this, it is hoped, at the end of the research, to develop a methodology of remote sensing for floristic studies in the forest formations of the State of São Paulo.

12

### Impact of raised concentrations of CO<sub>2</sub> on the physiology and the initial growth of four Brazilian forest species, in a future climatic simulation

Carlos Alberto Martinez Y Huaman

Ribeirão Preto School of Philosophy, Arts and Sciences

University of São Paulo (USP)

Process 2005/54804-7

Term: Oct/2005 to Mar/2008

Global climate changes, caused by the increase in the atmospheric concentration of gases, in particular CO<sub>2</sub>, is a current topic and of great relevance to the whole world. Despite the recent coming into effect of the Kyoto Protocol, which establishes goals for the reduction of greenhouse effect gases, the previsions indicate that the increase in the concentration of CO<sub>2</sub> will continue for a long time, given that alternatives for the immediate replacement of fossils fuels, are not currently viable. On the other hand, the coming into effect of this protocol opens new opportunities for investment in tropical countries, by means of Clean Development Mechanism (CDM), which focus on the sequestration of carbon by forests. Given that plants absorb CO<sub>2</sub> through photosynthesis, this process constitutes an important, environmentally clean mechanism, to reduce the additional greenhouse effect. Therefore, there is great potential for forests to exercise a significant impact on the global balance of carbon, by acting as sinks for CO<sub>2</sub>. However, the predictions are difficult because the effects of raised levels of CO<sub>2</sub> on tropical tree species are still not well understood and modeled. This proposal has as its object the determination of the effects of three concentrations of CO<sub>2</sub> (370,

540 and 720  $\mu\text{mol mol}^{-1}$ ) on the gas exchanges, chlorophyll fluorescence and the initial growth of four young tree species in a mesophilic semideciduous seasonal forest in Brazil, namely two pioneer species – *Cecropia pachystachya* (embaúba) and *Croton urucurana* (sangra d'água) and two non-pioneer species *Esenbeckia leiocarpa* (guarantã) and *Cariniana legalis* (jequitibá-rosa)–, grown in open-top chambers and cultivated in forest soil with and without nutritional correction. The information generated by this research will contribute to the characterization of the potential capacity of these Brazilian forest species as carbon sequestrers for the purposes of reforestation.

13

### Stock of carbon and mineral nutrients in cerrado soils: effects of forest cultivation use

Wellington Braz Carvalho Delitti  
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Process 2005/54052-5  
Term: Oct/2005 to Nov/2007

It is intended to evaluate the potential for storing carbon (C) in cerrado soils under cover of *Pinus* (Pi) and *Eucalyptus* (Eu) when compared with native vegetation (Ce), as well as the effects of plantations on the nutritional state of the soil. The areas of study are located in the São Paulo municipalities of Itirapina, Mogi-Guaçu, Luiz Antônio and Pederneiras, SP. A treatment replica will be defined (Ce, Pi and Eu) in each municipality and 30 collection points of undergrowth and soil (0-5, 10-25 and 35-50 cm) per treatment. The levels of carbon and nutrients of the samples will be determined in laboratories of the Center for Nuclear Energy in Agriculture (Cena) and the Department of Soils and Nutrition of Plants at USP's Luiz de Queiroz Advanced School of Agriculture (Esalq). Significant differences will be tested through ANOVA procedures. The treatments, if different, will be discriminated through Post hoc tests (LSD). The reservoirs of C and nutrients in the soil and in the undergrowth will be determined on the basis of values obtained and data on thickness and density of the horizons. The reservoir of C in the first meter of soil will be calculated integrating this data in equations of vertical pedotransference. The results could be used comparatively on a global scale.

14

### Dynamic of carbon in the sugarcane agrosystem: mathematical modeling and environmental implications

Carlos Clemente Cerri  
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University of São Paulo (USP)  
Process 2005/50970-0  
Term: Jul/2005 to Oct/2007

Sugarcane is an important crop in Brazilian agriculture, both for the generation of income and employment and for the generation of foreign currency through increasing exports of sugar and alcohol. The burning of the sugarcane straw, to facilitate the harvest and the transport of the stalks, has been practiced for centuries in Brazil. Nowadays, for economic and legal reasons, the no-burn harvesting of sugarcane, leaving the straw on the ground, has increased. Little is known, however, about the long-term effects of the presence or absence of straw on the carbon dynamic in the sugarcane agrosystem. Mathematical modeling could be an effective tool for understanding these processes and to estimate the potential of carbon sequestration in the soil under sugarcane cultivation. The sequestration of carbon has agronomic, environmental and economic importance, in the context of climate changes and the so-called "carbon market". The objective of this study is to evaluate the effect of the management with and without burning on the carbon dynamic in the sugarcane agrosystem, with the view to mitigating the greenhouse effect, using the Century model. We will use areas in the São Martinho sugar mill in Pradópolis, São Paulo. Two chronosequences will be analyzed, that is, fields in which sugarcane has been planted eight, six, four and two years ago, in addition to native vegetation. The areas studied are located in the class of soil predominant in the region, red latosol. One chronosequence handled the harvest with biomass burning and another, without burning. Collections of soil will be gathered, for evaluation of the following attributes: pH, density, clay fractions, silt and sand, total C and N and C microbial biomass. The results of the chemical and physical analyses will be used in establishing the parameters of the model and subjected to multivariate statistical analysis.

15

### Stocks of carbon and nitrogen in cerrado soils aimed at agricultural sustainability

Marisa de Cássia Piccolo  
Center for Nuclear Energy in Agriculture  
University of São Paulo (USP)  
Process 2004/15538-7  
Term: Oct/2005 to Feb/2008

The Cerrado represents one of the most promising agricultural frontiers in the world, although the conversion of natural areas into productive systems has pro-

voked an intense debate in relation to the changes that have occurred in the dynamic of the soil organic matter (SOM) and alterations in the fluxes of trace gases responsible for the greenhouse effect ( $\text{CO}_2$ ,  $\text{N}_2\text{O}$  and  $\text{CH}_4$ ). The clearing and burning of the natural vegetation, followed by cultivation of the soil lead to a decrease in the stock of soil organic matter (SOM) and an increase in the emission of greenhouse effect gases. Conservationist practices, such as the no-tillage system, are efficient strategies for mitigating these effects. The general objective of the research is to evaluate the alterations in the stocks of C and N in the soil and the emissions of significant gases for the greenhouse effect ( $\text{CO}_2$ ,  $\text{N}_2\text{O}$  and  $\text{CH}_4$ ) in the process of the conversion of the Cerrado in Rio Verde (GO) to systems of conventional and no-tillage cultivation. The areas for study selected are: native vegetation (1CN, 2CN and 3CN); conventional planting system established 15 years ago (PC); and no-tillage system: chronosequence with 12 years of planting (PD0, PD1, PD4, PD5, PD7, PD8, PD10 and PD12). Other variables such as the granulometry of the soil, microbial C and N, mineralization of hydrosoluble N and C in the soil (DOC) will be studied in order to understand the dynamic of C and N in the systems. Mathematical simulations of the SOM will be undertaken with the aid of the Century mathematical model.

16

### Local management and conservation of natural resources in the Atlantic Rainforest (Vale do Ribeira, São Paulo)

Alpina Begossi

Nucleus for Environmental Studies and Research  
Campinas State University (Unicamp)  
Process 2001/07618-2  
Term: Jan/2002 to Dec/2003

The integrated analysis of data on the ecological aspects of the resource and the characteristics of the users is fundamental to evaluate the sustainability of an ecosystem. In this sense, users are potential partners in a management system, where its success depends on the compatibility of the forms of use, on the internal social structure of the user group and on the channels of integration between the local and external institutions. The objective of this project is to study the forms of local management in communities of two conservation units with different levels of ecological and institutional access for natural resources: the Alto Ribeira State Park (Petar), located in the mountainous region and legally restricted to indirect use through scientific research and tourism, and the Ilha Comprida environmental protection area, located in the costal region, and legally available for direct use of resources subject to some res-

trictions, both in the State of São Paulo. The study is being undertaken together with the Nucleus for Environmental Research (Nepam-Unicamp), in collaboration with the thematic project *Forest and sea: uses and conflicts in the Vale do Ribeira and south coast, São Paulo* and will run for two years. In the first year, we will undertake a contextual regional analysis of each area of study, in accordance with the ecological categories (topography, vegetal cover, types of resource) and social aspects (actors, conservation policy, infrastructure, tourism). In the second year, we will carry out a local contextualization of each study area, focusing on the local perception of the use of resources, family economics and social organization. The methodology adopted will be interviews, participative mapping and classification of satellite images. Comparisons between communities from different areas of study will be outlined in relation to the potential and the limitation of the local management of natural resources. The analysis of the data will focus both on practical aspects of the environmental question related to participative management and on theoretical aspects on the relationship between forms of appropriation and degree of conservation of the natural resources.

17

### Comparative ecophysiological analysis between species of macroalgae from lotic environments: temperature and irradiance

Orlando Necchi Júnior

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Process 2001/06139-3  
Term: Aug/2001 to Mar/2004

With this research we propose to tackle ecophysiological aspects of lotic environments, namely: 1) to compare the photosynthetic performance between species and populations, in the field and in the laboratory, involving variations in temperature and irradiance; the field evaluations will be carried out using fluorometry, in terms of effective quantum yield of photosystem II and relative rate of electron transport (ETR), and in the laboratory we will use both techniques, fluorometry and concentration of dissolved oxygen through the technique of clear and dark flasks (rates of gross photosynthesis, liquid and respiration); 2) to analyze the rates of photosynthesis and respiration in relation to the taxonomic group (Bacillariophyta, Chlorophyta, Cyanophyta, Rhodophyta and Xanthophyta) and of morphofunctional characteristics, through the study of representative species from each group and morphological type. As principal justification for the proposition of this project, we should highlight the lack of similar

works, in scope and depth, on lotic macroalgae worldwide. The information available is limited to few species, which does not permit broader conclusions and there is still a notable lack of representation of species/populations from tropical regions. In this context, it becomes even more important to analyze, essential ecophysiological parameters (rates of photosynthesis and respiration) under different temperatures and irradiance in a representative number of species and morphological types of the groups of algae well represented in lotic environments. More global and representative information will provide assistance to better interpret the ecological role of these algae in lotic ecosystems. It is proposed to analyze the lotic algae in relation to the morphofunctional characteristics, in a similar way to the model developed for benthic marine macroalgae, analyzing representatives from each morphological type in relation to some characteristics: production (gross and liquid) and respiration, taxonomic group and type of thallus. This will permit better understanding of the adaptations of each morphological type or group of algae to the environmental characteristics, particularly temperature and irradiance.

18

### Acid precipitations and their implications in the biogeochemistry of the basin of the river Piracicaba

Luiz Antônio Martinelli

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 1998/11429-6

Term: Dec/1998 to Feb/2001

The project is aimed at the evaluation of the chemical composition of the wet precipitation in the basin of the river Piracicaba. Wet precipitation collectors will be set up all along the basin and the rain will be sampled throughout the year, for the analysis and interpretation of inorganic and organic components and their relationship with the acidity of the precipitation. We will also evaluate the transport of masses of air all along the basin, to understand the origins of the precipitation and correlate the occurrence of acidity with natural or anthropogenic sources. Based on the knowledge about the atmospheric phase of the hydrological cycle, it will be possible to add this important information to the understanding of the biogeochemistry of the basin of the river Piracicaba.

19

### Effects of air pollution on gas exchanges of young individuals of *Tibouchina pulchra Cogn* (Melastomataceae), in the region of Cubatão, São Paulo (SP)

Wellington Braz Carvalho Delitti

Institute of Biosciences

University of São Paulo (USP)

Process 1997/12163-7

Term: Jan/1998 to Dec/1999

In Cubatão (SP) high levels have been observed of pollutants such as HF, SO<sub>2</sub> and NO<sub>x</sub> and the vegetation of the Atlantic Rainforest that surrounds it displays clear signs of degradation. This project aims to verify the impact of air pollution on gaseous exchanges of CO<sub>2</sub> in regions of Cubatão that are different in terms of type and level of pollution. Seedlings of *Tibouchina pulchra* cultivated under standardized conditions will be exposed to the atmosphere in these areas and, after six and 12 months, will be quantified: assimilation of carbon, stomatic conductance, chlorophyll and ascorbic acid content, HF, macronutrients and parameters of growth, aimed at a better understanding of the state of the plant under stress caused by air pollution.

20

### Thermal comfort in cities: effect of tree-planting on the control of solar radiation

Lucila Chebel Labaki

School of Civil Engineering and Architecture and

Urbanism/Campinas State University (Unicamp)

Process 1996/01262-1

Term: Sep/1996 to Feb/1999

The benefits that tree-planting brings to a city are common knowledge, principally when it is a question of thermal comfort. However, there is little data which points to the thermal efficiency of the action of tree-planting in urban areas. Thus, this project proposes the study of the effects of tree-planting on the control of the intensity of solar radiation incident in urban centers, through the experimental observation of the relationships between solar radiation which passes through the tops of trees and the intensity of the heat transferred to the environment.

21

### Mapping of ground fires in the Emas National Park, Goiás: 1973-1994

Alberto Waingort Setzer

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)



Process 1995/02674-9  
Term: Aug/1995 a Aug/1997

The project has the objective of identifying and mapping the ground fires which occur in the Emas National Park (PNE), GO, since 1973, to provide information for the study of the role of fire in this region of cerrado (wooded savanna). For this purpose, satellite images will be used for the Landsat systems, sensor MSS (1973-1983) on the scale 1:250,000 and TM (1984-1994) on the scale 1:100,000. With the aid of records available in the park, to be obtained from the Brazilian Institute of the Environment and of Natural Renewable Resources (Ibama), we will analyze annual images from that location and, when the occurrence of ground fire is noted, the limits of that fire will be mapped. These maps, produced on the basis of visual interpretation of the images, will be managed through the Geographical Information System (GIS) of the National Institute for Space Research (Inpe), thus creating an information plan (IP) for each ground fire event recorded. Finally, all the IPs will be superimposed in the GIS environment, creating maps for temporal and spatial analysis of the areas affected by ground fires in that park.

22

### **Adaptation strategies of arboreal species typical of waterlogged ground environments: a morphological, biochemical and ecophysiological approach**

Carlos Alfredo Joly  
Institute of Biology  
Campinas State University (Unicamp)  
Process 1994/02058-3  
Term: Sep/1994 to Mar/1998

Riverine forests constitute an extremely degraded ecosystem in the State of São Paulo, with few representative remnants remaining principally in the interior of the state. In the face of this situation, some projects for the recuperation of these areas have been proposed. Due to the fact that the riverine environment is very peculiar in its abiotic characteristics, and subject to periodical flooding, few species manage to develop in these conditions. This characteristic is confirmed by the low floristic diversity of these areas, if compared to the mesophile forests of the tableland. There exists few studies tackling the strategies of tolerance to flooding of Brazilian species. Works with this focus could provide important support for projects of recomposition of riverine vegetation. The objective of this work is to provide this support, through the study of the effect of hydric saturation of the soil on typical species of this environment, evaluating the ger-

minative behavior and the morphological, physiological and metabolic responses, both of the root system and the exposed part of the plants.

23

### **Changes in land use in Amazonia and dynamic of the organic matter in the soil using carbon isotopes**

Luiz Antônio Martinelli  
Center for Nuclear Energy in Agriculture  
University of São Paulo (USP)  
Process 1992/04169-1  
Term: Apr/1993 to Sep/1994

Changes in land use in the Amazonian region, among other consequences, modify the dynamic and the quality of organic matter in the soil. In this project we propose to evaluate these changes, studying a typical area of new landscape that is taking shape in Amazonia. In the region of Paragominas (state of Pará) we have the coexistence of primary and secondary (capoeira) forests and active and abandoned pastures. Through the elementary composition of the organic matter and of the natural radioactive isotope carbon-14 and of the stable isotope carbon-13 we intend to determine changes in the soil stocks, as well as changes in the time of residence and of the refractoriness of the organic matter in profiles of soil under forest, secondary forest and pastures.

24

### **Aspects of the hydrological cycle in the Amazon basin: a temporal and spatial study**

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Center for Nuclear Energy in Agriculture (Cena)  
University of São Paulo (USP)  
Process 1992/00362-1  
Term: Jun/1992 a Jun/1995

The hydrological cycle in Amazonia proves to be of great importance due to the huge volume of water involved. Annually the region receives  $12 \times 10^{12} \text{m}^3$  (2,200mm) of water through precipitation, and approximately 50 per cent of this total returns to the atmosphere through evapotranspiration, demonstrating the role of vegetation. We do not know, however, basic information relating to localized processes, which require a different scale of study. Our intention in this project is to refine our knowledge on two aspects of the region's hydrological cycle: 1) in what manner does the transfer of the water from the atmosphere to the soil take place; 2) and how does part of this water return to the atmosphere via vegetation. To attain the first objec-

tive we intend to analyze the historic series of precipitation and prove whether most of the events are convective, as in Manaus, where in 80 per cent of the cases it rains less than 15mm. In the second case, through isotopic analyses we intend to identify the sources of vapor for the forest and from there to the atmosphere.

## BIOTA-FAPESP PROGRAM

25

### Modeling of the dynamic of the organic matter in the soil in the zone of agricultural expansion in southwest Amazonia: basis for research into global climate changes

Carlos Eduardo Pellegrino Cerri  
Center for Nuclear Energy in Agriculture  
University of São Paulo (USP)  
Process 2005/60255-6  
Term: Apr/2006 to Mar/2010

The research aims to evaluate, through the use of mathematical modeling, the alterations in the stocks of carbon and nitrogen in the soil due to the agricultural expansion which has occurred over the last 30 years in the states of Rondônia and Mato Grosso. In addition, simulations involving future scenarios will generate information which could be useful when taking decisions on public policies which deal with global climate changes. To this end we will apply the four models of simulation (Century, RothC, DNDC and TEM) most relevant which deal with the dynamic of organic matter in the soil, as well as the empirical model proposed by the IPCC/ONU, taking advantages thus of the data available in the literature. The results derived from the models mentioned will make it possible to obtain estimates of the alterations in the stocks of carbon and nitrogen in the soil contemplating the present, retrospective and prospective scenarios of changes in land use.

26

### Floristic composition, structure and functioning of the dense ombrophilous forest in the Picinguaba and Santa Virgínia nuclei of the Serra do Mar State Park

Carlos Alfredo Joly  
Institute of Biology / Campinas State University (Unicamp)  
Process 2003/12595-7  
Term: Jun/2005 to May/2009

The objective of this project is to determine which are the really relevant intrinsic characteristics for us to understand the role of each species/functional group in the determination of the floristic composition, of the

structure and the functioning of the different physiognomies of the dense ombrophilous forest in the north-east region of the State of São Paulo: Picinguaba and Santa Virgínia nuclei in the Serra do Mar State Park. Simultaneously, with the data on the functioning of this ecosystem, we will be able to determine the role, as the source of emission or sink of CO<sub>2</sub>, of the dense ombrophilous forest in the Atlantic region on the inter-annual climate variation and on the scenarios of global climate changes. This data will enable the comparison with results being collected by the LBA (Large Scale Biosphere-Atmosphere experiment in Amazonia) Project in the dense ombrophilous forest of the Amazon basin.

27

### Environmental Information System of the Biota-FAPESP Program: development of indicators for monitoring, updating the labeling of the cartographic base and improvements to the *Biota Neotrópica* magazine

Carlos Alfredo Joly  
Institute of Biology / Campinas State University (Unicamp)  
Process 2003/01214-2  
Term: Oct/2003 to Dec/2005

Biota-FAPESP's Environmental Information System Program constantly requires new developments to meet both the needs of the program and the specific peculiarities of some projects. The principal products of this new stage should be: a) to convert the current vegetation labeling of the Atlas for the Biota-FAPESP Program to the IBGE's Vegetation Classification System; b) development of indicators for the monitoring of the performance of the Program's Environmental Information System; c) refine the integration tools of the *Biota Neotrópica* magazine with databases internal and external to the program.

28

### Conservation of the biodiversity in fragmented landscapes on the Atlantic Plateau of São Paulo (Brazil)

Jean Paul Walter Metzger  
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Process 1999/05123-4  
Term: Mar/2000 to Feb/2005

The fragmentation of habitats is today one of the most serious problems that exists. In the tropics, every day a huge quantity of species are lost even before science discovers them. Since fragmented landscapes will be the norm in the future, it is necessary to undertake

actions of environmental management to prevent the destruction of the biological diversity and all the benefits derived from it. This project aims to study some vital effects of the fragmentation in a landscape made up of fragments of secondary tropical forest in the Atlantic Rainforest bioma (23035'S, 23050'S; and 46° 45'W, 47015'W) and to provide an ecological basis for the regional management, to promote the permanence of the greatest number of species possible in the landscape. In this context, the main objective of the project is to verify what spatial arrangement and which elements of the landscape are necessary to maintain the biological diversity, by: 1) describing the history of the fragmentation and of the regeneration of the landscape; 2) correlating the size of the fragment and the type of matrix with diversity of species of some taxonomic groups, the presence and abundance of (meta) forest populations, according to their sensitivity to fragmentation; 3) investigating the ecological processes that determine the maintenance of (meta) populations, particularly those related to the influence of the surrounding matrix and forest connectivity. These objectives meet the requirements of the Biota-FAPESP Program. The project plan includes eight sub-projects dealing with the same landscapes and groups of forest fragments, with complementary objectives. We propose an approach that involves a multiple scale analysis, in which the entire landscape and the fragments will be focused on, detailing the effects on the matrix and the corridor; studies will be undertaken of the levels of population and of community, in which a broad range of taxa will be examined (forest plants, primates, birds); umbrella species and key processes that may maintain a high biodiversity will be sought. Different theories of landscape ecologies will be tested and parameters of the spatial structure of the landscape and the quality of the habitat will be integrated to metapopulation models, particularly to the likelihood function model. To understand the existing structure of the landscape and its history of fragmentation and regeneration, two types of landscape will be distinguished: one consisting of a forest matrix and the other of an agricultural matrix. These will be characterized taking into account: 1) connectivity and heterogeneity of landscape, forest fragmentation and isolation (subproject 1); 2) geomorphologic and pedologic characteristics and principal physical geoindicators to measure the magnitude and the speed of decisive abiotic processes (subproject 2). Each fragment will be characterized by: 1) size; 2) heterogeneity of the forest eco-units; 3) quality of the internal environment and heterogeneity of the eco-units; 4) effects of shape and fringes ; 5) complexity of edge; 6) degree of isolation and connectivity and the

potential for (re)colonization; 7) age and history of the regeneration, obtained from the analysis of aerial photographs from 1962, 1973 and 1988 (subprojects 1 and 3). To correlate the patterns of biodiversity with size of forest fragment and type of matrix, 12 fragments will be studied in detail, with respect to the: 1) composition and diversity of species of adult trees (subproject 3); 2) composition and diversity of seedlings and new trees (subproject 7); 3) the abundance of six species of birds (subproject 6); 4) the biomass and density of primates (subproject 5). The influence of matrices and corridors on seed flows (subproject 8), forest regeneration (subproject 7) and movement of selected species of birds (subproject 6) will be analyzed in greater detail, when tackling a smaller number of fragments. The size and connectivity of the fragments will also be related to the patterns of potential occupation of fragments for (re)colonization, working with landscape of high and low demands, as well as types of landscape that only support species of low demand. Here, 50 to 60 fragments will be considered, of 4-5 hectares to 90 hectares, around half with agricultural matrix. Initially the following organisms will have their patterns of occupation considered: 1) six species of birds (subproject 6); 2) one species of endemic palm tree (subproject 4); 3) several species of trees (subproject 3). The comparison of these two groups of fragments in terms of size, environmental quality (subproject 3) and spatial attributes (isolation, connectivity, type of matrix) (subproject 1) should indicate the factors that dictate the permanence of a given species in the landscape. Likelihood function models will be applied to analyze patterns of occupation of segment and to simulate the occurrence of the species in different scenarios of the evolution of the landscape. This approach will enable us to identify the best conditions of fragment to maintain the species in the landscape on a long term basis, supposing that they behave like a metapopulation, providing a direct ecological basis for the management of the conservation of tropical forest fragments. One of the main results of the proposed project will be the creation of the data base with specialized information on the regional physiography, the structure and dynamic of regional flora and landscape, in addition to dissemination in specialized publications, informative articles, multimedia material with CD-ROM and online database and a guide to regional forest species, aimed at non-specialists, in particular, at children in the regional public schools.

Luiz Antônio Martinelli

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University of São Paulo (Cena/USP)

Process 1999/05279-4

Term: Jan/2000 to Aug/2004

The paradigm of this project is that biodiversity in hydrographic basins is generated and preserved by the interactions between the physical environment, biogeochemical processes and anthropic actions. Therefore, based on this paradigm, biodiversity cannot be properly investigated without a characterization of the structure and functioning of hydrographic basins. The Biota-FAPESP Program offers a unique opportunity to investigate the effects of the attributes of landscape and biogeochemistry on biodiversity, given that there will be, in an interactive way, several projects dealing with these topics. In this project we intend to investigate the biogeochemistry of basins of meso (101 to 104 km<sup>2</sup>) and microscale (101 to 102 km<sup>2</sup>) as an aid to interpreting results emanating from projects related to aquatic biodiversity within the Biota-FAPESP Program. The link between the environmental factors and biodiversity will be established: 1) working in the same areas as the projects geared to investigating aquatic biodiversity; 2) through specific parameters and analyses which link attributes of landscape and biogeochemistry to those related to biodiversity. On the mesoscale our specific objective will be to determine whether chemical and physical attributes respond differently between basins with different impacts. Our strategy will be to compare mesoscale basins with different levels of impact, with the main scientific questions being: 1) What are the effects of domestic sewage, industrial effluents and changes in use of the land on the distribution of carbon, nitrogen and phosphorus in basins with different levels of impact? Aiming to answer this first question, we intend to compare key parameters of aquatic biogeochemistry between basins with different levels of impact; 2) What are the effects of the urbanization, industrial activities and use of land on the composition of the atmosphere in basins with different degrees of impact? To answer this question, we propose to compare the dry and wet deposition in the basins selected for this study. On the microscale we intend to investigate the biogeochemistry of small basins, with a view to answering the following questions: 3) Is the aquatic biodiversity related to chemical or biological aspects of the rivers?; 4) Is aquatic biodiversity related to attributes of the landscape, specifically to those related to the riverside zones? Our approach in this case will be to compare microscale basins along the gradient of biodiversity.

30

### Viability of the conservation of the remains of the Cerrado in the State of São Paulo

Marisa Dantas Bitencourt

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Process 1998/05251-0

Term: Apr/1999 to Sep/2003

The rate of disappearance of the cerrados in the State of São Paulo highlighted in the last Forest Inventory (FI) indicated the urgent establishment of conservation measures and, possibly restoration of their remnants. The interdisciplinarity of the teams involved ensures the success of the project, which aims to indicate areas where physiognomies of Cerrado may be conserved ecologically and economically. Taking advantage of the efforts already undertaken by the FI and the experience of different teams in questions related to the Cerrado, this project will: a) update the physiognomic classes; b) indicate their state of conservation and agents responsible for their degradation; c) indicate how the species there present may be economically viable; e) indicate legal measures that act as incentives for conservation and disincentives to degradation; f) inform the non-academic community about their discoveries. The number of fragments studied will depend on the previously hierarchized and programmed analysis, depending on time and money.

31

### Conservation and sustainable use of the vegetal biodiversity of the Cerrado and the Atlantic Rainforest: the storage of carbohydrates and its role in the adaptation and maintenance of plants in their natural habitat

Marcos Silveira Buckeridge

Institute of Botany / São Paulo State Ministry of the Environment

Process 1998/05124-8

Term: Apr/1999 to Aug/2005

The periods in which plants temporarily lose the capacity to maintain their autotrophy, or rather, in which the photosynthetic system is temporarily prevented from functioning (periods of dormancy), constitute fragile links in the life cycle of the plants, given that they remain totally dependent on their reserves to resume their photosynthetic activity, as soon as the environmental conditions are favorable. Thus, it is during the unfavorable periods that the plants store, in specific and specialized organs, reserves of organic compounds such as carbohydrates and lipids (carbon

reserves) and proteins (nitrogen reserves). These reserves are consumed during specific periods and under rigid metabolic control, in such a way as to supply the energy needs and at the same time the raw material for the resumption of growth. This resumption requires large quantities of carbon, given that the resumption of growth requires an increase in energy consumption, in the cell division and extension, which in turn requires the biosynthesis of cell wall, which is composed principally of carbohydrates. The principal reserves of carbohydrates in plants can be divided into intra and extra cellular. The reserves accumulated in the interior of the cells can be found in the vacuole (fructans, sucrose, raffinose series) or in the cytoplasm (starch) and the accumulations in the extracellular space are made up of polysaccharides belonging to the classes of hemicelluloses and pectins. For every type of polysaccharide used as reserve there corresponds one or more strategies for survival, defense, use and mobilization of these resources. In this sense, it is possible that the maintenance of biodiversity presents a relatively high degree of dependency on these periods of accumulation and mobilization of reserves, making it important to study these phenomena in detail, since their understanding will enable not only the maintenance of biodiversity, but in many cases its recovery and use in a sustainable manner. The present proposal has the general objective of studying the types of reserve carbohydrates, their accumulation and mobilization and the consequences for subsequent development of native plants in the Cerrado and the Atlantic Rainforest, with a view to obtaining a solid scientific base for the conservation and recovery of the biodiversity of those biomas, as well as the use in sustainable manner of compounds produced by some of these plants.

#### YOUNG RESEARCHERS IN EMERGING CENTERS

32

**Total atmospheric deposition (wet and dry) in Brazil: implications of anthropic activities on the biogeochemical cycles of N and C**

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Institute of Physics  
University of São Paulo (USP)  
Process 2005/00298-3  
Term: Nov/2005 to Oct/2009

Nowadays, tropical forest are of recognized importance in relation to extremely high indices of wealth of species and of endemisms. Studies on the structure and the functioning of tropical forests have become even more important given the importance of these biomas

because of the role they play in the carbon cycle, modulating exchanges between the atmosphere and terrestrial systems, and in the cycle of nitrogen, in the face of the increase in atmospheric deposition of this nutrient. The understanding of the preserved and/or altered ecosystems will provide the necessary discernment for the conception of sustainable management systems, which will be able to emulate the biological adaptations which developed in particular environmental conditions of tropical regions. Given the scarcity of information on the structure and functioning of tropical ecosystems, the principal objective of this project is to investigate the wet and dry deposition and provide information which could lead to the contemplation of other multidisciplinary studies developed in tropical regions. For this purpose, different types of bioma were selected: Amazon Forest, Cerrado, Atlantic Rainforest and urbanized regions in the State of São Paulo. This study will be an integral part of the Biota-FAPESP Program, LBA project (Grand Scale Experiment of the Amazonian Biosphere and Atmosphere) and the Millennium Institute.

33

**Study of the relationship between the trophic state and the emission of greenhouse effect gases (CH<sub>4</sub>, CO<sub>2</sub> and N<sub>2</sub>O) in reservoirs in the middle Tietê river and evaluation of the capacity to remove carbon, nitrogen...**

Donato Seiji Abe  
International Institute of Ecology and Environmental Management  
Process 2004/13782-8  
Term: May/2005 to Sep/2007

The present project has as its objective the quantification of the emission of the principal greenhouse effect gases of biogenic origin (CH<sub>4</sub>, CO<sub>2</sub> and N<sub>2</sub>O) in the water and in the sediment of the Barra Bonita, Bariri, Ibitinga and Promissão reservoirs, located in cascade in the middle Tietê river, State of São Paulo. It is intended to report on, twice a year (summer and winter), the trophic state and other environmental factors of bodies of water with the emission of greenhouse effect gases in a simultaneous way and at different times of the year. We will also quantify, in points located along the reservoirs, the levels of denitrification, of methanogenesis and of respiration, aiming to identify the principal sources of the emission of greenhouse effect gases, as well as estimate the capacity which each system possesses to remove the existing excess of carbon and nitrogen.

34

### Seasonal variations and tolerance to hydric deficiency in seedlings of tropical tree species from different successional groups

Gustavo Maia Souza

Presidente Prudente School of Agrarian Sciences

Paulista West University (Unoeste)

Process 2003/06939-5

Term: Jun/2004 to May/2008

The increasing importance in conserving and restoring natural environments, such as tropical forest, brings the need to develop programs of management and forest restoration projects that are increasingly efficient and ecologically suited to the maintenance of biodiversity. In this context, the knowledge of the ecophysiology of native tropical species assume a fundamental role in assisting the adaptation of projects of maintenance of biodiversity, enabling the appropriate choice of species for each type of environment, as well as the ideal planting conditions. In addition to this, the study of the relationship of plants with the variations in their environments enables a better understanding of the intricate ecological relationships which shape tropical forests, such as their process of auto-regeneration and auto-maintenance via the dynamic of clearings. In this way, the research project aims to carry out a judicious study of the ecophysiology of tropical tree species enabling: a) the establishment of physiological parameters which permit a clear distinction between the successional groups; b) determination of the variation of the responses of different species to seasonal variations in a natural environment; c) determination of the degree of adaptation of each successional group to a particular environment in the forest (clearing or understory); d) verification of the differences in the mechanisms and degrees of tolerance to hydric deficiency between two different successional groups in semi-controlled conditions (greenhouse).

35

### Biogeochemical cycle of carbon in rivers: an integrative approach through analysis without multiscales using multiple tracers

Alex Vladimir Krusche

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 2000/07006-4

Term: Oct/2000 to Sep/2004

To understand the biogeochemical cycle of carbon in river systems in such a way as to describe it by means of a comprehensive functional model is one of the most important objectives of the studies undertaken in these

systems. Research carried out in the Amazon river over the last 20 years led to the formulation of one of these models, known as River Basin Organic Matter and Biogeochemistry Synthesis (Rombus). However, this model is based merely on results obtained in this river on a continental scale, and its validity for systems of micro and mesoscale is still an unknown quantity, which the project intends to ascertain. To this end, we will expand the experiments previously carried out on that scale for small igarapés (narrow riverbanks) on the Nova Vida Farm and for the river Ji-Paraná, all located in the basin of the river Madeira, in the state of Rondônia. In this way, the validity of the model will be tested also for micro and mesoscales. Such experiments, their results and the formulation of the model presuppose the fractioning of organic matter in physically quantifiable units and its elemental, isotopic and molecular speciation. While the first two (elemental and isotopic) provide important information on the sources of carbon in transport in the river systems, based on the latter unit (molecular) it is also possible to infer the degree of diagenetic alteration of the organic matter. Associated with direct measurements of the metabolic rates and of possible substrates of the same, as organic compounds of low molecular weight, this study expands and consolidates organic geochemistry as a line of research in the Cena Isotopic Ecology Laboratory in (USP), implementing analytical techniques still far from common in this area of knowledge in Brazil.

## GRANTS

### NEW FRONTIERS

1

#### Evaluation of the impact of ozone and its precursors on the emission of volatile organic compounds and on the antioxidant activity of leaves of model plants exposed to the controlled conditions of fumigation

Grant holder: Silvia Ribeiro de Souza

Institution: Institute of Botany / São Paulo State Ministry of the Environment

Process 2008/03208-3

### RESEARCH ABROAD

2

#### Characterization of Cerrado remnants in the State of São Paulo of the flora, phytogeography and state of conservation

Grant holder: Giselda Durigan

Supervisor: James Alexander Ratter  
 Institution: Forestry Institute / São Paulo State Ministry  
 of the Environment  
 Institution abroad: Royal Botanic Garden Edinburg, Escócia  
 Process 2001/01237-7

3

### Hydrogen fuel derived from water and solar light using the components of photosynthesis

Grant holder: Carmen Fernandez  
 Institution abroad: University of California Berkeley, EUA  
 Process 1996/04960-1

#### POST-DOCTORATE

4

### Stomata as foliar structures indicating climate changes in trees of the Atlantic Rainforest

Grant holder: Simone Godoi  
 Supervisor: Marcos Silveira Buckeridge  
 Institution: Institute of Biosciences / University  
 of São Paulo (USP)  
 Process 2007/03477-1

5

### Aerial phytomass from different biomass in the southwest of Amazonia and its contribution to the greenhouse effect, due to deforestation and burning

Grant holder: Ciro Abbud Righi  
 Supervisor: Carlos Clemente Cerri  
 Institution: Luiz de Queiroz Advanced School of Agriculture /  
 University of São Paulo (USP)  
 Process 2006/54790-9

6

### Norms and diversity of functional types in dense ombrophilous forest in the Picinguaba and Santa Virgínia nuclei of the Serra do Mar State Park

Grant holder: Enio Egon Sosinski Júnior  
 Supervisor: Carlos Alfredo Joly  
 Institution: Instituto de Biologia /  
 Campinas State University (Unicamp)  
 Process 2005/59168-1

7

### Dynamic of carbon in vegetation along the east-west axis of Brazilian Amazonia

Grant holder: Simone Aparecida Vieira  
 Supervisor: Plínio Barbosa de Camargo  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 2004/05555-1

8

### Fluxes of carbon in fluvial environments and their origin in western Amazonia

Grant holder: Cleber Ibraim Salimon  
 Supervisor: Reynaldo Luiz Victoria  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 2003/07778-5

9

### Diversity and biogeography of amphibians in islands of the State of São Paulo

Grant holder: Cíntia Aguirre Brasileiro  
 Supervisor: Ivan Sazima  
 Institution: Institute of Biology /  
 Campinas State University (Unicamp)  
 Process 2003/06014-1

10

### Isolation and characterization of the genes involved in the metabolism of carbohydrates during the growth and establishment of two species of the *Hymenaea* genus and in different environmental conditions

Grant holder: Marília Gaspar Mais  
 Supervisor: Marcos Silveira Buckeridge  
 Institution: Institute of Botany / São Paulo State Ministry  
 of the Environment  
 Processo: 2001/10419-1

11

### Biogeography of the interactions between *Asteraceae* and the endophagous insects of their capitula in cerrados of São Paulo

Grant holder: Adriana Monteiro de Almeida  
 Supervisor: Thomas Michael Lewinsohn  
 Institution: Institute of Biology /  
 Campinas State University (Unicamp)  
 Process 2001/08619-2

12

### Chemical composition of the precipitation and inhalable particulate matter and their correlations with the gradient of anthropic interferences in the São Paulo

Grant holder: Luciene de Barros Lorandi Silveira Lara  
 Supervisor: Luiz Antônio Martinelli  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 2001/02698-8

**13 Mapping of the cover and soil use in the hydrographic basins of the Alto Paranapanema Aguapeí, Peixe/Santo Anastácio and São José dos Dourados, based on satellite images**

Grant holder: Alexandre Marco da Silva  
 Supervisor: Luiz Antônio Martinelli  
 Institution: Center for Nuclear Energy in Agriculture (Cena) /  
 University of São Paulo (USP)  
 Process 2000/12939-0

**14 Effect of connectivity on the abundance and wealth of plantules and young tree species in fragmented landscapes**

Grant holder: Luciana Ferreira Alves  
 Supervisor: Jean Paul Walter Metzger  
 Institution: Institute of Biosciences /  
 University of São Paulo (USP)  
 Process 2000/03945-6

**DOCTORATE**

**15 Expansion of the agricultural frontier in Amazonia and its implications in the cycling of N in the adjacent natural systems**

Grant holder: Adelaine Michela and Silva Figueira  
 Supervisor: Luiz Antônio Martinelli  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 2008/51343-7

**16 Interaction between the atmosphere enriched in CO<sub>2</sub> and the water deficit: effects on the growth and the metabolism of fructans in *Vernonia herbaceae* (Vell.) Rusby**

Grant holder: Vanessa Fátima de Oliveira  
 Supervisor: Maria Ângela Machado de Carvalho  
 Institution: Institute of Botany / São Paulo State Ministry  
 of the Environment  
 Process 2007/59782-7

**17 Sources of carbon and nitrogen for primary and secondary aquatic consumers in the microbasins of the Atlantic Rainforest in the region of Ubatuba, São Paulo**

Grant holder: Alexandre Leandro Pereira  
 Supervisor: Luiz Antônio Martinelli  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 2007/55586-9

**18 Photosynthetic and metabolic mechanisms related to the responses of sugarcane cultivated in CO<sub>2</sub> enriched atmosphere**

Grant holder: Amanda Pereira de Souza  
 Supervisor: Marcos Silveira Buckeridge  
 Institution: Institute of Biosciences /  
 University of São Paulo (USP)  
 Process 2007/55457-4

**19 Adaptation strategies, growth and assimilation of carbon in five tropical tree species subjected to hydric saturation of the ground**

Grant holder: Viviane Camila de Oliveira  
 Supervisor: Carlos Alfredo Joly  
 Institution: Institute of Biology /  
 Campinas State University (Unicamp)  
 Process 2007/53263-8

**20 Evaluation of the ecological sustainability of restored riparian forests**

Grant holder: Letícia Couto Garcia  
 Supervisor: Ricardo Ribeiro Rodrigues  
 Institution: Institute of Biology /  
 Campinas State University (Unicamp)  
 Processo: 2007/50885-8

**21 Physiological and metabolic responses of three species of tropical legumes to global climate changes**

Grant holder: Adriana Yepes Mayorga  
 Supervisor: Marcos Silveira Buckeridge  
 Institution: Institute of Biosciences / University of São Paulo  
 (USP)  
 Process 2006/61544-4



22

### Primary liquid productivity in different phytophysiognomies in the Serra do Mar State Park, São Paulo

Grant holder: Cristina Aledi Felsemburgh  
 Supervisor: Plínio Barbosa de Camargo  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2006/57010-4

23

### Isotopic composition in the fluxes of CO<sub>2</sub> in the Cerrado area (Vassununga State Park)

Grant holder: Jadson Dezincourt Dias  
 Supervisor: Plínio Barbosa de Camargo  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2006/56863-3

24

### Use of forest remnants by anurans in the north-east region of the State of São Paulo

Grant holder: Vitor Hugo Mendonça do Prado  
 Supervisor: Denise de Cerqueira Rossa Feres  
 Institution: São José do Rio Preto Institute of Biosciences, Arts and Exact Sciences / São Paulo State University (Unesp)  
 Process 2006/51534-1

25

### Effect of climate changes on the productivity and offer of water: an investigation into the São Paulo agroecosystems

Grant holder: Jonatan Dupont Tatsch  
 Supervisor: Humberto Ribeiro da Rocha  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Processo 2006/50924-0

26

### A large-scale synthetic model applied to the hydroclimatology and eco-geodynamics of the Amazon river basin

Grant holder: Vincent Bustillo  
 Supervisor: Reynaldo Luiz Victoria  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2005/58884-5

27

### Cycling of nutrients from the soil and litter in dense ombrophilous forest in the Serra do Mar State Park

Grant holder: Susian Christian Martins  
 Supervisor: Marisa de Cássia Piccolo  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2005/57950-4

28

### Effect of solar radiation on the bioavailability of dissolved organic matter (DOM) produced by *Microcystis aeruginosa*

Grant holder: Thaís Beraldo Bittar  
 Supervisor: Armando Augusto Henriques Vieira  
 Institution: Center for Biological Sciences and Health/ Federal University of São Carlos (UFSCar)  
 Process 2005/57213-0

29

### Isotopic discrimination of sources of methane in tropical forests of Amazonia

Grant holder: José Mauro Sousa de Moura  
 Supervisor: Reynaldo Luiz Victoria  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2005/56386-8

30

### The carbon cycle in the drainage basin of the river Cuieiras, Amazonas: of the interactions between terrestrial and aquatic environments to the exports through discharge and evasion of CO<sub>2</sub>

Grant holder: Vania Neu  
 Supervisor: Reynaldo Luiz Victoria  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2005/55758-9

31

### Use of nitrogen strategies in tree species in the forests of the State of São Paulo

Grant holder: Érico Fernando Lopes Pereira da Silva  
 Supervisor: Carlos Alfredo Joly  
 Institution: Institute of Biology / Campinas State University (Unicamp)  
 Process 2004/03647-6

**32** **The occurrence of bamboo formations on the wooded hillside of the Atlantic Rainforest and their influence on local diversity**

Grant holder: Luciana Spinelli de Araújo  
 Supervisor: Gerd Sparovek  
 Institution: Luiz de Queiroz Advanced School of Agriculture / University of São Paulo (USP)  
 Process 2003/12485-7

**33** **Organic acidity of precipitation and use of soil in the State of São Paulo: spatial and temporal variability**

Grant holder: Vanessa Prezotto Silveira  
 Supervisor: Plínio Barbosa de Camargo  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2002/12819-0

**34** **Influence of the seasonal climatic variations on bat-plant interactions: effects on patterns of foraging and dispersion of seeds in bats of the *Sturnira lilium* species**

Grant holder: Marco Aurélio Ribeiro de Mello  
 Supervisor: Wesley Rodrigues Silva  
 Institution: Institute of Biology / Campinas State University (Unicamp)  
 Process 2002/09286-0

**35** **The role of carboxylic acids of low molecular weight in the biogeochemical cycle of carbon in rivers of the Amazon basin**

Grant holder: Cristiane Tumang Frare  
 Supervisor: Reynaldo Luiz Victoria  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2002/08684-1

**36** **System for geographical information and classification of the capacity of land use applied in the diagnosis of intensity of use of the hydrographic basin of the river Ji-Paraná, Rondônia**

Grant holder: André Marcondes Andrade Toledo  
 Supervisor: Reynaldo Luiz Victoria  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2002/00155-0

**37** **Effects of the environmental alterations in hydrographic basins, in the alimentary sources available to the ichthyofauna, using carbon isotopes**

Grant holder: Ivan Vieira  
 Supervisor: Plínio Barbosa de Camargo  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2001/05622-2

**38** **Modeling of anthropic factors that influence the Cerrado fragments in the State of São Paulo**

Grant holder: Jorge Alberto Bustamante Becerra  
 Supervisor: Marisa Dantas Bitencourt  
 Institution: Institute of Biosciences / Universidade of São Paulo (USP)  
 Process 2000/07106-9

**39** **Alteration of the dynamic of carbon in relation to changes in land use in two micro-scale paired basins (Nova Vida farm, Rondônia)**

Grant holder: Luiz Fernando Charbel  
 Supervisor: Luiz Antônio Martinelli  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2000/01111-0

**40** **Studies of hydrological and hydrogeochemical processes in the drainage basin of the river Piracicaba**

Grant holder: Manuel Enrique Gamero Guandique  
 Supervisor: Reynaldo Luiz Victoria  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 1999/12263-7

**41** **Spatial and temporal variability of carbon in the soil in the conversion of forest into pastures in Western Amazonia (Rondônia)**

Grant holder: Carlos Eduardo Pellegrino Cerri  
 Supervisor: Reynaldo Luiz Victoria  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 1999/07103-0

42

**Modeling of the variations in the spectral response of the physiognomies of Cerrado in relation to seasonal climatic variations**

Grant holder: Humberto Navarro de Mesquita Júnior  
Supervisor: Marisa Dantas Bitencourt  
Institution: Institute of Biosciences /  
University of São Paulo (USP)  
Process 1999/05041-8

43

**Global changes and rate of growth of arboreal species in Amazonia**

Grant holder: Simone Aparecida Vieira  
Supervisor: Luiz Antônio Martinelli  
Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 1999/03353-2

44

**Flux of carbon between soil and atmosphere in a chronosequence in Western Amazonia (Acre)**

Grant holder: Cleber Ibraim Salimon  
Supervisor: Reynaldo Luiz Victoria  
Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 1999/03315-3

45

**Determination of origins and spatial and temporal variations of the flux of methane in hydroelectric plants in Amazonia**

Grant holder: Ivan Bergier Tavares de Lima  
Supervisor: Reynaldo Luiz Victoria  
Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 1999/02228-0

46

**Dynamic of organic matter in the soil in areas with climatic and textural differences in Amazonia**

Grant holder: Everaldo de Carvalho Conceição Telles  
Supervisor: Luiz Antônio Martinelli  
Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 1997/14073-5

47

**Adaptation strategies of arboreal species typical of waterlogged soil environment: a morphological, biochemical and ecophysiological approach**

Grant holder: Patrícia Carneiro Lobo  
Supervisor: Carlos Alfredo Joly  
Institution: Institute of Biology / Campinas State University (Unicamp)  
Process 1997/08794-1

48

**Study of the ground burning regime in the Brazilian cerrados with AVHRR/NOAA images: 1985-1988**

Grant holder: Helena França  
Supervisor: Alberto Waingort Setzer  
Institution: Institute of Biosciences /  
University of São Paulo (USP)  
Process 1997/07695-0

49

**Decomposition of residues of sugarcane in no-burn harvesting system**

Grant holder: Marilda Zanoni Mariotti Abbas  
Supervisor: Carlos Clemente Cerri  
Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 1996/12013-2

50

**Chemical characterization of precipitation in the basin of the river Piracicaba: spatial and temporal variability**

Grant holder: Luciene de Barros Lorandi Silveira Lara  
Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 1996/07318-9

51

**The dynamic of organic carbon dissolved in the hydrographic basin of the river Piracicaba, São Paulo**

Grant holder: Marcelo Corrêa Bernardes  
Supervisor: Reynaldo Luiz Victoria  
Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 1996/00383-0

52

**Concentration, stock of nutrients and isotopic composition of the wet tropical forest, Samuel Ecological Station, Rondônia**

Grant holder: Sergio Antônio da Silva Almeida  
 Supervisor: Luiz Antônio Martinelli  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 1992/02942-5

53

**Aspects of the hydrological cycle in the Amazon basin: a temporal and spatial study**

Grant holder: Aristides Ribeiro  
 Supervisor: Reynaldo Luiz Victoria  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 1992/00361-5

#### MASTERS

54

**Study of the hydric balance and biogeochemical balance of nitrogen in a microbasin with a forest plantation of eucalyptus on the northern coast of the State of São Paulo**

Grant holder: Rodrigo Trevisan  
 Supervisor: Jorge Marcos de Moraes  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Processo: 2006/59536-3

55

**Integrated analysis of dendrochronology, anatomy and stable isotopes of carbon in *Hymenaea courbaril* L. for identification of possible effects of the elevation of atmospheric CO<sub>2</sub> and climatic changes**

Grant holder: Giuliano Maselli Locosselli  
 Supervisor: Gregório Cardoso Tapias Ceccantini  
 Institution: Institute of Biosciences / University of São Paulo (USP)  
 Process 2006/58698-0

56

**Study of the hydric balance and the biogeochemical balance of nitrogen in a first order microbasin with pasture cover on the north coast of the State of São Paulo**

Grant holder: Luiz Felipe Salemi  
 Supervisor: Luiz Antônio Martinelli  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 2006/54292-9

57

**Impact of raised concentrations of CO<sub>2</sub> on the physiology and the initial growth of croton *Urucurana baill* and *Cariniana legalis* (mart) *kuntze*, in a future climatic simulation**

Grant holder: Eduardo Augusto Dias de Oliveira  
 Supervisor: Carlos Alberto Martinez Y Huaman  
 Institution: Ribeirão Preto School of Philosophy, Arts and Sciences / University of São Paulo (USP)  
 Process 2006/54286-9

58

**Spatio-temporal study of the distribution of dissolved forms of nitrogen and carbon in microbasins of the Atlantic Rainforest with different degrees of disturbance**

Grant holder: Tatiana Morgan Berteli de Andrade  
 Supervisor: Plínio Barbosa de Camargo  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 2005/57812-0

59

**Nitrogen losses through the emission of gases and their relationship with the decomposition of the forest litter and biomass of roots in the woodlands of the Atlantic Rainforest**

Grant holder: Eráclito Rodrigues de Sousa Neto  
 Supervisor: Luiz Antônio Martinelli  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 2005/57549-8

60

**Evaluation of the changes in genic expression in jatobá (*Hymenaea courbaril*) in the response to increase in the concentration of CO<sub>2</sub>**

Grant holder: Luiz Eduardo Vieira Del Bem  
 Supervisor: Michel Georges Albert Vincentz  
 Institution: Center for Molecular Biology and Genetic Engineering / Campinas State University (Unicamp)  
 Process 2005/57098-6

61

**Effect of CO<sub>2</sub> enriched atmosphere on growth, on the allocation of biomass and on the metabolism of fructans of *Vernonia herbacea* (Vell.) Rusby**

Grant holder: Vanessa Fátima de Oliveira  
 Supervisor: Maria Ângela Machado de Carvalho  
 Institution: Institute of Botany / São Paulo State Ministry of the Environment  
 Process 2005/52290-6

62

**Seasonal dynamic of gas exchanges and of the hydric potential in arboreal species of a Cerrado *sensu stricto* in the Pé-de-gigante farmland, P.E. Vassununga, São Paulo**

Grant holder: Sabrina Latansio Costa Ribeiro  
 Supervisor: Marcos Pereira Marinho Aidar  
 Institution: Institute of Botany / São Paulo State Ministry of the Environment  
 Process 2005/51190-8

63

**Environmental heterogeneity: what is its role in the regulation of the wealth and diversity of species of amphibian anurans in open area?**

Grant holder: Carolina Panin Candeira  
 Supervisor: Denise de Cerqueira Rossa Feres  
 Institution: São José do Rio Preto Institute of Biosciences, Arts and Exact Sciences / São Paulo State University (Unesp)  
 Process 2004/12224-1

64

**Influence of the atmosphere enriched with CO<sub>2</sub> and the nitric oxide radical in the production of phytoalexins in plantules of soybean**

Grant holder: Fernanda dos Santos Kretzschmar  
 Supervisor: Márcia Regina Braga  
 Institution: Institute of Botany / São Paulo State Ministry of the Environment  
 Process 2004/11455-0

65

**Study of the effects in the short and long term of a CO<sub>2</sub> enriched atmosphere on the growth, development and metabolism of carbohydrates of sugarcane (*Saccharum ssp.*)**

Grant holder: Amanda Pereira de Souza  
 Supervisor: Marcos Silveira Buckeridge

Instituição: Instituto de Botânica /  
 Secretaria Estadual do Meio Ambiente (SMA-SP)  
 Processo 2004/11421-8

66

**Socioecological dynamics in participative fish farm management: the case of a marine extractivist reserve**

Grant holder: Cristiana Simão Seixas  
 Supervisor: Alpina Begossi  
 Institution: Nucleus for Environmental Studies and Research / Campinas State University (Unicamp)  
 Process 2004/11273-9

67

**The role of fluxes of nitrous oxide from the rivers to the atmosphere in the nitrogen cycle in Brazilian Amazonia**

Grant holder: Carolina Barisson Marques de Oliveira  
 Supervisor: Alex Vladimir Krusche  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2004/10009-6

68

**Effects of anthropic activity and forest fragmentation on the lepidoptera guild**

Grant holder: Danilo Bandini Ribeiro  
 Supervisor: Keith Spalding Brown Júnior  
 Institution: Institute of Biology / Campinas State University (Unicamp)  
 Process 2003/11697-0

69

**Ecological similarity in communities of anuran tadpoles: the role of historical (phylogenetic) and contemporary (ecological) components**

Grant holder: Vitor Hugo Mendonça do Prado  
 Supervisor: Denise de Cerqueira Rossa Feres  
 Institution: São José do Rio Preto Institute of Biosciences, Arts and Exact Sciences / São Paulo State University (Unesp)  
 Process 2003/11049-9

70

**Flux of radon-222 and methane in soils and sediments in Amazonia**

Grant holder: José Mauro Sousa de Moura  
 Supervisor: Marcelo Zacharias Moreira

Institution: Center for Nuclear Energy in Agriculture /  
University of São Paulo (USP)  
Process 2003/03969-0

71

**Biodiversity, spatial distribution and seasonal occurrence of tadpoles and adult anurans in Nova Itapirema, north-east region of the State of São Paulo**

Grant holder: Tiago da Silveira Vasconcelos  
Supervisor: Denise de Cerqueira Rossa Feres  
Institution: São José do Rio Preto Institute of Biosciences,  
Arts and Exact Sciences / São Paulo State University (Unesp)  
Process 2002/11388-5

72

**The effects of the clearing of forest and of the use of fire in the herbaceous community of a terra firme forest in central Amazonia**

Grant holder: Maria Beatriz Nogueira Ribeiro  
Supervisor: Waldir Mantovani  
Institution: Institute of Biosciences / University of São Paulo (USP)  
Process 2002/11196-9

73

**Nictemeral variation in the structure and dynamic of the phytoplanktonic community in the dry and wet seasons in the mesotropical environment (Ninféias lake), Fontes do Ipiranga State Park, São Paulo**

Grant holder: Karin Ferraz Biesemeyer  
Supervisor: Carlos Eduardo de Mattos Bicudo  
Institution: Institute of Botany / São Paulo State Ministry of the Environment  
Process 2002/10938-1

74

**The role of CO<sub>2</sub> emissions into the atmosphere in the carbon cycle, in rivers in the state of Rondônia under different land uses**

Grant holder: Maria de Fátima Fernandes Lamy Rasera  
Supervisor: Reynaldo Luiz Victoria  
Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
Process 2002/09567-9

75

**Study and tendencies in time series of the quality of water of some rivers in the State of São Paulo presenting different degrees of anthropic intervention**

Grant holder: Juliano Daniel Groppo  
Supervisor: Luiz Antônio Martinelli  
Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
Processo 2002/04932-0

76

**Effects of the conversion of forests into pastures on the metabolism of rivers of micro and meso scale in the state of Rondônia**

Grant holder: Michelle Cristine Cogo  
Supervisor: Alex Vladimir Krusche  
Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
Process 2002/04071-5

77

**Analysis of the spatial patterns of trees in for forest formations in the State of São Paulo, through second order analyses (Ripley's K function)**

Grant holder: Robson Louiz Capretz  
Supervisor: João Luís Ferreira Batista  
Institution: Luiz de Queiroz Advanced School of Agriculture / University of São Paulo (USP)  
Process 2001/11825-3

78

**Abundance of capitula, flowering times and taxonomic isolation are decisive factors in the local wealth of endophagous insects of capitula?**

Grant holder: Umberto Kubota  
Supervisor: Thomas Michael Lewinsohn  
Institution: Institute of Biology / Campinas State University (Unicamp)  
Process 2001/00852-0

79

**Effects of forest fragmentation on butterfly guilds on the Atlantic Plateau of São Paulo**

Grant holder: Márcio Uehara Prado  
Supervisor: Keith Spalding Brown Júnior  
Institution: Institute of Biology /

Campinas State University (Unicamp)  
Process 2000/14717-4

80

### Demographic observation and estimate of carbon sequestration in a fragment of river-bordering forest

Grant holder: Patrícia Helena Pasqual  
Supervisor: Mario Benincasa  
Institution: Center for Environmental Studies /  
São Paulo State University (Unesp)  
Process 2000/12210-0

81

### Relationships between the pattern of relief and the diversity of tree species in fragments of the Atlantic Rainforest in the region of Caucaia, São Paulo

Grant holder: William Goulart da Silva  
Supervisor: Jean Paul Walter Metzger  
Institution: Institute of Biosciences /  
University of São Paulo (USP)  
Process 2000/01587-5

82

### Effect of the size of fragment and of the type of matrix in the abundance of six species of forest birds in Caucaia do Alto, São Paulo

Grant holder: Alexandre Uezu  
Supervisor: Jean Paul Walter Metzger  
Institution: Institute of Biosciences /  
University of São Paulo (USP)  
Process 2000/01120-0

83

### Dynamic of carbon in rivers with different degrees of development: comparison between two hydrographic basins (Piracicaba and Mogi-Guaçu, São Paulo)

Grant holder: Tomas Ferreira Domingues  
Supervisor: Reynaldo Luiz Victoria  
Institution: Center for Nuclear Energy in Agriculture (Cena) /  
University of São Paulo (USP)  
Process 1997/05898-0

## SCIENTIFIC INITIATION

84

### Climatic variations and concentrations of ozone in young plants of ipomoea nil scarlet o' hara

Grant holder: Sandra Regina de Araújo da Silva Viola  
Supervisor: Regina Maria de Moraes  
Institution: Institute of Botany / São Paulo State Ministry of  
the Environment  
Process 2008/51537-6

85

### Biomonitoring of the concentration of atmospheric ozone in Presidente Prudente, through the analysis of carbohydrates of the nicotiana *Tabacum* bel-W3 species

Grant holder: Maurício Moreno de Alencar  
Supervisor: Maria de Lourdes Corradi Custódio da Silva  
Institution: Presidente Prudente School of Sciences and  
Technology / São Paulo State University (Unesp)  
Process 2007/59912-8

86

### Effects of ozone on the growth and production of biomass in cultivars of tracaí and sambaíba de Glycine max (soybean)

Grant holder: Francisco Ricardo da Silva  
Supervisor: Patrícia Bulbovas  
Institution: Institute of Health Sciences /  
University Paulista (Unip)  
Process 2007/54396-1

87

### Characterization of the soil in dense ombrophilous forest in the Serra do Mar State Park, São Paulo

Grant holder: Carla Alberoni Rosada  
O: Marisa de Cássia Piccolo  
Instituição: Centro de Energia Nuclear na Agricultura /  
Universidade de São Paulo (Cena/USP)  
Processo 2007/50561-8

88

### Morphophysiological foliar variations in two woody species along a gradient of altitude in the Atlantic Rainforest

Bolsista: Lisa Cardillo Paes  
Orientador: Rafael Silva Oliveira  
Instituição: Centro de Energia Nuclear na Agricultura /  
Universidade de São Paulo (Cena/USP)  
Processo 2007/50540-0

89

### Effect of CO<sub>2</sub> on the establishment of the plantule of açai (*Euterpe oleracea* mart)

Grant holder: Leila Cristina Mortari

Supervisor: Marcos Silveira Buckeridge  
 Institution: Institute of Biosciences / University of São Paulo (USP)  
 Process 2007/04686-3

**90** **Relationship between concentration of chlorophyll, climatic variables and concentration of ozone in young plants of *Psidium guajava paluma* as an aid in biomonitoring**

Grant holder: Daiane Teixeira da Silva  
 Supervisor: Regina Maria de Moraes  
 Institution: Institute of Botany / São Paulo State Ministry of the Environment  
 Process 2006/61535-5

**91** **Greenhouse gas effect and global warming: evaluation of emissions of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O in soils under forest and pastures in Amazonia subjected to a temperature gradient**

Grant holder: Laila Caroline Zamboni Fraccaro  
 Supervisor: Carlos Clemente Cerri  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2006/56400-3

**92** **Inorganic forms of nitrogen in different areas of the tropical woodlands of the Atlantic Rainforest in the State of São Paulo**

Grant holder: Grasielle Fernanda Bueno  
 Supervisor: Luiz Antônio Martinelli  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2006/53412-0

**93** **Use of stable carbon and nitrogen isotopes in ecophysiological studies in the area of the *stricto sensu* Cerrado in the State of São Paulo**

Grant holder: Luciana Della Coletta  
 Supervisor: Jean Pierre Henry Balbaud Ometto  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2005/57141-9

**94** **Analysis of the changes in the use of the cover of the soil in the region of the reservoir of Tucuçu through the eyes of the Landsat 1 and Cbers 2**

Grant holder: Maria Luísa Bonazzi Palmieri  
 Supervisor: Maria Victória Ramos Ballester  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2005/04524-8

**95** **Emissions of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O from a soil irrigated with treated sewage effluent**

Grant holder: Rafael Oliveira Barufaldi  
 Supervisor: Reynaldo Luiz Victoria  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2004/12317-0

**96** **Use of yeasts on leaf surfaces as bioindicator of air pollution**

Grant holder: Guilherme Amstalden Valarini  
 Supervisor: Itamar Soares de Melo  
 Institution: Embrapa Environment / Brazilian Agricultural Research Corporation (Embrapa)  
 Process 2004/10904-5

**97** **Study of the relationship leaf necroses indicators of atmospheric ozone and antioxidant defenses in leaves of *nicotiana Tabacum bel-W3* under the effect of the urban air pollution of São Paulo**

Grant holder: Fabiana Kelly Mendes  
 Supervisor: Sílvia Ribeiro de Souza  
 Institution: Institute of Botany / São Paulo State Ministry of the Environment  
 Process 2004/03167-4

**98** **Development of automated processes employing flux analysis for the determination of total nitrogen and phosphorus dissolved in samples from the Amazon river**

Grant holder: Carla Carrara Fracassi  
 Supervisor: Reynaldo Luiz Victoria  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2003/07676-8



99

**Seed rain in a tropical mountain forest on the São Paulo Plateau**

Grant holder: Mariana Brando Balazs da Costa Faria  
 Supervisor: Luciana Ferreira Alves  
 Institution: Institute of Biosciences /  
 University of São Paulo (USP)  
 Process 2002/09823-5

100

**Study of the relative importance of the degree of connectivity and of the structure of the vegetation for the small mammal community in wooded fragments of the Atlantic Rainforest**

Grant holder: Sérgio Marques de Souza  
 Supervisor: Renata Pardini  
 Institution: Institute of Biosciences /  
 University of São Paulo (USP)  
 Process 2002/02126-7

101

**Effects of the fragmentation of the Atlantic Rainforest – investigating the importance of the size of the fragment and of the quality of the habitat in the structuring of the small mammal community**

Grant holder: Ricardo Braga Neto  
 Supervisor: Renata Pardini  
 Institution: Institute of Biosciences /  
 University of São Paulo (USP)  
 Process 2002/02125-0

102

**Influence of urbanization on the biogeochemistry of two mesoscale hydrographic basins in the State of São Paulo**

Grant holder: Felipe Cristiano Alves  
 Supervisor: Plínio Barbosa de Camargo  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 2001/04813-9

103

**Photosynthesis response in relation to foliar temperature and availability of CO<sub>2</sub> in young *Copaifera langsdorffii* plants**

Grant holder: Leonnardo Lopes Ferreira  
 Supervisor: Carlos Henrique Britto de Assis Prado  
 Institution: Center for Biological Sciences and Health/ Federal

University of São Carlos (UFSCar)  
 Process 2000/11839-1

104

**Influence of the connectivity of the landscape on seed dispersal in fragments of the Atlantic tropical forest – pilot project**

Grant holder: Regina de Azevedo Soares Alonso  
 Supervisor: Vânia Regina Pivello  
 Institution: Institute of Biosciences /  
 University of São Paulo (USP)  
 Process 2000/14606-8

105

**Influence of the connectivity of the landscape on seed dispersal in fragments of the Atlantic tropical forest – pilot project**

Grant holder: Daniela Petenon Barbosa  
 Supervisor: Vânia Regina Pivello  
 Institution: Institute of Biosciences /  
 University of São Paulo (USP)  
 Process 2000/14605-1

106

**Photosynthesis response in relation to different concentrations of CO<sub>2</sub> in two wooded species of cerrado in the dry and rainy seasons**

Grant holder: José Alberto Fernandez Monteiro  
 Supervisor: Carlos Henrique Britto de Assis Prado  
 Institution: Center for Biological Sciences and Health/ Federal  
 University of São Carlos (UFSCar)  
 Process 2000/10910-4

107

**Occupation and use of land in the hydrographic basin of the Ji-Paraná (Rondônia): socio-economic-agricultural survey**

Grant holder: Renata Marconato  
 Supervisor: Reynaldo Luiz Victoria  
 Institution: Center for Nuclear Energy in Agriculture (Cena) /  
 University of São Paulo (USP)  
 Process 2000/09030-0

108

**Concentration of organic and inorganic carbon dissolved in small tributaries of the basin of the river Piracicaba (SP)**

Grant holder: Alexandra Ayres Montebelo

Supervisor: Reynaldo Luiz Victoria

Institution: Center for Nuclear Energy in Agriculture (Cena) /

University of São Paulo (USP)

Process 1998/03500-2

**109** **Atmospheric pollution and mortality  
in the municipality of São Paulo:  
the role of the matrix of automobile fuels**

Grant holder: Renata Krelling

Supervisor: Paulo Hilário Nascimento Saldiva

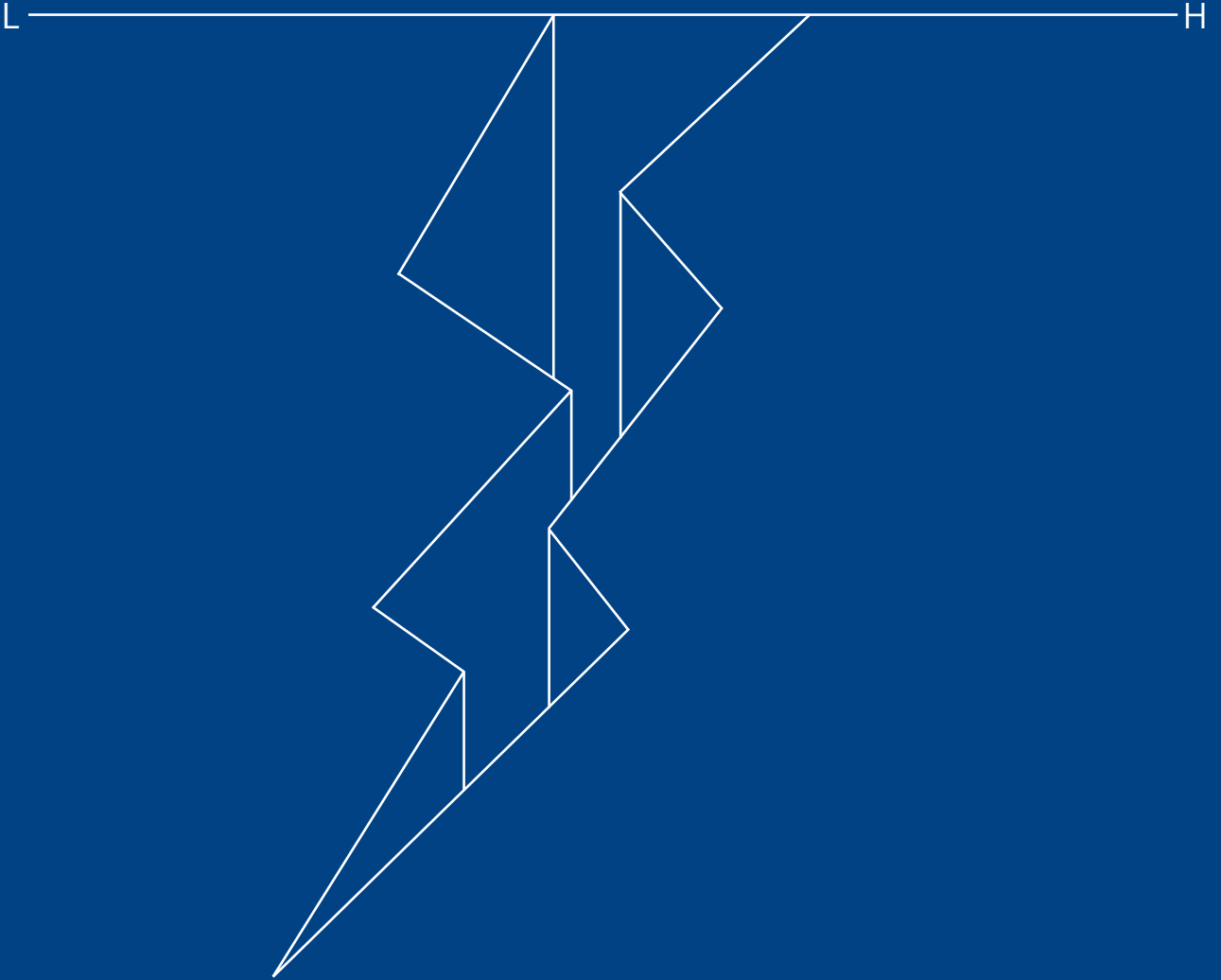
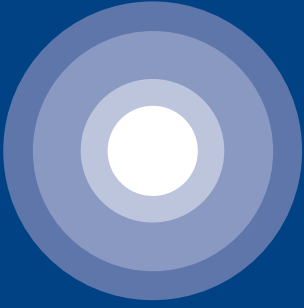
Institution: School of Medicine / University of São Paulo

(USP)

Process 1995/05087-7

# Engineering





## SUPPORT FOR REGULAR RESEARCH

1

**Concentrations of chemical species released during the combustion of biomass in the Amazon Forest**

João Andrade de Carvalho Júnior

Guaratinguetá School of Engineering / São Paulo State University (Unesp)

Process 2002/08964-4

Term: Mar/2003 to May/2007

Our work proposes, by means of experiments of combustion of biomass in the laboratory and in the field, to: a) cover an extensive range of combustibles, at least 10 most abundant species in a region of the Amazon Forest, in a strip of types of biomass (litter, branches, trunks); b) deduce tendencies and parameters of value to predict emissions in the combustion of biomass; how the emissions of certain types of biomass vary with the humidity, wind direction and oxygen supply; c) undertake detailed analysis in respect of the calibration of the instruments and their maintenance (to produce data of quality); d) to undertake elemental analysis of quality in the combustible and in the ash, at least for C, H, and N, and possibly for other elements (S, P, Cl, Br, I).

2

**Phytomonitoring and modeling of photosynthesis in *Hymenaea courbaril* (jatobá)**

Antônio Mauro Saraiva

Polytechnic School  
University of São Paulo (USP)  
Process 2001/08046-2

Term: Nov/2001 to Dec/2003

The quantification of absorption of CO<sub>2</sub> by forests or other ecosystems is a complex task due to the diverse factors involved. On the other hand this quantification is necessary, whether for the purposes of scientific studies of the balance of CO<sub>2</sub>, or for an economic motive such as that of clean development mechanisms. To assist in the solution to this problem this project proposes the development of a model for predicting liquid photosynthesis and stomatal conductance, at the level of leaf, in *Hymenaea courbaril* (jatobá). The techniques used for the modeling will be that of artificial neural networks. To achieve the proposed objective, monitoring will be undertaken of phytophysiological variables (liquid photosynthesis, stomatal conductance, transpiration, leaf temperature, leaf area and fluorescence) and environmental variables (active photosynthetic

radiation, relative air humidity, air temperature and concentration of atmospheric CO<sub>2</sub>) throughout one year. With part of this data the modeling will be undertaken and with the other part evaluation of the model will be undertaken.

3

**Effects of levels of CO<sub>2</sub> and doses of potassium applied via irrigation water to the melon crop (*Cucumis melo L.*) in protected environment**

José Antônio Frizzone

Luiz de Queiroz Advanced School of Agriculture  
University of São Paulo (USP)

Process 2000/11668-2

Term: Mar/2001 to Feb/2003

The objective of this project is to study the isolated effect and the effect of the combination of four levels of CO<sub>2</sub> (control 600, 800 and 1000 mmol CO<sub>2</sub>/mol) and of four doses of potassium (100, 200, 300 and 400 kg of K<sub>2</sub>O/ha) on the net melon (*Cucumis melo L.*) cultivated in greenhouse and drip-irrigated. The layout will be random blocks in a scheme of strips, with 16 treatments and four repetitions, resulting from the combination between the levels of CO<sub>2</sub> and doses of K<sub>2</sub>O. The CO<sub>2</sub> will be applied daily, and the K<sub>2</sub>O, every three days. Parameters to be evaluated: photosynthetic rate, nutritional state of the plants, productivity, quality of the fruit and efficiency of the use of water in the melon crop cultivated in protected environment.

4

**Energy efficiency and sustainability: evaluation of the thermal performance of coverings and of the behavior of transparent materials in relation to solar radiation**

Lucila Chebel Labaki

School of Civil Engineering, Architecture and Urbanism  
Campinas State University (Unicamp)

Process 1999/11097-6

Term: Nov/2000 to Aug/2004

Coverings and transparent surfaces merit special attention when dealing with thermal comfort of buildings, since they are elements vulnerable to considerable heat gain, especially in places with a great amount of insolation, as is the case in Brazil. Transparent surfaces also have to meet the needs of illumination, which when conjugated with the requirements for thermal comfort, guarantee the energy efficiency of the building. The present work aims to study the behavior of these two elements through measurements of prototyp-

pes. It is intended to evaluate the thermal performance both of combinations of ceilings and roofing existing on the market as well as experimental elements which are being developed in the Civil Construction Laboratory of the Department of Architecture at the São Carlos School of Engineering. These experimental coverings address the concept of sustainability, in that there is an effort to use materials derived from renewable resources, which require the least amount of energy possible, both in the sourcing phase and in the processing phase. With reference to the transparent materials, it is also intended to study the thermal and luminous behavior *in loco* of glasses, polycarbonates and solar control films, characterized in previous research.

### 5 Combustion of material of different sizes in ground fires in tropical forests

João Andrade de Carvalho Júnior  
National Institute for Space Research (Inpe)  
Ministry of Science and Technology (MST)  
Process 1998/00104-9  
Term: May/1998 to Mar/2008

The objectives of the project are: to investigate in the field and in the laboratory the characteristics of flameless combustion (incandescence/smoldering) of trunks of Brazilian biomass; to investigate in the field the limits of flammability of the forest adjacent to an area of biomass burning; to investigate in the field the combustion efficiency of burning biomass.

### 6 Geoenvironmental zoning as an aid to environmental management of hydrographic basins

José Eduardo Rodrigues  
São Carlos School of Engineering  
University of São Paulo (USP)  
Process 1997/12794-7  
Term: Mar/1998 to Oct/2000

This project seeks to provide a contribution to the refinement of programs of environmental management of hydrographic basins in operation in the State of São Paulo. The objective is to develop, and apply in a basin, a work method that permits the evaluation of the vulnerability of the physical environment and the actual stage of environmental degradation. For the development of the research we will retrieve the already existing information, which will be analyzed in conjunction with other data obtained by means of field surveys and

laboratory trials. This analysis will involve the processing of satellite images and consequent treatment in a Geographical Information System (GIS). The proposal involves a regional study, which permits hierarchization, in the environmental context, of the microbasins of a hydrographic basin and a quantitative study, aimed at the microbasins, which includes the evaluation of the quality of the waters in tributary canals and in free aquifers. The final product should be the geoenvironmental zoning of the terrain.

### 7 Monitoring and characterization of atmospheric particles in the city of São Carlos, central region of the State of São Paulo, Brazil

Wanda Maria de Carvalho  
Center for Exact Sciences and Technology  
Federal University of São Carlos (UFSCar)  
Process 1997/11615-1  
Term: Jan/1998 to Jan/2000

The project consists in the development of methodology for the chemical analysis of samples of atmospheric particulate material, using techniques of inductively coupled plasma atomic emission spectrometry (ICP-AES), analysis of C and S by LECO element analyzer and X-ray diffraction. This characterization is part of a monitoring and quantification project of the particulate material load in the region of São Carlos.

### 8 Characteristics of the combustion of biomass in tropical forest burnings

João Andrade de Carvalho Júnior  
National Institute for Space Research (Inpe)  
Ministry of Science and Technology (MST)  
Process 1996/11742-0  
Term: Mar/1997 to Nov/1998

One of the areas of activity of the LCP/Inpe is the project *Chemistry of the Atmosphere*, the main thrust of which is to reveal the effects on the atmosphere of the products of combustion generated by ground fires in tropical forests. The project is being undertaken within the ambit of the institutional Amazon project and includes research activity on micro-ground fires, carried out at premises belonging to the LCP, and on ground fires in the field, in forest regions. The objectives of the proposed project are: a) to carry out new experiments aimed at obtaining data relative to the emission of products of combustion in the atmosphere

re, due to biomass burnings; b) to establish equations for Brazilian biomass burnings.

9

### Biomass burning experiments in the Amazon region

João Andrade de Carvalho Júnior  
National Institute for Space Research (Inpe)  
Ministry of Science and Technology (MST)  
Process 1993/04753-8  
Term: Apr/1994 to Apr/1996

The research intends to carry out two experiments of biomass burning in the Amazon region, one of them in Tailândia or Tomé Açu, south of Belém, and the other in the Tropical Silviculture Reserve of the National Institute for Research in Amazonia (Inpa), to the north of Manaus.

## INFORMATION TECHNOLOGY IN THE DEVELOPMENT OF ADVANCED INTERNET (TIDIA)

10

### Research WebLabs in environmental services

Antônio Mauro Saraiva  
Polytechnic School  
University of São Paulo (USP)  
Process 2003/08134-4  
Term: Feb/2005 to Nov/2008

The use of advanced internet for the carrying out of experiments remotely will provide a qualitative leap in the research carried out on different aspects of environmental services. This project proposes the development of an infrastructure of advanced internet applications in the services of pollination and photosynthesis. With regard to pollination, it is proposed to monitor and control colonies of melipona bees to evaluate the flight activity and the thermoregulation in the colonies. In addition to the collection of numerical data the experiments will involve videos and/or images for analysis of the behavior of the insects. It is further proposed to apply monitoring and remote control of greenhouses which, in the future, will be used in experiments on pollination in protected cultivation. With regard to photosynthesis, it is proposed to apply the WebLab concept for the monitoring and remote control of experiments in the absorption of CO<sub>2</sub> in CO<sub>2</sub> chambers with enriched atmosphere and in greenhouses in controlled conditions.

## GRANTS

### POST-DOCTORATE

1

### Study of the techniques of remote sensing based on dealing with the monitoring of industrial atmospheric emissions

Grant holder: Juliana Steffens  
Supervisor: Roberto Guardani  
Institution: Polytechnic School / University of São Paulo (USP)  
Process 2008/50173-0

2

### Modified carbon nanomaterials for applications in clean energy systems

Grant holder: Eveline de Robertis  
Supervisor: Demétrio Bastos Netto  
Institution: National Institute for Space Research / Ministry of Science and Technology (MST)  
Process 2007/59997-3

3

### Perspectives in the Brazilian energy market in the light of the Kyoto mechanisms

Grant holder: Miriam Liliana Hinostroza Suarez  
Supervisor: Ildo Luís Sauer  
Institution: Institute of Electrotechnics and Energy / University of São Paulo (USP)  
Process 2000/11158-4

4

### Monitoring and characterization of atmospheric particles in the city of São Carlos, central region of the State of São Paulo, Brazil

Grant holder: Wanda Maria de Carvalho  
Institution: Center for Exact Sciences and Technology / Federal University of São Carlos (UFSCar)  
Process 1997/11616-8

### DOCTORATE

5

### Methodology for the evaluation of the emission of greenhouse gases produced in the life cycle of the fronts of commercial premises

Grant holder: Vanessa Montoro Taborianski  
Supervisor: Racine Tadeu Araújo Prado

Institution: Polytechnic School / University of São Paulo (USP)  
Process 2006/04034-3

6

### **Bolometric sensors for the THZ band in focal planes of radiation collectors for meteorological and solar applications**

Grant holder: Arline Maria Melo  
Supervisor: José Alexandre Diniz  
Institution: School of Electrical Engineering and Computing / Campinas State University (Unicamp)  
Process 2004/07835-1

7

### **Monitoring of concentration and characterization of the morphological structure of particulate material suspended in the atmosphere**

Grant holder: Wanda Batista de Amorim  
Supervisor: Meuris Gurgel Carlos da Silva  
Institution: School of Chemical Engineering / Campinas State University (Unicamp)  
Process 2000/09091-9

8

### **Study of the impact on the atmospheric emission of NO<sub>x</sub>, CO, SO<sub>x</sub> HC from the replacement of gasoline and diesel with natural gas in the fleet of taxis and buses in the municipality of São Paulo**

Grant holder: Luz Zoraida Dondero Villanueva  
Supervisor: José Goldemberg  
Institution: Institute of Electrotechnics and Energy / University of São Paulo (USP)  
Process 1999/00877-0

9

### **Estimate of the dynamic of the index of foliar area in a hydrographic basin by means of remote sensing**

Grant holder: Alexandre Cândido Xavier  
Supervisor: Carlos Alberto Vettorazzi  
Institution: Luiz de Queiroz Advanced School of Agriculture / University of São Paulo (USP)  
Process 1998/14499-5

10

### **Experimental analysis of the phenomena of combustion and of the emission of gases in internal combustion engines using mixtures of alcohol and gasoline as a fuel**

Grant holder: Felipe Soto Pau  
Supervisor: Antônio Moreira dos Santos  
Institution: São Carlos School of Engineering / University of São Paulo (USP)  
Process 1998/13542-4

11

### **Effects of levels of CO<sub>2</sub> and of doses of potassium applied via irrigation water to melon crops (*Cucumis melo L.*) in protected environment**

Grant holder: Silvana da Silva Cardoso  
Supervisor: José Antônio Frizzone  
Institution: Luiz de Queiroz Advanced School of Agriculture / University of São Paulo (USP)  
Process 1998/12697-4

12

### **Hydrological and climatic effects of forest plantations in areas of Cerrado**

Grant holder: Sílvio Dias Pereira Neto  
Supervisor: Arthur Mattos  
Institution: São Carlos School of Engineering / University of São Paulo (USP)  
Process 1998/06639-1

13

### **Effect of climatic conditions on the quality of natural rubber in rubber tree plantations in Votuporanga, São Paulo**

Grant holder: Rogério Manoel Biagi Moreno  
Supervisor: Luiz Henrique Capparelli Mattoso  
Institution: Embrapa Agricultural Instrumentation / Brazilian Agricultural Research Corporation (Embrapa)  
Process 1998/04878-9

14

### **Influence of vegetation in urban thermal comfort and in the built-up environment**

Grant holder: Carolina Lotufo Bueno Bartholomei  
Supervisor: Lucila Chebel Labaki  
Institution: School of Civil Engineering, Architecture and Urbanism / Campinas State University (Unicamp)  
Process 1997/12805-9

15

### **Study of the atmospheric environmental contamination and of surface waters using Energy Dispersive X-ray Fluorescence (EDXRF) and by Total reflection X-ray fluorescence (TXRF)**



Grant holder: Edson Matsumoto  
 Supervisor: Silvana Moreira  
 Institution: School of Civil Engineering, Architecture and Urbanism / Campinas State University (Unicamp)  
 Process 1996/07093-7

### 16 Determination of the distribution of electrostatic charges in aerosols

Grant holder: Wiclef Dymurgo Marra Júnior  
 Supervisor: José Renato Coury  
 Institution: Center for Exact Sciences and Technology / Federal University of São Carlos (UFSCar)  
 Process 1996/01956-3

### 17 Investigation of rates of carbon dioxide generated in biomass burning in the Amazon region

Grant holder: Thaís Maia Araújo  
 Supervisor: João Andrade de Carvalho Júnior  
 Institution: National Institute for Space Research / Ministry of Science and Technology (MST)  
 Process 1992/00950-0

## MASTERS

### 18 Thermal comfort and planning of green areas in Campinas, through measurements of solar radiation transmitted

Grant holder: Larissa Lemos Fonseca de Lima e Castro  
 Supervisor: Lucila Chebel Labaki  
 Institution: School of Civil Engineering, Architecture and Urbanism / Campinas State University (Unicamp)  
 Process 1996/07917-0

## SCIENTIFIC INITIATION

### 19 Contribution to the study of energy efficiency and economy of hydric resources in coupled systems of solar and electrical heating with residential use

Grant holder: Bruno Sarmiento dos Santos  
 Supervisor: Alberto Luiz Francato  
 Institution: School of Civil Engineering, Architecture and Urbanism / Campinas State University (Unicamp)  
 Process 2008/05073-8

### 20 Study, development and application of a control system dedicated to the automatic positioning of solar modules for water heating, via sun tracking

Grant holder: Leandro Gonçalves de Rezende  
 Supervisor: José Angelo Cagnon  
 Institution: School of Engineering de Bauru / São Paulo State University (Unesp)  
 Process 2007/59519-4

### 21 Evaluation of the concentrations of volatile organic compounds in the air of commercial gasoline stations in Espírito Santo do Pinhal (SP)

Grant holder: Danielle Gonçalves Rodrigues  
 Supervisor: Ana Cláudia Camargo de Lima Tresmondi  
 Institution: Academic Pro-Rectorry / Espírito Santo do Pinhal Regional University Center (Unipinhal)  
 Process 2007/53262-1

### 22 Experimental evaluation of the possible interference caused by global solar radiation and by the velocity of the flow of winds in different processes of air temperature measurement (recordings)

Grant holder: Marcos José de Oliveira  
 Supervisor: Francisco Arthur da Silva Vecchia  
 Institution: São Carlos School of Engineering / University of São Paulo (USP)  
 Process 2005/01792-1

### 23 Green rates, ecoefficiency and carbon credits market in the petroleum and gas sector

Grant holder: Fábio Cirilo  
 Supervisor: José Antônio Perrella Balestieri  
 Institution: Guaratinguetá School of Engineering / São Paulo State University (Unesp)  
 Process 2005/01229-5

### 24 Propagation of fire on forest floors

Grant holder: Dayvis Dias da Silva  
 Supervisor: João Andrade de Carvalho Júnior  
 Institution: School of Engineering de Guaratinguetá / São Paulo State University (Unesp)  
 Process 2001/14189-0



**Estimate of photosynthetically  
active radiation in relation to global  
radiation in Jaboticabal, São Paulo**

Grant holder: Claudenir Facincani Franco

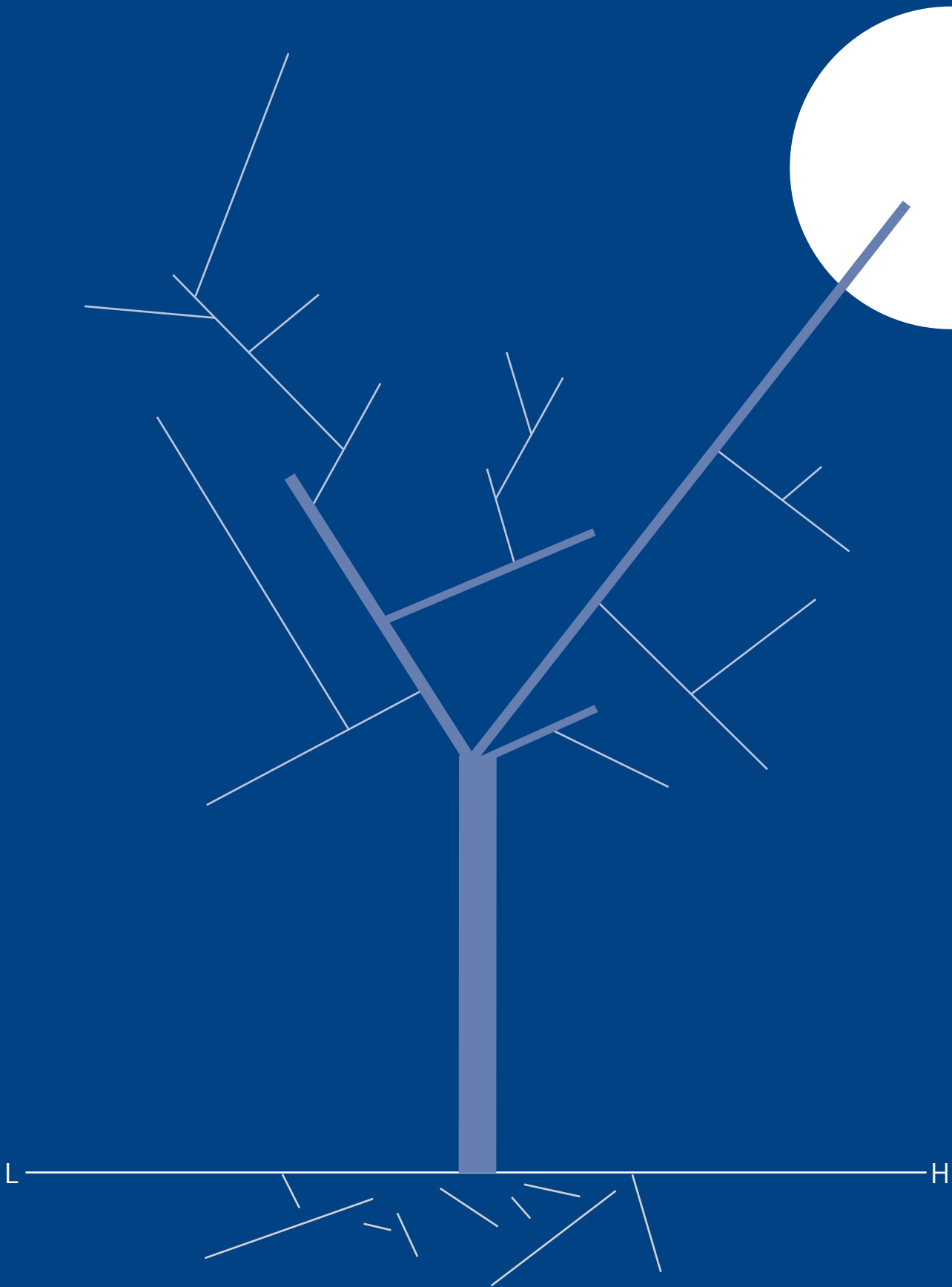
Supervisor: José Eduardo Pitelli Turco

Institution: Jaboticabal School of Agrarian and Veterinary  
Sciences / São Paulo State University (Unesp)

Process 2000/11985-8

# Physics





## THEMATIC PROJECTS

1

**Physical and chemical interactions between the biosphere and the atmosphere of Amazonia in the LBA experiment**

Paulo Eduardo Artaxo Netto  
 Institute of Physics  
 University of São Paulo (USP)  
 Process 1997/11358-9  
 Term: Aug/1998 to Jul/2002

This proposal implements studies on the physical and chemical interactions at the biosphere-atmosphere interface in Amazônia. It is an integrated part of the Large Scale Biosphere-Atmosphere Experiment in Amazônia – LBA. It is one of the five components of LBA: 1) Physical climate; 2) Carbon cycle and biogeochemistry; 3) Chemistry and physics of the atmosphere; 4) Hydrology and water chemistry; 5) numerical Modeling. We are proposing to install and operate continuously for four years three atmospheric monitoring stations at: 1) Tapajós National Forest; 2) Manaus; 3) São Gabriel da Cachoeira. These sites will have towers from the LBA experiment. At these sampling stations we will measure several trace gases, including CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, CO, VOCS (Volatile Organic Carbon compounds), hydrocarbons, NO<sub>x</sub>, NO<sub>y</sub> and Ozone. Aerosol particles will be studied in detail, with measurements of aerosol composition and ionic content, size distribution and optical properties, as well as organic and elemental carbon. In addition, precipitation composition in terms of trace elements, ionic content, dissolved and total carbon will be measured, in order to obtain the wet deposition fluxes of essential nutrients. Continuous measurements of aerosol optical thickness with sun-photometers will allow a detailed study of the influence of aerosol particles on the atmospheric radiation budget. Intensive field studies will be performed twice a year, in the dry and wet season. At these intensive campaigns, gaseous compounds and aerosol properties that are difficult to measure continuously will be determined. These campaigns will be runned in parallel with Europeans and American groups that will take part in LBA, with the objective of to assimilate in Brazil the large amount of new knowledge that will be generated. Large-scale experiments using aircraft will allow basin-wide studies on the atmospheric composition and properties. The atmospheric chemistry of VOCs, Nox and several oxidants will be studied from the point of view of photochemistry processes and atmospheric carbon cycling. Radiative transfer models will study the relationship between aerosols and the radiative balance in the dry and wet seasons. Biochemical models will work with nutrient pools and fluxes, and will study the dry

and wet deposition fluxes of essential nutrients. Chemical-dynamic transport models will be developed for the Amazon Basin, to integrate the atmospheric chemistry measurements with the large-scale transport.

## SUPPORT FOR REGULAR RESEARCH

2

**Study of natural radiation and characterization in brazilian soil**

Marcilei Aparecida Guazzelli da Silveira  
 FEI University Center  
 São Bernardo do Campo Campus (Unifei)  
 Process 2007/04663-3  
 Term: Feb/2008 to Jan/2010

This project of research aims the study of the distribution of soil natural activity. The analysis will be performed in the bordering places of the city of São Paulo, initiating with the study of the natural radiation in the city of São Bernardo do Campo, being later extended for other regions of the state of São Paulo. This research will supply the mapping of the natural radiation in several Brazilian regions. The contribution of the radiation will be evaluated to the dose mainly due to the isotope 40K, and the elements of the series of 238U and 232Th. The results will be compared with international average values of dose due to the external exposition to the gamma rays (0.48 mSv/yr) proceeding from terrestrial natural elements. With this project we intend to initiate a pioneering activity, of scientific and social importance, with the use of the gamma ray spectroscopy technique, in the Centro Universitário da FEI. The collaboration with the Institute of Physics da USP will make possible the transference of knowledge and scientific support in this specific area, in which already poses wide experience.

3

**Atmospheric aerosols in Amazonia: measured in long term, transport on large scale and effects on the atmospheric radioactive balance**

Paulo Eduardo Artaxo Netto  
 Institute of Physics  
 University of São Paulo (USP)  
 Process 1996/02672-9  
 Term: Jul/1996 to Jun/1998

We intend to operate for two years three continuous atmospheric monitoring stations in the Amazon basin, located in Cuiabá (Mato Grosso), Alta Floresta (Mato Grosso) and Serra do Navio (Amapá). We will operate

two new monitoring stations of atmospheric aerosols in areas of primary tropical forest: to the north of Manaus and in Benjamim Constant, in Amazonia. These five stations will measure the total concentration of aerosols, concentration of graphitic carbon and around 22 elements (Na, Mg, Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, Br, Sr, Rb, Zr, Pb) with the nuclear Particle Induced X-ray Emission (Pixe) analytical technique. Analyses of trace elements with High Resolution Inductively Coupled Plasma – Mass Spectrometry (HR ICP-MS) will also be carried out on the aerosol samples. Continuous measurements of optical attenuation by means of five solar photometers will also be carried out, for five different wavelengths. Models of atmospheric optical properties and the effect of the aerosol particles for the dry and rainy seasons will be developed. Model of large scale atmospheric transport for understanding of the mass flux of aerosols in the entire Amazon basin will be developed. Trajectories of air masses will be calculated for the whole year, with a view to understanding the seasonal variability of the transport processes on a large scale. The transport and the radioactive balance models will be coupled to measurements effected, so as to obtain a broader understanding of the role of atmospheric aerosols in diverse processes in the Amazon basin.

#### TECHNOLOGICAL INNOVATION IN SMALL BUSINESSES – PIPE

4

**Development of a system to measure pollutant concentrations in the atmosphere with infrared lasers (CO<sub>2</sub> and CO) by photo-acoustic spectroscopy**

Edjar Martins Telles

Unilaser Indústria e Comércio Ltda.

Process 1997/07445-3

Term: Jan/1998 to Nov/2001

This project proposes to develop an apparatus capable of measuring concentrations in situ of several molecular species (pollutants) present in the atmosphere with a detection limit of 1 ppb (10<sup>-9</sup>) or less. This involves an apparatus that uses an infrared laser to excite the molecular species of interest, given that the detection of the radiation absorbed is realized using the photo-acoustic effect. Pollution of the atmosphere by motor vehicles, factories, biomass burning and other sources, produces undesirable consequences both for human health and for the environment. The first step in dimensioning the problem (and for its solution) is the precise determination of the concentration of

diverse pollutants in the air, as well as their spatial and temporal distribution. To this end, initially we will use a CO<sub>2</sub> laser to develop the spectrometer. A laser which is of considerable interest is that of CO, with which it is possible to detect various pollutants deriving from the combustion of gasoline and diesel oil. Objectives of phase 1: the design of a photo-acoustic cell for gases to carry out preliminary measurements for testing; construction of a CO<sub>2</sub> laser operating on the 80 line, between 9-11 m, with output power of 5-10 W. In phase 2: construction of a photo-acoustic spectrometer for gases using CO<sub>2</sub> laser; development of software for the analysis of samples and development of software for analysis of samples development of a CO laser and market research.

#### GRANTS

##### POST-DOCTORATE

1

**Characterization of gases and particles of aerosols in the Amazon atmosphere and their relationship with processes of transport and emissions from biomass burnings**

Grant holder: Andrew George Allen

Institution: Institute of Physics / University of São Paulo (USP)

Process 1992/00453-7

##### DOCTORATE

2

**Processes of transformation of aerosols in nuclei of cloud condensation in Amazonia and the influence of the secondary organic aerosols**

Grant holder: Luciana Varanda Rizzo

Supervisor: Paulo Eduardo Artaxo Netto

Institution: Institute of Physics / University of São Paulo (USP)

Process 2002/07835-6

3

**Study of the radioactive forcing mechanisms of the aerosols in the Amazon region due to the burning of biomass and natural biogenic emissions**

Grant holder: Aline Sarmento Procópio

Supervisor: Paulo Eduardo Artaxo Netto

Institution: Institute of Physics / University of São Paulo (USP)

Process 1999/12867-0

4

**The effect of aerosol particles from ground fires on the radioactive balance of the atmosphere**

Grant holder: José Vanderlei Martins  
Supervisor: Paulo Eduardo Artaxo Netto  
Institution: Institute of Physics / University of São Paulo (USP)  
Process 1993/05017-3

5

**The development of nuclear analytical techniques applied to the study of ground fires in the Amazon Forest**

Grant holder: Fábio Gerab  
Supervisor: Paulo Eduardo Artaxo Netto  
Institution: Institute of Physics / University of São Paulo (USP)  
Process 1992/02281-9

**MASTERS**

6

**Modeling of physical and chemical properties of aerosols and their interactions with trace gases in Amazonia**

Grant holder: Luciana Varanda Rizzo  
Supervisor: Paulo Eduardo Artaxo Netto  
Institution: Institute of Physics / University of São Paulo (USP)  
Process 2000/09118-4

7

**The quantitative determination of sources of particulate material in the atmosphere in the city of São Paulo**

Grant holder: Andrea Dardes de Almeida Castanho  
Supervisor: Paulo Eduardo Artaxo Netto  
Institution: Institute of Physics / University of São Paulo (USP)  
Process 1997/00844-0

**SCIENTIFIC INITIATION**

8

**The analysis of individual particles of aerosols from Amazonia by sweeping electronic microscopy**

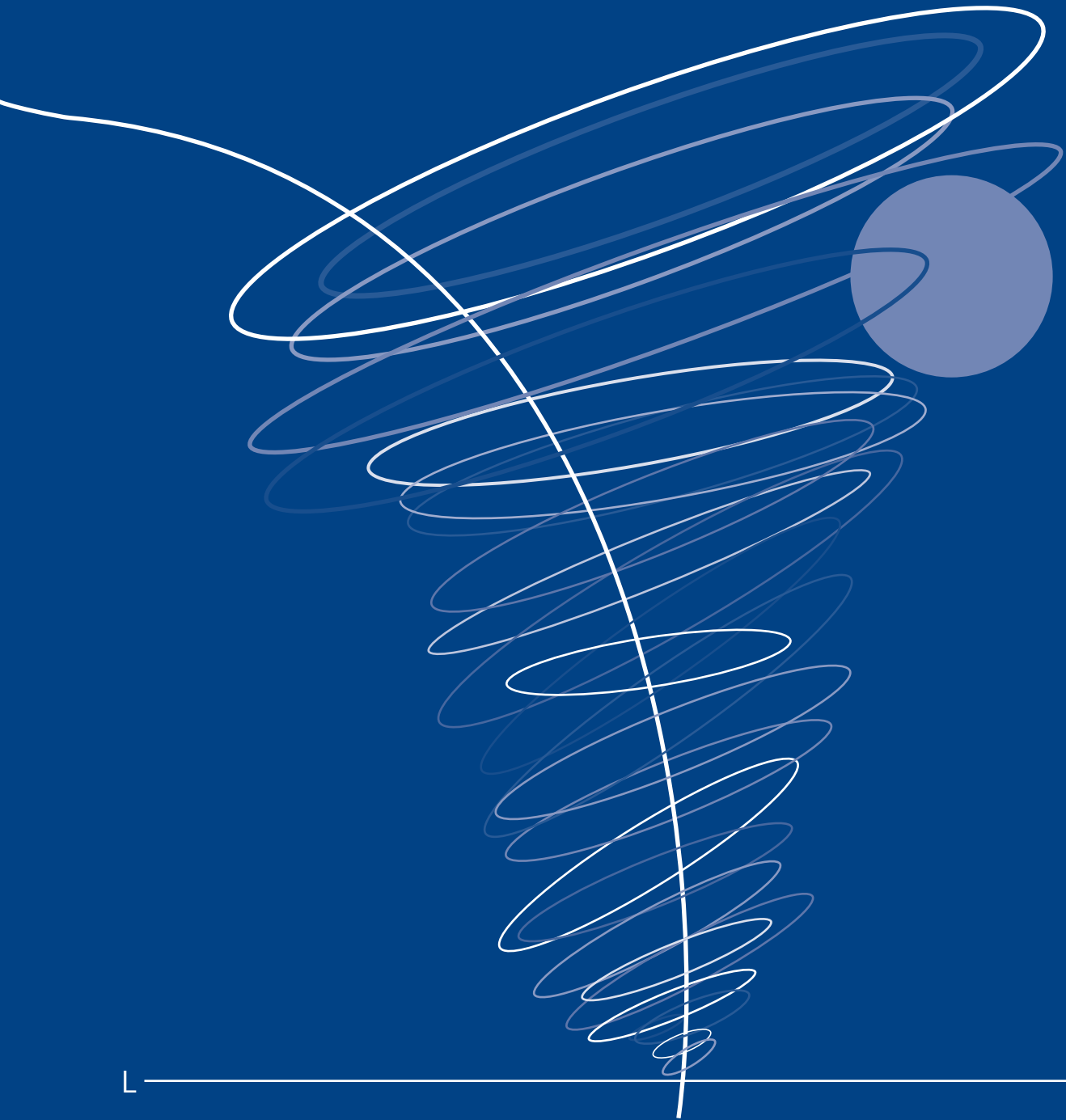
Grant holder: Andrea Dardes de Almeida Castanho  
Supervisor: Paulo Eduardo Artaxo Netto  
Institution: Institute of Physics / University of São Paulo (USP)  
Process 1996/02671-2





# Geosciences





## THEMATIC PROJECTS

1

**SMCos: System for the Monitoring and Study of Coastal Processes**

Valdir Innocentini

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 2005/59438-9

Term: Oct/2007 to Sep/2010

This project has the principal objective of studying, by means of numerical models, physical processes which act in the short, medium and long term on the evolution of the following coastal regions: 1) Massaguaçu; 2) Pecém; 3) Center-north coast of Santa Catarina; 4) Bay of Espírito Santo; 5) Center-south coast of Rio de Janeiro; 6) Amazon Estuary; and 7) Miraflores (Lima, Peru). To do this, we propose to develop a system, called SMCos – System for the Monitoring and Study of Coastal Processes -, consisting of numerical models in the public domain: atmospheric (WRF); hydrodynamic (POM); maritime agitation (WWATCH and SWAN); and transport of sediments (ECOMSED and MOHID). The principal questions and objectives dealt with in this project are: 1) to characterize the wave patterns with identification with meteorological phenomena; 2) to evaluate the effect of the local features in the regime of incident wave; 3) to evaluate the changes in the pattern of waves and transport of sediments due to human interference (engineering works); 4) to validate, compare and analyze critically the results of the models; 5) to evaluate the effect of the El Niño phenomenon on the wave regime; and 6) to study in detail cases of severe storms. The SMCos, in addition to permitting the study of the pattern of maritime agitation and of the currents in the regions mentioned, will be useful to study how local conditions, natural or due to human interference, affect the properties of factors responsible for the transport of sediments.

2

**Studies on the predictability of extreme meteorological events in the Serra do Mar**

Chou Sin Chan

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 2004/09649-0

Term: Sep/2005 to Aug/2009

Serra do Mar is a region of strategic importance for the State of São Paulo, both for sustainable development, and for being home to remaining portions of the Atlantic Rainforest, as well as for the economic deve-

lopment favored by railways, highways, pipelines and industrial and port installations. However, this region experiences recurring landslides on its slopes, causing considerable damage and several deaths. These events are of an hydrometeorological nature associated with a mountain region with steep slopes and subjected to anthropic action. The present project aims to develop a system of monitoring and forecasting of risks for the Serra do Mar region. To this end, it consists of six sub-projects called: 1) “Atmospheric modeling in high resolution of extreme events in the Serra do Mar”; 2) “Coupling of an atmospheric model to a hydrological model”; 3) “Characteristics of convective systems which result in extreme events in the Serra do Mar”; 4) “Large scale characteristics associated with extreme events in the Serra do Mar”; 5) “Development of a semi-automatic system of forecasts and hydrometeorological information to support the management of environmental risks and disasters in the Serra do Mar”; 6) “Impact of the information from telemetric stations for the collection of geotechnical and hydrometeorological data in the numerical forecasting for the Serra do Mar”. The large scale atmospheric environment that configures situations of risk will be identified using calculations of atmospheric parameters and by grouping techniques. The monitoring of the development, dislocation and evolution of the precipitant clouds will use satellite images and detection techniques of the morphological characteristics of the clouds with large vertical development. This technique will produce very short term forecasts, less than 12 h, known as “Nowcasting”. Forecasts of winds supplied by the meso-scale model could extend the forecasting period of convective precipitant clouds. The critical events will be simulated by the Eta atmospheric model and TOPOG hydrological model. In these simulations we will test higher horizontal and vertical resolutions, approximation of the dynamic (hydrostatic and non-hydrostatic), the parameterizations of convective and stratiform clouds (microphysics) and the sensitivity of the model to different types of surface cover. These simulations are aimed at obtaining better configuration and adjustment of the model to produce forecasts up to 72 hours in advance. The TOPOG model will produce streamflow forecasts and will indicate risks of landslides and floods using the data observed. This model will be coupled to the atmospheric model aiming to obtain better rain and streamflow forecasts. The joint forecast will provide the probability of the occurrence of an event. We propose to increase the network of automatic stations with measurements in real time to capture the sea winds, the rains, the level of some of the more critical rivers in the region and the indication of risks. These measurements will help not only in the monitoring of the rains, but also in the better adjustment of the

numerical models and greater understanding of the phenomena. A database with socioeconomic information and information on the surface cover will be implemented. This information will be combined with the measurements in real time and with the numerical forecasts and will be available on the internet through a system of georeferenced information, so that the regions and situations of risk can be more easily identified. By way of final product, it is hoped to have a system for monitoring and forecasting risks in the region of the Serra do Mar.

3

### **Brazilian component of the South American low level jet east of the Andes field experiment: interaction in Meso and Large scale between the Amazon and La Plata River Basins**

José Antônio Marengo Orsini

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 2001/13816-1

Term: May/2002 to Jun/2006

This project is part of a broader international research agenda of the Variability of American Monsoon Systems (VAMOS) and its component Monsoon Experiment in South America (MESA), which are sponsored by the Climate Variability and Predictability (CLIVAR) Program of the World Meteorological Organization (WMO). The proposed field experiment is also relevant to the observational and scientific activities in the continental scale experiment basins of the hydrographic basins of the Global Energy and Water Cycle Experiment (GEWEX) that includes the Amazon and La Plata River basins. In the context of VAMOS and MESA, the regional experiment on South American Low Level Jet East of the Andes (SALLJ) is basically dedicated to field observations and modeling studies of moisture transport between the Amazon and La Plata basins. There are some observational evidences as well as modeling studies that show that the Low Level Jet East of the Andes (hereafter, LLJ) is responsible for most of the moisture and energy transport between these two basins. The SALLJ field experiment has regional components in each country involved (Argentina, Bolivia, Chile, Paraguay, Peru, Uruguay and United States), and some of them already have secured or are looking for funds from international institutions as well as US agencies. The current proposal is directed to obtain funding for the Brazilian component of the SALLJ for the implementation of the Brazilian component of the LLJ field experiment (SALLJ-Brazil), and the observational and modeling studies associated to it. The involvement of

scientists from institutions São Paulo (CPTEC/INPE, USP-IAG, CTA and IPMET), with the collaboration of researchers from Alagoas, Pará, Paraná, Rio de Janeiro, Acre, Rondônia and from countries of the southeastern region of South America plus the United States, will provide an starting point in a series of detailed and high resolution surface, upper-air and remote sensing observation, and will allow to get some answers to this science question: what is the role of the LLJ on the moisture transport from the Amazon to the La Plata basins? More specific science questions include: 1) how is the synoptic variability of the LLJ?, what is the role of the synoptic forcing associated with upper-level westerly flow?, is the Chaco Low Important in the modulation of the LLJ?, what is the role of the heat source associated to latent heat release versus sensible heat on the Bolivian Altiplano and in Amazonia/West Central Brazil?; 2) what is the spatial structure and time variability from diurnal to intraseasonal time scales?, what is the role of the LLJ in the intraseasonal variability of precipitation along the ZCAS?, what is the role of the LLJ in the dynamics of the Mesoscale Convective Complexes over the La Plata Basin?, what is the dependence of the diurnal cycle of in the Andean Region to the east of the Andes in relation to the LLJ?; 3) how is the interannual variability of the LLJ?, what is the dependence of the LLJ in relation to SST anomalies in the Pacific and Atlantic?; 4) do the atmospheric models reproduce adequately the spatial and temporal structure of the LLJ at different time and space scales?, is there any difference in the representation of the LLJ in terms of the vertical and horizontal discretization of the numerical models?; 5) what is the coupling between the occurrence or not of LLJ episodes and rainfall in the Andean region, east of the Andes, and southern Brazil-northern Argentina?; 6) what satellite based techniques and monitoring describe adequately the spatial structure and temporal variability of the LLJ? The extension and upgrading of the current observational network will allow for better and more frequent surface and upper-air directed towards a better understanding of the LLJ, based on a combination of observation and monitoring of circulation and fluxes associated to the LLJ, complemented by regional and global models.

4

### **Radiation, cloud and climate interactions in the Amazon during the Dry-To-Wet transition season/LBA**

Maria Assunção Faus da Silva Dias

Institute of Astronomy, Geophysics and Atmospheric Sciences

University of São Paulo (USP)

Process 2001/06908-7

Term: May/2002 to Aug/2008

The scientific questions and objectives of the present proposal are based on an integrated view of the physical environment of the Amazon region and its role in global climate. The project has as a general objective the understanding of the processes controlling the transition season in southwest Amazonia. Specifically the main scientific questions are: What is the comparative impact of remote climate forcing and of the regional effects of biomass burning generated aerosol on the beginning of the rainy season? Is the local effect of aerosol more significant through its radiative impact or through cloud microphysical processes? What are the feedback mechanisms between the Amazon region and the global climate, specifically in the transition season? How does the surface heterogeneity influence vertical motion and cloud formation? What is the effect of these processes on the regional and long distant transport of heat, moisture, trace gases and aerosol? Are the presently available models good enough to be used in the analysis of future scenarios of different land use and of climate change? With these questions as a framework, the specific objectives are: describe the global and large scale controls of the beginning of the rainy season in the Amazon Region; describe the impact of convection in the Amazon region on the global and regional climate in the transition season; describe the transition season in terms of cloud pattern evolution and aerosol concentration; describe the weather systems and air mass evolution during the transition from the dry to wet season; analyze the several convective features of the Amazon region in the transition season including life cycle, rainfall intensity, lightning, dynamics and thermodynamics; analyze the relationship between CCN and convective patterns; describe the temperature inversion equilibrium in the presence of a mixed layer with aerosol and its evolution after the first major rains; describe the evolution of the PBL during the transition season as a function of soil moisture and of evapotranspiration; describe the surface and PBL radiative budget before, during and after the beginning of the rainy season, over forest and over pasture; describe the impact of land cover heterogeneity on PBL and surface layer turbulence during the transition season; describe the evolution of surface energy, momentum, water and CO<sub>2</sub> budgets in pasture and forest and its seasonal and interannual variability; analyze the radiative transfer processes in the presence of aerosol and to what extent they modify the processes associated to water vapor seasonality; describe the microphysics processes with different aerosol concentration; improve the ability to model the different processes in an integrated view of climate and regional weather. The specific objectives above involve different observational activities and numerical modeling strategy in different scales.

## 5

## Organization and hydrobiogeochemical functioning of lateritic coverings in Amazonia

Adolpho José Melfi

Luiz de Queiroz Advanced School of Agriculture

University of São Paulo (USP)

Process 1996/01447-1

Term: Aug/1996 to Apr/2000

The Amazon basin is the biggest area of the world covered by rain forest and lateritic soil. There is a growing concern about extensive land clearing in the basin which might alter the climate and the productivity of the soils. However, are still poorly understood and only known through dispersed pedological and hydrological studies. The project is a first attempt to link soil distribution in the Amazon lateritic landscapes to weathering and pedogenetic processes as well as to water flow and water quality. Soil distribution at subcatchment scale and the scale of the whole Amazon basin is principally deduced from the broad scale soil maps of the radamBrasil project. Therefore our actual knowledge on soil distribution and soil water processes were used to propose in the project a conceptual soil-water landscape model for the laterites of the Amazon basin with strong emphasis on natural land degradation. The model illustrates in seven superimposed cross sections the morphological change of the uppermost laterites due to ancient and/or recent expansion of waterlogged areas in the landscape. Soil changes under aquic conditions are linked to the successive development of the following processes: 1) redistribution and exportation of iron; 2) exportation of Si and Al and 3) redistribution and exportation of organic matter and iron-clay residue. By activating the geochemical erosion, these processes modify the morphology of the landscape. They also reduce the productivity of the soil, increase the electrolyte load ground watertables and rivers. The project also tend to demonstrate that the Amazon laterites have been placed into desequilibrium in response to regional environmental conditions thereby developing severe land degradation problems at specific places in the basin. It is suggested that human activities will accelerate land degradation by activating pre-existing processes. Accordingly the model and the soil maps could be used in the future by land and water supply managers to develop more efficient management strategies according to conditions of increasing land degradation. The objective of the project is carry out detailed pedological and hidro-geochemical investigations at four key sites representatives of the main lateritic soil landscapes of the Amazon basin in order to 1) validate or modify the global soil-water landscape model suggested in the project; 2) better characterize the processes

involved in the transformation of these landscapes and 3) state whereas these processes are ancient or still occurring nowadays.

## 6

### Meteorology and atmospheric pollution in São Paulo

Pedro Leite da Silva Dias

Institute of Astronomy, Geophysics and Atmospheric Sciences  
University of São Paulo (USP)

Process 1996/01403-4

Term: May/1998 to Jul/2003

It is proposed to carry out this project with the following broad themes: 1) meteorological aspects in the Metropolitan Region of São Paulo (RMSP) during the winter; 2) atmospheric circulation in São Paulo and the transport of ozone: simulation of the photochemical production of pollutants; 3) study of the pollutants in the aerosol phase, the study of the species of primary and secondary origin including removal processes; 4) study of the influence of anticyclone blocking on the winter conditions in the State of São Paulo; 5) the atmospheric aerosol and its interaction with solar irradiance in São Paulo.

## 7

### Summer rainfall in São Paulo, Brazil

Maria Assunção Faus da Silva Dias

Institute of Astronomy, Geophysics and Atmospheric Sciences  
University of São Paulo (USP)

Process 1993/00545-1

Term: Dec/1993 to Jan/1998

The project deals with a basic problem related to weather forecasting in the region where the city of São Paulo is located: the large amounts of rainfall in summer which often lead to floods. Rainfall monitoring and its evolution are analysed from the global and large scale perspective by studying the remote influences (teleconnections) and the synoptic systems associated to enhanced rainfall events, and the mesoscale where the formation of convective systems forced by local circulations (topography and land/sea contrasts). This goals are achieved through the use of numerical simulations, diagnostic analysis using data from the operational networks, global analysis, and remote sensing products from radar and satellite. Results from observational campaigns conducted in the past (RADASP Project – FAPESP) are used to test the validity of the

numerical simulations. The regional mesoscale modeling system – RAMS – is used for the limited area simulations; global simplified models are used for the teleconnections. The tradition of the group in research involving large scale and mesoscale atmospheric dynamics as well as in remote sensing techniques is the basis for the present work. The main focus of the present work is the South Atlantic convergence zone – SACZ: its relationship with other tropical heat sources like the South Pacific convergence zone – SPCZ, the intertropical convergence zone – ITCZ, and the Amazon convection; its climatology and diurnal variation; its relationship with orographic intensification of rainfall; the formation of enhanced convection embedded in stratiform regions; the influence of surface processes; the fine structure of the associated precipitation.

### SUPPORT FOR REGULAR RESEARCH

## 8

### Controls of the Atlantic Rainforest on the local and regional climate

Carlos Afonso Nobre

National Institute for Space Research  
Ministry of Science and Technology (MCT)

Process 2008/50285-3

Term: Jul/2008 to Jun/2010

This proposal intends to investigate the control of the forest of the Serra do Mar on the local regional climate, by means of precise measurements of the local processes (surface and local fluxes) on an area of the Atlantic Rainforest in an instrumented microbasin in the southeast of the State of São Paulo. The proposal will benefit from complementary micrometeorological measurements from a tower for measuring turbulent fluxes implemented in the thematic project *Composition, structure and functioning of the forest in the Serra do Mar State Park*, a Sodar deriving from a partnership established between the University of São Paulo and Petrobras. These measurements will be carried out in parallel with the results of the FAPESP project *Balance of carbon in the Atlantic Rainforest through biometric and micrometeorological measurements* and a network of meteorological stations from the project *Study of the predictability of extreme events in the Serra do Mar with a view to refining the knowledge of the dynamic of the exchanges of water and carbon in the Atlantic Rainforest*, together with data on the vertical profile of wind and temperature obtained with the help of a Sodar. The body of information collected will promote the validation of atmospheric models and the carrying

out of simulations tackling the question of control of the Atlantic Rainforest on local and regional climate and will try to establish what is the magnitude of the forest's contribution to the climatic regime (temperature and precipitation) on a local and regional scale and whether deforestation or the introduction of new forms of land use (pastures, eucalyptus, etc.) could alter the local and regional climate pattern.

9

### The carbon balance over an area of Atlantic Rainforest with micrometeorological and biometrical measurements

Humberto Ribeiro da Rocha

Institute of Astronomy, Geophysics and Atmospheric Sciences  
University of São Paulo (USP)

Process 2007/57465-4

Term: Apr/2008 to Mar/2010

To understand and quantify the patterns of productivity and functionality of tropical forests with respect to climate signifies increasing the predictability of the state of the ecosystems and of their environmental services. The projections of increase in temperature and variability of rainfall in South America in the coming decades point to scenarios which promote new states of equilibrium and areas of potential occupation of forest and cerrados, including the Atlantic Rainforest. This region does not have integrated hydroclimatic information and information on the carbon cycle obtained with modern techniques which make it possible to track the biophysical rhythms in progress with the potential changes in environment and climate. The micrometeorological approach to estimate the Liquid Flux of CO<sub>2</sub> in the Ecosystem (FLE) is a sum of three contributions: the turbulent flux (or eddy covariance), the vertical non-turbulent flux (accumulation or removal of CO<sub>2</sub>) and the vertical and horizontal advective flux. In the areas of gentle topography the first two terms respond for the greater variance of the FLE, and in regions of valleys and mountains the estimate of the advective term is imperative. This proposal intends to study an area of the Atlantic Rainforest, in the Serra do Mar in SP, planned under a multidisciplinary investigation with high technical detailing, to implement a system for measuring advective atmospheric fluxes of CO<sub>2</sub>, in parallel with the measurement of variation in the stocks of carbon using biometrical techniques, taking advantage also of the data from a flux tower implemented in the thematic project Composition, structure and functioning of the forest in the Serra do Mar State Park.

10

### Study of natural fires in the Cerrado

Helena França

Pro-Rectorcy of Research and Post-graduation  
University of Taubaté (Unitau)

Process 2007/55843-1

Term: Mar/2008 to Feb/2010

Natural fires started by atmospheric discharges are common events in several regions of the world. They form a part of those ecosystems and have already been well studied and documented in other countries. In Brazil there is evidence that natural fires are frequent in the Cerrado, although they remain practically unknown to science. Fire in the Cerrado is considered a natural disturbance and integral to its dynamic and the natural fires may be important for the maintenance of the ecological processes and the biodiversity, especially in the conservation units (CU). This project intends to investigate the occurrence of natural fires in the cerrados in the following National Parks: Serra da Canastra (PNSCa), Emas (PNE), Brasília (PNB) and Serra do Cipó (PNSCi), characterizing the biotic and abiotic factors involved in these events. The quantification and physical characterization of the bolts of lightning that strike the parks will be determined with data from the Brazilian Network for the Detection of Atmospheric Discharges (BrasilDat). Meteorological data from all areas of study will also be used. In the PNSCa and PNE the combustible materials will be characterized according to the class of vegetation, diameter, time elapsed since the last fire and the accumulation of biomass. Physical aspects of the landscape such as topography and the presence of barriers (rivers, roads) to the propagation of the fire will also be considered. The data will be integrated, processed and analyzed in a Geographical Information System (GIS). It is hoped to understand the interactions between the occurrence of bolts of lightning, combustibles, weather and landscape conditions in these parks. The results will contribute to understanding the dynamic of fire in the Cerrado and the electrical characteristics of the storms in those areas. It will also provide important information for the management plans of these parks, aimed at conservation of remnants of the Cerrado.

11

### Reconstruction of vegetation and climate since the middle Holocene in Brazil

Luiz Carlos Ruiz Pessenda

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)  
 Process 2007/03615-5  
 Term: Mar/2008 to Feb/2011

It is intended to develop in the southeastern and northern Brazil, a comparative study involving paleo environmental records (vegetation, climate and dynamics of the marine level) since the mid Holocene (~ last 6000 years and when possible in secular resolution), using pollen, isotopes (C and N) and geochemical analyses of lacustrine sediments and peat bogs, with the possibility of associating biological tracers as diatoms and sponge spicules, when it will have the presence of the same ones. Through the association of these paleoenvironmental studies with recent climatic events that occurred in the North Hemisphere (for example, Warm Medieval Period (WMP), Little Ice Age (LIA), etc.), it is also the objective of a better understanding of the dynamics of transport of humidity between the regions north and southeast of Brazil, associated with the displacements of the ITCZ (Inter Tropical Convergence Zone) and of the ZCSA (Zone of Convergence of the South Atlantic) during the emphasized period, as well as the influence of these in the events of cold-fronts, etc.

12

**Mapping environmental indicators and remote sensing and GIS techniques applied to coastal regions – study case: Santos/São Vicente estuarine system, São Paulo**

Luís Américo Conti  
 School of Arts, Sciences and Humanities  
 University of São Paulo (USP)  
 Process 2007/02419-8  
 Term: Dec/2007 to Nov/2009

This project examines the evolutive characteristics of an impacted tropical estuary (Santos/São Vicente region, São Paulo state) providing opportunities to assess the cumulative impact of environmental changes and their consequences on the land use/occupation. To achieve this objective we propose the implementation and analysis of a geographically referenced database, temporal satellite images in order to select a set of target areas where we will investigate the relationships between various environmental patterns such as local vegetation, human occupation and erosional and depositional indicators. Based on the empirical relationships found, the project assesses the utility of models of land-use patterns based on remote sensing as indicators of environmental conditions, furthering the integration of causal factors into environmental monitoring frameworks for coastal zones.

13

**Study of the influence of aerosol particles emitted by ground fires on photosynthesis in Amazonia**

Márcia Akemi Yamasoe  
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 Process 2006/56550-5  
 Term: Feb/2007 to Jan/2009

The burning of biomass emits a large quantity of gases and aerosol particles into the atmosphere. The particles interact with solar radiation, spreading out and absorbing, in such a way as to diminish the total quantity available on the surface and increasing the diffuse fraction. Such alterations in the profile of radiation affect the balance of radiation and the turbulent fluxes of sensible and latent heat and can affect photosynthesis. The principal objective of this research project is to continue with the study of the effect of aerosol particles emitted by burning in Amazonia on the photosynthesis of a primary tropical forest. It is also intended to evaluate whether the high concentrations of ozone, another subproduct of the fires, affect the photosynthesis process.

14

**Evaluation of air quality for ozone in the metropolitan region of Campinas**

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 Process 2006/54356-7  
 Term: Apr/2007 to Mar/2009

It is proposed to study the meteorological chemical factors and emissions, which determine the air quality in the Metropolitan Region of Campinas (RMC), especially the formation of ozone, with the possibility of indices of air quality for that pollutant. The motivation for carrying out this work comes from the preliminary results obtained by Cetesb in the monitoring of ozone, carried out during the first 11 months of 2003, in Americana (40 km from Campinas), which classified for that period the air of that city as being the second most polluted by ozone in the interior of the State of São Paulo, attributing this poor air quality to episodes of ozone transport from the source regions of Campinas and Paulínia, by mechanisms of local circulation. For this study we will use the CIT photochemical model (air quality model of the Caltech Institute of Technology). The model will be calibrated beforehand with the data on surface ozone collected from the air quality stations of Cetesb for critical periods in terms of



concentration for the years 2003 and 2004 and later, based on prediction of air quality, we will define the period of carrying out a campaign for the launch of ECC (Electrochemical Concentration Cell) ozonesondes, aimed at validating the results of the modeling with experimental data of vertical profiles of ozone. This campaign will be conducted in partnerships with the Inpe Ozone Laboratory. An experiment of ozone soundings will be carried out in the Metropolitan Region of São Paulo (RMSP), within the ambit of the public policy project *Photochemical models of air quality: implementation for simulation and evaluation of tropospheric concentrations of ozone in urban regions*. It is intended that the experiments should be carried out in the same period, permitting, thus, the description of the transport between these metropolitan regions. At a later stage, it is aimed to carry out simulations, using the RAMS (Regional Atmospheric Modeling System) meteorological model, which has a simplified chemical mechanism being set up for the management of the entry parameters: meteorological, air circulation and ozone concentration, for the purposes of comparison with the results obtained when using data from Cetesb in the CIT photochemical model of air quality.

15

### Prognostic studies of the use of the Aqua satellite in the inference of the concentration of carbon monoxide in the atmosphere

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Ministry of Science and Technology (MCT)  
Process 2006/53277-6  
Term: Oct/2006 to Oct/2008

The warmest three years in the history of Earth occurred in the last decade. It is probable that most of this warming stems from the emission, due to human activities, of gases which retain thermal radiation. These gases are also known as greenhouse gases. Important instruments that can be used to study the emission of greenhouse effect gases in the earth's atmosphere are sounders on board space platforms. Currently, the Division of Satellites and Environmental Systems of the Weather Forecasting and Climate Studies Center (DSA/Cptec/Inpe) has made available the concentration of some greenhouse effect gases estimated using information from the Aqua satellite. This research project aims to quantify the quality of the estimates of carbon monoxide, comparing them with field measurements, with data obtained from other satellites, with calibrated instruments recognized as "terrestrial truth" by the scientific community, in addition to the verification of the internal consistency through the comparison with

results from models of air quality available from Cptec. It is important to observe that the quality of the remote soundings depends on the surrounding conditions imposed, as well as the appropriate choice of channels of the sounding system. In this context, we aim to contribute to the improvement in satellite products, restructuring algorithms in order to refine the inversion procedure under Brazilian climatic conditions and make available concentrations of carbon monoxide with quality control for researchers and users in general. In addition to scientific interest, it should be stressed that the better understanding of the emissions of greenhouse effect gases over Brazil is fundamental for the adoption of public policies which reduce biomass burning and deforestation, our greatest source of emissions.

16

### The role of mesoscale and submesoscale activity in the Brazil-Malvinas frontal system

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Process 2006/03968-2  
Term: Nov/2006 to Oct/2008

In this project we propose to investigate the role of mesoscale and submesoscale turbulent activity in the Brazil Malvinas frontal system. Our premise is that both are important to explain the distribution of water properties such as T,S, nutrients and potential vorticity in the region because they condition the transformation and subduction of the different water masses. Using the 3-D primitive equation numerical model ROMS, we propose to investigate and quantify these processes. The main outcome expected is an improved understanding of the role played by the South West Atlantic (SWA) in the thermocline ventilation and, more generally, in the Atlantic meridional overturning circulation. This project was motivated by discussions held during the SACOS Workshop and contributions to the SACC Consortium are anticipated. This project will be developed with the participation of two post-doc fellows, for whom we are requesting fellowships from FAPESP. One will be mostly involved with the research plan described here. The other will develop a project of data assimilation for ocean forecast, in which the model component is the one implemented as part of this work.

17

### Implementation and calibration of a Raman Lidar – water vapor and aerosols

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São Paulo State Ministry for Development  
 Process 2006/02092-6  
 Term: Nov/2006 to Oct/2008

We intend to implement a calibration procedure for a Raman Lidar. We propose the use of a stabilized calibration lamp to determine the radiometric efficiency of the Lidar system present in Ipen and, starting from first principles apply a method of auto-calibration of the system to improve the accuracy of the system.

18

**Investigation of the southern ocean circulation for the 20<sup>th</sup> century – part I: effect of the southern ocean modes of variability on the Weddell sea**

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 Process 2005/03161-9  
 Term: Jul/2006 to Jun/2009

The behavior of the circulation of the southern oceans, with special focus on the Weddell sea is examined through a simulation with the state-of-the art coupled climate model of the National Center for Atmospheric Research (NCAR-CCSM 3.0). Results are analyzed from 1870 to the year 2000 where both solar constant and greenhouse gases vary.

19

**Reconstruction of paleovegetation and paleoclimate in regions of the southern coast of the State of São Paulo (Serra do Mar State Park – Nucleus of Curucutu and Ilha do Cardoso) in the Late Quaternary**

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 Process 2004/15531-2  
 Term: Sep/2005 to Aug/2008

Studies of paleoenvironmental reconstruction (vegetation and climate) have continued to be developed in the Amazonian, Central, Northeast, Southeast and South regions of Brazil, in some locations using pollen grains deposited in lake and turf deposits, and in others, isotopes of carbon from the organic matter of the soil (OMS) and fragments of charcoal found in the soil, among other indicators. To reinforce the paleoenvironmental studies carried out up to the present in the Southeast region it is intended through this project, to develop comparative studies involving isotopic records

of the OMS and plants, palinological studies in peateries and in mangrove swamps and with the possibility of associating it with antracological analysis, if there is found to be the presence of carbon fragment buried in the ground. Samples will be taken from the Serra do Mar State Park –Curucutu Nucleus, São Paulo (SP), and on the Ilha do Cardoso, south coast of the State of São Paulo. We will collect soil samples for physical, chemical and isotopic analysis of the OMS and also of <sup>14</sup>C of the humin fraction of these soils. Equally, if found, we will sample fragments of carbon, wood and other buried vegetal remains in order, together with the humin, to establish the chronology of probable vegetational and climatic changes which occurred in the region in the last 20,000 years. Samples of turf and mangrove will be collected for palinological, isotopic analyses <sup>14</sup>C dating. The integration of techniques and researchers should back up significantly the studies in vegetational and climate changes which occurred during the Late Pleistocene and Holocene in the Southeast region of Brazil and enable a multi and interdisciplinary approach.

20

**Study of the composition of aerosols and the isotopic signature of Pb as tracer of the source of atmospheric pollution in the city of São Paulo**

Marly Babinski  
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 University of São Paulo (USP)  
 Process 2004/15277-9  
 Term: Sep/2005 to Dec/2008

The present research project aims to study the composition and morphology of the aerosols in the city of São Paulo and, together with the meteorological parameters and Pb isotopes, trace the possible sources of natural and anthropic emissions. The research will involve seasonal campaigns for the collection of fine (PM<sub>2,5</sub>) and coarse (PM<sub>10</sub>) particles in periods of 12 hours, enabling the modeling of the polluting sources and the dispersion of their pollutants, by means of the evaluation of trajectories of air mass. The same collection systematics will be applied in a remote area, the most pollutant-free possible in order to characterize the region's background system. What distinguishes this project from those carried out already in the city will be the association of several analytical techniques and the use of Pb isotopes as tracers of pollutant and natural sources, already widely used in countries in the Northern hemisphere and recently developed in Brazil for environmental studies.

21

### **Refinement of the description and numerical simulation of the surface and convection processes in the Cptec modeling of the atmosphere**

Saulo Ribeiro de Freitas

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 2004/13445-1

Term: May/2005 to Jul/2007

Work project on the improvement of the quality of forecasts of the state of the atmosphere in atmospheric models of Cptec and introduction of new functionalities. Efforts will be made to find an improvement in the description and the numerical simulation of surface processes responsible for the exchange of internal energy, water and momentum between the surface and the atmosphere and in wet convective processes, precipitant or not. In surface processes, efforts will be concentrated on the introduction of global data of vegetation, texture of soil and IVDN updated with high spatial resolution, modern SIB 2.5 surface with patches scheme and operational initiation of ground humidity. In deep convection, we will implement the training procedure with the modern parameterization of Grell cumulus, while in shallow convection we will focus on the introduction of new closing phases in the parameterization of Grell shallow cumulus. Coupling the cumulus scheme with cloud microphysics will be implemented by the explicit tendency of total water in water vapor and water in liquid or solid state. We will also examine the question of coupling between the cumulus schemes themselves (shallow and deep) aimed at improvements in the simulation of the diurnal cycle of precipitation. It is hoped for an effective improvement in the performance of the Cptec models in the numerical simulation of the thermodynamic properties of the planetary boundary layer and of the positioning and temporal occurrence of convective systems.

22

### **An experiment to evaluate the effect of seasonal biomass burnings in central Brazil and the Amazon region on the increase in concentrations of carbon monoxide from tropospheric ozone in Southeast Brazil**

Volker Walter Johann Heinrich Kirchhoff

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 2004/03404-6

Term: Aug/2004 to Jul/2005

A study is proposed to evaluate the impact of emissions from biomass burning in central Brazil and Amazonia in the composition of the atmosphere of the Southeast region of Brazil, in particular the Vale do Paraíba, São Paulo. This proposal envisages implementing an atmospheric chemical experiment in this region, with measurements at surface level of the concentrations of carbon monoxide (CO) and ozone (O<sub>3</sub>), in addition to other long life gases, and the launching of balloons with probes for measurements of ozone and aerosol particles. The experimental measurements will be planned and have their results analyzed in real time, with the aid of results from a transport model of pollutants emitted by biomass burning and by sources associated with urban industrial areas. Preliminary observations carried out in the region of the Vale do Paraíba shows a complex structure of data, with high variability in the values observed of concentrations of trace gases. The concentration of CO in Vale do Paraíba is typically of the order of 300 ppbv, but in some cases much higher values, above 600 ppbv, rising to reach 1,600 ppbv, were observed. A preliminary analysis of retrograde trajectories of the air masses indicates the possibility of completely different contributions. There could be supremacy of anthropogenic sources from the metropolitan areas of Rio de Janeiro and São Paulo, or from the emissions of seasonal biomass burning in central Brazil and Amazonia. It also has to be taken into consideration that the region of Vale do Paraíba is important and industrially developed, constituting, therefore, a significant local source of pollutants. It is of great interest to investigate better how the incidental air masses are constituted and the relative role of each one of the contributions. The surface measurements will be carried out in a container, which is, in fact, a transportable laboratory for group use, with which other projects have already been carried out. Inside it we will centralize the continuous measurements of O<sub>3</sub> and CO<sub>2</sub>. The measurements of CO (and CH<sub>4</sub>, which will be used to discriminate the origin of the sample) will be obtained through grab samples, which are taken to the laboratory in special sampling flasks, where they are analyzed by gas chromatography. It is proposed to complement the observations at surface level with measurements of O<sub>3</sub> and of particulate matter at different vertical levels, through the use of probes launched in balloons. Our proposal is to launch balloons with ozone probes, but also another type of launch, using larger balloons, which also carry a special probe to measure the vertical distribution of aerosol particles. The Inpe ozone group already carried out these measurements, systematically, in Natal, Rio Grande do Norte, and sporadically in other locations in Brazil and Antarctica. Similarly, the Cptec

group has carried out air quality monitoring on a regional scale through numerical modeling. His study has demonstrated the role of transport processes on different scales, from turbulence to convection and advection, in the definition of the spatial and vertical distribution of atmospheric pollutants originating from biomass burnings and other anthropogenic sources.

23

### **Variabilities of the South Atlantic. Connections with the thermohaline circulation and the climate in South America (VARIAS 2)**

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Process 2004/01850-9  
Term: Jun/2004 to May/2006

Numerical experiments with ocean-atmosphere coupled models and observational data will be used in the investigation of physical mechanisms which control the interannual and decadal modes of climatic variabilities in the South Atlantic and their teleconnections with variations in other regions of the planet. In particular it is intended to investigate the correlations between the dipolar mode of sea surface temperature anomalies in the South Atlantic and variabilities in two areas: the region of formation of deep waters in the North Atlantic and the zone of atmospheric convergence over Brazil (South Atlantic Convergence Zone – SACZ). Connections between the South Atlantic and these two regions were observed in results of previous projects, financed by FAPESP. In addition to these teleconnections, another objective of the present project will be the study of the impact of the SST anomalies on the shallow circulation cell of the Subtropical South Atlantic.

24

### **Study of the influence of atmospheric and geographical factors on the levels of ultraviolet radiation in regions of high population density in the State of São Paulo**

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National Institute for Space Research (Inpe)  
Ministry of Science and Technology (MCT)  
Process 2004/00937-3  
Term: Jun/2004 to Mar/2008

This research project is aimed at improving knowledge on atmospheric and geographical phenomena inherent in estimates of surface ultraviolet radiation

(R-UV). However, studies involving R-UV should not merely limit themselves to scientific objectives, but also supply parameters for the support of public and social policies for raising the population's awareness of the harmful effect of excessive exposure to the sun. Given this range of motivations, this project proposes a set of studies on R-UV to be carried out in the State of São Paulo, given that the region presents important points in relation to the theme. From the point of view of public health, the region is home to around 25 per cent of the Brazilian population and has the highest number of skin cancer diagnoses in the country, and from the scientific point of view, possesses relevant regions of interest due to its geographical and atmospheric differences, as one of the world's largest urban agglomerations, the city of São Paulo, the coastal and mountain tourist resorts. Due to this geographical heterogeneity, the implementation of this project, which includes the acquisition of sensors for measurements of global fluxes of R-UV, has the objective of carrying out theoretical-experimental studies related to the influence of : a) presence of aerosols; b) surface altitude; c) ground reflectance; d) cloud cover; and, in addition, taking advantage of the undertaking of systematic measurements, it is proposed to monitor levels of R-UV in large urban and tourist centers.

25

### **Study of the dynamics of water circulation between lotic, lentic systems and the floodplain**

Evlyn Marcia Leão de Moraes Novo  
National Institute for Space Research (Inpe)  
Ministry of Science and Technology (MCT)  
Process 2003/06999-8  
Term: Nov/2003 to Dec/2005

The objective of the project is to develop methods of integration of remote sensing techniques, image processing, spatial statistics and geoprocessing to understand, quantify and model the spatio-temporal dynamic and the patterns of circulation of different types of water on the Amazon flood plain. The previous research created an exploratory campaign, the result of which enabled the outlining of the experiment to be carried out in four subsequent campaigns.

26

### **Vertical structure of aerosols and their variations observed by balloon probes**

Volker Walter Johann Heinrich Kirchhoff  
National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)  
 Process 2003/06992-3  
 Term: Nov/2003 to Oct/2004

The Inpe Ozone Laboratory has dedicated itself to the launching of balloons with ozone probes since 1978 (Logan and Kirchhoff, 1996; Kirchhoff *et al.*, 1991; Oltmans *et al.*, 2001; Thompson *et al.*, 2003) from Natal, Rio Grande do Norte (RN), and more recently from Maxaranguape (RN). We now have an opportunity to extend these measurements to include the observation of aerosols in relation to altitude, which would be a significant addition to current measurements. By means of an agreement, we already have the probes to measure aerosols and the surface equipment for the reception of the signals from the probes. We just need the ozone probe to couple this together. We propose to carry out monthly launches from Monte Alegre, a small city in Rio Grande do Norte, where the winds are sufficiently weak not to interfere with the work of launching the balloons. A preliminary launch already carried out demonstrated the potential of the project. We obtained not only the vertical profile we were looking for, but also layers with an excess of scattering and excess of ozone, showing a correlation between the two parameters. The period of duration will be 12 months, to test the possibility of a seasonal variation.

27

### Climatic simulations for the summer in the Southeast of the country

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 Process 2003/01271-6  
 Term: Jun/2004 to Aug/2006

Knowledge in advance of a forecast that indicates whether the next wet season will be normal or not represents a huge scientific contribution to society in general. One of the tools to obtain this kind of forecast are regional climatic models, which became feasible at the start of the 1990s. These models make it possible to resolve with greater detail the factors that locally influence the climate of a particular region, in relation to current global climate models, the spatial resolution of which is still insufficient. The present project proposes to use a regional model to study the regime of precipitation and air temperature in the summer in the Southeast region of Brazil with a view to its predictability. Specifically, it is intended to evaluate which representation of the wet processes on meso-scale more precisely reproduces the seasonal forecast of precipitation and air temperature close to the sur-

face, which are important climatic elements for the region being studied.

28

### Study of carboxylic acids and aldehydes in the wet deposition in the metropolitan region of São Paulo

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 Process 2003/01194-1  
 Term: Jul/2004 to Jan/2007

The present plan fits into the line of research geared to the evaluation of the chemical composition of the liquid phase of the atmosphere (rain waters and fogs). Special attention will be given to the simultaneous determination of carboxylic acids and aldehydes and their interrelationships, given that, in addition to being removed from the gaseous phase by solubilization, some studies suggest that carboxylic acids may be formed from the oxidation of aldehydes in the liquid phase. These species, in addition to direct vehicular emission, are produced by reactions of the "photochemical smog". We will also undertake measurements of pH and conductivity and the destination of majority inorganic ions. For evaluation of the processes of removal we will take sequential samples for intra-event chemical analyses, collecting, alongside meteorological data and data on intensity of rains, information on the size of raindrops (disdrometer). It is important to highlight that studies of the chemical composition of water of fogs/mists are unprecedented for São Paulo.

29

### Improvements in the description of parameters of surface and vegetation in the Northeast region of Brazil for use in meteorological and hydrological models

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 Ministry of Science and Technology (MCT)  
 Process 2003/00142-8  
 Term: Jul/2003 to Aug/2006

The coupled meteorological models used in the Center for Weather Forecasting and Climatic Studies (Cptec) need the representation of the spatial variation of ground and vegetation, which requires the adaptation of a more detailed database and one with parameters which represent more accurately the physical properties of the ground and the distribution of types of

vegetation. In this context, the objective of this project is to elaborate an updated map of the vegetation, including changes in land use, for the Northeast region of Brazil, plus the northern parts of the states of Minas Gerais and Espírito Santo, which fall within the ambit of the former Superintendency of the Development of the Northeast (Sudene), through the process of high resolution orbital sensor images and the integration of digital data of use/cover of the earth. The map should be adapted to the operational meteorological and hydrological models of Cptec and of several other state meteorological centers. This updating of the surface parameters will permit the study of possible changes in the balance of energy on the surface and the local and regional circulations on the Northeast deriving from the changes in land use and, in a more general way, for the subsequent verification of the impact of the improvement of the representation of vegetation in the models of weather forecasting, climate and water on the ground in the region.

30

**Paleo-environmental reconstruction (vegetation and climate) in the Late Quaternary based on a multi/interdisciplinary study in the Vale do Ribeira (south of the State of São Paulo)**

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Center for Nuclear Energy in Agriculture

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Process 2002/08024-1

Term: Jul/2003 to Jul/2006

In Brazil, paleo-environmental studies (vegetation and climate) have been more intensely developed since the beginning of the 1990s decade, using pollens deposited in lake and peaty sediments, isotopes of the organic matter of the soil (OMS) and fragments of charcoal found in the soils, among other indicators. However, in these studies, there is a feeling of the lack of joint actions, both analytical and interpretative, preventing an interdisciplinary approach. With this project, it is intended to develop in the Vale do Ribeira, in the region of Iporanga, south of the State of São Paulo, a comparative study involving paleo-environmental records, through the joint and systematized analyses of lake sediments, of speleothems and isotopes of the OMS and plants, with the possibility of associating them with antracological analysis, when there is the presence of charcoal buried in the soils. This integration of techniques and researchers should significantly reinforce studies of the reconstruction of vegetational and climatic exchanges that occurred in the Late Pleistocene and Holocene in the Southeast region of Brazil.

31

**Climatic variability on the intrazonal scale in the Southern hemisphere with emphasis on the influences on South America and Southeast Brazil: the behavior of the Cptec/Cola model of global circulation of the atmosphere**

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Process 2002/07424-6

Term: May/2003 to Jun/2005

It has been observed, in results of forecasting and seasonal simulation, that the Southeast region of Brazil is the region with the lowest predictability in the country. This is a transition region between the tropical region of the north and the extratropical region to the south, affected by synoptic systems which can be the result of the model, have different behaviors, not necessarily the same as those observed. Also shown, in some observational studies, has been the influence of trains of low frequency waves and of oscillation from 30 to 60 days, on the Southeast region of Brazil. Considering that intraseasonal anomalies, such as blockades, oscillations of 30 to 60 days and patterns of low frequency teleconnection can affect the behavior of synoptic systems that act on the South American continent, it is important to know whether a model of general circulation is capable of reproducing the low frequency variability that can influence the high frequency. The proposal of this work is to analyze the atmospheric variability of the Southern hemisphere, on the intraseasonal scale, simulated by the MCGA Cptec/Cola, comparing with the variability observed on this scale and establishing the dominance of patterns for some bands of frequency, to elaborate indices associated with the patterns of teleconnections identified. It is hoped that the comparison of the indices obtained in the analyses with the data from the model and observational data and the verification of the influence of extreme indices in the atmospheric conditions above South America and the Southeast of Brazil may contribute to a better understanding of the action of the low frequency and of the behavior of the model in these regions, with a view to better seasonal forecasts.

32

**Survey of the physiognomic structure of the vegetation of the Caatinga, oriented towards the control of techniques of detection in changes, using remote orbital sensing**

Vitor Celso de Carvalho

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Ministry of Science and Technology (MCT)  
 Process 2002/03522-3  
 Term: Oct/2002 to Sep/2003

The dimension reached by the practice of biomass burnings in the tropical region has been the object of concern and polemic at national and international level. This generalized phenomenon in Brazilian agriculture and its environmental impact will only be elucidated when objective facts and data are obtained as to their occurrence, locality, causes, spatial and temporal dynamic, vegetation involved, nature and size of the fire, qualitative and quantitative evaluation of the gaseous emissions on several scales, etc. The dissemination of this information through organized sectors of society is also fundamental in order for agricultural practices to evolve and the control to become more efficient. Aiming to obtain scientific data on the theme of the burnings and to generate systematized and adequate information for national and international public opinion, Ecoforça – a non-governmental not-for-profit organization geared to questions of research and environmental development – has been carrying out research with a view to filling this lack of information for the scientific, environmentalist communities and society in general, by means of multi-institutional actions. The principal objective of this research project is to structure and bring into operation a system of orbital monitoring and mapping of the biomass burnings which occur in the national territory, as well as guaranteeing the access and free dissemination of these results via electronic media to the scientific community and society in general.

### 33 The influence of atmospheric aerosol on the formation of photochemical pollutants

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 Process 2001/13855-7  
 Term: Mar/2002 to Jul/2005

To evaluate the influence of atmospheric aerosol on the processes of formation of photochemical oxidants present in urban and remote atmospheres. This influence occurs due to the fact that the particles can increase or decrease depending on the photolysis of certain compounds. In this study, we will use experimental data from urban (in the metropolitan region of São Paulo) and biogenic (from the Amazon region) aerosol, in their soluble, insoluble and black carbon components, their physical-chemical and optical properties calculated through the methodology developed in the

doctoral thesis of the student Regina Maura de Miranda (FAPESP Process 97/01505-4), and these will be inserted in a model of radioactive transference in order to obtain the ratios of photolysis of the NO<sub>2</sub> and O<sub>3</sub>. These results will then be introduced into a photochemical model, obtaining the temporal and spatial variation of tracers of the photochemical processes (such as O<sub>3</sub> and others), as well as their vertical profile and also of the aerosol. In a second stage, the influence of the profile of temperature will be studied, using numerical models for this.

### 34 Estimate of the effects of aerosol particles on the balance of atmospheric radiation in Amazonia

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 / University of São Paulo (USP)  
 Process 2001/08574-9  
 Term: Jan/2002 to Dec/2003

It is intended, using experimental measurements and numerical calculations using radioactive transfer codes, to quantify the effect of aerosol particles present in the Amazon region of the solar irradiances observed on the surface and the top of the atmosphere. Particular emphasis will be given to the aerosol particles deriving from the burning of biomass. In cooperation with researchers from the Nasa Goddard Space Flight Center, experimental measurements will be evaluated obtained with a network of automatic spectral radiometers installed in the region and with the Modis sensor on board the Terra and Aqua satellites. A study of the effect of the layer of aerosol particles from the burning on the vegetation of the region will also be carried out, evaluating the consequence of the disturbance in the balance of photosynthetically active radiation on the surface on the photosynthesis, using a radioactive transfer code linked to a vegetation model.

### 35 Sun-climate relationships studied in tree rings in Chile

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 Ministry of Science and Technology (MCT)  
 Process 2001/01569-0  
 Term: May/2001 to Apr/2002

This work aims to clarify the relationships that exist between the variation in sun luminosity associated with solar activity and environmental and climatic pheno-

mena recorded in the variations of the thickness of the growth rings of trees. The scale of time chosen covers the last two millennia and the samples of trees used to obtain the temporal series of thickness of their rings are cypresses originating in Chile, given the fact that we can find in them series covering the desired interval of time. Thus, we will study the temporal series of the thickness of growth rings of trees sensitive to environmental parameters, such as temperatures and pluviometry, among others, and of pertinent observational data, such as the number of sunspots. The study comprises the mathematical analysis of the temporal series, searching for characteristic periodicities of geophysical and/or climatic phenomena. The methodology used includes spectral analysis through the methods of maximum entropy and iterative regression and principally through the method of wavelets. The study will be concentrated geographically on the records and observational data from Chile.

36

### Measurement of trace gases in regions under the influence of the transport of pollutants from biomass burning

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National Institute for Space Research (Inpe)  
Ministry of Science and Technology (MCT)  
Process 2000/14632-9  
Term: May/2001 to Apr/2003

Through the aerial measurements of trace gases from biomass burning and from a numerical model developed in a doctoral thesis, we verified the existence of high concentrations of CO<sub>2</sub> in regions where there is no burning (brought in by transport). In this work we aim to measure these concentrations in situ. We will install monitoring stations for trace gases from biomass burning in the cities of Campo Grande, Mato Grosso do Sul and Apucarana, Paraná, where we will take measurements, on the surface of carbon monoxide, ozone and carbon dioxide (dry and wet season), and will also undertake the launching of ozone probes to determine the ozone profiles in both cities. With this we hope to prove the existence of high concentrations of carbon monoxide in regions with little burning.

37

### Local circulations in the region of Santarém: observations and numerical modeling in the multidisciplinary context of the LBA

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Process 2000/11865-2  
Term: May/2001 to Nov/2002

The present proposal fits into the LBA project: Large-scale experiment on the biosphere-atmosphere interaction in Amazonia, which is an international project led by Inpe with participation from Nasa and the European Community. Recent research on the surface-atmosphere interaction suggests a strong dependence between surface processes and climate. Wet convection is the principal path through which water, energy and trace gases are transported from the surface layer of the atmosphere to the troposphere. Heterogeneities of surface caused by different types of vegetation and by land/water contrasts are causes of local circulations and have been observed in Amazonia. The present proposal aims to undertake a campaign of intensive measurements in the region of Santarém to characterize the impact of the heterogeneities of surface on local circulations and on the formation of cloud and to validate the numerical simulations of the lake breeze phenomena and circulations between forest and pasture in areas surrounding Santarém.

38

### Investigation of the variability of low frequency in the South Atlantic. Analysis of the results of the ocean-atmosphere coupled model

Edmo José Dias Campos  
Institute of Oceanography  
University of São Paulo (USP)  
Process 2000/04673-0  
Term: Aug/2001 to Jul/2003

Investigation of variabilities in decadal and interdecadal scales in the component of the thermohaline circulation and in the temperature of the sea surface in the South Atlantic, taking into consideration the set of data supplied by simulations with the ocean-atmosphere coupled model. We will analyze the results of the execution of several centuries of coupled model comprising the University of Miami Oceanic Model (Micom) and the CCM3 atmospheric model of the National Center for Atmospheric Research (NCAR). These simulations are executed on supercomputers of the Los Alamos National Laboratories. In the first year, the work will be undertaken by a Brazilian researcher visiting Los Alamos.

39

### Numerical study of climatic variability in the South Atlantic ocean

Ilana Elazari Klein Coaracy Wainer



Institute of Oceanography  
University of São Paulo (USP)  
Process 2000/02958-7  
Term: May/2001 to Jul/2004

Seasonal climatic variability in the South Atlantic is investigated using a series of numerical simulations with the coupled Climate System Model (CSM), undertaken by the National Center of Atmospheric Research (NCAR). The first simulation is implemented for 300 years to study the existence of variability on the decadal and interdecadal scale. Two other simulations are undertaken with the view to verifying the role of the atmosphere in this time scale. The first contains levels of tracer gases and greenhouse effect gases from the pre-industrial era, while the second simulation assumes the levels indicated in the Intergovernmental Panel on Climate Changes (IPCC). Finally, it is intended to implement a simulation for 150 years merely with the atmospheric component, to evaluate whether the variability obtained in scales of low frequency is intrinsically oceanic. The statistical analysis of the data obtained is done with the techniques of EOF (empirical orthogonal functions) and SVD (singular value decomposition). The EOF method is applied to each field in isolation, while the SVD method is applied to both fields simultaneously. The significance of the ocean-atmosphere will be revealed by the strong resemblance between the individual EOF and the couple SVD of TSM and PPT and associated fluxes of heat and momentum. The area of the study goes from 0N to 55S and from 70W (coast of South America), where the region of confluence between the subtropical and subpolar waters is located, represented by the Brazil and Malvinas currents, to 20E (coast of South Africa).

40

#### Study of the spatio-temporal variability of convection in the tropical region of South America

Luiz Augusto Toledo Machado  
Aeronautics and Space Institute  
Aerospace Technical Center (CTA)  
Process 1999/06045-7  
Term: Nov/1999 to Nov/2001

This project aims to study, in the tropical region, the relationships between climatic variability, organization of convection and the impact on the surface (vegetation stress). The objective of this project is to increase the knowledge and understanding of the climatic fluctuations in the tropical zone, studying the organization and the variability of the convective systems, which are the key element in the atmospheric processes, and the

impact of this variability on the surface. This project is divided into three parts. The first topic of study consists of the development of tools for the analysis of the convection and of the climate. These tools will be useful in the processing of the satellite images obtained during the implementation of the project. This information, added to the observations obtained in experiments (LBA), projects (PIRATA) and in the Alcântara Launch Center (ALC), will consist of a set of data to be processed in the second topic. This data will be used to carry out case studies, making it possible to analyze in detail the convective system of the continent, in the coastal region and in the ocean and their relationships with the fluxes on the surface. The third topic consists of the analysis of historical series of data aimed at obtaining a climatological description of the frequency of occurrence of the convective systems and of the interdiurnal, intraseasonal and interannual variability of the cloud cover. In association with this analysis, we will analyze the variability of the stress in vegetation on a climatic scale, aiming to relate the variability of the cloud cover to the variations in the conditions on the surface.

41

#### Simultaneous observations of the CO and O<sub>3</sub> minority gases in the lower atmosphere

Volker Walter Johann Heinrich Kirchhoff  
National Institute for Space Research (Inpe)  
Ministry of Science and Technology (MCT)  
Process 1999/05578-1  
Term: Dec/1999 to Jan/2001

What is proposed is a piece of research involving simultaneous observations of carbon monoxide (CO), and ozone (O<sub>3</sub>), with the objective of studying their origin, correlation and photochemistry. The measurements will be carried out in the municipality of Maxaranguape, Rio Grande do Norte, Brazil. This location has special characteristics, extremely propitious for this present research. It is located near the sea, next to the beach. It is in fact a location still isolated from the closest larger municipality, which is Natal. It receives air masses directly from the ocean. The paths of the air masses in this locality are very regular, in the sense of always originating in the region of the South Atlantic. For this reason the components of minority gases present in the air masses are the purest possible, having traveled over the oceans for several days. The objective of the work is to take samples in the location indicated, measuring the concentrations of CO and O<sub>3</sub>, simultaneously. For the measurements of CO we will use gas chromatography, with a mercury oxide detector, and for the measurement of O<sub>3</sub>, we will use the technique of balloon sounding, to obtain the concentration in the entire troposphere.

42

**Paleoenvironmental dynamic of vegetation and climate in the recent Quaternary in domains of Atlantic Rainforest, semi-arid heathland and north-eastern Cerrado, using carbon isotopes of the soil organic matter (SOM)**

Luiz Carlos Ruiz Pessenda

Center for Nuclear Energy in Agriculture

University of São Paulo (USP)

Process 1998/16044-5

Term: Aug/1999 to Apr/2002

With the use of carbon isotopes of the soil organic matter (SOM) and of modern plants, it is intended to study the dynamic of expansion and regression existing between ecotones of forest-cerrado and forest-caatinga, located in Pernambuco, and of forest-cerrado in Maranhão. Based on datings for  $^{14}\text{C}$  of the SOM, the study should outline the probable changes of vegetation and climate that occurred in these Brazilian regions, comprising approximately the last 15 thousand years.

43

**Applications of meteorological satellites**

Juan Carlos Ceballos

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 1998/13951-1

Term: Jun/1999 to Jul/2001

The proposal will be carried out by researchers from several institutions, coordinating around the capability of reception and processing of images installed in the Cptec/Inpe. We will develop four studies along four lines: 1) monitoring of winds and systems by satellite (using Goes channels 1,3,4); 2) radioactive fluxes in the earth-atmosphere system (Goes im. channels 1,4; AVHRR im.); 3) temperature of the sea surface (AVHRR-Noaa images channels 1-5 and Goes 1,4,5); 4) properties of continental surfaces (AVHRR and Goes images): indices of vegetation and detection of biomass burnings. All the lines should lead to the development of operational processes of monitoring weather and climate.

44

**Structure of radar echoes in the summer in Amazonia**

Maurício de Agostinho Antônio

Bauru Institute for Meteorological Research

São Paulo State University (Unesp)

Process 1998/13382-7

Term: Mar/1999 to Feb/2001

The use of scientific data from the TRMM (Tropical Rainfall Measuring Mission) is not restricted to climatological studies. In addition to data from on-board satellite sensors, the so-called “terrestrial validation” programs, that include specific campaigns of data acquisition, constitute a unique database for studying clouds and precipitation processes in tropical areas. In this context, the experiment to occur in the wet season in Amazonia in 1999 – TRMM/Brazil – will provide a much better coverage than other experiments in continental tropical areas. The data to be collected, with the latest technology for observation of the atmosphere, will permit the characterization of the structures of the precipitation systems and comparison of these results with those obtained in subtropical latitudes.

45

**Dynamic study of the impact of El Niño/south oscillation on the climate of the Americas**

Tércio Ambrizzi

Institute of Astronomy, Geophysics and Atmospheric Sciences

University of São Paulo (USP)

Process 1998/12976-0

Term: May/1999 to Apr/2001

In this study, the difference in the climatic anomalies over the subtropical part of the Americas during several Enos events is examined. The differences observed in the phase and intensity of the almost stationary cyclonic circulation between these events will be studied through the analysis of the characteristics of the anomalous convective warming in the central Pacific. By means of observational studies and numerical experiments with a baroclinical model of primitive equations, the response of the atmosphere to various types of thermal forcings will be shown. Data derived from simulations carried out with the CCM3/NCAR model, which used monthly averages of observed TSM, will also be analyzed.

46

**Transport of atmospheric pollutants in the atmosphere-soil interface in natural and urban areas in the State of São Paulo**

Adolpho José Melfi

Luiz de Queiroz Advanced School of Agriculture

University of São Paulo (USP)

Process 1998/10356-5

Term: Jan/1999 to May/2001

The principal objective of this project is to quantify the transfer and transport of polycyclic aromatics (PAHs) associated with particulate material, between the atmosphere and the ground, in remote and urban areas in the State of São Paulo. The physical-chemical characterization of this material will be undertaken under different meteorological conditions (wet and dry periods) from fixed sampling units. Thus, we will study the morphological parameters (size and shape) and the chemical composition of the aerosols, as well as the physicochemistry of the solutions that circulate in the atmosphere-ground interface. With regard to the chemical composition, in addition to the polycyclic aromatics, we will determine the fundamental composition (Al, Mn, Fe, Pb, Cu, Zn, etc.) and the soluble species (larger cations and anions). This characterization will make it possible to establish relationships between the different descriptive parameters of the particulate material in suspension in the atmosphere, associated with the variations resulting from the meteorological conditions and from anthropic activity. It will also make it possible to evaluate the impact of this material on the soil.

47

### Studies of greenhouse effect gases

Plínio Carlos Alvares

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 1998/09566-5

Term: Mar/1999 to Feb/2001

There are many locations monitoring the concentrations of the most important greenhouse gases in the world. However, in the South Atlantic there is only one station making this monitoring. This project pretends to get the first information about the most important greenhouse gases: CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, CFC13 (CFC-11), CF<sub>2</sub>CL<sub>2</sub> (CFC-12), in that region. The sampling will be taken in stainless steel flasks from aboard the Oceanographic and Supply Ship (NAPoc) Ary Rongel, from Brazil's Navy. The cruises will be between Rio de Janeiro (22°, 43°W) and the Brazilian Antarctic Station Comandante Ferraz (62°S, 58°W), each 5 degrees in latitude. The ship makes this trajectory every year between march and april, and october and november. After, the samples will be analyzed at INPE's Laboratory using gas chromatography technique. Samples from Natal (6°S, 35°W) will be used for comparison also. The concentrations will give information about a region where there is a lack of in situ measurements, both spatial and temporal. This information will be used to study the latitudinal distribution and global budget of that gas,

and could be useful to validate modeling results for the region. The development of this project will provide support to initiation works, master dissertation and doctoral theses, while the results will be disseminated through the scientific literature.

48

### Climatology of the South-Southeast coastal region of Brazil

Cláudio Solano Pereira

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 1998/04332-6

Term: Dec/1998 to Jan/2001

This research aims to contribute to the understanding of the behavior of the climate along the South-Southeast (S-SE) coastal region of Brazil. Several sources of meteorological data will be processed with the aim of constructing a sound database of historical climatological data for this region. Based on this, we will construct a reliable synoptic climatology to identify the physical mechanisms responsible for the regional climatic anomalies. In particular, emphasis will be given to the anomalies of precipitation, atmospheric circulation and sea surface temperature (SST) in this coastal strip of the South Atlantic Ocean. The project will be developed in the National Institute for Space Research (Inpe)/São José dos Campos, with the participation of researchers from Inpe's Meteorological Science Division (MSD) and of a researcher from the Federal University of Paraíba (UFPb), within the ambit of the "ocean-atmosphere interaction" line of research. The data processed in this research will feed the Meteorological Database (MDB), located in DCM/Inpe. With a sound database of historical climatological data, the results of this project could provide information for other studies related to the climate variability of this important Brazilian coastal region.

49

### Study of the surface boundary layer of Pantanal in south Mato Grosso

Antônio Ocimar Manzi

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 1998/00105-5

Term: May/1998 to Jun/2003

This micrometeorological project, with the help of the University Federal de Mato Grosso do Sul (UFMS), is the initial part of a broad experimental program to study the characteristics of the weather and the climate

of the central region of Brazil. Thus, a first data collection campaign during the flood season, in the south Mato Grosso Pantanal, is proposed to be carried out in an experimental site in the Fazenda São Bento (19°33'48, 2"S; 57°00'53, 8"W), a site representative of the region, located ca. 1.5 km from the Pantanal Studies Base of UFMS, in Passo do Lontra, Miranda, MS. A micrometeorological tower, 21 m high, is already installed, and it will serve as support both for fast response sensors to measure turbulence and for conventional meteorological instrumentation to measure vertical wind velocity, temperature and specific humidity profiles, as well as to obtain the radiation balance. Air samples will be collected to evaluate the surface emission of methane in the region. So, the seasonal structure of the surface boundary layer above the Pantanal will be investigated. Also, the influence in the change of the structure of the boundary layer due to meteorological phenomena of larger spatial scales, such as the incidence of cold fronts, the intensification of the South American Convergence Zone and the atmospheric instabilities will be studied. Furthermore, to better understand and parameterize the characteristics of the turbulent processes above the Pantanal, theoretical studies using modern signal analysis techniques, such as the wavelet transform, will be carried out. And special emphasis will be given to the error introduced by the sampling conditions, and by the surface roughness, for determination of the vertical fluxes of momentum, sensible heat and moisture. Part of the research activities proposed will result in scientific initiation works, master dissertations and doctoral theses, while all the results will be disseminated through the scientific literature.

50

### Effects of biomass burning on the lower atmosphere in transition Cerrado-forest ecosystems

Volker Walter Johann Heinrich Kirchhoff  
National Institute for Space Research (Inpe)  
Ministry of Science and Technology (MCT)  
Process 1997/11718-5  
Term: May/1998 to Apr/2000

Biomass burnings in the tropics in Brazil are a seasonal event. Every dry season, which occurs between June and October, large areas in the Cerrado are burned. The combustible material in this region is composed of grass, sedge, bushes and small trees. It is estimated that around 30 per cent of this region, which is of the order of 3 million square kilometers, is affected by the burning each year. In recent years, tropical countries were severely criticized by the international community for the occurrence of large numbers of bur-

nings, which are considered a serious act of negligence on the environment. In addition to the burning of the Cerrado, another type of burning occurs on the boundaries between the cerrado and the forest. These are areas principally affected by the ever increasing need to obtain new lands for agriculture. In contrast to the burnings in the Cerrado, this type of burning destroys huge masses of vegetation, compared with the burning of sedge and bushes in the cerrado. The surveys of deforestation in recent years showed that the rates of deforestation decreased in the period up to 1991, but, recently, new increases have been observed, amounting actually to the order of 13,000 km<sup>2</sup> per year. It would be very important to establish a correlation between deforestation and burnings. The effect of the burnings on the lower atmosphere can be evaluated by the observation of ozone which is produced indirectly in the atmosphere. The ozone is produced by chemical reactions which always begin with carbon monoxide emitted directly from the burnings of open fields which burn by incomplete combustion. As the burnings occur on the surface, their effect is also observed primarily on the surface. However, the consequences of the burnings end up spreading throughout the lower atmosphere. The objective of this research is to document the distribution of gases produced by burnings, especially ozone, in the troposphere of the tropics in Brazil. This work should be carried out on areas in which the burnings are efficient, and the results should be correlated with rates of deforestation. Sporadic field campaigns were undertaken in the past, but we have still not conducted systematic observations. We propose a continuous and systematic observational campaign during two consecutive periods of the burnings. This proposal focuses on an important theme in tropical ecosystems and offers an opportunity to better understand an important problem in tropical Brazil.

51

### Monitoring of bioclimatic variabilities and their impact on agricultural production in Brazil through NOAA AVHRR data

William Tse Horng Liu  
Institute of Astronomy, Geophysics and Atmospheric Sciences  
University of São Paulo (USP)  
Process 1997/11568-3  
Term: Mar/1998 to 2/29/2000

The objectives of this project are: a) application of software for the generation of indices of environmental stress, such as TST, NDVI, VCI and TCI, using the data from NOAA AVHRR, available from the "Satellite Research Laboratory (SRL), NOAA/Nesdis", in Washington, D.C.; b) monitoring of the climatic variability inferred

from the indices of environmental stresses and their impact on the conditions of agricultural growth and production in Brazil; c) development of alternative models of forecasting of soybean crops in the producing states in Brazil via Noaa satellite; d) dissemination of methods and software developed through the internet via netscape; e) transfer of the methods developed to the operational system of the Agricultural Harvest Forecasting Division of the IBGE in Rio de Janeiro; f) updating of the computer facilities in the Laboratory of Remote Sensing Applications (LRSA) of the ACA-IAG-USP, to refine the infrastructure for undergraduate and postgraduate education.

52

### Mesoscale interactions between biosphere and atmosphere in Amazonia

Maria Assunção Faus da Silva Dias

Institute of Astronomy, Geophysics and Atmospheric Sciences  
University of São Paulo (USP)

Process 1997/09926-9

Term: Jun/1998 to Oct/2001

This project is part of a broader international proposal the "Large-scale biosphere-atmosphere experiment in Amazonia - LBA", lead by Brazilian scientists with the cooperation of north and south americans and europeans. Within LBA there is a need to study the biosphere-atmosphere interactions in regional scale, or mesoscale. A focus on the local effects of deforestation as well as on the regional response to large scale forcing, within the scope of LBA, is the objective of the present proposal. The fundamental questions of the mesoscale interactions between biosphere and atmosphere in Amazonia are the following: what are the mesoscale mechanisms that link vegetation cover differences into large scale and climate anomalies?; what are the roles of moist and dry convection in transferring energy and redistributing atmospheric constituents, and how does convection change as a response to land-use? Specifically: what is the role of local circulations, including those generated by topography, in the transports of biomass burning products in the dry season? What is the role of the Andes mountains in the local atmospheric flow?; how can we improve the radiation parameterizations in view of biomass burning products in the dry season?; what is the role of moist convection in transferring energy, water, carbon and other chemistry species? how well can we numerically simulate the atmosphere in the mesoscale with different land cover, convection, trace gases and nutrients?; how can we improve and couple the surface, convective and radioactive parameterizations? what is the specific role of different land cover (primary forest, secondary

regret, pasture, savannah) in the hydrologic cycle? What changes in water and energy fluxes are associated to land-use land-cover change? ; what is the role of the spatial organization of cloudiness in the regional energy budget? ; how do the cloudiness patterns relate to vegetation and soil moisture? How does the basin scale precipitation relate to the different cloud type and to the diurnal cycle of convection?; what is the role of organized mesoscale convective systems in determining the precipitation scale in the basins?; what are the interactions between the mesoscale convective systems and the large scale systems like SACZ, Bolivian High. Cold fronts, easterly waves, among others?; what is the role of land cover in the modification of physical and thermodynamical parameters and how can they influence local circulation?; how is the remote sensing from satellite going to improve the surface temperature estimates and the lower troposphere thermodynamics structure over different land-cover scenes?

53

### Observations on the ozone layer in Punta Arenas, Chile

Volker Walter Johann Heinrich Kirchhoff

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 1997/06179-8

Term: Oct/1997 to Sep/1998

The specific objective of the present proposal is the experimental observation and documentation of the ozone layer in Punta Arenas, Chile, in collaboration with the local university, the Magallanes University (Umag), using the technique of measuring ozone via ECC probe launched in a balloon. The Inpe group already has considerable experience in the execution of this technique. The work is being programmed for the end of September, beginning of October, and is related to the phenomenon of the ozone gap in Antarctica, which appears in the region at that time of the year. The secondary objective of the project is training in the technique of balloon launching for the Chilean group, our collaborators.

54

### Information system and modeling of solar radiation (Simras)

João Francisco Escobedo

Botucatu School of Agronomical Sciences

São Paulo State University (Unesp)

Process 1997/02475-1

Term: Oct/1997 to Sep/1999

The project aims to develop an information system and modeling of solar radiation for use in meteorological and/or climatological stations, consisting of a database which will permit the quality control, generation of statistical results and the validation of models, as well as the exchange of data between institutions via internet and /or through physically stored means.

55

**Evaluation of orbital radar images in the study of natural aquatic environments and environments of anthropic origin in: Monte Alegre's Lago Grande and the reservoir of the Tucuruí hydroelectric plant**

Evlyn Marcia Leão de Moraes Novo  
National Institute for Space Research (Inpe)  
Ministry of Science and Technology (MCT)  
Process 1996/04523-0  
Term: Nov/1996 to Oct/1998

The research project consists in evaluating the use of orbital radar data in the comparative study of two distinct aquatic environments, one little altered by man (Lago Grande in Monte Alegre) and the other resulting from the construction of an artificial lake for the generation of electricity (the reservoir of the Tucuruí Hydroelectric Plant). The project envisages the simultaneous acquisition of field data and images from the Radarsat, JERS-1 and ERS-1 satellites. The field data will be used to characterize the environments. We will then make estimates of the potential for the emission of methane based on data from the space field with the help of information on the area occupied by aquatic plants, water and flooded forest extracted from images.

56

**South American cooperative on modeling of ocean, coastal and estuary processes related to global changes**

Edmo José Dias Campos  
Institute of Oceanography  
University of São Paulo (USP)  
Process 1996/04060-0  
Term: Sep/1996 to May/1999

In April 1996 the Interamerican Institute for Research into Global Changes (IAI) approved the research project entitled *A South American modeling cooperative for global change related oceanic, coastal and estuarine processes*, the objective of which was to begin the installation of a center dedicated to the coordination of studies and modeling of several processes associated with global changes in oceanic, coastal and estu-

ary regions, in South America. This project, part of the Initial Science Program of the IAI, has the participation of scientists from four countries (Argentina, Brazil, United States and Uruguay) and is coordinated from USP's Institute of Oceanography. The project aims to optimize the process of installation of the center.

57

**Regular sounding of the stratosphere – SRS**

Ngan André Bui Van  
Bauru Institute of Meteorological Research  
São Paulo State University (Unesp)  
Process 1996/02838-4  
Term: Sep/1996 to Mar/1998

The objective of this project is to use the resources available in the Institute for Meteorological Research (IPMet) in the São Paulo State University (Unesp), to develop, in collaboration with the European Community, the Stratospheric Regular Soundings program (SRS) which studies the chemistry of the stratosphere in tropical regions.

58

**The use of carbon isotopes in charcoals and humin in the soils. An indispensable tool to evaluate systematically the velocity of biological turnover and of paleoclimatic events**

Luiz Carlos Ruiz Pessenda  
Center for Nuclear Energy in Agriculture  
University of São Paulo (USP)  
Process 1995/05047-5  
Term: Mar/1996 to Aug/1998

Using the carbon isotopes ( $^{12}\text{C}$ ,  $^{13}\text{C}$ ,  $^{14}\text{C}$ ) of the organic matter of latosols from different locations in the State of São Paulo, it is intended to evaluate the existing correlation between the ages of the charcoals and the ages of the humin as an indicator of the biological turnover in soils devoid of charcoals. Simultaneously it is intended to carry out paleoclimatic studies and establish a database of carbon isotopes in soils in the State of São Paulo.

59

**Atmospheric teleconnections via data from the Total Ozone Mapping Spectrometer**

Tércio Ambrizzi  
Institute of Astronomy, Geophysics and Atmospheric Sciences  
University of São Paulo (USP)

Process 1995/02331-4  
Term: Apr/1996 to Mar/1998

This project aims to identify the patterns of global teleconnection, previously documented by means of statistical analysis of data of geopotential height and current function, using the total ozone variable. We will use monthly global data from 13 years of the Total Ozone Mapping Spectrometer (TOMS) to study the possible relation of linearity between this variable and the geopotential height, as suggested in recent works. Based on the establishment of this linearity, we will study the stationary waves in the high troposphere and their low frequency variability, as well as several patterns of teleconnections known from other observational studies. A comparison between these various results will be carried out through the use of global climatological data obtained by means of a Model of General Circulation (MGC), which was integrated for the same period as the TOMS, with a triangular resolution in wave number 42 (T42). This comparative analysis should permit the verification of possible systematic errors of the MGC, which could be improved and integrated again, aimed at the determination of more reliable climatological averages.

60

### Modeling and observation of the biosphere-atmosphere interaction in the State of São Paulo

Maria Assunção Faus da Silva Dias  
Institute of Astronomy, Geophysics and Atmospheric Sciences  
University of São Paulo (USP)  
Process 1995/01816-4  
Term: Sep/1995 to Dec/1998

Given the significant importance of the surface processes, especially the fluxes of energy, mass and momentum, in the interaction with the planetary boundary layer, the formation of cumulus clouds and the development of meso-scale systems, it is intended to quantify by means of micrometeorological measurements the energy balance above areas of vegetation predominant in the State of São Paulo (sugarcane, pasture and maize). In addition to the understanding itself of the relationship between the phenological cycle and the dynamic of water vapor, carbon and energy in these ecosystems, the observational data will be used in the calibration of biosphere-atmosphere coupled models (SiB-RAMS), a tool to be used in the study of the impact of different types of soil-vegetation system in the numerical simulation of the atmosphere above the Southeast region. The calibration is equally viable for the validation of large scale models, such as, for example, the Cptec/Inpe model.

61

### Experiment on the boundary layer in Rondônia (RBLE)

Carlos Afonso Nobre  
National Institute for Space Research (Inpe)  
Ministry of Science and Technology (MCT)  
Process 1995/01596-4  
Term: Nov/1995 to Oct/1996

The objective of this project is to collect meteorological data (atmospheric pressure, temperature and specific air humidity, velocity and direction of winds) from the structure of the nighttime boundary layer, using a fixed balloon, as a special sensor for measuring coupled CO<sub>2</sub>. The experiment will be carried out in Manaus, during the dry season (July 95), in an area of tropical forest. The project is an Anglo-Brazilian scientific cooperation, with participation from Inpe, Inpa and CTA/IAE.

62

### Dynamic of waters of the continental platform and of the slope in the bay of Santos (Dabas)

Edmo José Dias Campos  
Institute of Oceanography  
University of São Paulo (USP)  
Process 1994/03091-4  
Term: Mar/1995 to Feb/1997

As a continuation of the activity of the thematic project "Meso-scale Hydrography" COROAS (FAPESP 91/00542-7), the present research project aims to understand the structure and the characteristics of the flow of the current in Brazil and its transportation of masses of water along the outline of the west coast of the South Atlantic. Data generated by COROAS will be analyzed and reduced for the initialization of a numerical model in the study of the dynamic of the current in Brazil and its meanders. The numerical model to be used is the Princeton Ocean Model (POM). This research project represents a bilateral cooperation endeavor to be implemented in conjunction with Prof. Jerry L. Miller, of the Old Dominion University, in Norfolk, Virginia (USA).

63

### Carbon isotopes in soils in the tropical region of Brazil and relationships with the cerrado-natural forest sequence of vegetations

Luiz Carlos Ruiz Pessenda  
Center for Nuclear Energy in Agriculture

University of São Paulo (USP)  
 Process 1994/01272-1  
 Term: Aug/1994 to Jul/1996

Using carbon isotopes ( $C_{12}$ ,  $C_{13}$  and  $C_{14}$ ) from the organic matter of the soils of three regions in the state of Rondônia, it is intended to evaluate and discover a better understanding of the processes of environmental modification involved in the sequence cerrado-natural forest located from the south to the center-north of the state. For this purpose we will seek to answer questions such as: a) in the sequence of vegetations, which one is in expansion/regression, or is there a balance in this ecosystem?; b) for how many years did each one of these vegetations predominate in their respective areas?; c) could there be fossils (charcoals) buried in the depths in the soils suggesting ancient fires and, possibly, drier past climates?

64

#### Measurements of the ozone layer and ultraviolet radiation

Volker Walter Johann Heinrich Kirchoff  
 National Institute for Space Research (Inpe)  
 Ministry of Science and Technology (MCT)  
 Process 1994/00192-4  
 Term: Jul/1994 to Jun/1996

With the fact of the ozone gap in Antarctica and its indirect manifestations already proven in the South of Brazil, it is all the more important to establish sampling sites close to the tropic of Capricorn. The specific objective of the project is the experimental observation and documentation of the ozone layer observed by soundings and ultraviolet radiation in the region of São Paulo, by means of the installation of sampling sites in strategic locations. The secondary objective of the project is to carry out complementary measurements using the already existing infrastructure, principally of oxidizing gases in the troposphere.

65

#### Experiment on the boundary layer in Rondônia (RBLE)

Carlos Afonso Nobre  
 National Institute for Space Research (Inpe)  
 Ministry of Science and Technology (MCT)  
 Process 1994/00155-1  
 Term: Jul/1994 to Jan/1995

The principal objective is to study the dynamic of the planetary boundary layer (PBL) over areas of tropical forest and pasture in Rondônia. This objective will

be attained through three field campaigns in experimental areas around Ji-Paraná, Rondônia. The first camp mission occurred in September 1992, the second in July 1993 and the third will take place in July 1994, with continuous measurements of the dynamic and thermodynamic profiles above the forest and pasture simultaneously, for a period of three weeks. To analyze and synthesize the observations numerical models will be used, from the most simple, such as one-dimensional models of PBL, to complex three-dimensional meso-scale models.

66

#### Research into temporal variation of the neutrally charged particles and intensity of ozone and electric field in the stratosphere

Inácio Malmonge Martin  
 Gleb Wataghin Physics Institute  
 Campinas State University (Unicamp)  
 Process 1993/04978-0  
 Term: Mar/1994 to Mar/1997

Study of the precipitation of charged and neutral particles as well as the intensity of ozone and electric field in the stratosphere of the region of the Brazilian anomaly. To verify their temporal variation in relation to magnetic field and correlations existing between these radiations. Study of the influences of these radiations in the environment of the region, principally variation in the level of rain/variation of cosmic radiation in the atmosphere.

67

#### Monitoring of ozone together with meteorological soundings

Ngan André Bui Van  
 Bauru Institute for Meteorological Research  
 São Paulo State University (Unesp)  
 Process 1993/04798-1  
 Term: Oct/1994 to Sep/1995

The objective of this project is to establish the means that make it possible to study the alteration in the ozone ( $O_3$ ) layers in the upper stratosphere and which can change the climate. The collaboration with the Service d'Aéronomie do Centre National de la Recherche Scientifique (CNRS), in France, will make it possible to establish a study program of the mechanism that causes the variations in the density of ozone in the upper atmosphere. This program envisages an observation campaign, with three balloon launches, to measure, with a visible UV spectrometer, the atmospheric profiles of constituents such as  $O_3$ ,  $NO_x$ ,  $C_{10x}$ . The



information acquired will be compared with meteorological data in order to determine a possible correlation between the climatic alterations and the variations in the density of O<sub>3</sub>, being able, also, to complement the measurements taken on board satellites.

68

### Monitoring system of biomass burnings and electronic dissemination of the information

Evaristo Eduardo de Miranda

Ecoforça Research and Development

Process 1993/03295-6

Term: Jan/1994 to Jun/1995

The dimension reached by the practice of biomass burnings in the tropical region has been the object of concern and polemic at national and international level. This generalized phenomenon in Brazilian agriculture and its environmental impact will only be elucidated when objective facts and data are obtained as to their occurrence, locality, causes, spatial and temporal dynamic, vegetation involved, nature and size of the fire, qualitative and quantitative evaluation of the gaseous emissions on several scales, etc. The dissemination of this information through organized sectors of society is also fundamental in order for agricultural practices to evolve and the control to become more efficient. Aiming to obtain scientific data on the theme of the burnings and to generate systematized and adequate information for national and international public opinion, Ecoforça – a non-governmental not-for-profit organization geared to questions of research and environmental development – has been carrying out research with a view to filling this lack of information for the scientific, environmentalist communities and society in general, by means of multi-institutional actions. The principal objective of this research project is to structure and bring into operation a system of orbital monitoring and mapping of the biomass burnings which occur in the national territory, as well as guaranteeing the access and free dissemination of these results via electronic media to the scientific community and society in general.

69

### Investigation into the application of wavelet transform in the study of turbulent exchanges in the surface boundary layer of the atmosphere

Leonardo Deane de Abreu Sá

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 1993/02715-1

Term: Dec/1993 to Mar/1996

The recent advent of the theoretical formulation of the wavelet transform (WT) constitutes a very important advance in the analysis of the turbulent signal, since it enables the evolutive spectral decomposition, which it is not possible to obtain with the traditional Fourier transform. Given its recent character, only since the 90s decade has WT come to be used in the study of turbulent signal, opening a broad perspective for the better understanding of the structures in dissipative processes. However, its application to atmospheric signals is still very rare in the literature. The aim of this project consists in contributing to a better understanding of the physical processes of turbulent exchange in the atmospheric surface boundary layer based on the application of WT to the study of turbulent signal sampled at high frequencies. It is intended: 1) to implement algorithms which enable a multi-resolution decomposition of the signal based on the WT; 2) to study the specific characteristics of turbulent exchange above and within the forest; 3) to determine with better precision the error associated with estimation of the turbulent fluxes in the atmosphere; 4) to better understand the statistical distributions associated with the various turbulent parameters of the atmospheric surface boundary layer.

70

### The influence of the Atlantic Ocean on global climate variation

Ilana Elazari Klein Coaracy Wainer

Institute of Oceanography

University of São Paulo (USP)

Process 1993/01387-0

Term: Nov/1993 to Feb/1997

The study of the interaction between ocean and the atmosphere in the Atlantic Ocean is still fairly recent. Bjerknes in 1964 formulated the hypothesis that the air-sea interaction in this region occurs in different timescales, in contrast to what happens in the Pacific Ocean, where the timescale for the coupling of the atmosphere and the ocean is a single one. This work has the objective of exploring the time scales of the coupled system between the Atlantic Ocean and the atmosphere. In the first place, we wish to determine which are the timescales that characterize the air-sea interaction in the Atlantic Ocean. The intention is next to characterize the spatial distribution of the active regions and try to correlate one region with another. In particular it is intended to examine what is the relationship of the oscillation of the North Atlantic (WALLACE and

GUTZLER, 1981) with the sea surface temperature anomalies in the tropical region and with the droughts in the Northeast of Brazil. (MOURA and SHUKLA, 1981). To achieve this objective, several sets of historical data (containing ten or more years of observation) will be analyzed. In the long term, it is intended to construct a coupled model for the study of the interaction between the Atlantic Ocean and the global atmosphere. The great barrier to the understanding of this problem is the fact of being very difficult to distinguish what is natural climate variation and that caused by external factors. With the analysis of observational data and data from models of oceanic circulation and atmosphere it is hoped to understand the role of the Atlantic Ocean in the variation of the climate.

71

### Experiment on the boundary-layer in Rondônia

Carlos Afonso Nobre

National Institute for Space Research (Inpe)  
Ministry of Science and Technology (MCT)  
Process 1993/00642-7  
Term: Jul/1993 to Dec/1993

The principal objective is to study the dynamic of the planetary boundary layer (PBL) above areas of tropical forest and pasture in Rondônia. This objective will be reached by means of: 1) two field measurement campaigns in experimental areas around Ji-Paraná, Rondônia. The first camp mission occurred in September 1992, the second in July 1993, with continuous measurements of the dynamic and thermodynamic profiles above the forest and pasture simultaneously, for a period of three weeks; measurements of turbulent fluxes of heat and momentum on the surface will be supplied by the experiment which will take place simultaneously; 2) for analysis and synthesis of the observations numerical models will be used, from the most simple, such as one-dimensional models of PBL, to complex three-dimensional meso-scale models.

72

### Measurement of greenhouse effect gases in natural Brazilian ecosystems

Volker Walter Johann Heinrich Kirchhoff

National Institute for Space Research (Inpe)  
Ministry of Science and Technology (MCT)  
Process 1992/04881-3  
Term: Apr/1993 to Mar/1994

There currently exists great interest in the study of certain atmospheric gases of long life which share the

common property of absorbing infrared radiation. These gases, responsible for the greenhouse effect, are being eliminated into the atmosphere by anthropogenic activity in the processes connected to agriculture and also industrial processes. The group already has considerable experience in observations of ozone, and has specialized in recent years to be able also to measure CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub>, the most important of the greenhouse effect gases. The intention of this work aims, in the first stage, to study and compare different behaviors in natural ecosystems and, at the same time, to gather sufficient data to be able to determine the tendency of annual growth of these gases.

73

### Numerical study of the circulation of the tropical Atlantic with model of isopical coordinates (Nustrac)

Edmo José Dias Campos

Institute of Oceanography  
University of São Paulo (USP)  
Process 1992/01196-8  
Term: Sep/1992 to Apr/1997

The objective of this project is the study of dynamic and thermodynamic processes governing the circulation of the tropical Atlantic, based on numerical simulations. The model to be used is a thermodynamically active version of the model of isopical coordinates developed in the University of Miami (BLECK et al., 1989, 1992), the principal advantage of which in this context is the elimination of vertical diffusion of numerically induced heat. A comprehensive study of the oceanic response to atmospheric thermodynamic forcing mechanisms is envisaged. Of particular interest will be the interannual and decadal variation of the temperature anomaly of the sea surface (SST), usually referred to as the "the Atlantic SST dipole".

### BIOTA-FAPESP PROGRAM

74

### Biosphere-atmosphere interaction phase 2: cerrados and changes of land use

Humberto Ribeiro da Rocha

Institute of Astronomy, Geophysics and Atmospheric Sciences  
University of São Paulo (USP)  
Process 2002/09289-9  
Term: Sep/2004 to Jun/2009

The project is geared to multidisciplinary expansion and in-depth examination of the knowledge acquired in the Biota-FAPESP Program *Biosphere-atmosphere inte-*

*reaction in natural and agroecosystems: a monitoring of the Cerrado and sugarcane*, addressing the following specific goals: (i) ecophysiological functionality of the dry and floodable cerrados: scaled projection of the physiology on cellular, foliar scale and on the ecosystem; (ii) control of interannual climate variability on the carbon cycle and the hydrological cycle of the ecosystems; (iii) regional impact of changes of use of land and climatic changes on the water balance and indicators of biodiversity with biosphere-atmosphere models. The study will be undertaken with activities of field observations and theoretical studies of biosphere-atmosphere modeling, with results of interest to biodiversity on the question of climatic balance on regional scale, and with the generation of information for public policies on the use of water, projects of carbon sequestration in the ambit of mechanisms of flexibility and knowledge for studies of vulnerability and adaptation of ecosystems.

75

### **Biosphere-atmosphere interaction in natural ecosystems and agroecosystems: a monitoring of sugarcane and Cerrado**

Humberto Ribeiro da Rocha

Institute of Astronomy, Geophysics and Atmospheric Sciences  
University of São Paulo (USP)

Process 1999/11215-9

Term: Jan/2000 to Dec/2001

This project is in line with the proposals of Biotafapesp, focusing on a multidisciplinary analysis of the ecophysiology of two ecosystems of high relevance in the State of São Paulo, sugarcane and the cerrado. Through the use of advanced methodologies of measurement of the exchanges of the biosphere, such as the eddy correlation method, it is intended to establish an instrumental platform in two experimental sites (sugarcane and cerrado), to carry out long term monitoring of the fluxes of surface water, energy and CO<sub>2</sub> in the biosphere-atmosphere interface. It is intended in this way to estimate the total balances of water and carbon in the ecosystems, quantifying their potential as sources or sinks in relation to the terrestrial systems; to add information on transpiration and photosynthesis and their dependence on climatic forcing mechanisms (temperature, humidity, radiation and hydric stress); to gather indices of these means as sequesterers of atmospheric carbon and establish a reference for comparison of the sugarcane and cerrado ecosystems as representative regional biomas and the impacts associated with the conversion of vegetation. The sugarcane experimental site is already established and is part of the organized network of Amerflux surface fluxes. The cer-

rado experimental site will be implemented in 2000. The project will receive the collaboration of another project in progress, coordinated by Dr. Marisa Bittencourt, which will provide updating of the relief, physiognomies of vegetation, state of conservation on the cerrado fragments and surroundings.

76

### **Environmental study in the estuary of the river Itanhaém, southern coast of the State of São Paulo**

Sueli Yoshinaga Pereira

Institute of Geosciences / Campinas State University  
(Unicamp)

Process 2001/09881-2

Term: Jul/2003 to Oct/2006

The present research proposal has as its general objectives: 1) analysis of the environment of deposition and taphonomy of macroremains and pollens from the subaquatic environment and of the anthropic modifications in the river estuary, with application of actuo-paleontology, hydrogeology and current sedimentology (depositional geomorphology); 2) elaboration of integrated models which provide information for studies of environmental impact which the above-mentioned anthropic activities produce; 3) definition of environmental indicators for estuary environments. The river Itanhaém estuary is located on the southern coast of the State of São Paulo, in the municipality of Itanhaém, and is part of the Baixada Santista. It presents characteristics belonging to tropical regions, both in environmental aspects (for example, mangrove and sandbank vegetation) and in socioeconomic aspects, being the second largest estuary in the state (surpassed only by the Ribeira, further to the South, close to the border with Paraná) (Lamparelli, 1999). It has a mangrove swamp area of 3,75 km<sup>2</sup> (Lamparelli, 1999), considered to be one of the best protected in the state, where it is possible to study its evolution since the Holocene. Along the river – upstream from the mangroves – there are innumerable points of sand exploitation, many already abandoned, which significantly altered the hydrological profile, forming huge lakes. The river course was modified more than 50 years ago due to the opening of a canal joining the rivers Branco and Preto. The entire margins of the Itanhaém river as well as its tributaries are occupied by dense sandbank vegetation, for the most part in primary conditions of conservation, which contributes plant material (leaves, seeds, pollens, etc.) to the sediments of the river. In localized areas there exists more recent vegetation – secondary woodlands and plantations, in addition to the mangrove vegetation itself.

## YOUNG RESEARCHERS IN EMERGING CENTERS

### 77 Late quaternary paleoclimate in Brazil from oxygen and carbon isotope ratios on speleothems

Francisco William da Cruz Júnior  
 Institute of Geosciences  
 University of São Paulo (USP)  
 Process 2006/06761-0  
 Term: May/2007 to Apr/2011

Stable oxygen and carbon isotope of speleothems precisely dated by U/Th method have become important proxies of climate change in the Late Pleistocene and Holocene (sub) tropical regions. In this way, Brazil is one the most potential countries for these isotopic studies. First, cave occurrences are widely distributed within its territory and cover a broad latitudinal range. Second, the previous speleothems studies demonstrated a summer insolation forcing of changes in rainfall regimes over southern-southeastern Brazil during the Late Quaternary (cycles of ~23.000 years). In addition the past climate in this region was also impacted on millennial time-scales by cooler climate conditions in northern hemisphere during Heinrich events. The present proposal aims to extend these studies for different tropical sites in Brazil by addressing questions about climate regional variability during Late Pleistocene and Holocene. It proposes to investigate the following problems: 1) is the precipitation associated with the South American Summer Monsoon (SASM) responding to changes in the summer insolation on long-term time scales and how insolarations affect large-scale atmospheric circulation in South America?; 2) how are the rapid climate shifts of the last glacial period and Holocene expressed in the southern hemisphere tropics? What is the impact of large-scale mode of natural climate variability such as El Niño-Southern Oscillation and North Atlantic Oscillation on short-term changes of past rainfall in the SASM region? In conjunction with our paleoclimate studies, we propose a stable isotope and geochemistry study in water samples. This work is important for understanding how the rainfall  $\delta^{18}O$  signal is transferred from precipitation to the karst system and is finally recorded in speleothem calcite and also how the chemical composition of cave drips forming speleothems is associated to rainfall variations.

### 78 An integrated seasonal forecasting system for South America

Caio Augusto dos Santos Coelho  
 National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)  
 Process 2005/05210-7  
 Term: Jul/2006 to Jun/2009

This research project proposes the implementation of an objective integrated forecasting system at the Centre for Weather Prediction and Climate Studies (CPTEC) for producing well-calibrated probabilistic seasonal forecasts for South America. The system is composed by two components: 1) a multi-model ensemble, composed by four coupled ocean-atmosphere dynamical models (the CPTEC coupled model plus three European coupled models) and 2) an empirical (statistical) model that uses Pacific and Atlantic sea surface temperatures as predictors for rainfall and temperature over South America. The predictions of these two components will be integrated, i.e. combined and calibrated, using a Bayesian procedure for producing a single probabilistic forecast that gathers all available information at the time the forecast is issued. The quality of the predictions produced by each component of the proposed system as well as of the forecasts produced by the integrated system will be assessed using standard deterministic and probabilistic forecast verification measures. Therefore, this project will contribute for scientific and technological developments in three areas: 1) multi-model seasonal forecasting; 2) calibration and combination of probabilistic seasonal forecasts and 3) forecast verification. It is expected that at the end of the project it will be possible to quantify how well predictable are the climate variations observed over South America on the seasonal time scale. The project will also develop applied research, focusing on governmental activities that use seasonal forecast information (e.g. water resource management for the hydro-power sector for electricity production).

### 79 Atmospheric aerosols and climatic changes on regional scale based on radiometers in satellites

Alexandre Lima Correia  
 National Institute for Space Research (Inpe)  
 Ministry of Science and Technology (MCT)  
 Process 2004/10084-8  
 Term: May/2005 to Apr/2007

The importance of atmospheric aerosols to the climate has been discussed for several years by the international scientific community. The difficulties associated with the characterization of atmospheric aerosols contribute to the non-existent uncertainties in models of climate changes. One of the instruments used for studies of atmospheric aerosols on a large scale are sensors

on board satellites, such as the Moderate Resolution Imaging Spectroradiometer (Modis). However, because of its global cover, the Modis products are notably simplified, which attracts inferences with significant errors on regional scales. This project aims to study the interaction between aerosols and climate on regional scales in Brazil, based on the development of Modis products of microphysics and optical thickness of specific aerosols for the characteristics of national ecosystems, with results in better spatial resolution than the products currently available. At the end of the project it will be possible, in principle, to reprocess images already obtained by the Modis sensor since its launch in 1999, making it possible to study the interactions between aerosols and climate on regional scale through the years. This project is furthermore structured in such a way as to permit the later absorption of the products of aerosols in meteorological and climatic models, making it possible to improve the precisions of climatic changes due to the effects of atmospheric aerosols.

80

**Development of an integrator of information acquired by pluviometers, satellites, lightning networks and meteorological radars and analysis of precipitant systems in Brazil – Precibra**

Carlos Frederico de Angelis

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 2003/10508-0

Term: Sep/2004 to Aug/2008

It is proposed to create an integrator of information on precipitation and some climatic and atmospheric variables to facilitate the investigation of local and regional meteorological and climatologically parameters over Brazil. The grouping of a large volume of available information, currently dispersed, in a single database will notably improve the knowledge on the climatology of precipitation, atmospheric circulation and the climate in general of South America and principally of Brazil. The deficiencies found in the estimators of precipitation that use data from meteorological satellites and radar will be appreciably minimized due to the integration and to the simultaneous use of data from pluviometers, satellites, radars, probes of atmospheric variables and occurrence of lightning. This data will be used not only in the development of estimating algorithms of precipitation which occurs over Brazilian territory, but also for the elaboration of a method of monitoring of the precipitation in Brazil that will be available for consultation in almost real time. Given that precipitation is the principal source of freshwater

for South America, the execution of the proposed project is of extreme relevance to the country, since it is necessary to meet the needs of various management sectors of hydric resources that need consistent information on precipitation.

81

**Space technology center for study of dynamic processes and oceanic fluxes on global scale**

Paulo Simionatto Polito

Institute of Oceanography

University of São Paulo (USP)

Process 2001/06921-3

Term: Feb/2002 to Mar/2006

We propose an emergent center for the study of the dynamic and thermodynamic of the oceans and their connections with the meteorology, biological and chemical oceanography, using global data from multiple sensors on board oceanographic satellites. We will examine global data containing the height anomaly, temperature and wind on the sea surface, concentration of chlorophyll and vapor integrated in the atmosphere. Digital filters will be used to separate the original measurements in various bands of the spatio-temporal spectrum associated with several dynamic regimes. This center is characterized by interdisciplinarity. This is evident in the specific aspects of the four main topics of this proposal. The first of them is the study of the ocean-atmosphere interaction on various spatio-temporal scales. In the second topic the influence of dynamic and thermodynamic regimes on the concentration of phytoplankton is dealt with using a similar methodology to that of the first topic. The third part deals with various aspects of the heat balance and includes estimates of the flux on the surface, of the heat stored and of the Ekman heat flux. The fourth topic presents an innovative method for calculating the flux of CO<sub>2</sub> from the atmosphere to the ocean due to the new primary production, based on altimetry data.

82

**Numerical modeling of the transformation and transport of atmospheric aerosol particles in the Amazon region. An evaluation of their climatic impact**

Karla Maria Longo

Institute of Astronomy, Geophysics and Atmospheric Sciences

University of São Paulo (USP)

Process 2001/05296-8

Term: Sep/2001 to Aug/2003

In this project it is proposed to use numerical models in the modeling of the transformation and transport of natural aerosol particles and particles from biomass burnings in the Amazon region. We will develop interfaces that will permit the coupled use of the Regional Atmospheric System (RAMS), the physics aerosol model Community Aerosol & Radiation Model for Atmospheres (CARMA), and a model of emitting sources of aerosols from biomass burnings. The system composed of these three models will enable the undertaking of numerical simulations of the spatial and temporal distribution of the aerosol particles, as well as of their optical properties. Special attention will be dedicated to the interaction of these particles with solar radiation and with the microphysics of clouds and to their potential climatic effects. We will emphasize the use of products of remote sensing in the initialization and validation of the results.

83

### **Numerical modeling of the transport and of atmospheric processes acting on gases and aerosols from biomass burnings in South America**

Saulo Ribeiro de Freitas

Institute of Astronomy, Geophysics and Atmospheric Sciences  
University of São Paulo (USP)  
Process 2001/05025-4  
Term: Sep/2001 to Oct/2004

Project to study transport and transformation of aerosols and gases in the atmosphere of South America. The study is envisaged through means of numerical modeling using (Eulerian and Lagrangean) models of transport, atmospheric model of meso-scale and model of physics of aerosols. The Eulerian model coupled to the atmospheric model will enable the 3D simulation of the mass distribution of these contaminants, and the implementation of the aerosols model on the meso-scale model will enable the investigation of the interaction of these with the evolution of the atmospheric state on a regional scale. Several refinements in the methodology developed by the proponent are planned. Observational data obtained locally and remotely will be used for a continuous validation of the methodology and proposed studies.

84

### **Simple hydrological model to estimate humidity of soil and runoff in macro-scale bays**

Javier Tomasella

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 1999/00394-0

Term: Jul/1999 to 2/29/2004

In this work, we will develop a macro-scale hydrological model, based on the equation of balance, of resolution compatible with the existing atmospheric models. The parameters of the model could be estimated using information already existing in surveys of soil, of topography and vegetation, avoiding, in principle, the need for calibration using existing hydrological series and/or new measurements. The model will be tested comparing its results with observations from the existing hydrological series, with other hydrological models, and with SVATS models for the principal bays in Brazil. Its implementation will be put into operation in order to generate information such as storing of water in the soil, to assist in the taking of decisions related to agricultural activities.

## **FIRST PROJECTS**

85

### **Evaluation of the air quality for ozone in the Metropolitan Region of Campinas**

Cláudia Boian

Institute of Astronomy, Geophysics and Atmospheric Sciences  
University of São Paulo (USP)  
Process 2006/60217-0  
Term: May/2007 to Sep/2008

It is proposed to study the meteorological chemical factors and emissions, that determine the air quality in the Metropolitan Region of Campinas (MRC), especially the formation of ozone, with the possibility of forecasting indices of air quality for this pollutant. The motivation for carrying out this work comes from the preliminary results obtained from the Cetesb, in the monitoring of ozone carried out during the first 11 months of 2003, in Americana (40 km away from Campinas), which classified the air of this city for the period as being the second most polluted by ozone in the interior of the State of São Paulo. The bad quality of the air was attributed to episodes of transport of ozone from the source regions Campinas and Paulínia, by mechanisms of local circulation. For this study we will use the CIT photochemical model (air quality model of the Caltech Institute of Technology). The model will be calibrated beforehand with the data on surface ozone collected from the air quality stations of Cetesb for critical periods in terms of concentration for the years 2003 and 2004. Later, based on prediction of air quality, we will define the period of carrying out a campaign for the launch of ECC (Electrochemical Concentration

Cell) ozonesondes, aimed at validating the results of the modeling with experimental data of vertical profiles of ozone. This campaign will be undertaken in partnership with the Inpe Ozone Laboratory. An experiment of ozone soundings will be carried out in the Metropolitan Region of São Paulo (RMSP) within the ambit of the public policies project *Photochemical air quality models, implementation for simulation and evaluation of concentrations of tropospheric ozone in urban regions* (Process 03/06414-0, FAPESP). It is intended that the experiments will be carried out in the same period, permitting, in this way, the description of the transport between these metropolitan regions. At a later stage, it is aimed to carry out simulations, using the RAMS (Regional Atmospheric Modeling System) meteorological model, which has a simplified chemical mechanism being set up for the management of the entry parameters: meteorological parameters, air circulation and ozone concentration, for the purposes of comparison with the results obtained when using data from Cetesb in the CIT photochemical model of air quality.

86

### Contributions of solar variability and geophysical events in the climate of South America: study of the Sun-climate relationships in growth rings of trees

Heloísa Helena de Faria

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 2003/11064-8

Term: Jul/2004 to Oct/2004

To better understand the relationship between the phenomena involved and extend the forecasts for a bigger time scale in the future, it is necessary to push back even further the timescale of analysis of the past. It is therefore necessary to study natural records that represent indicators of the variations in environmental, meteorological and climatic parameters, for example. Several natural phenomena contributed to the accumulation through time of isotopes, elements or compounds deposited in marine or lake sediments and in the ice of the polar icecaps and glaciers. The concentrations of material deposited represent natural records of the phenomena involved in their rate of formation and/or accumulation. The physical growth of trees also represents an indicator of various environmental parameters, such as air temperatures, pluviometry, presence of nutrients, etc. The trees thus present natural records of the variations in the environmental parameters most

involved in their growth. When the trees show growth rings in the interior of their trunks and branches, the simple counting of these annual rings represents in a direct way the scale of time. The variation in the thickness of the growth rings of trees deserves to be investigated as a regional and/or global indicator of the climatic variability on the continents to the scale of one year to thousands of years. The following stage of this research is the search for the influence of solar variability, of volcanic activity and phenomena such as El Niño events, for the identification of characteristic periodicities and other correlations. In addition to this identification of characteristic periodicities, an analysis will be undertaken of the variations of respective amplitudes of these signals by the wavelet method. Thus we will be able to reconstitute the history of variations (activity and emission of energy) of the Sun in the past covered by the duration of the chronologies of the trees studied, that is, typically for the past, moving from the present to 2 thousand years back in time.

87

### The role of aerosols in the formation of severe storms in the Metropolitan Region of São Paulo

Edmilson Dias de Freitas

Institute of Astronomy, Geophysics and Atmospheric Sciences

University of São Paulo (USP)

Process 2003/11013-4

Term: Jul/2004 to Aug/2005

In this project it is intended, by means of using numerical models, to study the effects related to the presence of aerosols, deriving from human activity, in the formation of severe storms during the periods of spring and summer in the MRSP. Emphasis will be given to the effects of these particles on the radiation and on their participation in the formation of cloud droplets, serving as nuclei of cloud condensation. The study will be carried out through interfaces developed for the coupled use of the RAMS atmospheric model, the TEB model, the CARMA model of the physics of aerosols and a Eulerian model of emission sources of aerosols of anthropogenic origin. The coupling of these models will permit the three-dimensional simulation of the distribution of the mass of the aerosols and the investigation of the interactions of these contaminants with the evolution of the atmospheric state on regional scale. We will use surface data obtained by the operational network of the Cetesb and data from remote sensing provided by meteorological radars and satellites for the validation of the proposed methodology.

## TECHNOLOGICAL INNOVATION IN SMALL BUSINESSES (PIPE)

88

### Generation of digital models of elevation through radargrammetry with Radarsat-1 satellite images

Waldir Renato Paradella

Geoambiente Sensoriamento Remoto Ltda.

Process 1999/06271-7

Term: Feb/2000 to Sep/2003

The proposed research project is aimed at the training of the company in the generation of Digital Elevation Models – (DEM), by means of orbital radar images, as an aid to the creation of topographical charts and SAR Integrated Products for geoenvironmental applications. The methodology is based on radargrammetry with the use of Standard and Fine images from the Canadian Radarsat-1 satellite. The proposal prioritizes, also, the establishment of a culture in the use of the radar imaging technology in the company. Brazil has the dimensions of a continent and a poor cartographic knowledge. Only 60 per cent of the country is mapped topographically on the scale 1:100,000 and the bulk of this is out of date. In this sense, the use of Integrated Radar Products has great potential for added value, but this depends on a rigorous geometric correction (orthorectification) of the images. The project focuses on the generation of DEM of a test area located in the Carajás mountains (state of Pará), through Radarsat Fine and Standard images, treated with OrthoEngine SE software (PCI Geomatics), with a radargrammetric approach (radar stereoscopy). In addition we will investigate the potential for creating topographical charts on the semi-detail scale (1:100,000). In its second phase we intend to refine the results focusing on the generation of DEMs in the creation of topographic charts and Integrated Radar Products for geoenvironmental applications. In addition to this we will look on the international market for alternative devices (hardware and software) which will enable the plotting of the GCPs in three-dimensional vision (less propagation of error in the accuracy of the final elevation of the DEMs).

## PARTNERSHIP FOR TECHNOLOGICAL INNOVATION PROGRAM (PITE)

89

### A research program on earth system science with special emphasis on global climate change

Carlos Afonso Nobre

National Institute for Space Research (Inpe)

Ministry of Science and Technology (MCT)

Process 2007/58726-6

Term: May/2008 to Apr/2011

Earth System Science (ESS) addresses the changes that are occurring at the planetary level, and the implications of these changes for global and local sustainability. This science refers not only to the natural sciences but also to the human dimensions. In general terms, the purpose of the ESS research is to understand the physical-ecological-anthropogenic systems as complex and dynamic interacting entities. ESS is a new paradigm in which the Earth's environment is seen as being influenced by the dynamic interaction of natural and social systems. The objective of the research project is to support the development in Brazil of scientific capacity to observe, model, analyze and integrate components of the Earth System. The focus of ESS in Brazil will be to explore the interfaces of global environmental change and issues of relevance to regional development, particularly those associated with Brazil and South America and to provide information for Earth System governance. This project will foster the development of advanced Earth System models and observations in Brazil, including global and regional and climate models. Towards that goal, the project will implement a state-of-the-art supercomputer facility at Inpe for use by the Brazilian scientific community to advance modeling of the ES and production of scenarios of global environmental change, specially global climate change of interest and relevance to Brazil and South America.

## PUBLIC POLICIES RESEARCH PROGRAM

90

### Implementation of the air quality model for the Metropolitan Region of São Paulo

Maria de Fátima Andrade

Institute of Astronomy, Geophysics and Atmospheric Sciences

University of São Paulo (USP)

Process 2003/06414-0

Term: Apr/2004 to Jul/2007

Pollution from gases and particles has been a difficult problem to tackle in complex urban regions, as is the case in the metropolitan regions of São Paulo. The factors that lead to poor air quality include gas emissions and particles, topography, meteorology, chemistry, and gas-particle conversion. Since the interactions between all these factors are complex, computational models were developed to simulate the production of pollution, and to understand these interactions. Technologically advanced countries have demonstrated



the need to analyze the complex interactions between the chemistry and the meteorology which control the phenomena associated with atmospheric dispersion of pollutants. The appropriate methodology for this is the application of air quality models that include a description both of the chemical mechanisms and well as dispersion and transport. The Department of Atmospheric Sciences has considerable experience in the use of the CIT model, developed in the California Institute of Technology and Carnegie Mellon University. This model has been applied to the problem of the description of the formation of photochemical pollutants in São Paulo. The basic components of these modules are: a kinetic mechanism describing the chemical reactions; a description of the sources, with spatial and temporal distribution of the emissions; a meteorological description, including velocity and direction of the wind for each station, the vertical structure of the temperature and the intensity of the radiation. This model will be the host for the inclusion of the module of the formation of fine particles, which includes gas-particle conversion and growth by condensation and coagulation. This more complete model called CIT-AERO is being implemented in the Department of Atmospheric Sciences, in collaboration with the Carnegie Mellon University of Pittsburgh.

## GRANTS

### RESEARCH ABROAD

#### 1 Influence of the South Atlantic circulation on the modes of variability of the Equatorial Atlantic. Study with ocean-atmosphere coupled model

Grant holder: Edmo José Dias Campos  
 Institution: Institute of Oceanography / University of São Paulo (USP)  
 Institution abroad: Koninklijk Nederlands Meteorologisch Instituut, Holanda  
 Process 2006/03949-8

#### 2 Sensitivity of the circulation of the Weddell Sea in the extension and concentration of ice from the Antarctic sea – a preliminary numerical study

Grant holder: Ilana Elazari Klein Coaracy Wainer  
 Institution: Institute of Oceanography / University of São Paulo (USP)  
 Institution abroad: National Center for Atmospheric Research, USA  
 Process 2005/02687-7

#### 3 Validation of data and calibration of a Raman lidar of water vapor

Grant holder: Eduardo Landulfo  
 Institution: Institute for Energy and Nuclear Research / São Paulo State Ministry for Development (SDSP)  
 Institution abroad: Goddard Space Flight Center, USA  
 Process 2005/02158-4

#### 4 Paleoclimatology of the South Atlantic Ocean in the Quaternary, part I: last glacial maximum

Grant holder: Ilana Elazari Klein Coaracy Wainer  
 Institution: Institute of Oceanography / University of São Paulo (USP)  
 Institution abroad: National Center for Atmospheric Research, USA  
 Process 2003/05997-1

#### 5 Seasonal variability in the South Atlantic with the NCAR ocean-atmosphere circulation coupled model

Grant holder: Ilana Elazari Klein Coaracy Wainer  
 Institution: Institute of Oceanography / University of São Paulo (USP)  
 Institution abroad: National Center for Atmospheric Research, USA  
 Process 1998/13397-4

#### 6 Monitoring of bioclimatic variability and its impact on agricultural production through data from AVHRR-NOAA

Grant holder: William Tse Horng Liu  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Institution abroad: National Center for Atmospheric Research, USA  
 Process 1998/02409-1

#### 7 Evaluation of the most appropriate indicators for the multilevel and integrated monitoring of the process of desertification (geared to the semi-arid Brazilian tropic)

Grant holder: Vitor Celso de Carvalho  
 Institution: National Institute for Space Research/Ministry of Science and Technology (MCT)  
 Institution abroad: University of Toulouse Le Mirail, France  
 Process 1997/11439-9

## 8 Evaluation of precipitable atmospheric water using photometric measurements

Grant holder: Artêmio Plana Fattori

Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Institution abroad: Université Sciences Technologies Lille, France  
 Process 1995/03384-4

## 9 High resolution spectral remote sensing: study of advanced techniques of processing and applications in the study of hydrothermal alteration minerals

Grant holder: Álvaro Penteado Crosta

Institution: Geosciences Institute/ Campinas State University (Unicamp)  
 Institution abroad: Desert Research Institute, USA  
 Process 1994/03474-0

## 10 Application of air quality models in São Paulo: production and transport of tropospheric ozone

Grant holder: Maria de Fátima Andrade

Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Institution abroad: California Institute Technology, USA  
 Process 1993/04996-8

## 11 Performance of forecasts of precipitant systems in the summer of 1993/94 in the tropical and subtropical regions of Brazil

Grant holder: Maria Assunção Faus da Silva Dias

Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Institution abroad: National Meteorological Center  
 Process 1993/03459-9

### POST-DOCTORATE

## 12 Improving meteorological downscaling methods with neural network models: South American rainfall

Grant holder: David Mendes

Supervisor: José Antônio Marengo Orsini  
 Institution: National Institute for Space Research / Ministry of Science and Technology (MCT)  
 Process 2007/50145-4

## 13 The role of variability in the Tropical and South Atlantic in the climate of the Northeast of Brazil in El Niño years

Grant holder: Regina Rodrigues Rodrigues

Supervisor: Edmo José Dias Campos  
 Institution: Institute of Oceanography / University of São Paulo (USP)  
 Process 2007/03279-5

## 14 Interaction between atmospheric equatorial waves through resonance with wet convection

Grant holder: Carlos Frederico Mendonça Raupp

Supervisor: Pedro Leite da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2006/53606-0

## 15 Assimilation of atmospheric aerosols by satellite in the Catt-Brams model of chemical transport

Grant holder: Judith Johanna Hoelzemann

Supervisor: Karla Maria Longo  
 Institution: National Institute for Space Research / Ministry of Science and Technology (MCT)  
 Process 2005/60890-3

## 16 Classification of precipitant systems by means of remote sensing and artificial neural networks

Grant holder: Evaldo Araújo de Oliveira Filho

Supervisor: Augusto José Pereira Filho  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2005/60141-0

## 17 Stochastic forecasting in meteorology. Part 1 – model of shallow waters with rain mechanism

Grant holder: Paul Krause

Supervisor: Pedro Leite da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2005/56460-3

18

**Use of advanced techniques of remote sensing in the measurement of particulate material in suspension in the atmosphere – a proposal to increase resolution and reduce uncertainties**

Grant holder: Andrea Dardes de Almeida Castanho  
 Supervisor: Paulo Eduardo Artaxo Netto  
 Institution: Institute of Physics / University of São Paulo (USP)  
 Process 2005/54768-0

19

**Evaluation of the air quality for ozone in the Metropolitan Region of Campinas**

Grant holder: Cláudia Boian  
 Supervisor: Maria de Fátima Andrade  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2005/51401-9

20

**Study and forecasting of occurrence of storms, substorms and HILDCAAS**

Grant holder: Fernando Luís Guarnieri  
 Supervisor: Walter Demetrio Gonzalez Alarcon  
 Institution: National Institute for Space Research / Ministry of Science and Technology (MCT)  
 Process 2004/14784-4

21

**Study of the composition of the aerosols and of the isotopic signature of Pb as tracer of the sources of atmospheric pollution in the city of São Paulo**

Grant holder: Simone Maria Costa Lima Gioia  
 Supervisor: Marly Babinski  
 Institution: Geosciences Institute / University of São Paulo (USP)  
 Process 2004/09879-6

22

**Numerical study of the responses of the ocean-atmosphere coupled system to climatic variabilities in the South Atlantic**

Grant holder: Carlos Alexandre Domingos Lentini  
 Supervisor: Edmo José Dias Campos  
 Institution: Institute of Oceanography / University of São Paulo (USP)  
 Process 2004/01849-0

23

**Sensitivity of the climate and regional productivity to changes in land use and to global changes: a study of biosphere-atmosphere coupled modeling**

Grant holder: Robinson Isaac Negron Juarez  
 Supervisor: Humberto Ribeiro da Rocha  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2004/01468-7

24

**Role of aerosols in the formation of severe storms in the Metropolitan Region of São Paulo**

Grant holder: Edmilson Dias de Freitas  
 Supervisor: Pedro Leite da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2003/04890-9

25

**Study of the coupled neutral-ionosphere atmosphere system in the Brazilian equatorial region through radio – multiple soundings**

Grant holder: Clezio Marcos de Nardin  
 Supervisor: Mangalathayil Ali Abdu  
 Institution: National Institute for Space Research / Ministry of Science and Technology (MCT)  
 Process 2003/01146-7

26

**Modeling of gases and aerosols deriving from biomass burning – physical and chemical processes**

Grant holder: Leila Maria Merce de Albuquerque Martins  
 Supervisor: Carlos Afonso Nobre  
 Institution: National Institute for Space Research / Ministry of Science and Technology (MCT)  
 Process 2002/09732-0

27

**Contributions of solar variability and geophysical events to the climate of South America**

Grant holder: Heloísa Helena de Faria  
 Supervisor: Daniel Jean Roger Nordemann  
 Institution: National Institute for Space Research / Ministry of Science and Technology (MCT)  
 Process 2002/05163-0

28

**Remote sensing and analysis of the ozone layer gap**

Grant holder: Iara Regina Nocentini André

Supervisor: Nelson Jesus Ferreira

Institution: National Institute for Space Research /

Ministry of Science and Technology (MCT)

Process 2001/09902-0

29

**The influence of the atmospheric aerosol on the concentrations of photochemical pollutants**

Grant holder: Regina Maura de Miranda

Supervisor: Maria de Fátima Andrade

Institution: Institute of Astronomy, Geophysics and

Atmospheric Sciences / University of São Paulo (USP)

Process 2001/03425-5

30

**Modeling and forecasting of oceanic waves in the Cptec**

Grant holder: Leandro Farina

Supervisor: Carlos Afonso Nobre

Institution: National Institute for Space Research (Inpe) /

Ministry of Science and Technology

Process: 2000/01284-2

31

**Measurements of trace gases in regions under the influence of transport of contaminant from biomass burnings**

Grant holder: Cláudia Boian

Supervisor: Volker Walter Johann Heinrich Kirchhoff

Institution: National Institute for Space Research /

Ministry of Science and Technology (MCT)

Process 2000/14630-6

32

**Interaction between aerosol particles and clouds in the Amazon region: observational analysis and numerical modeling**

Grant holder: Karla Maria Longo

Supervisor: Maria Assunção Faus da Silva Dias

Institution: Institute of Astronomy, Geophysics and

Atmospheric Sciences / University of São Paulo (USP)

Process 1999/10421-4

33

**Numerical modeling of the transport of trace gases and aerosols from biomass burning in the Cerrado and tropical forest of South America. Validation of a methodology**

Grant holder: Saulo Ribeiro de Freitas

Supervisor: Maria Assunção Faus da Silva Dias

Institution: Institute of Astronomy, Geophysics and

Atmospheric Sciences / University of São Paulo (USP)

Process 1999/07370-9

34

**Effect of biogenic aerosols and of biomass burning in the Amazon on the structure of the atmosphere – regional and global effects**

Grant holder: José Vanderlei Martins

Supervisor: Paulo Eduardo Artaxo Netto

Institution: Institute of Physics / University of São Paulo

(USP)

Process 1999/04572-0

35

**Aerosols and atmospheric radiation balance in Amazonia: studies with measurements in situ through solar radiometers**

Grant holder: Márcia Akemi Yamasoe

Supervisor: Paulo Eduardo Artaxo Netto

Institution: Institute of Physics / University of São Paulo

(USP)

Process 1999/04361-9

36

**An investigation into the application of wavelet transform in the study of atmospheric and chaotic phenomena**

Grant holder: Gannabathula Sri Sessa Durga Prasad

Institution: National Institute for Space Research /

Ministry of Science and Technology (MCT)

Process 1994/02276-0

**DOCTORATE**

37

**Impact of atmospheric aerosols on the formation of clouds and precipitation over the Metropolitan Region of São Paulo**

Grant holder: Márcio Gledson Lopes Oliveira

Supervisor: Maria de Fátima Andrade

Institution: Institute of Astronomy, Geophysics and

Atmospheric Sciences / University of São Paulo (USP)

Process 2007/57466-0

38

**Dynamic and thermodynamic of the lines of instability in Amazonia**

Grant holder: Clenia Rodrigues Alcântara

Supervisor: Maria Assunção Faus da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and  
 Atmospheric Sciences / University of São Paulo (USP)  
 Process 2007/50295-6

39

### Multiscale interaction between ocean and atmosphere and variability of low frequency

Grant holder: Enver Manuel Amador Ramirez Gutierrez  
 Supervisor: Pedro Leite da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and  
 Atmospheric Sciences / University of São Paulo (USP)  
 Process 2006/60488-3

40

### Impact of megacities on the quality of air on local and regional scale: the cases of the metropolitan regions of São Paulo and of Rio de Janeiro

Grant holder: Vanessa Silveira Barreto Carvalho  
 Supervisor: Edmilson Dias de Freitas  
 Institution: Institute of Astronomy, Geophysics and  
 Atmospheric Sciences / University of São Paulo (USP)  
 Process 2006/59546-9

41

### Effect of climate changes on the productivity and water offer: an investigation for the São Paulo agroecosystems

Grant holder: Jonatan Dupont Tatsch  
 Supervisor: Humberto Ribeiro da Rocha  
 Institution: Institute of Astronomy, Geophysics and  
 Atmospheric Sciences / University of São Paulo (USP)  
 Process 2006/50924-0

42

### Quantitative forecast of precipitation through the combination of multiple numerical forecasts

Grant holder: América Murgía Espinosa  
 Supervisor: Pedro Leite da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and  
 Atmospheric Sciences / University of São Paulo (USP)  
 Process 2005/59116-1

43

### Formation and transport of fine inorganic particles in an urban atmosphere

Grant holder: Taciana Toledo de Almeida Albuquerque  
 Supervisor: Maria de Fátima Andrade

Institution: Institute of Astronomy, Geophysics and  
 Atmospheric Sciences / University of São Paulo (USP)  
 Process 2005/58750-9

44

### Variability of the regime of summer monsoons in South America and interaction with the biosphere in the Southeast and Center-West

Grant holder: Ana Elizabete da Silva  
 Supervisor: Leila Maria Vespoli de Carvalho  
 Institution: Institute of Astronomy, Geophysics and  
 Atmospheric Sciences / University of São Paulo (USP)  
 Process 2005/56487-9

45

### Influence of the inter-Enos variability on the dynamic associated with low-level jet to the east of the Andes and cold fronts during the southern summer and winter

Grant holder: Gyrlene Aparecida Mendes da Silva  
 Supervisor: Tércio Ambrizzi  
 Institution: Institute of Astronomy, Geophysics and  
 Atmospheric Sciences / University of São Paulo (USP)  
 Process 2005/01804-0

46

### Electrification of the precipitant systems in the Amazon region: physical and dynamic processes of development of storms

Grant holder: Rachel Ifanger Albrecht  
 Supervisor: Maria Assunção Faus da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and  
 Atmospheric Sciences / University of São Paulo (USP)  
 Process 2004/09049-3

47

### The South Atlantic convergence zone and the Pacific and Atlantic oceanic processes

Grant holder: Tatiana Jorgetti  
 Supervisor: Pedro Leite da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and  
 Atmospheric Sciences / University of São Paulo (USP)  
 Process 2004/07953-4

48

### Extratropical cyclones above the South Atlantic: climatic simulations and the impact of sea surface temperature

Grant holder: Michelle Simoes Reboita

Supervisor: Tércio Ambrizzi

Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 2004/02446-7

49

### Forecasting of severe storms at very short notice in the State of São Paulo

Grant holder: Wando Celso Maugeri Amorim  
Supervisor: Carlos Augusto Morales Rodriguez  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 2003/09395-6

50

### Interaction between the Antarctic sea ice and the South Atlantic Ocean using a coupled model of general circulation

Grant holder: Janini Pereira  
Supervisor: Ilana Elazari Klein Coaracy Wainer  
Institution: Institute of Oceanography / University of São Paulo (USP)  
Process 2003/03054-2

51

### Observational and modeling studies of the structure and variability of low-level jets to the east of the Andes in South America

Grant holder: Wagner Rodrigues Soares  
Supervisor: José Antônio Marengo Orsini  
Institution: National Institute for Space Research / Ministry of Science and Technology (MCT)  
Process 2002/12670-6

52

### Impact of non-linearity of the interaction between the tropical and extratropical atmospheric circulations

Grant holder: Carlos Frederico Mendonça Raupp  
Supervisor: Pedro Leite da Silva Dias  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 2002/09683-9

53

### Study of the formation of photochemical oxidants and control strategies for the São Paulo atmosphere

Grant holder: Leila Droprinchinski Martins  
Supervisor: Maria de Fátima Andrade

Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 2002/09060-1

54

### Ocean-atmosphere interaction in the South Atlantic ocean and its global impact

Grant holder: Andrea Sardinha Taschetto  
Supervisor: Ilana Elazari Klein Coaracy Wainer  
Institution: Institute of Oceanography / University of São Paulo (USP)  
Process 2002/01211-0

55

### Study of the influence of the subtropical Atlantic ocean on the climate of South America

Grant holder: Anita Rodrigues de Moraes Drumond  
Supervisor: Tércio Ambrizzi  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 2001/06842-6

56

### Dynamic of the circulation of the South Atlantic ocean from the last glacial maximum to the present

Grant holder: Gabriel Clauzet  
Supervisor: Ilana Elazari Klein Coaracy Wainer  
Institution: Institute of Oceanography / University of São Paulo (USP)  
Process 2001/04920-0

57

### Analysis of the physical characteristics of lightning bolts in the Southeast region of Brazil with data from a storm location system (SLS)

Grant holder: Kleber Pinheiro Naccarato  
Supervisor: Osmar Pinto Júnior  
Institution: National Institute for Space Research / Ministry of Science and Technology (MCT)  
Process 2001/04026-7

58

### Relationship between the sea surface temperature in the Atlantic and Pacific oceans and the climatic conditions in the South and Southeast regions of Brazil

Grant holder: Andrea de Oliveira Cardoso

Supervisor: Pedro Leite da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and  
 Atmospheric Sciences / University of São Paulo (USP)  
 Process 2001/00227-8

59

### **Aerosols, clouds and precipitation and their climatic effects**

Grant holder: Theotônio Mendes Pauliquevis Júnior  
 Supervisor: Paulo Eduardo Artaxo Netto  
 Institution: Institute of Physics / University  
 of São Paulo (USP)  
 Process 2000/10677-8

60

### **Characterization of physical and chemical properties of the aerosol particles for the metropolitan region of São Paulo**

Grant holder: Andrea Dardes de Almeida Castanho  
 Supervisor: Paulo Eduardo Artaxo Netto  
 Institution: Institute of Physics / University  
 of São Paulo (USP)  
 Process 1999/12493-2

61

### **Formation of fine particle constituent of the urban aerosol in the metropolitan region of São Paulo**

Grant holder: Rita Yuri Ynoue  
 Supervisor: Maria de Fátima Andrade  
 Institution: Institute of Astronomy, Geophysics and  
 Atmospheric Sciences / University of São Paulo (USP)  
 Process 1999/08211-1

62

### **Characterization and dynamic of CO<sub>2</sub> on the soil/atmosphere interface, in ecosystems with natural and anthropized vegetation, using the carbon isotopes (12C, 13C and 14C)**

Grant holder: Hermes Augusto de Freitas  
 Supervisor: Luiz Carlos Ruiz Pessenda  
 Institution: Center for Nuclear Energy in Agriculture /  
 University of São Paulo (USP)  
 Process 1999/07700-9

63

### **Application of biophysical parameters in the development of forecasting models of agricultural harvests via NOAA satellite**

Grant holder: André Luiz Farias de Souza

Supervisor: Oswaldo Massambani  
 Institution: Institute of Astronomy, Geophysics and  
 Atmospheric Sciences / University of São Paulo (USP)  
 Process 1999/07632-3

64

### **Chemical processes and the transport of O<sub>3</sub>, NO<sub>x</sub>, CO gases and VOCs in the Amazon atmosphere**

Grant holder: Ana Maria Cordova Leal  
 Supervisor: Paulo Eduardo Artaxo Netto  
 Institution: Institute for Energy and Nuclear Research / São  
 Paulo State Ministry for Development (SDSP)  
 Process 1999/04281-5

65

### **Surface and local circulation processes in São Paulo**

Grant holder: Edmilson Dias de Freitas  
 Supervisor: Pedro Leite da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and  
 Atmospheric Sciences / University of São Paulo (USP)  
 Process 1998/15663-3

66

### **Study of the influence of aerosols in the calculation model of solar radiation on the surface using satellite data; and the automatic mapping of clouds**

Grant holder: Fernando Ramos Martins  
 Supervisor: Enio Bueno Pereira  
 Institution: National Institute for Space Research/Ministry of  
 Science and Technology (MCT)  
 Process 1996/01243-7

67

### **Dynamic and circulation of water masses on the western edge of the South Atlantic between 20s and 30s**

Grant holder: José Eduardo Gonçalves  
 Supervisor: Edmo José Dias Campos  
 Institution: Institute of Oceanography / University  
 of São Paulo (USP)  
 Process 1995/00485-4

## **DIRECT DOCTORATE**

68

### **Low frequency climatic variabilities in the South Atlantic. Analysis of the results of an ocean-atmosphere coupled model**

Grant holder: Roberto Antônio Ferreira de Almeida  
 Supervisor: Edmo José Dias Campos  
 Institution: Institute of Oceanography / University of São Paulo (USP)  
 Process 2001/09408-5

## MASTERS

69

**Climatic and vegetational variations and their influence on the Holocene pattern of human occupation in the region of Lagoa Santa: palinology of a terrace in Ribeirão da Mata, municipality of Pedro Leopoldo, MG**

Grant holder: Marco Felipe Raczka  
 Supervisor: Paulo Eduardo de Oliveira  
 Institution: Center for Postgraduate studies, Research and Extension / University of Guarulhos (UnG)  
 Process 2007/52246-2

70

**GIS and remote sensing applied to the study of the dynamic of flooding of an area of the Alto Paraná flood plain, center south of Brazil**

Grant holder: Tiago Matsuo Samizava  
 Supervisor: Nilton Nobuhiro Imai  
 Institution: Presidente Prudente School of Science and Technology / São Paulo State University (Unesp)  
 Process 2007/01863-1

71

**Effect of *Eucalyptus* plantations on the local circulations and quality of air in the Vale da Paraíba**

Grant holder: Karin Rafaella Koop  
 Supervisor: Pedro Leite da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2006/59216-9

69

**Use of a meso-scale atmospheric model for the forecasting of air quality in the metropolitan region of São Paulo**

Grant holder: Melissa Santi Itimura  
 Supervisor: Edmilson Dias de Freitas  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2006/58505-7

73

**Study of the sensitivity of the AIRS channels to the alterations in the concentration of carbon monoxide in the atmosphere**

Grant holder: Rudinei Martins de Oliveira  
 Supervisor: Rodrigo Augusto Ferreira de Souza  
 Institution: National Institute for Space Research / Ministry of Science and Technology (MCT)  
 Process 2006/54765-4

74

**Climatic extremes in the Southeast and Center-West of Brazil: the present climate and projections for the XXI century**

Grant holder: Rodrigo José Bombardi  
 Supervisor: Leila Maria Vespoli de Carvalho  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2006/53769-6

75

**Vegetation dynamic and climatic inferences in the Late Quaternary in the region of the Ilha de Marajó, PA, using carbon isotopes ( $^{12}\text{C}$ ,  $^{13}\text{C}$ ,  $^{14}\text{C}$ ) of organic matter from the soils and sediments**

Grant holder: Cláudia More de Lima  
 Supervisor: Luiz Carlos Ruiz Pessenda  
 Institution: Center for Nuclear Energy in Agriculture / University of São Paulo (USP)  
 Process 2006/52173-2

76

**Relationships between the extension and the form of forest clearing and the impacts on precipitation: a case study on the Cuiabá–Santarém highway**

Grant holder: Sandra Isay Saad  
 Supervisor: Humberto Ribeiro da Rocha  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2005/57829-0

77

**Remote sensing of aerosols in high resolution in the Amazon region**

Grant holder: Sílvia de Lucca  
 Supervisor: Paulo Eduardo Artaxo Netto  
 Institution: Institute of Physics / University of São Paulo (USP)  
 Process 2005/57456-0



78

**Validation and analysis of climatic variability of a model of the climate in 6000 bp**

Grant holder: Cândida de Freitas Dewes  
Supervisor: Pedro Leite da Silva Dias  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 2005/53200-0

79

**Climate extremes in Antarctica and relationships with the climate of South America**

Grant holder: Nathalie Tissot Boiaski  
Supervisor: Leila Maria Vespoli de Carvalho  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 2005/52389-2

80

**A model of potential vegetation including carbon cycle and natural fire: consequences of climate change in global biomas**

Grant holder: David Montenegro Lapola  
Supervisor: Marcos Daisuke Oyama  
Institution: National Institute for Space Research / Ministry of Science and Technology (MCT)  
Process 2004/12235-3

81

**Tropical-extratropical interactions and climatic implications for the Southern hemisphere**

Grant holder: Fábio Ullmann Furtado de Lima  
Supervisor: Leila Maria Vespoli de Carvalho  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 2004/11808-0

82

**Regional simulation of the interannual climatic variability in the Brazilian Northeast**

Grant holder: Jonathan Mota da Silva  
Supervisor: Adilson Wagner Gandu  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 2004/11617-0

83

**Study of the seasonal variability of the optical depth of the aerosol in São Paulo based on MFRSR radiometer**

Grant holder: André Cozza Sayao  
Supervisor: Márcia Akemi Yamasoe  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 2004/11553-1

84

**Evolution of the distributions of sizes in mass and number of atmospheric aerosol in São Paulo**

Grant holder: Márcio Gledson Lopes Oliveira  
Supervisor: Maria de Fátima Andrade  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 2004/11382-2

85

**Study of greenhouse effect gases in Amazonia**

Grant holder: Mônica Taís Siqueira D'Amélio  
Supervisor: Luciana Vanni Gatti  
Institution: Institute for Energy and Nuclear Research / São Paulo State Ministry for Development (SDSP)  
Process 2004/04148-3

86

**Effect of aerosols from biomass burnings in the concentrations of photochemical oxidants**

Grant holder: Eder Paulo Vendrasco  
Supervisor: Pedro Leite da Silva Dias  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 2003/10354-2

87

**Estimate of precipitation via remote sensing in microwaves in the Amazon basin**

Grant holder: Thiago Souza Biscaro  
Supervisor: Carlos Augusto Morales Rodriguez  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 2003/10310-5

88

### **Climatic variations and hydrological cycle in the conversion of cerrados for eucalyptus and sugarcane**

Grant holder: Jonatan Dupont Tatsch  
 Supervisor: Humberto Ribeiro da Rocha  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2003/10004-1

89

### **Extreme events of precipitation in the South of Brazil associated with low-level jet**

Grant holder: Fabiana Victória Weykamp  
 Supervisor: Tércio Ambrizzi  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2003/09973-0

90

### **Intercomparison of paleoclimatic simulations for the Middle Holocene and the present in the region of the South Atlantic**

Grant holder: Adriana Brasil de Oliveira  
 Supervisor: Ilana Elazari Klein Coaracy Wainer  
 Institution: Institute of Oceanography / University of São Paulo (USP)  
 Process 2003/09971-7

91

### **Analysis of storms in the transition between the dry and rainy season in Rondônia**

Grant holder: Alana de Lima Pontes  
 Supervisor: Maria Assunção Faus da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2003/09694-3

92

### **Relationships between meteorological events and acid rain in São Paulo**

Grant holder: Ana Elizabethe da Silva  
 Supervisor: Adalgiza Fornaro  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2003/03072-0

93

### **Impact of wet convection in the lower stratosphere of the tropical region of South America**

Grant holder: Thaís Machado Scherrer  
 Supervisor: Pedro Leite da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2002/11268-0

94

### **The impact of deforestation on the hydrological cycle: a prognosis for the case of the Cuiabá-Santarém highway**

Grant holder: Rafael Rosolem  
 Supervisor: Humberto Ribeiro da Rocha  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2002/11004-2

95

### **Study of the 3D redistribution of gases and aerosols from biomass burning in Roraima, 1998**

Grant holder: Rodrigo Gevaerd  
 Supervisor: Saulo Ribeiro de Freitas  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2002/10469-1

96

### **The transition between convectives and stratiform periods associated with intraseasonal oscillation in the southeast region of Amazonia**

Grant holder: Rachel Ifanger Albrecht  
 Supervisor: Maria Assunção Faus da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2001/11532-6

97

### **Analysis of a modeling of the present tropical climate of South America and in 6000 bp**

Grant holder: Tatiana Jorgetti  
 Supervisor: Pedro Leite da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2001/11403-1

98

### **Analysis of local circulations in the confluence of the Tapajós and Amazon rivers**

Grant holder: Priscila Brier D'Auria  
 Supervisor: Maria Assunção Faus da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2001/11402-5

99

### Experimental study of the vertical profile of aerosols in the troposphere using the lidar technique

Grant holder: Renata Fernandes de Souza  
 Supervisor: Eduardo Landulfo  
 Institution: Institute for Energy and Nuclear Research / São Paulo State Ministry for Development (SDSP)  
 Process 2001/07304-8

100

### Dynamic of squall fronts of meso-scale convective systems in Amazonia

Grant holder: Marcos Longo  
 Supervisor: Maria Assunção Faus da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2000/13976-6

101

### A study on the fluxes of heat on the surface in the western region of the Tropical Atlantic

Grant holder: Guilherme Pimenta Castelão  
 Supervisor: João Antônio Lorenzetti  
 Institution: Institute of Oceanography / University of São Paulo (USP)  
 Process 2000/06028-4

102

### Evaluation of climatic oscillations in the Upper Quaternary on the southeast continental margin of Brazil based on the study of the association of foraminifera

Grant holder: Luiz Fernando D'Agostino  
 Supervisor: Michel Michaelovitch de Mahiques  
 Institution: Institute of Oceanography / University of São Paulo (USP)  
 Process 2000/02135-0

103

### Effects of non-linear processes on the inter-hemispheric influence of sources of heat

Grant holder: Carlos Frederico Mendonça Raupp  
 Supervisor: Pedro Leite da Silva Dias

Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 1999/12792-0

104

### Analysis of cases of extreme precipitations in the winter in the city of São Paulo

Grant holder: Estael Elisabete Kems Sias  
 Supervisor: Maria Assunção Faus da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 1999/12702-0

105

### Turbulent energy fluxes over a wet tropical forest in Amazonia

Grant holder: Leandro Della Vedova de Oliveira Pinto  
 Supervisor: Humberto Ferreira da Rocha  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 1999/12443-5

106

### Variability of the sea surface in the region of retroflexion of the north current of Brazil based on results from numerical model

Grant holder: Carlos Augusto Fonseca  
 Supervisor: Edmo José Dias Campos  
 Institution: Institute of Oceanography / University of São Paulo (USP)  
 Process 1999/11382-2

107

### Mangrove swamps of Guaratiba in the light of a possible rising of the relative average level of the sea (bay of Sepetiba, state of Rio de Janeiro)

Grant holder: Ana Margarida Marques Portugal  
 Supervisor: Hilda de Souza Lima Mesquita  
 Institution: Institute of Oceanography / University of São Paulo (USP)  
 Process 1999/07886-5

108

### Determination of criteria for the actioning of the parameterization of cumulus in regional models

Grant holder: Christiane Yuko Botelho Chiba  
 Supervisor: Adilson Wagner Gandu

Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 1999/00421-7

**109** Calculation of the atmospheric CO<sub>2</sub> balance on the surface: an analysis of the turbulent fluxes by eddy correlation and from soil respiration

Grant holder: Helber Custódio de Freitas  
Supervisor: Humberto Ferreira da Rocha  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 1999/00153-2

**110** The influence of sea surface temperature on the winter climate in the city of São Paulo

Grant holder: Andrea de Oliveira Cardoso  
Supervisor: Pedro Leite da Silva Dias  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 1998/16277-0

**111** Study of the ocean-atmosphere interaction in the region of the Tropical Atlantic using the data of the PIRATA program and data obtained from numerical simulation of the Atlantic Ocean with a model of general circulation

Grant holder: Gabriel Clauzet  
Supervisor: Ilana Elazari Klein Coaracy Wainer  
Institution: Institute of Oceanography / University of São Paulo (USP)  
Process 1998/15771-0

**112** Theoretical and experimental validation of computational algorithms employed in the evaluation of atmospheric irradiation

Grant holder: Simone Marilene Sievert da Costa  
Supervisor: Artêmio Plana Fattori  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 1998/15506-5

**113** Numerical simulations of extreme periods of the south oscillations and their impact on the climate of the Americas

Grant holder: Anita Rodrigues de Moraes Drumond  
Supervisor: Tércio Ambrizzi  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 1998/15257-5

**114** Numerical simulation of vortices of cold air: conveyor belts and meso-scale characteristics

Grant holder: Ricardo Hallak  
Supervisor: Maria Assunção Faus da Silva Dias  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 1997/14119-5

**115** Direction of wind and burning of sugar plantations in the mean Paulista Peripheral Depression – the secondary circulation and the aggravation of the urban pollution

Grant holder: Márcia Regina Fernandes da Silva Storer  
Supervisor: João Afonso Zavattini  
Institution: Rio Claro Institute of Geosciences and Exact Sciences / São Paulo State University (Unesp)  
Process 1997/00736-2

**116** Validity of the hypotheses of single scattering in the evaluation of irradiation

Grant holder: Marcelo de Paula Corrêa  
Supervisor: Artêmio Plana Fattori  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 1996/12625-8

**117** Observational experiments and modeling of losses through interception of the precipitation in the Amazon forest

Grant holder: Vinícius Nóbrega Ubarana  
Supervisor: Carlos Afonso Nobre  
Institution: National Institute for Space Research (Inpe) / Ministry of Science and Technology (MCT)

#### SCIENTIFIC INITIATION

**118** Urban climate in the municipality of Ourinhos, São Paulo

Grant holder: Bruna Regina de Oliveira Lima  
 Supervisor: Jonas Teixeira Nery  
 Institution: Campus Experimental de Ourinhos / São Paulo State University (Unesp)  
 Process 2007/54502-6

**119** **Analysis of news related to weather and climate in the newspaper *O Estado de S. Paulo* in 2006**

Grant holder: Rafael Irmão Faltz  
 Supervisor: Luci Hidalgo Nunes  
 Institution: Geosciences Institute/ Campinas State University (Unicamp)  
 Process 2007/03865-1

**120** **Lagrangian analysis of the variability of the tropospheric ozone in São Paulo: case studies for autumn and spring 2006**

Grant holder: Samya de Lara Lins de Araújo Pinheiro  
 Supervisor: Maria de Fátima Andrade  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2006/59326-9

**121** **The vertical profile of ozone in São Paulo**

Grant holder: Cindy de Albuquerque  
 Supervisor: Maria de Fátima Andrade  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2006/56658-0

**122** **Preliminary study of the relationship between ozone, hydrogen peroxide and meteorological parameters in the São Paulo atmosphere**

Grant holder: Wagner Galichio  
 Supervisor: Adalgiza Fornaro  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2006/56232-3

**123** **Climatology interfaces: urban planning, medialogical approach and environmental perception**

Grant holder: Flávio Renato Nascimento dos Santos  
 Supervisor: Luci Hidalgo Nunes  
 Institution: Geosciences Institute / Campinas State University (Unicamp)  
 Process 2006/56179-5

**124** **Study of the sulfur compounds in the gaseous phase ( $\text{SO}_2$ ) and aqueous ( $\text{SO}_4^{2-}$ ) phase in the city of São Paulo**

Grant holder: Beatriz Sayuri Oyama  
 Supervisor: Adalgiza Fornaro  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2006/54973-6

**125** **The control of the fluxes of surface energy in the formation of nebulosity: an investigation using measurements in flow towers**

Grant holder: Sandra Isay Saad  
 Supervisor: Humberto Ribeiro da Rocha  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2005/55011-0

**126** **Study of the variation of the sea level in the southwest region of the South Atlantic, comparison with results of numerical simulation and correlation with the variation of sea surface temperature**

Grant holder: Daniel Menon Simões Moita  
 Supervisor: Ilana Elazari Klein Coaracy Wainer  
 Institution: Institute of Oceanography / University of São Paulo (USP)  
 Process 2005/54674-6

**127** **Analysis of the thermal field in Araraquara, São Paulo**

Grant holder: Fabrício Ismael Aud Caruano  
 Supervisor: Margarete Cristiane de Costa Trindade Amorim  
 Institution: Presidente Prudente School of Science and Technology / São Paulo State University (Unesp)  
 Process 2005/01875-4

**128** **Analysis of the variation in the level of the tides associated with frontal disturbances in the genesis of extreme episodes on the northern coast of São Paulo state**

Grant holder: Newton Brigatti  
 Supervisor: João Lima Sant'Anna Neto  
 Institution: Presidente Prudente School of Science and Technology / São Paulo State University (Unesp)  
 Process 2004/07910-3

**129** **Climatic variability of rain and temperature in the State of São Paulo**

Grant holder: Amanda Sabatini Dufek  
 Supervisor: Tércio Ambrizzi  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2004/01851-5

**130** **Analysis of the climatic extremes in the west of the State of São Paulo based on news carried by local press**

Grant holder: Camila Grosso de Souza  
 Supervisor: João Lima Sant'Anna Neto  
 Institution: Presidente Prudente School of Science and Technology / São Paulo State University (Unesp)  
 Process 2003/00235-6

**131** **Analysis of the variability of the climate associated with the occurrence of epidemics (malaria, dengue, and yellow fever) in the west of São Paulo state**

Grant holder: Ademilson Damasceno  
 Supervisor: João Lima Sant'Anna Neto  
 Institution: Presidente Prudente School of Science and Technology / São Paulo State University (Unesp)  
 Process 2003/00234-0

**132** **Determination of the humidity of the soil by remote sensing for initialization of models of numerical forecasting of the weather**

Grant holder: Rodrigo Gevaerd  
 Supervisor: Saulo Ribeiro de Freitas  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 2001/14981-6

**133** **Climatic classifications to identify the typical and atypical years in some localities in the State of São Paulo**

Grant holder: Janaína Jurca  
 Supervisor: José Tadeu Garcia Tommaselli  
 Institution: Presidente Prudente School of Science and Technology / São Paulo State University (Unesp)  
 Process 2000/08088-4

**134** **Comparative analysis of the TM-Landsat and HRV-Spot images in the mapping of the land use and ground cover on the south coast of the State of São Paulo**

Grant holder: Fernando Shinji Kawakubo  
 Supervisor: Ailton Luchiari  
 Institution: School of Philosophy, Arts and Human Sciences / University of São Paulo (USP)  
 Process 2000/01477-5

**135** **Detection of environmental impacts through images of remote sensing**

Grant holder: Jonas Luís Ortiz  
 Supervisor: Maria Isabel Castreghini de Freitas  
 Institution: Rio Claro Institute of Geosciences and Exact Sciences / São Paulo State University (Unesp)  
 Process 1999/11240-3

**136** **The increase in biomass burnings in the winter period in the State of São Paulo**

Grant holder: Marisa Boteon Varella Amancio  
 Supervisor: Ana Tereza Caceres Cortez  
 Institution: Rio Claro Institute of Geosciences and Exact Sciences / São Paulo State University (Unesp)  
 Process 1999/11196-4

**137** **Characterization of the beginning of diurnal convection in the rainy season over the forest and over deforested regions in Rondônia**

Grant holder: Luís Gustavo de Paiva Pereira  
 Supervisor: Maria Assunção Faus da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 1999/09328-0

**138** **Analysis of the thermodynamic characteristics of the wind gusts associated with meso-scale convective systems in Amazonia**

Grant holder: Marcos Longo  
 Supervisor: Maria Assunção Faus da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 1999/07882-0

**139** **Climatological study of the resurgence in the southwest region of the South Atlantic**

Grant holder: Andrea Sardinha Taschetto  
 Supervisor: Ilana Elazari Klein Coaracy Wainer  
 Institution: Institute of Oceanography / University of São Paulo (USP)  
 Process 1999/07202-9

**140** **Applications of a spectral model of the shallow water to the problem of inter-hemispheric influence of heat sources**

Grant holder: Carlos Frederico Mendonça Raupp  
 Supervisor: Pedro Leite da Silva Dias  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 1998/16584-0

**141** **Analysis of the convective instability during the meteorological experiment on the atmosphere of the Sertão (Emas)**

Grant holder: Alexandre José do Nascimento Silva  
 Supervisor: Adilson Wagner Gandu  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 1996/07897-9

**142** **Comparative analysis of the regimes of evapotranspiration and precipitation in cleared and forested areas in the Amazon region**

Grant holder: Francisco Sérgio Maia Alves  
 Supervisor: Iria Fernandes Vendrame  
 Institution: Technological Institute of Aeronautics / Airspace Technical Center (CTA)  
 Process 1996/01950-5

**143** **Experimental evaluation of the atmospheric turbidity in the city of São Paulo**

Grant holder: José Roberto Rozante  
 Supervisor: Artêmio Plana Fattori  
 Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
 Process 1994/04949-2

**144** **Refinement of the calculation of water transport in the SIB (Simple Biosphere) model**

Grant holder: Paulo Marcos Santo de Almeida  
 Supervisor: Carlos Afonso Nobre  
 Institution: National Institute for Space Research / Ministry of Science and Technology  
 Process 1992/05139-9

**145** **The forest-pasture interaction in the soil-water balance**

Grant holder: Marcos Daisuke Oyama  
 Supervisor: Carlos Afonso Nobre  
 Institution: National Institute for Space Research / Ministry of Science and Technology (MCT)  
 Process 1992/05138-2

#### SCIENTIFIC JOURNALISM

**146** **Dissemination of the activities of remote sensing undertaken by the National Institute of Space Research, São José dos Campos, SP**

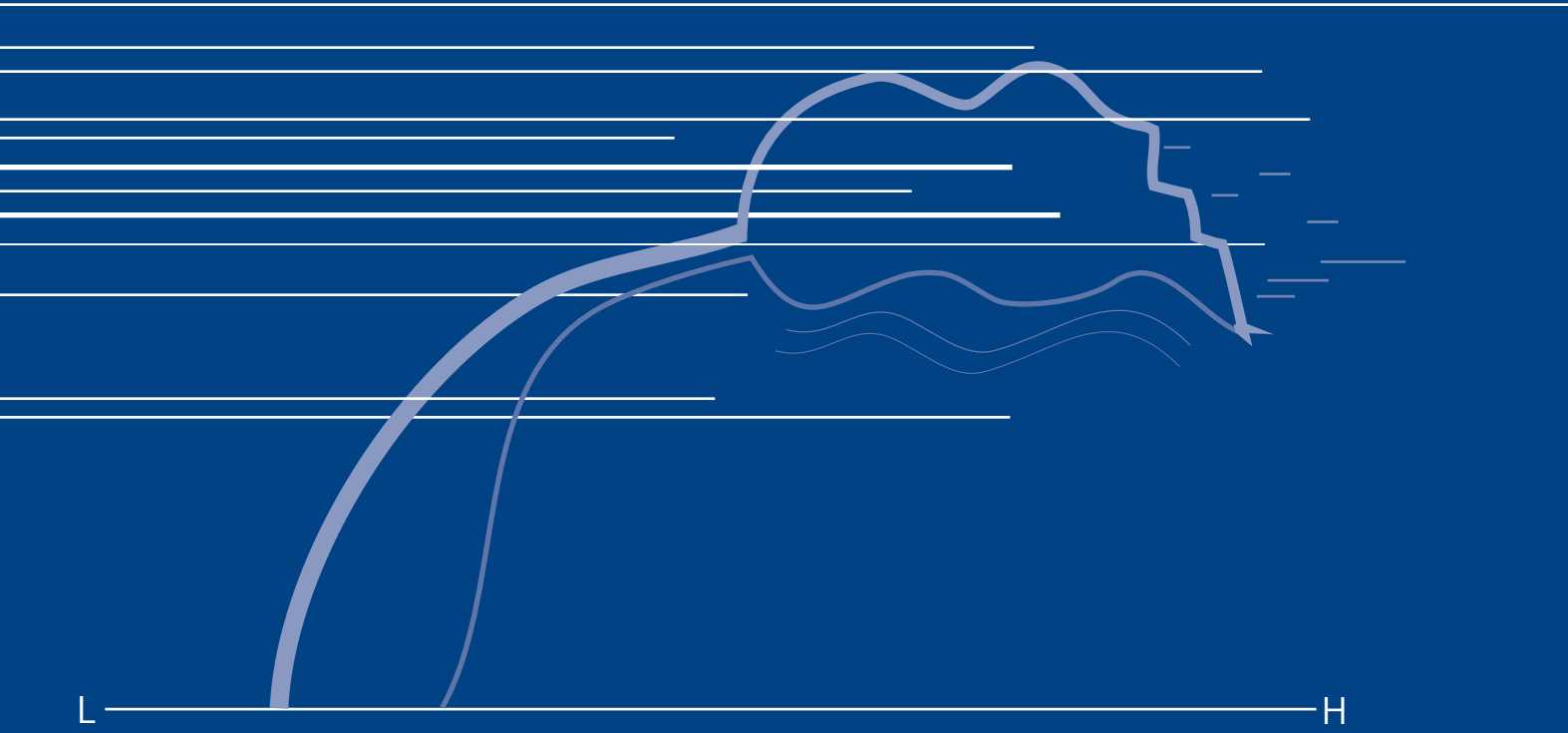
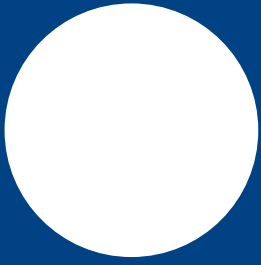
Grant holder: Mayla Yara Porto  
 Supervisor: Carlos Alberto Vogt  
 Institution: Nucleus for Development and Creativity / Campinas State University (Unicamp)  
 Process 2001/03282-0





# Human and Social





## THEMATIC PROJECTS

1

**Socio-environmental dynamics, local development and sustainability on the São Paulo–Paraná–Mato Grosso do Sul frontier**

Messias Modesto dos Passos

Presidente Prudente School of Science and Technology

São Paulo State University (Unesp)

Process 2005/55505-3

Term: Dec/2005 to Nov/2009

The “frontiers” are boundaries, that is, areas of intergradation where the processes present themselves according to a logic of objective landscape discontinuity or, rather, according to: a highly accentuated impermeability between the plots of land subjected to more or less independent territorial definitions and redefinitions. The principal objective of the present project is the study of different forms of integration in territorial fragments which, because they belong to different regional ambits, experience different stages of development, different administrative structures and different relationships with the markets. Understanding of these processes will only be possible starting from the convergence of different perspectives: study of the environment, of the rural development, of the regional and urban planning and, in addition, on the socio-environmental and territorial dynamics. In this sense, it is necessary to develop studies within the predominant economic and social context throughout the history of the occupation of this territory and, above all, to take into consideration the “successive societies” and their relationships with the environment, or rather: 1) the degradation of the environment starting from an integrated analysis: deforestation-erosion-silting up-seasonalization of water courses; 2) the history of the use and of the ownership of the land; 3) of the impact of major works – hydroelectric, alcohol plants; 4) of the reflections of social movements, notably the MST; 5) of the reflections of the alterations in ecological potential and biological exploration on the sustainability of local-regional development. The integrated analysis will be carried out based on the theoretical-methodological approach centered on the geosystemic model, recognized as an anthropic concept, or rather, it (the geosystem) does not have the function of explaining society in its relationship with the territory, but of understanding the physiognomy and the functioning of the territory under the impact of society. One of the objectives of the project, the production of texts, under the general title “the dividing border and its municipalities: socio-environmental contrasts and conflicts”, to be published, initially, in the form of fortnightly inserts (in the regional press), which will subsequently be gathered together and published in book format.

2

**Intrametropolitan dynamic and socio-demographic vulnerability in the metropolises in the interior of the State of São Paulo: Campinas and Santos**

José Marcos Pinto da Cunha

Nucleus for Population Studies

Campinas State University (Unicamp)

Process 2003/09043-2

Term: Aug/2004 to Feb/2009

The present project seeks to understand the dynamic of spatial distribution and populational mobility in two of the most important metropolitan regions of the State of São Paulo; the consequences of this mobility for the distribution of the population in the space; and the determining factors and socioeconomic, demographic and environmental consequences of these factors. Campinas and Santos are highly urbanized regions, the expansion of which some time ago has gone beyond their own municipal boundaries to enter into the municipalities of their surroundings, where the rates of growth today are much higher than that of the central municipality. The question in this research is: What are the factors and the socio-demographic processes that mediate the negative (or positive) consequences of this pattern of growth for the local populations? How do these factors operate in the population’s capability of dealing with different types of risk? While socioeconomic level is the most important factor in the protection of populations from the adverse effects of social or natural origin, populations in similar situations demonstrate different capacities in responding to these disturbances. It is in this sense that it is considered that forms of capital can be of equal importance. The concept of vulnerability is used in this project to account for differentiated capabilities for self-protection. The focus is given to families and homes, and to the socio-demographic variables relevant to avoiding the impacts of social and environmental risks. Our hypothesis is that factors such as age, type of family, stage in the life cycle, family setups, educational level, period of residence and the existence of social networks and community organizations represent reserves of social and human capital that can be mobilized to help in facing risks. The project will analyze, first, secondary sources – principally the censuses of 1970, 1980, 1991 and 2000 – to produce a portrait of the socio-demographic characteristics related to the territorial expansion of the urban areas. Combining three dimensions relative to physical-financial, human, and social capital, the first stage of this project aims to identify and map zones of vulnerability within the urban areas of the metropolitan regions of Campinas and Santos. Of especial interest are the areas recently occupied on the edges of the cities

of the region, where the centrifugal expansion of the pole city, as well as each of the smaller cities, resulted in sparsely occupied areas, where basic social and environmental infrastructure is lacking. The demography of the urban sprawl and the importance of its environmental component are little studied phenomena in the country. It is hoped that the project, in addition to a theoretical contribution, will also bring important contributions to the understanding of the demographic and territorial components of urban growth and, especially, of the differentiated capacities of individuals and homes in dealing with the negative aspects of this growth. Considering that the data from the censuses is limited in the examination of the phenomena in question and therefore, in order to conduct the proposed analysis, the second phase of this project includes sample surveys of the population in the two metropolitan regions. The perspectives of understanding the complex matrix of the factors involved in the reduction of the vulnerability will be greatly widened by the house-to-house research.

#### SUPPORT FOR REGULAR RESEARCH

3

#### Study of the socio-environmental impacts motivated by the advance of the agricultural frontier along the BR-163

Messias Modesto dos Passos

Presidente Prudente School of Science and Technology

São Paulo State University (Unesp)

Process 2003/07064-2

Term: Dec/2003 to Dec/2006

The process of colonization, throughout Brazil's history, occurred in stages, obeying the east-west movement and was motivated by the production of raw material geared to the international market. This is one of the reasons for its fragility. Amazonia and the Center-West suffered great impact from the policies of the military government. Amazonia, identified with rubber, and the Center-West with extensive cattle farming, are going to have their economies diversified. The decades of the 1970s and 1980s were marked by the rapid retreat of those surfaces occupied by tropical forests. This phenomenon is particularly spectacular in Brazil, where it is estimated that 551 thousand km<sup>2</sup> of Amazon Forest were destroyed for agricultural development (livestock farming). The case of Mato Grosso is very revealing from that evolution, due to the extension of the surfaces conquered by agriculture at the expense of the forest and, also, due to the diversity of the pre-existing landscapes and the actual forms of

occupation of the so-called "empty spaces". The temporal-spatial scale of the territorial dynamics requires a permanent and rapid tracking of the cartography of those regions: satellite images meet this objective. In Mato Grosso, agricultural colonization is carried out, notably, by large private businesses from the South and Southeast of the country. The center-north of the state was "divided up" in the 1970s between three companies (Líder, Sinop and Indeco), which established colonization programs based on agricultural development of the lands supported by an "urban" network and in rural centers. Each one of these companies turned themselves into prime motive for the foundation of the principal urban centers of the north of Mato Grosso, respectively Colider, Sinop and Alta Floresta. The first stage of agricultural colonization is the opening of terrestrial paths of communication. The tracks, more or less passable in the rainy season, degrade rapidly, but permit the arrival and installation of the colonizers. Or rather, the maintenance of these axes is essential for the success of the explorations (commercialization of the agricultural products). Two levels of paths of communication can be identified in Mato Grosso: 1) a main network of asphalted roads: the BR (federal highways) 364 and 174 which cross Mato Grosso in the east-west direction linking Rondônia to the south of the country; the BR-163 which links Cuiabá to Santarém and which crosses the state in the south-north direction; secondly we should mention the BR-158 (half asphalted), which crosses the east part of the state, in the north-south direction; 2) a network of main tracks (state roads), linking the principal urban centers to each other. Their maintenance is haphazard, but these axes play an important role in sustaining the pioneering zones of the north of the state. As the deforestations are concentrated initially in proximity to the roads and the tracks, it could be considered that the distance from these axes constitutes a primary factor to be considered by the modelization. The expectation/objective of our study is, initially, to establish a hierarchy of the explanatory factors of the phenomena observed, proposing a simplified representation of the reality. Thus, we will be able to highlight the evidence of those regions at risk of being the next to be subjected to deforestation and calculate, for example, an index of deforestation risk based on the parameters obtained. We believe that, based on this, it is possible to propose probable evolutions of the extension of the deforestation by extrapolation and supply entry data for medium scale climatic models. Thus, we are going to take control of the territorial fragment, for the purposes of more systematic investigation, defined by the strip of land of the BR-163 – from Cuiabá (Mato Grosso) to Santarém (Pará).

4

### Urban restructuring and the environment: the case of São Paulo

Daniel Joseph Hogan

Institute of Philosophy and Human Sciences

Campinas State University (Unicamp)

Process 1995/04717-7

Term: Oct/1995 to Sep/1996

The aim is to evaluate the environmental consequences of the process of urban restructuring of the metropolitan region of São Paulo, taking as reference the double process of de-industrialization and reinforcement of the metropolis as a center for services. The abrupt change in the structure of employment, as well as the increase in relative poverty deriving from this process of restructuring, induces growing portions of the population to reside in environmentally inadequate areas. The eastern zone of the city of São Paulo is used as case study, observing the evolution of the population residing in areas subject to flooding, as well as their economic and social conditions.

5

### Social actors in the deforestation in the Serra do Mar, São Paulo: conflicts of interest between preservation and regional development

Daniel Joseph Hogan

Nucleus for Environmental Studies and Research

Campinas State University (Unicamp)

Process 1994/00275-7

Term: Jun/1994 to Nov/1994

This research aims to analyze the formation of social actors during the negotiation process for the establishment of the reserve in the Atlantic Rainforest biosphere, with emphasis on the case of the Serra do Mar, in the state of São Paulo. It is intended to investigate the possibilities of environmental conservation programs in poor dependent economies. The central hypothesis of the research indicates that any emergent social demand must be incorporated by broad sectors of society in order for them to be turned into a government program. In the case of the demand for environmental quality, the alarming indices of poverty end up relegating conservation plans to the second category on official agendas and in the demands of civil society. The solutions for the conservation of the bioma in the Atlantic Rainforest will only be possible and effective if there is greater possible coincidence between the space of legitimization and the field of action of the decision-making distances.

6

### Evaluating international scientific collaboration in Amazonia

Lea Maria Leme Strini Velho

Institute of Geosciences

Campinas State University (Unicamp)

Process 1992/04823-3

Term: Mar/1993 to Feb/1994

The biological diversity existing in the Brazilian ecosystems, today under threat of irrecoverable loss, is of an inestimable value to humanity. For the preservation of this patrimony, the participation of more scientifically and economically developed countries is fundamental, for example, The United States, Japan, Germany, United Kingdom, France and Spain. It is important, however, to bear in mind that this natural wealth has a very great potential to produce economic wealth the appropriation of which could be one of the variables that generates the interest of the developed countries in tropical ecosystems. Probably, for this motive, projects of scientific cooperation in Amazonia have, systematically, been the focus of controversies in relation to the scientific themes that should be studied, to the appropriate methods for studying them and, principally, to the use and ownership of the results generated. This research is based on the premise that such projects of scientific collaboration on the biodiversity of Amazonia are necessary, but that they should be evaluated in order for their benefits and problems to be made explicit. In view of this, the study we intend to develop will analyze two scientific collaboration projects in the region: the Inpa/Orstom (France) agreement and the Maracá project (Inpa/Royal Geographical Society – United Kingdom). It is believed that the results from this research could provide support for the establishment of national public policies relating to scientific collaboration with other countries.

## GRANTS

### RESEARCH ABROAD

1

### Use of geotechnologies in the analysis of climate changes in metropolises: the example of São Paulo and Lisbon

Grant holder: Magda Adelaide Lombardo

Institution: Rio Claro Institute for Geosciences and Exact Sciences / São Paulo State University (Unesp)

Institution abroad: University of Lisbon, Portugal

Process 2007/00974-4

## POST-DOCTORATE

2

**Challenges for sustainable urbanization in the intra-metropolitan space of Campinas and Santos: populational mobility, socio-environmental vulnerability and the evidence (local, regional and global)**

Grant holder: Ricardo Ojima  
 Supervisor: Daniel Joseph Hogan  
 Institution: Nucleus for Population Studies / Campinas State University (Unicamp)  
 Process 2007/01251-6

## DOCTORATE

3

**The perception of rubber tappers on climate changes in the extractivist reserves of Alto Juruá and Chico Mendes, Acre**

Grant holder: Erika Mesquita  
 Supervisor: Mauro William Barbosa de Almeida  
 Institution: Institute of Philosophy and Human Sciences / Campinas State University (Unicamp)  
 Process 2007/59254-0

## MASTERS

4

**Social and environmental vulnerability in Cubatão, São Paulo: the case of the Cota 200 neighborhood**

Grant holder: Diomário Coelho Cerqueira  
 Supervisor: Daniel Joseph Hogan  
 Institution: Institute of Philosophy and Human Sciences / Campinas State University (Unicamp)  
 Process 2008/52191-6

5

**Press and environment – study of the journalistic discourse on biodiversity**

Grant holder: Aparecida Célia de Sousa Camboim  
 Supervisor: Cremilda Celeste de Araújo Medina  
 Institution: School of Communications and Arts / University of São Paulo (USP)  
 Process 1995/08902-3

## SCIENTIFIC INITIATION

6

**The Kyoto protocol and the international environmental order: scenarios for 2012**

Grant holder: Daniel Salles  
 Supervisor: Wagner Costa Ribeiro  
 Institution: School of Philosophy, Arts and Human Sciences / University of São Paulo (USP)  
 Process 2006/60801-3

7

**Pluviometric variability and agricultural productivity in the Vale do Médio Paranapanema, São Paulo**

Grant holder: Daniela Fernanda da Silva  
 Supervisor: João Lima Sant'Anna Neto  
 Institution: Ourinhos Experimental Campus / São Paulo State University (Unesp)  
 Process 2006/56113-4

8

**Kyoto protocol: transfer of clean energy technology in developing countries**

Grant holder: Helena Margarido Moreira  
 Supervisor: Analúcia Bueno dos Reis Giometti  
 Institution: Franca School of History, Law and Social Services / São Paulo State University (Unesp)  
 Process 2005/51866-1

9

**Brazil and the international debate on the greenhouse effect**

Grant holder: Leandro Belini  
 Supervisor: Mirian Cláudia Lourenção Simonetti  
 Institution: Marília School of Philosophy and Sciences / São Paulo State University (Unesp)  
 Process 2000/14387-4

## SCIENTIFIC JOURNALISM

10

**Explanatory animation on the methodologies used to show evidence of and explain climate changes that occurred in recent years**

Grant holder: Felipe Bondezan Rodrigues de Oliveira  
 Supervisor: Maria Elisa Siqueira Silva  
 Institution: School of Communications and Arts / University of São Paulo (USP)  
 Process 2007/52012-1

**11** Dissemination of activities of Laboratory of Climate Studies in the Institute of Geosciences (LEC/IG)

Grant holder: André Gardini

Supervisor: Carlos Alberto Vogt

Institution: Rectory / Campinas State University (Unicamp)

Process 2007/05588-5

**12** Dissemination of activities of the changes in land use in Amazonia project: implications for climate and the carbon cycle

Grant holder: Ana Luiza de Azevedo Pires Sérgio

Supervisor: Carlos Alberto Vogt

Institution: Nucleus for Development and Creativity / Campinas State University (Unicamp)

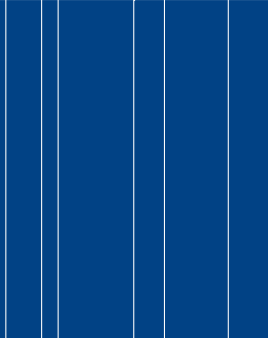
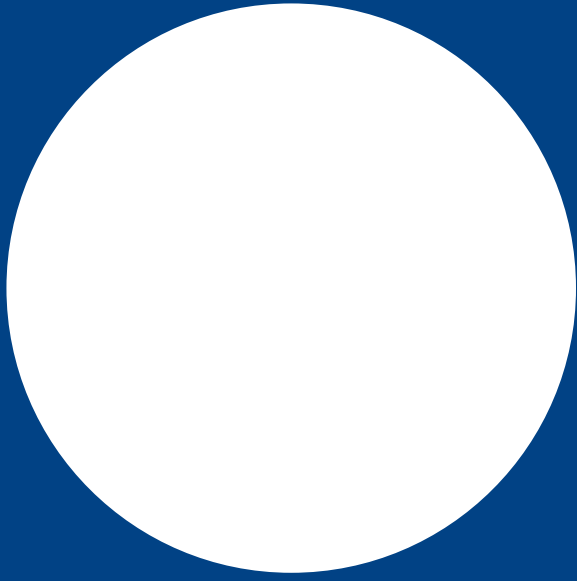
Process 2003/02126-0





# Chemistry





## THEMATIC PROJECTS

1

**Mercury fluxes in the Rio Negro Basin, Amazon**

Wilson de Figueiredo Jardim

Institute of Chemistry

Campinas State University (Unicamp)

Process 2000/13517-1

Term: May/2001 to Aug/2004

This thematic project is of strategic importance for Brazil since it intends to generate detailed knowledge about the dynamics of the chemical element mercury in the Negro River basin of the Amazon region. To attain this principal objective, the project unites a multi-institutional team from UNICAMP, UNESP and PUC-Campinas, which is engaged in quantifying the chemical components in the several potential reservoirs for mercury, as well as in measuring the flux of these species between water and the mechanisms and the controlling agents of these processes. To attain this principal objective, the team proposes the following activities: a) validation of analytical methods to determine mercury in the several matrices of interest, followed by quantification of mercury in the several reservoirs and determination of the metal flux between these reservoirs; b) study of the dynamics of transfer of mercury in the water/atmosphere interface, identifying and quantifying the fluxes between these matrices as well as the role played by such environmental parameters as the pH of the water, the intensity of solar radiation, the quantity of dissolved organic matter and the presence of natural oxidizing agents, in order to establish mechanisms which explain the formation and transfer of gaseous mercury; c) study of the dynamics of the transfer of mercury present in the soil to the atmosphere, identifying and quantifying the emission and deposition of gaseous mercury between these interfaces and determining their dependence on the type of soil and the amount of plant coverage, as well as the influence of factors such as the humidity and temperature of the soil, the intensity of light and the temperature and humidity of the air; d) quantify the distribution of mercury in the river basin as a function of the type of soil, to establish the role that humic material has in the speciation of mercury in the soil and its leaching into the aquatic system.

## SUPPORT FOR REGULAR RESEARCH

2

**Determination of polycyclic aromatic derivatives in atmospheric aerosols**

Lilian Rothschild

Institute of Chemistry

University of São Paulo (USP)

Process 2006/55506-2

Term: Oct/2006 to Sep/2008

The existence of a relationship between the exposure to atmospheric particulate matter and the effects on human health has been the goal of much research. In urban areas, the principal source of particulate matter is the incomplete burning of fuel in the engines of vehicles, and the inhalable fraction of this matter is associated with a large variety of chemical substances, many of which are toxic. Polycyclic aromatic hydrocarbons (PAHs) were identified as being significant components of atmospheric particulate matter, since they present mutagenic and/or cancerigenic activity. More recently, some nitro-PAHs and oxy-PAHs were recognized as more toxic compounds than their precursors and, even present in low levels in atmospheric particulate matter, the accentuated mutagenic activity makes them of great toxicological interest. Despite efforts to characterize particulate matter in urban atmospheres, the organic compounds identified to-date do not explain all the toxicity found in this matter. The objective of this project is to determine nitro-PAH and oxy-PAH in atmospheric particulate matter in the city of São Paulo, a highly polluted urban center in which the predominant sources of emissions are motor vehicles driven by gasoline, ethanol and diesel. The determination of levels of concentration of the derivatives of PAHs will be carried out in localities which are highly and barely impacted by anthropogenic sources, especially vehicles, using bidimensional gas chromatography which offers interesting analytical characteristics for complex matrices such as samples of atmospheric particulate matter.

3

**Organic compounds indicators of natural and anthropic emissions**

Pérola de Castro Vasconcellos

Institute of Chemistry/University of São Paulo (USP)

Process 2006/51476-1

Term: Jul/2006 to Dec/2008

In the tropics the major source of aerosols is biomass burning. In Brazil, sugar cane production expanded mainly for ethanol production used as automotive fuel. The leaves are burnt and polycyclic aromatic hydrocarbons (PAH) are formed. PAH characterization has been done in three urban areas with sugarcane burning influences and one mega city area to assess the air quality and determine human exposure levels to these

compounds. Studies have been done in the burning season (August 2002 and July 2003) and in the wet season (March 2003). N-alkanes, PAH, and nitro-PAH associated with atmospheric particulate matter were identified and quantified (n=82 samples) in ambient air and in direct emissions samples. Trace gases were monitored in the mega city site. Air mass back trajectories have been calculated to identify the origin of the smoke. After particulate extraction in Soxhlet and fractions separation by HPLC, the samples were analyzed by GC/MS. Fractions and total extracts from three samples were tested in the Salmonella/microsome assay with TA98 and YG104 strains, and nitro-PAH seemed to be responsible to the mutagenicity detected in all samples analyzed. The results show the highest total PAH (43 ng/m<sup>3</sup>) and PM10 levels (91 µg/m<sup>3</sup>) were found in ARA-2002. This site receives strong contributions of sugarcane burning. 2-nitrofluoranthene and 2-nitropyrene, photochemical mutagenic compounds were found mostly in urban site (61 pg/m<sup>3</sup> and 15 pg/m<sup>3</sup>). Considering all sites 68% of the ambient samples collected (n=40) were above WHO standards for PM10 (50 µg/m<sup>3</sup>) and for TSP (120 µg/m<sup>3</sup>). Among the PAH fluoranthene (346 µg/m<sup>3</sup>), pyrene (333 µg/m<sup>3</sup>) and benzo(a)anthracene (251 µg/m<sup>3</sup>) presented the highest levels in direct emissions.

4

#### Studies of nitrogen compounds present in the atmosphere in the central region of the State of São Paulo

Arnaldo Alves Cardoso

Araraquara Institute of Chemistry  
São Paulo State University (Unesp)  
Process 2005/53001-8  
Term: Aug/2005 to Jul/2008

This project has the objective of understanding the sources, composition, transformations and possible environmental implications resulting from the emission and presence of some nitrogen compounds in the atmosphere in the central region of the State of São Paulo. To attain these objectives samples of the atmosphere will be collected throughout the year for the determination of the average composition of the species NO, NO<sub>2</sub>, NH<sub>3</sub>, ozone in the gaseous phase and NH<sub>4</sub><sup>+</sup>, NO<sub>2</sub><sup>-</sup>, NH<sub>4</sub><sup>+</sup> in the particulate matter and in the rainwater collected in the region. By way of result it is hoped to create a model for emission, transport and deposition of these compounds in the region and make it possible with this knowledge to understand possible effects on the atmosphere.

5

#### Use of diffuse reflectance spectrophotometry for verifying the detailed history of the whitening of marine coral samples

Inês Joekes

Institute of Chemistry  
Campinas State University (Unicamp)  
Process 2003/06625-0  
Term: Nov/2003 to Dec/2005

In situations of environmental stress corals can lose the algal symbionts that live in their gastroderm and which give them their color, turning whitish. The whitening leaves the corals vulnerable to several pathologies and can evolve into cases of mortality of the colony or regression in cases of recuperation of algae and resumption of growth of the colonies. In this project it is intended to adapt and optimize the technique of diffuse reflectance spectrophotometry for verification of the whitening of samples with a known detailed history in order to validate the technique. With the technique validated, it is intended to determine the detailed history of the whitening of samples with unknown history. It is intended to carry out complementary and alternative trials for the determination of the history of whitening of coral samples.

6

#### Biogeochemistry of metals in aquatic environments and in the atmosphere. Part I: chemical speciation of metals in rainwater

Maria Lúcia Arruda de Moura Campos

Ribeirão Preto School of Philosophy, Arts and Sciences  
University of São Paulo (USP)  
Process 2003/01532-4  
Term: Nov/2003 to Nov/2007

In this project the proposal is to evaluate the chemical speciation of several metals (Cu, Cd, Pb, Zn and Al) and the concentrations of organic carbon dissolved in rainwater, with the objective of investigating some of the physical-chemical mechanisms which may alter metallic species in the atmosphere and, consequently, the species that will be deposited in the aquatic environment. The rain samples will be collected principally in Ribeirão Preto, and possible seasonal differences in the deposition of metals and organic matter will be investigated. The concentrations of metals in the dissolved phase and the lixiviable metals (pH 1) of the particulate phase will be evaluated by cathodic stripping voltammetry. This study aims to provide a contribution to the clarification of the role of organic matter and of the photochemical reactions in the alterations of the physical-chemical properties of metals in the atmosphere.

7

**Development of methods *in situ* close to real time for atmospheric trace gases**

Arnaldo Alves Cardoso

Araraquara Institute of Chemistry  
 São Paulo State University (Unesp)  
 Process 2000/14810-4  
 Term: Sep/2001 to Nov/2005

The project intends to develop a method for the determination of gases in the atmosphere, seeking to use a set-up which is easy to transport and, therefore, can be used in the location where the problem exists. The determination should be made immediately after the end of the sampling phase and using a specific reaction with color formation. The determination will be undertaken colorimetrically, using LEDs as light source and equipment to read the analytical signal. For the development of the project it is intended to adapt a reaction to gaseous ammonia, possibly the Berthelot reaction which forms blue coloring. The project should be developed using the hanging drop technique, where a drop of solution is coupled to a device for reading of the absorbency variation directly in the drop.

8

**Study of the contribution of sugarcane burning to atmospheric contamination by PAHs and nitro PAH. Evaluation of the occupational exposure of sugarcane cutters to PAHs**

Mary Rosa Rodrigues de Marchi

Araraquara Institute of Chemistry /  
 São Paulo State University (Unesp)  
 Process 1998/01514-6  
 Term: Aug/1998 to Apr/2001

It is intended to study the contribution of sugarcane burning to atmospheric contamination through the emission of PAHs and nitro-PAHs and evaluate the occupational exposure of sugarcane cutters to these compounds by means of the determination of these emissions in the particulate matter in suspension and inhalable and through monitoring of the biological indicator excreted in the urine as 1-hydroxypyrene. The samples of IPM will be collected through Hi-vol samplers in the city and in the canefields, throughout the year, to obtain a seasonal view of the contamination studied. The IPM will be collected in the respiratory zone of the sugarcane cutters and from these same workers urine will be collected for the determination of the biological indicator.

9

**Aquatic chemistry of mercury in the river Negro: importance of sunlight in the redox process**

Wilson de Figueiredo Jardim

Institute of Chemistry  
 Campinas State University (Unicamp)  
 Process 1997/10160-0  
 Term: Nov/1997 to Jun/1999

The present project aims to study the importance of solar light in the reduction of the HgC<sup>+</sup> species present in waters rich in organic carbon in the bay of the river Negro, Amazonas, as well as possible ecotoxicological consequences of this mechanism.

10

**Study of the paleoclimatic alterations in central Amazonia, through the use of <sup>14</sup>C dating and isotopic reason <sup>13</sup>C/<sup>12</sup>C**

Luiz Carlos Ruiz Pessenda

Center for Nuclear Energy in Agriculture  
 University of São Paulo (USP)  
 Process 1995/03037-2  
 Term: Sep/1995 to Dec/1997

With the use of carbon isotopes (<sup>12</sup>C, <sup>13</sup>C and <sup>14</sup>C) from the organic matter of soils in the region of Humaitá, south of the state of Amazonas, it is intended to evaluate the existing dynamic in the sequence cerrado-transition-natural forest predominant in the area. How long these vegetations have been present naturally in the Amazonian ecosystem, appearing to be in equilibrium or in regression/expansion, are important questions to be answered. Using the same isotopic analyses in fossils buried in the ground (charcoals), additional information with respect to paleovegetations from photosynthetic cycle C3 or C4 could also be obtained.

11

**Determination of partial pressure of CO<sub>2</sub> in the ocean mixed layer**

Rolf Roland Weber

Institute of Oceanography  
 University of São Paulo (USP)  
 Process 1994/05978-6  
 Term: Jun/1995 a May/1997

From the investigation of the oceanic carbonate system it is possible to quantify the oceans as anthropogenic CO<sub>2</sub> sinks. With this objective it is intended to contribute to the elaboration of an analytical methodology for the determination of PCO<sub>2</sub> and with its measure-

ment in the South Atlantic ocean, currently, very little documented. To estimate the liquid fluxes of CO<sub>2</sub> in the atmosphere-ocean interface, it is necessary to study the factors which regulate the distribution of PCO<sub>2</sub> in the marine environment. In this way, we will also determine in the same samples salinity, temperature, pH, nutrients and chlorophyll.

12

### **Characterization of atmospheric particulate matter: II. Identification and quantification of polar organic compounds**

Lilian Rothschild  
Institute of Chemistry  
University of São Paulo (USP)  
Process 1994/01634-0  
Term: Oct/1994 to Sep/1996

The present project has as its objective: a) separation and identification of organic classes present in the polar fraction of atmospheric particulate matter, with emphasis on the potentially mutagenic and/or carcinogenic compounds; b) development of an analytical methodology suitable for the recognition of the compounds of interest, evaluating the identity of the species and the quantification of the same and the chemical characterization of the location of sampling in relation to the compounds found and the comparative study with other urban sites, which were investigated using similar methodologies of collection, extraction fractioning and analyses.

## GRANTS

### RESEARCH ABROAD

1

### **Detectors for ozone and other oxidizing gases in the atmosphere**

Grant holder: Arnaldo Alves Cardoso  
Institution: Araraquara Institute of Chemistry / São Paulo State University (Unesp)  
Institution abroad: Texas Tech University, USA  
Process 2002/07005-3

### POST-DOCTORATE

2

### **Study of the spatial and temporal distribution of macronutrients in the atmosphere of the State of São Paulo**

Grant holder: Cristine de Mello Dias Machado  
Supervisor: Arnaldo Alves Cardoso  
Institution: Araraquara Institute of Chemistry / São Paulo State University (Unesp)  
Process 2007/58219-7

3

### **Studies for the chemical characterization of rain waters in São Paulo**

Grant holder: Adalgiza Fornaro  
Institution: Institute of Chemistry / University of São Paulo (USP)  
Process 1998/13421-2

## DOCTORATE

4

### **Refinement of methodologies for the collection and determination of pollutants in gas phase in the atmosphere using diffusion sampling with micro-porous capillary membranes**

Grant holder: Lúcia Helena Gomes Coelho  
Supervisor: Ivano Gebhardt Rolf Gutz  
Institution: Institute of Chemistry / University of São Paulo (USP)  
Process 2004/15290-5

5

### **Structure and reactivity of organic matter in areas with potential for carbon sequestration in the soil: studies with spectroscopic methods**

Grant holder: Aline Segnini  
Supervisor: Ladislau Martin Neto  
Institution: Embrapa Farming Instrumentation / Brazilian Agricultural Research Corporation (Embrapa)  
Process 2003/06096-8

6

### **Emissions of gases responsible for greenhouse effect in hydroelectric reservoirs**

Grant holder: Raquel de Cássia Rodrigues Sofia  
Supervisor: Wilson de Figueiredo Jardim  
Institution: Institute of Chemistry / Campinas State University (Unicamp)  
Process 1997/00758-6

7

**The chemical behavior of mercury in the Rio Negro region: speciation, photo-interactions and inter-reservoir transport**

Grant holder: Pedro Sérgio Fadini  
Supervisor: Wilson de Figueiredo Jardim  
Institution: Institute of Chemistry /  
Campinas State University (Unicamp)  
Process 1995/02975-9

**MASTERS**

8

**Refinement and application of methods for the determination of basic and acidic compounds in rainwater and monitoring of hydrogen peroxide in the liquid and gas phase in the São Paulo atmosphere**

Grant holder: Lúcia Helena Gomes Coelho  
Supervisor: Ivano Gebhardt Rolf Gutz  
Institution: Institute of Chemistry / University of São Paulo (USP)  
Process 2002/11336-5

9

**Evaluation of the impact of emissions of hydrocarbons by vegetation in the formation of photochemical oxidants in São Paulo**

Grant holder: Leila Droprinchinski Martins  
Supervisor: Pérola de Castro Vasconcellos  
Institution: Institute of Astronomy, Geophysics and  
Atmospheric Sciences / University of São Paulo (USP)  
Process 2000/01400-2

10

**Seasonal combustion of sugarcane in the State of São Paulo as a source of non-volatile hydrocarbons in atmospheric aerosols**

Grant holder: Alexandre Franco  
Supervisor: Arnaldo Alves Cardoso  
Institution: Araraquara Institute of Chemistry /  
São Paulo State University (Unesp)  
Process 1998/16419-9

**SCIENTIFIC INITIATION**

11

**Development of analytical methodology to refine the determination of greenhouse effect gases CH<sub>4</sub> and CO in samples collected in Amazonia**

Grant holder: Lilian Polakiewicz  
Supervisor: Elaine Arantes Jardim Martins  
Institution: Institute for Energy and Nuclear Research /São  
Paulo State Development Ministry (SDSP)  
Process 2005/50138-2

12

**Evaluation of fluxes of organic carbon dissolved by the rain in Ribeirão Preto in support of the investigation into the biogeochemical cycle in a sugarcane growing area**

Grant holder: Cidelmara Helena Coelho  
Supervisor: Maria Lúcia Arruda de Moura Campos  
Institution: Ribeirão Preto School of Philosophy, Arts and  
Sciences / University of São Paulo (USP)  
Process 2003/13913-2

13

**Determination of low concentrations of hydrogen sulphide in natural waters and in the atmosphere**

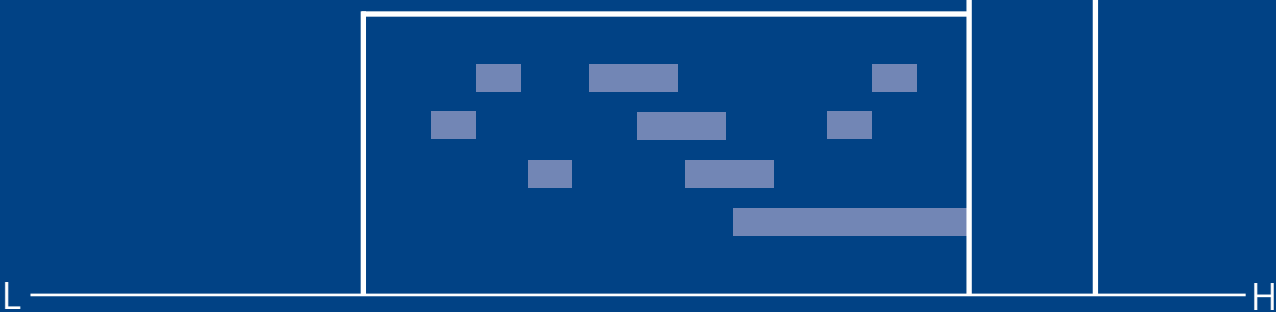
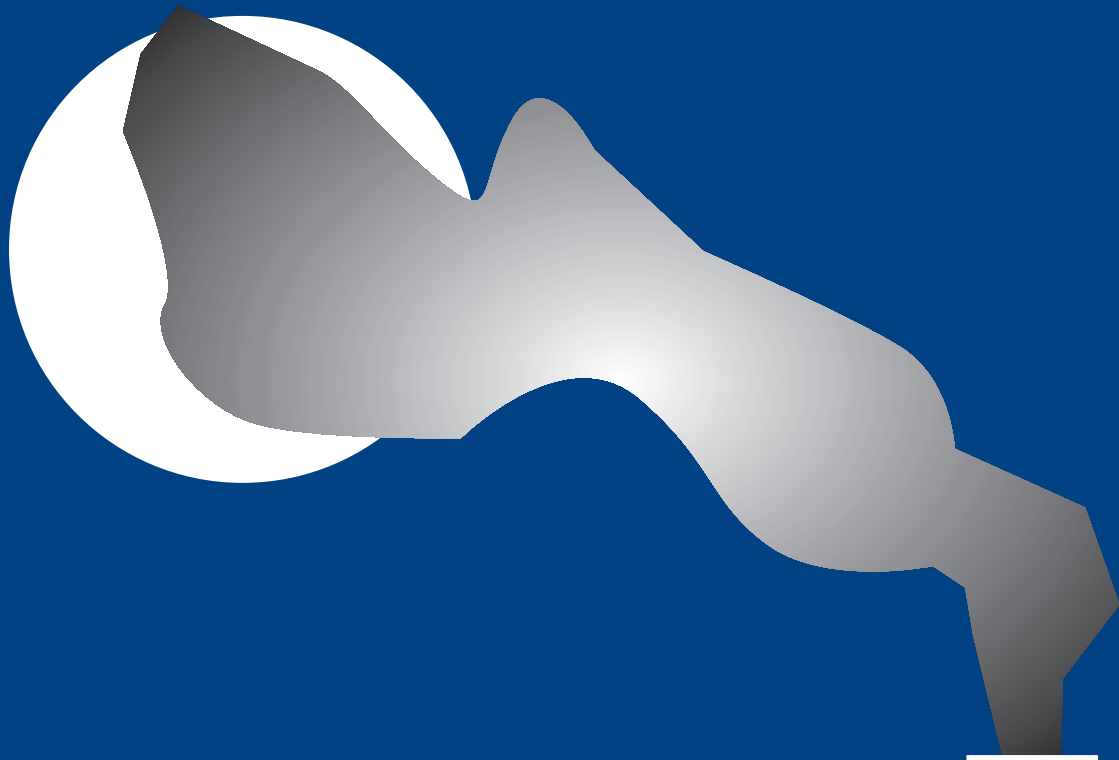
Grant holder: Mariana Beraldo Masutti  
Supervisor: Antônio Aparecido Mozeto  
Institution: Center for Exact Sciences and Technology /  
Federal University of São Carlos (UFSCar)  
Process 1994/00190-1





Health





## THEMATIC PROJECTS

1

### The impact of intra-uterine exposures and in the initial phases of the development to atmospheric pollutants in the development of adverse alterations in adult life

Paulo Hilário Nascimento Saldiva

School of Medicine

University of São Paulo (USP)

Process 2003/10772-9

Term: Nov/2004 to Mar/2008

Our nucleus of research activities seeks to advance in the knowledge of the effects of air pollution on health, evaluating the role of intra-uterine exposure and in the initial phases of post natal development as a determining factor of adverse functional alterations in the adult phase. It is known that children are exposed to a variety of toxic environmental agents present in the air, in food and in water. The vulnerability of children is increased given the particular characteristics of this phase of life: greater relative exposure, xenobiotic metabolism not totally developed, high rate of somatic growth and cell division. What is intended with this project is to evaluate in an objective manner the potential for promoting diseases in the adult phase represented by the exposure to environmental levels of atmospheric pollution effected in the intra-uterine and post natal phases of their development. In the sense of preventing the proposition from becoming too broad, it was decided to limit the object of our attention to the adverse effects caused by the exposure of mice to urban atmospheric pollution, throughout the course of different phases of their development, as well as choosing as the objective of the study some reproductive parameters, the development of bronchial hyper-reactivity and pulmonary inflammation. To evaluate the problem, we will chronically expose three generations of mice to atmospheric pollution in São Paulo. In this experimental protocol, we will use two inhalation chambers – one receiving the integral, environmental air, and the other, filtered air – in order to create the gradient of pollution necessary to achieve our objectives. The chambers are set up side by side in the School of Medicine garden. In the chamber with filtered air, we adapted a filtering system with four aligned filters, so as to be able to significantly reduce the particulate material and reactive gases in the atmosphere. Through the crossing of animals with different past histories of exposure to environmental pollutants, the following hypotheses will be tested: a) the prolonged exposure to environmental levels of air pollution in São Paulo has the potential to cause inflammatory alterations in the airways and pulmonary tissue, bronchial hyper-reactivity and reproductive alte-

rations; b) the embryonic phase and the beginning of post-natal development condition a greater vulnerability to the action of pollutants; c) reproductive and respiratory parameters can be influenced by exposure to pollutants in the initial phases of development; d) intra-uterine and post-uterine exposures can exercise a synergetic role in the pathogenicity of the alterations caused by air pollution; e) the magnitude of the alterations caused by the pollution at the beginning of life can be sufficient to cause significant dysfunctions in the adult phase.

2

### Atmospheric pollution in the metropolitan region of São Paulo: impacts on health of the population and proposition of remedial measures

Paulo Hilário Nascimento Saldiva

School of Medicine

University of São Paulo (USP)

Process 1994/00552-0

Term: Dec/1994 to Feb/1998

The present study proposes experiments which aim to provide information on the relationship between urban atmospheric pollution and health. To this end, epidemiological and laboratory techniques will be applied in the context of the city of São Paulo, constituting a set of experiments which seek: a) to draw up statistical models which aim to explore the relationship between mortality and pollution; b) to study the possible relationship between atmospheric pollution and indicators of respiratory health in the infant population; c) to evaluate the toxicity *in vitro* on the respiratory epithelium of inhalable particulate material in the São Paulo atmosphere. The carrying out of this project requires the integration of different research groups.

## SUPPORT FOR REGULAR RESEARCH

3

### Analysis of the chemical signatures of particulate material emitted by different diesel/biodiesel concentrations and their toxic effects in biological systems

Paulo Hilário Nascimento Saldiva

School of Medicine

University of São Paulo (USP)

Process 2007/57747-0

Term: Dec/2007 to Nov/2009

Atmospheric pollution presents itself as a public health problem in industrialized urban centers, with

the ever increasing presence of automobiles and industries as polluting sources. The effects on health have been intensively studied in recent years, demonstrating that exposure to atmospheric pollutants has been responsible for an increase in morbid-mortality and in hospitalizations due to cardio-respiratory problems and cancer. The adoption of programs of alternative fuels, such as alcohol in the decade of the 70s and nowadays biodiesel, has as one of its objectives the reduction in the emission of atmospheric pollutants, as well as the minimization of its toxic effects on health. Thus this work intends to analyze the chemical composition of the combustible material of the following fuels: diesel (2000ppm and 500ppm of sulfur) and biodiesel (B5, B20, B100) correlating the effects with health, with a view to providing data on the advantages and disadvantages of the use of these alternative fuels for the elaboration of public policies which aim for an improvement in the quality of the air and in the life of the population.

4

#### **An analysis of the bioaerosols in the atmosphere of the metropolitan region of the city of São Paulo**

Fábio Luiz Teixeira Gonçalves

Institute of Astronomy, Geophysics and Atmospheric Sciences  
University of São Paulo (USP)

Process 2003/05506-8

Term: Aug/2004 to Apr/2007

The objective of this study is to quantify and classify the bioaerosols in the region of Greater São Paulo. Currently there is no information with regard to the concentration and the species prevalent in the air of São Paulo. The simple presence of these bioaerosols impacts directly on various areas of science, from public health to its influence on the formation of clouds above the city. Therefore, the quantification and taxonomic classification of the fungal and bacterial ecosystems becomes important in a metropolis such as São Paulo to facilitate the understanding of natural phenomena, as well as risks of aggravation to the health of its population.

5

#### **Pulmonary and cardiovascular alterations induced by inhalation of concentrated particulate material from the atmosphere of São Paulo**

Paulo Hilário Nascimento Saldiva

School of Medicine  
University of São Paulo (USP)

Process 2002/09804-0

Term: Jan/2005 to Sep/2008

The determination of the toxic potential of inhalable particulate material (PM<sub>2.5</sub>) is not totally determined, especially when one is working with particles derived from the "real world". Clarification of this point is of primordial importance when seeking to determine the mechanisms through which PM<sub>2.5</sub> causes increases in morbidity and mortality in the exposed populations, as pointed out in the epidemiological studies. The general objective of this study will be to determine the toxicity of different doses of PM<sub>2.5</sub>. We will evaluate an extensive battery of histopathological, hematological and cardiovascular tests in mice exposed to the ambient particle concentrator (CPA) in São Paulo. By means of the variation in the profile of the emitting sources, it is hoped that the present project may contribute to the question of pulmonary and cardiovascular toxicity of the different constituent elements of PM<sub>2.5</sub>.

6

#### **Effect of air pollution in the carcinogenesis of mice**

Paulo Hilário Nascimento Saldiva

School of Medicine  
University of São Paulo (USP)

Process 2002/09803-4

Term: Jul/2003 to Jul/2005

The effects of air pollution are amply documented. Atmospheric pollutants constitute a public health problem, potentially, in the metropolitan region of São Paulo, which breaches the norms of air quality. Not all the adverse effects to health which those pollutants can cause have been well established, although several harmful effects have been well documented. Neoplasms are among the most frequently professed chronic effects of the exposure to air pollution. Thus, this study intends to evaluate the potential of the formation of neoplasms, using mice as the experimental model. The mice will be placed in open-topped chambers, in the following conditions of exposure: clean air, with filter for particles and gases; intermediary 1, with filter for gases; intermediary 2, with filter for particulate material and unclean air, without filtering. In each chamber the mice will be divided in two groups, one will receive n-nitroso-methylurea and the other will be used as control. The mice will be accompanied for six months, taking as base the experiment of Reymão et al. (1997). At the end of the experiment the mice will be sacrificed and an autopsy performed, and the selected material will be subjected to verification for the presence of tumors. The results of the exposure will be subjected to

statistical analysis matching with data obtained from the Cetesb monitoring station.

## PUBLIC POLICIES RESEARCH PROGRAM – SUS

### 7 Analysis of morbidity and mortality associated with climate variation in the municipality of São Paulo

Miguel Cendoroglo Neto

Albert Einstein Hospital / Albert Einstein Brazilian Israeli Beneficent Society

Process 2006/61520-8

Term: May/2007 to Jun/2008

The present study will analyze climatic factors association – humidity, lowest temperature, and atmospheric pressure, versus morbidity incidence and mortality in acute myocardium infarction, stroke, pneumonia and asthma in the city of São Paulo between 2001 and 2005. The analysis of those associations by implementing a statistical model based on climatologic data and institutional data of morbid-mortality plotted in São Paulo city map, using a geographic information system, will allow the healthcare services to plan and to optimize their resources for the demand variations.

## GRANTS

### RESEARCH ABROAD

### 1 Ambient air particles increase cardiac vulnerability to ischemia

Grant holder: Paulo Hilário Nascimento Saldiva

Institution: School of Medicine / University of São Paulo (USP)

Institution abroad: Harvard School of Public Health, United States

Process 1999/0116-7

### 2 Development of techniques of analysis to be used in the epidemiological vigilance of the effects of air pollution on health

Grant holder: Alfesio Luís Ferreira Braga

Institution: School of Medicine / University of Santo Amaro (Unisa)

Institution abroad: Harvard School of Public Health, EUA

Process 1998/13021-4

## POST-DOCTORATE

### 3 Fetal alterations induced by the exposure to atmospheric pollution: a study with focus on placentary morphogenesis

Grant holder: Ana Julia de Faria Coimbra Lichtenfels

Supervisor: Paulo Hilário Nascimento Saldiva

Institution: School of Medicine / University of São Paulo (USP)

Process 2007/56479-1

## DOCTORATE

### 4 Study of the alterations in the development, behavior and cerebral biochemistry of male mice exposed to environmental atmospheric pollution in the intra-uterine phase

Grant holder: Ana Cláudia Tedesco Zanchi

Supervisor: Paulo Hilário Nascimento Saldiva

Institution: School of Medicine / University of São Paulo (USP)

Process 1994/00642-0

### 5 Study of the mutagenic effects of environmental pollution on street workers in São Paulo

Grant holder: Ariadini Negri

Supervisor: Paulo Hilário Nascimento Saldiva

Institution: School of Medicine / University of São Paulo (USP)

Process 2005/55367-0

### 6 Evaluation of the effects of air pollution in the city of São Paulo on placentas of animals exposed in different phases of gestation: study of gestation, immunohistochemical and morphometric study of the alterations

Grant holder: Mariana Matera Veras

Supervisor: Marisa Dolhnikoff

Institution: School of Medicine / University of São Paulo (USP)

Process 2005/54857-3

### 7 Evaluation of health costs due to atmospheric pollution in the municipality of São Paulo

Grant holder: Simone Georges El Khouri Miraglia

Supervisor: Gyorgy Miklos Bohm

Institution: School of Medicine / University of São Paulo (USP)  
Process 1998/15617-1

## MASTERS

8

**Effects of atmospheric pollution on initial embryonic development and on uterine receptivity: morphological and molecular studies**

Grant holder: Daniela Aparecida Nicolosi Foltran Januário  
Supervisor: Paulo Hilário Nascimento Saldiva  
Institution: School of Medicine / University of São Paulo (USP)  
Process 2007/51746-1

9

**Retrospective evaluation of the relationship between mortality and atmospheric pollution in the city of São Paulo**

Grant holder: Débora Já de Araújo Lobo  
Supervisor: Paulo Hilário Nascimento Saldiva  
Institution: School of Medicine / University of São Paulo (USP)  
Process 1994/00642-0

## SCIENTIFIC INITIATION

10

**Relationship between climate alterations and determining factors in the mortality of the elderly in the municipality of São Carlos, São Paulo**

Grant holder: Fabiana Vieira Soares  
Supervisor: José Rubens Rebelatto  
Institution: Center for Biological Sciences and Health / Federal University of São Carlos (UFSCar)  
Process 2008/50871-0

11

**Participation of carbon monoxide in orofacial nociception**

Grant holder: Raquel Sesso Perches  
Supervisor: Luiz Guilherme de Siqueira Branco  
Institution: Ribeirão Preto School of Dentistry / University of São Paulo (USP)  
Process 2006/60656-3

12

**Role of specific environmental pollutants in birth weight in São José dos Campos, São Paulo**

Grant holder: Douglas Amaral Moreira  
Supervisor: Luiz Fernando Costa Nascimento  
Institution: Basic Institute of Biosciences / University of Taubaté (Unitau)  
Process 2006/59447-0

13

**Determination of regional levels of PTS, NO<sub>2</sub> and O<sub>3</sub> on the University City campus and correlation of these with the prevalence and possible aggravation of respiratory symptoms in employees**

Grant holder: Antônio Fernando Barros de Azevedo Filho  
Supervisor: Paulo Hilário Nascimento Saldiva  
Institution: School of Medicine / University of São Paulo (USP)  
Process 2006/56038-2

14

**Determination of regional levels of PTS, NO<sub>2</sub> and O<sub>3</sub> on the University City campus and correlation of these with the prevalence and possible aggravation of respiratory symptoms in employees**

Grant holder: Bruna Abílio Gomes de Almeida  
Supervisor: Paulo Hilário Nascimento Saldiva  
Institution: School of Medicine / University of São Paulo (USP)  
Process 2006/56037-6

15

**Role of bronchial innervation in the analysis of cardiac effects after the instillation of particulate matter from the São Paulo atmosphere**

Grant holder: Matheus Ramos Tozi  
Supervisor: Paulo Hilário Nascimento Saldiva  
Institution: School of Medicine / University of São Paulo (USP)  
Process 2005/59298-2

16

**Effects of air pollution on cardiac frequency and arterial oxygen saturation in healthy adults**

Grant holder: Letícia Bellinaso  
Supervisor: Ubiratan de Paula Santos  
Institution: School of Medicine / University of São Paulo (USP)  
Process 2005/55827-0

17

**Impact of environmental levels of atmospheric pollution in embryonic development: an experimental study in mice**

Grant holder: Edson Luiz Costa Zapparoli  
 Supervisor: Paulo Hilário Nascimento Saldiva  
 Institution: School of Medicine / University of São Paulo (USP)  
 Process 2004/11165-1

**18** **Severe coronary syndromes: analysis of seasonal and climatic variations, relationship with days of the week and air pollution**

Grant holder: Leonardo Manoel Quicoli Rosa de Oliveira  
 Supervisor: Antônio Carlos de Camargo Carvalho  
 Institution: Paulista School of Medicine / São Paulo Federal University (Unifesp)  
 Process 2004/08044-8

**19** **Vascular alterations in mice chronically exposed to pollution in the city of São Paulo: quantitative histopathological study**

Grant holder: Cláudia Kwei Fong Dai Tanabe  
 Supervisor: Paulo Hilário Nascimento Saldiva  
 Institution: School of Medicine / University of São Paulo (USP)  
 Process 2004/01488-8

**20** **Urban atmosphere and health in São Paulo: study with vegetal biological indicators**

Grant holder: Fátima Suyama  
 Supervisor: Paulo Hilário Nascimento Saldiva  
 Institution: School of Medicine / University of São Paulo (USP)  
 Process 1998/12798-5

**21** **Effects of air pollution in São Paulo on the ciliated epithelium of RA – subproject 1: study of the influence of particulate material (PM10) mucociliar transport and in the difference of transepithelial potential**

Grant holder: Alexandre Pereira de Oliveira  
 Supervisor: Paulo Hilário Nascimento Saldiva  
 Institution: School of Medicine / University of São Paulo (USP)  
 Process 1996/12519-3

**22** **Effects of air pollution in São Paulo on the ciliated epithelium of RA – subproject 2: effects of particulate material (PM10) on ciliary beating**

Grant holder: Christina Terra Gallafrio  
 Supervisor: Paulo Hilário Nascimento Saldiva

Institution: School of Medicine / University of São Paulo (USP)  
 Process 1996/12518-7

**23** **Effects of air pollution in São Paulo on the ciliated epithelium of RA – subproject 3: effects of Ph and oxidant potential of PM10 on the speed of mucociliar transport**

Grant holder: Marcos Takeo Obara  
 Supervisor: Paulo Hilário Nascimento Saldiva  
 Institution: School of Medicine / University of São Paulo (USP)  
 Process 1996/12516-4

**24** **Correlation between atmospheric pollution and mortality due to respiratory diseases in children and the elderly in São Paulo**

Grant holder: Ivana Aparecida Barone  
 Supervisor: Paulo Hilário Nascimento Saldiva  
 Institution: School of Medicine / University of São Paulo (USP)  
 Process 1992/04772-0

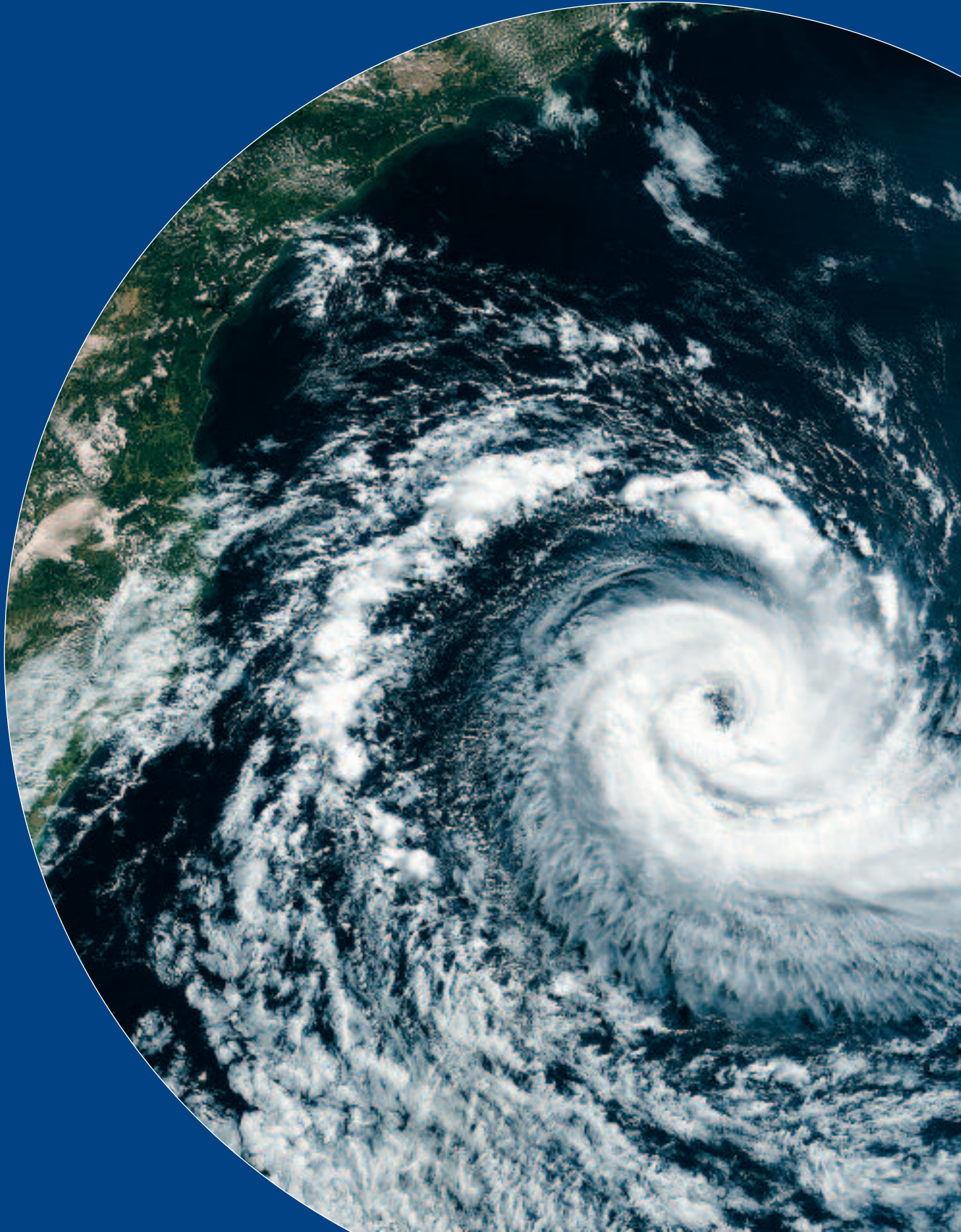
**25** **Correlation between atmospheric pollution and mortality due to respiratory diseases in children and the elderly in São Paulo**

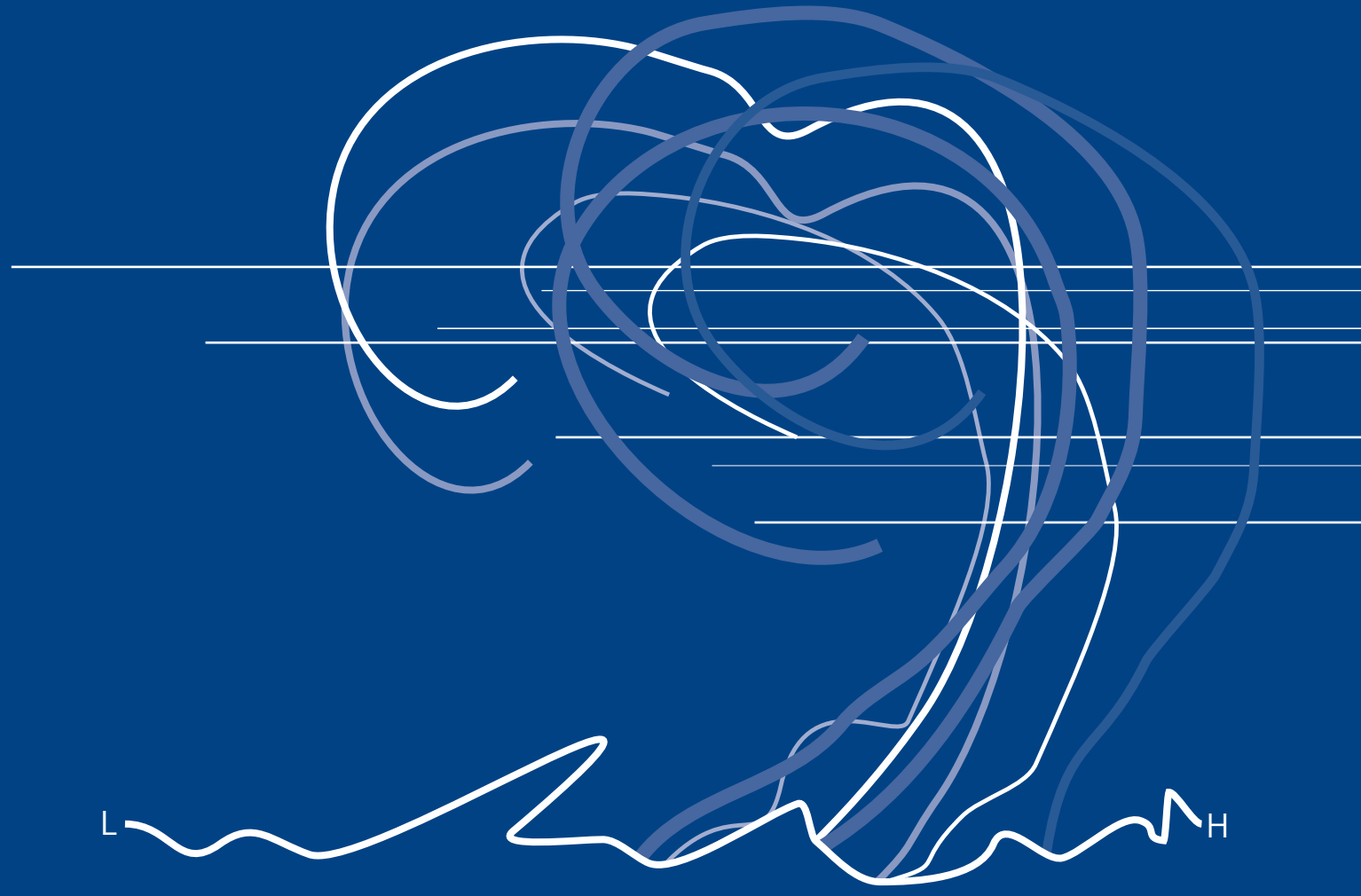
Grant holder: João Marcos Salge  
 Supervisor: Paulo Hilário Nascimento Saldiva  
 Institution: School of Medicine / University of São Paulo (USP)  
 Process 1992/04763-0





Interdisciplinary and grants  
for other areas





## PUBLIC POLICIES RESEARCH PROGRAM

1

### Development of technology for ozone forecasting in the lower atmosphere

Roberto Guardani  
Polytechnic School  
University of São Paulo (USP)  
Process 1998/14157-7  
Term: Nov/1999 to May/2005

The present project aims to develop a technology for the forecasting of levels of ozone as an atmospheric pollutant in the Metropolitan Region of São Paulo (MRSP), to be used both in services of forecasting levels of air pollution, and in the identification of the primary causal agents, enabling preventative actions on the part of the government of the State of São Paulo. The technology to be implemented consists of a computer simulation program, that uses mathematical models based on neural networks. Such models are suitable for the simulation of the complex systems of chemical reactions and of gas dispersion, contemplated here. For the development and adjustment of the mathematical models, data will be used from measurements of concentrations of gaseous components in the atmosphere, as well as meteorological information, supplied by Cetesb's network of measurement stations in the MRSP. The final product, in the form of a set of computational algorithms, will be subsequently implemented for use in the control of air pollution in the region under consideration, with the possibility of being extended to other regions of the State, based on the experience to be acquired in this project.

## GRANTS

### ASTRONOMY AND SPACE SCIENCE

#### SCIENTIFIC INITIATION

1

### Cosmologies with vacuum decay: conceptual aspects and observational tests

Grant holder: José Fernando de Jesus  
Supervisor: José Ademir Sales de Lima  
Institution: Institute of Astronomy, Geophysics and Atmospheric Sciences / University of São Paulo (USP)  
Process 2003/14019-3

## SCIENCE AND COMPUTER ENGINEERING

#### MASTERS

2

### Semi-automatic recognition and vectorization of regions in remote sensing images

Grant holder: Jefersson Alex dos Santos  
Supervisor: Ricardo da Silva Torres  
Institution: Computer Institute / Campinas State University (Unicamp)  
Process 2007/53607-9

#### SCIENTIFIC INITIATION

3

### Comparative study of descriptors of remote sensing images

Grant holder: Lucas Moutinho Bueno  
Supervisor: Cláudia Maria Bauzer Medeiros  
Institution: Computer Institute / Campinas State University (Unicamp)  
Process 2008/51921-0

## ECONOMY AND ADMINISTRATION

#### RESEARCH ABROAD

4

### Indicators of sustainability

Grant holder: José Eli Savóia da Veiga  
Institution: School of Economy, Administration and Accounting / University of São Paulo (USP)  
Institution abroad: University Oxford, UK  
Process 2007/04485-8

#### DOCTORATE

5

### Socio-environmental responsibility: the level of evidentiatio in Latin America

Grant holder: Laura Calixto  
Supervisor: Maria Cecília Coutinho de Arruda  
Institution: São Paulo School of Business Administration / São Paulo Getúlio Vargas Foundation (FGV-SP)  
Process 2007/54295-0

**DIRECT DOCTORATE****6****Evaluation of the influence of the state of conservation of highways in the emissions of carbon gas by freight transport vehicles**

Grant holder: Daniela Bacchi Bartholomeu  
 Supervisor: José Vicente Caixeta Filho  
 Institution: Luiz de Queiroz Advanced School of Agriculture /  
 University of São Paulo (USP)  
 Process 2003/03009-7

**10****Spatial Analysis of climate variable in the State of São Paulo**

Grant holder: Marcio Colombo Fenille  
 Supervisor: Marcio Cardim  
 Institution: Presidente Prudente School of Sciences and  
 Technology / São Paulo State University (Unesp)  
 Process 2002/03528-1

**MASTERS****7****Evaluation of the influence of the state of conservation of highways in the emissions of carbon gas by freight transport vehicles**

Grant holder: Daniela Bacchi Bartholomeu  
 Supervisor: José Vicente Caixeta Filho  
 Institution: Luiz de Queiroz Advanced School of Agriculture /  
 University of São Paulo (USP)  
 Process 2002/05736-0

**SCIENTIFIC INITIATION****8****Air pollution and human health: a study of the costs in the municipality of São Paulo**

Grant holder: Tatiana Schor  
 Supervisor: Antônio Evaldo Comune  
 Institution: School of Economy, Administration and  
 Accounting / University of São Paulo (USP)  
 Process 1992/04908-9

**MATHEMATICS AND STATISTICS****SCIENTIFIC INITIATION****9****Spatial variability of climate variables in the State of São Paulo**

Grant holder: Dayane da Silva Donaire  
 Supervisor: Marcio Cardim  
 Institution: Presidente Prudente School of Sciences and  
 Technology / São Paulo State University (Unesp)  
 Process 2005/60177-5

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