

MEMBER COUNTRY: BRAZIL						
National Report to SCAR for year: 2009						
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8) Op Met - Operational Meteorology in Antarctic	Dr. Alberto W. Setzer	INPE/CPTEC Cx.Postal 515 - 12245-970 São José dos Campos, SP- BRAZIL	55 12 3945 6464	5512 3945 6652	asetzer@cptec.inpe.br	http://www.cptec.inpe.br/antartica
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A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS:

In 2009, the Brazilian Antarctic Program (PROANTAR) invested in a Public Call for the support of scientific research projects as well as to encourage scientific cooperation with other Antarctic programs in South America. Also, two National Institutes of Science and Technology focused on Antarctica were created with federal funding for research: one related to the Cryosphere and the other to Environmental Research in Antarctica. The newly acquired polar ship, Almirante Maximiano, participated in his first oceanographic campaign supporting research projects in the Austral Ocean. The India-Brazil-South Africa forum (IBSA) initiated proposals for cooperation in Antarctic scientific affairs among the three countries. Public biddings were launched in the three countries in order to contract researches related to Antarctic Science.

Glaciology

The first Brazilian national expedition to the interior of the continent unfolded from a base camp at Patriot Hills (80°18'S, 81°22'W) and carried out glaciological and atmospheric chemistry studies. In the region of the base camp, the surface atmosphere was continuously sampled to study the transport of biomass burning subproducts (black carbon and levoglucosan) from South America and Africa to high latitudes. Aerosols and recent deposited snow were sampled, simultaneously, to look for microorganisms associated to long-range transport. In addition, this investigation included exploratory studies about the local glacial geomorphology evolution and soil formation processes under extremely low temperatures. Our main investigation was carried out at an advanced camp site, around Mont Johns (79°55'S, 94°23'W; altitude 2125 m; mean annual temperature 33°C) in the West Antarctic ice sheet. There, we recovered a 95-m ice core to reconstruct precipitation and atmospheric chemistry variation during the last 250 years. This is part of the project is the first Brazilian contribution to the International Partnership in Ice Core Sciences). Recently, a proposal for the creation of a National Institute for Cryospheric Sciences was approved and this will put together scientists from 7 Brazilian research institutions to investigate Antarctic glaciology and its relationship to the South American and Southern Ocean environmental.

Atmospheric research

1. 'New Diagnostics of the Geospace Anomalies and their effects in the Polar, Regional and Global Earth Atmosphere' - Project in collaboration with Mackenzie University. It consists in monitoring the solar phenomena and the income particles in the Earth atmosphere, which can damage the satellites as well as change their orbit, can produce blackouts in the telecommunications and climate changes. VLF radio waves have been used to study the variations in the lower ionosphere (D-layer). This region is maintained by the solar Lyman-alpha emission, but is highly disturbed by enhancements of X-ray emission during solar flares (e.g. Raulin et al, 2006), and also by electron precipitation events from the radiation (Correia et al, 2007). These disturbances produce changes in the ionization rates, and consequently in the D-region parameters, conductivity gradient and reference height (Pacini and Raulin, 2006), which govern the refractive index. Thus VLF amplitude and phase are sensitive to changes in the electrical conductivity of the lower ionosphere, and can be used to probe ionospheric changes. Long data series are necessary to investigate the long term trends of the ionosphere as a function of the solar cycle and of its variations (Rivero et al, 2009). These data will complement the vertical and oblique sounding performed with HF radars and riometers. VLF soundings have suggested the basement of ionosphere is coupled with lower atmospheric layers, presenting a close association with winter polar vortex from stratosphere (Correia et al, 2009), as well response to the atmospheric waves (planetary, gravity and TID). The ionospheric radio soundings have been done with VLF network SAVNET (Raulin et al, 2009), riometer network SARINET (Nishino et al., 2004) and GPS network RBMC/IBGE, covering the region from King George Island till equatorial region of South America.
 2. 'Mesospheric temperature monitoring in the Antarctic region' - Observations of the mesospheric temperature, region of the high atmosphere (90 km of altitude), for investigating the dynamics and coupling processes between the lower and upper atmosphere. "
 3. Study of the Ozone and UV Radiation in the Antarctic and South America - Ozone layer monitoring in the Antarctic and South America region launching ozonsondes on meteorological balloons and the total ozone detected by ground-base and satellites measurements. Study of the UV radiation mostly during the Ozone Hole, where the ozone concentration have severe depletion, with 80% the ozone loss. Project in collaboration with Magallanes University, Chile and CEILAP, Argentina.
 4. The project MST – ASA is a study of the Mesosphere-Stratosphere-Troposphere using different techniques in the Antarctic region and South America. This cooperation will be directed toward ground-based experimental campaigns. Spectrophotometers, radiometers, ECC sonde technique launched on balloons, to increase understanding of the Antarctic atmosphere and the teleconnection to South America. Within the Brazilian Antarctic Programme and with other countries participation, a joint project is proposed to act in the investigation in integrated research lines: Stratospheric Ozone Depletion, Dynamical coupling from troposphere – stratosphere to mesosphere, Effects of gravity, tidal and planetary waves on the Polar atmosphere circulation system and Vortex and on Earth's climate. UV radiation. Ferraz for characterization of the planetary waves associated with polar vortex. f) Monitor the minor gases and green house gases, in Brazilian Antarctic Station (eg.: N₂O, O₃, CFCs and CH₄). g) Integrate simultaneous numerical transport models and back trajectories analysis. Monitor the stratospheric and tropospheric ozone, temperature, pressure, humidity and winds by ozone soundings and LIDAR and automatic weather stations. UV radiatio impact
 5. "Antarctic Meteorology" Project in collaboration with University of Rio Grande do Sul (UFRGS), studies the effects of Antarctica in the Brazilian weather and the climatic variation in the Antarctic Peninsula; it also maintains three automatic weather stations and supports PROANTAR with weather data and forecasts.
 6. Studies of the Ice and Atmosphere Relation - Project in collaboration with University of Rio de Janeiro (UERJ). It evaluates the level and the type of pollution of tropical origin and that it arrives at Antarctica, through analyses of Antarctic ice sample. Admiralty Bay GIS, King George Island, SCAR DATABASE
 7. "Antarctic Meteorology" Project in collaboration with University of Rio Grande do Sul (UFRGS), studies the effects of Antarctica in the Brazilian weather and the climatic variation in the Antarctic Peninsula; it also maintains three automatic weather stations and supports PROANTAR with weather data and forecasts.
 8. Studies of the Ice and Atmosphere Relation - Project in collaboration with University of Rio de Janeiro (UERJ). It evaluates the level and the type of pollution of tropical origin and that it arrives at Antarctica, through analyses of Antarctic ice sample. 8. A soil survey was carried out at Byers Peninsula, in Livingstone island, during the 2008/2009 summer. This way, great part of the most expressive ice-free areas of maritime Antarctica have being surveyed and mapped. The most representative soils in maritime Antarctica have been analyzed. Adaptations to the main international soil classification systems have been proposed in face of the peculiar characteristics of soils form this part of Antarctica, specially the ornithogenic and acid sulphate Cryosols. Aerial photographic surveys have allowed the construction of ortho-rectified mosaics, generating cartographic base in an adequate scale for mapping terrestrial environments of maritime Antarctica. Advances were also made regarding soils organic carbon stocks and dynamics as well and their relation with faunal activity and plant communities.
- During 2008, the results of researches in progress since 2002 have been published in international journals of recognized importance in the soil science and geochemistry fields

Oceanographic research

During last Austral summer(2008/9) the High Latitude Oceanography Group (GOAL) undertook expeditions to the southern ocean. One to the SubAntarctic region off the Patagonian Shelf in the scope of PATEX (Patagonian Experiment). The aim of this study is to collect in-situ and remote sensing data along the very high productivity algae blooms that occur along the shelf-break and slope in that area. During certain times of the summer season those blooms are strongly dominated by coccolithophors, which are particularly important to the global biogeochemical cycle and climate. In february, GOAL headed to the Weddell Sea and Bransfield Strait, in the vicinity of the Antarctic Peninsula to occupy its regular hydrographic high-resolution grid and also, for the first time within the Brazilian Antarctic Program, to undertake two ambitious experimentos. The first was to deploy three current meter moorings along the Bransfield Central Basin slope to measure the cold High Salinity Shelf Water plume which comes from the Weddell Sea (normally in winter). The operation was successfull and the moorings will be recovered and serviced in feb/2010. The second experiment was to tag with GPS markers 3 medium-size 'table' icebergs in NW Weddell Sea in order to contribute to the internation effort to estimate the freshwater fluxes and iceberg calving rates around the Antarctic. It was done successfully and the buoys transmitted some very peculiar data on the bergs advection around James Ross Island. GOAL plans to deploy more "ice buoys" in the near future and also will focus on the investigation of local water mass production and advection along the long underwater canyons near the tip of the Antarctic Peninsula.

Biological research

1. Biological research on the Antarctic Specially Managed Area in Admiralty Bay, King George Island, was carried out by several research groups from different Universities and Research Institutes in Brazil. The main purpose was to better understand the ecosystems' dynamics, biodiversity and ecology and to detect the eventual effects that human activities would have on this ecosystem. In the terrestrial environment, plant communities in ice melting areas adjacent to Admiralty Bay were analyzed (A.B. Pereira batista@ulbra.tche.br, Brazil's Lutheram University – ULBRA). In the marine environment the project developed was MABIREH (Marine Antarctic Biodiversity in Relation to Environmenatl Heterogeneity at Admiralty Bay, KGI, and adjacent areas at Bransfield Strait) (LS Campos campos-lucia@biologia.ufrj.br, Federal University of Rio de Janeiro – UFRJ), in which biodiversity was studied from microbes to top predators and was related to the complexity of the marine environment. This project has allowed the continuity of relevant research that investigates signals of global and regional changes in Antarctica, and integrates the Census of Antarctic Marine Life (CAML# 53) and the Antarctic Marine Biodiversity Information System (SCARMarBIN # 83). A small remotely operated vehicle (ROV LUMA) has been developed to function down to the deepest zone of the bay (near 500 m).
2. Research was carried out to detect eventual pollution in the Admiralty Bay through the use of biomarkers to monitor environmental impacts (PV Ngan phanvn@usp.br, Oceanographic Institute of the University São Paulo – USP), and the detection of contamination by petroleum hydrocarbons (M C Bicego marcia@io.usp.br, Oceanographic Institute of the University São Paulo – USP), and by sewage and persistent organic pollutants (POPs) (R C Montone Oceanographic Institute of the University São Paulo – USP).
3. A project was developed to implement studies of molecular biodiversity and to integrate knowledge of the microbial ecology and biocomplexity in the Antarctic environment. The project included studies of the biological cycle of the methane, biodiversity of cyanobacterias, fungi, viruses in birds, magnetobacteria, microbes from permafrost and, important aspects for bioprospection (V H Pellizari viviamp@usp.br, Institute of Biomedical Science of the University São Paulo – USP). Effects of Ultraviolet Radiation on DNA of Marine Organisms in Admiralty Bay, King George Island, Antarctica (Phan Van Gnan- phanvn@usp.br, Vicente Gomes- vicgomes@usp.br, IO/USP; Neusa Paes Leme- nleme@dge.inpe.br- INPE
4. A project was created to investigate the Antarctic and global changes, the environmental and teleconections with the South American Continent, from the oceanographic point of view (C A E Garcia dfsGAR@furg.br, Federal University of Rio Grande Foundation – FURG), and to evaluate the size structure of the phytoplanktonic community in the Antarctic ecosystem (F W Kurtz fwkurtz@uerj.br, Rio de Janeiro State University). There was also studies on how global changes affect the trophic ecology of top predators such as Mirounga spp (M M C Muelbert mamiferos@furg.br, Federal University of Rio Grande Foundation – FURG), and how the temporal-space characteristics of physical and biological parameters influence the whales distribution and abundance (P G Kinas dmtkinas@super.furg.br, Oceanographic and Antarctic Museum of the Federal University of Rio Grande Foundation – FURG).
5. The project on Evolution and Biodiversity in the Antarctic (EBA) had the objective of developed research that evaluates the genotype and phenotype plasticity in the Antarctic fishes and their successful adaptations of the biochemical and physiological mechanisms arising from the oscillations in the salinity, temperature and the bio-accumulation of fluoride in the marine Antarctic ecosystems. This is also important to predict how these organisms and communities are responding or will respond to the present and future global climate changes in the environment that are reflected in the metabolism and enzyme systems with consequences in the animals' behaviour, morphology and physiology. This project integrates the program EBA: a response of life to changes of SCAR. There was also a participation on the IPY 131 – AMES (Integrated Circumpolar Studies of Antarctic Marine Ecosystems to the Conservation of Living Resources), in which krill and fishes were collected in the Atlantic-Indian Southern Ocean Confluence for studies of distribution and condition indexes (L. Donatti donatti@ufpr.br, Federal University of Paraná; F. Rios flaviasrios@ufpr.br, Federal University of Paraná; E. Rodrigues edsonrod@unitau.br, University of Taubaté; G. Sree Vaneé svrani@hotmail.com University of Taubaté; C. S Carvalho san-cleo@ufscar.br Federal University of São Carlos; H G Kawall, helena.kawall@gmail.com, University Centre Campos de Andrade).

Geoscience

Extensive and excellent exposures resulting from the fast retreat of the Wyspianski glacier at Wesele Cove, KGI, during the last decades allowed detailed examination of rocks recording the passage from Eocene greenhouse to Oligocene ice house conditons. Rocks belong respectively to the Hennequi Point Formation and the Krakowiak Glacier Member (Polonez Cove Formation).

A relatively thick section (>60m) of basalt from the Hennequin Point Formation (Eocene). Is made up of at least thirteen m-thick terrestrial lava flows, each one composed of a lower zone of fresh basalt overlain by a weathered basalt (saprolith) zone. Correspondent weathering indexes were established by Petrographic and Geochemical analyses. A sandstone bed intercalated between two lava flows. The basalt is overlain along an erosive contact by subglacial and glacial marine diamictites and sandstones from the Krakowiak Glacier Member (Mid Oligocene).