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National Report to SCAR for year: 2010						
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NATIONAL ANTARCTIC DATA CENTRE						
SCAR DATABASE						
A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS:						
<p>Since 2009, the Brazilian Antarctic Program (PROANTAR) invested in scientific research projects, including scientific cooperation with other Antarctic programs in South America. This financial investment is responsible for supporting 19 projects, involving six South American countries (Argentina, Chile, Uruguay, Ecuador, Peru and Venezuela), and also, other 13 countries (United States, UK, Germany, Spain, Portugal, Sweden, Russia, France, Italy, Belgium, Japan, Australia and New Zealand).</p> <p>Also, both National Institutes of Science and Technology for Antarctica issues (Cryosphere and Antarctica Environmental Research) are with their research activities in full swing (see <a href="http://www.cnpq.br/programas/inct/_apresentacao/inct_criosfera.html">http://www.cnpq.br/programas/inct/_apresentacao/inct_criosfera.html</a> and <a href="http://www.inct-antartico.com.br">http://www.inct-antartico.com.br</a>).</p> <p>The newly acquired polar ship, Almirante Maximiano, started the second oceanographic campaign (the 29th Brazilian Antarctic Campaign - 2010-2011), after having succeeded its first one (2009-2010) for supporting research projects in the Austral Ocean.</p> <p>The India-Brazil-South Africa forum (IBSA) for cooperation in Antarctic scientific affairs started the first initiatives for Antarctic scientific research.</p>						
Glaciology						
<p>The National Institute for Cryospheric Sciences has put together scientists from 7 Brazilian research institutions to investigate Antarctic glaciology and its relationship to the South American and Southern Ocean environmental.</p> <p>This Institute's first year was devoted to several expeditions to Antarctica, The Southern Ocean and the Bolivian Andes. Among which, the first national scientific expedition to the interior of Antarctica to collect ice cores, allowing us to retrieve a set of ice cores holding the climatic history of the last 300 years. Initial results point to signs of biomass burning patterns of South America. Over the next three years, teleconnections between the Antarctic and South American climates will be intensively investigated based on these ice cores. One new international programme was established, CASA (Climate of Antarctica and South America, <a href="http://www.polar tropical.org/casa/">http://www.polar tropical.org/casa/</a>), a joint initiative with the Climate Change Institute, University of Maine, USA. Along with these endeavours, to understand water resources issues related to the cryosphere, Brazilian researchers are monitoring, in the Bolivian Andes, glaciers that form the headwaters of the Madeira River drainage basin.</p> <p>Also, this institute has established one of the largest networks to monitor permafrost areas and associated ice-free ecosystems in Maritime Antarctica and Antarctic Peninsula sites; these studies will be expanded to the Andes and the Arctic in the near future. The oceanographic groups conducted several expeditions to the Southern Ocean, mainly near to Antarctic Peninsula, to investigate the temporal variability of hydrological parameters. Oceanic bottom waters freshening is observed in the region, possibly resulting from the Antarctic Peninsula continental ice masses losses. This institute research groups have carried out observations in the Southwest Atlantic Ocean, mainly to study the confluence of the Brazilian and Falklands (Malvinas) currents, essential to understand the connections between Antarctica-Southern Ocean and south-southeastern Brazilian coastal and oceanic processes.</p>						

## 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 has complemented 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-based 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, and Effects of gravity, tidal and planetary waves on the Polar atmosphere circulation system and Vortex and on Earth's climate. UV radiation. Characterization of the planetary waves associated with polar vortex. Monitor the minor gases and green house gases, in Brazilian Antarctic Station (eg.: N<sub>2</sub>O, O<sub>3</sub>, CFCs and CH<sub>4</sub>). 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 radiation impacts.
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. 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.
8. Ongoing aerosol research is been conducted over the South Atlantic and Southern Ocean, within the Marine Aerosol Network Program/NASA, as well as within a joint international cooperation network among Argentina, Chile and Brazil. This international cooperation is providing atmospheric monitoring stations that operate continuously and simultaneously at the Argentine Patagonian semi-desert (City of Trelew - runned by Argentine), at the Southern Chilian Patagonia (City of Punta Arenas - runned by Chile/INACH) and at the Antarctic Peninsula/King George Island - runned by the Brazilian Antarctic Program. It is also programmed that a monitoring station will run near the South Pole during the 2011 campaign. All the the stations are designed to analyse terrigenous, marine, anthropic and biogenic elements in the atmospheric in monthly resolution.
9. Atmospheric emissions from the Brazilian Antarctic Station is monitored by the Aerosol Research Group with respect to black carbon and VOCs.
10. Bioaerosols and microorganisms attached to terrigenous aerosols are monitored in atmospheric samples and dated snow/firn/ice samples from King George Island, Detroit Plateau/Antarctic Peninsula and Central Antarctica/Patriot Hills.
11. On board measurements at the Southern Ocean involve the estimates of FeII and FeIII fluxes from the atmosphere to the ocean, precipitable water and AOT (Aerosol Optical Thickness) at 5 wavelenght.

## Oceanographic research

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. 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 experiments. 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 successful and the moorings were recovered and serviced in 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 international 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.

## 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 conditions. 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).

## 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 Environmental 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 cyanobacteria, 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 teleconnections 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 were 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 srvani@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).

**Besides the Brazilian Statement about its no bioprospecting activities in 2009, the discussion about this topic will be done in a larger forum with the participation of other South American countries working in Antarctica. So, the debate on bioprospecting in Antarctica must be cover in the event called "I South American Workshop on Polar Microbiology", which is being organized by Brazil and Argentina and will be held at Oceanographic Institute (IO-USP), Sao Paulo, Brazil, in July 2011.**