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RECENT ACTIVITIES OF THE BRAZILIAN ANTARCTIC PROGRAM IN PHYSICS AND CHEMISTRY OF THE ATMOSPHERE.

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ABSTRACT

A summary of the most recent research activities of the Brazilian Antarctic Program (PROANTAR) in Physics and Chemistry of the Atmosphere is presented. Research are performed primarily at the Brazilian Antarctic Station, Ferraz, which is located in the Admiralty Bay area, at King George island - Antarctic Peninsula (*62° 05'S; 058° 23.5'W*) and onboard the Brazilian polar oceanography ship Ary Rongel.

HISTORICAL ASPECTS

The first official Brazilian research effort in Antarctica started within the Brazilian Antarctic Program (PROANTAR) in the summer of 1982/1983. The mission started in December 1982 onboard the Oceanographic and Supply ship Barão de Teffé with the duty of undertaking the first Brazilian hydrographic, oceanographic, and atmospheric surveys off the Antarctic Peninsula Northwest Region, and selecting an area to establish the Brazilian Antarctic Station. This first expedition was helpful for planing future strategy for the next years, even though the scientific results were modest. It opened the doors for Brazil to become a Consulting Member of the Antarctic Treaty in September 12, 1983.

During the austral summer of 1983/1984, the first modules of the Brazilian Antarctic station Comandante Ferraz (EACF) were deployed (Inaugurated in February 6, 1984) at King George Island, South Shetland Archipelago, Antarctic Peninsula. The Station consisted of only 8 ship containers of corrugated steel (6m x 2,5m x 2,5m) adapted as living quarters and laboratories, tied together, and lied down on the shores southeast of Keller Peninsula, Lat. 62° 05' South and Long 058° 23.5' West (Figure 1). A staff of only ten support staff and two researchers spent this first summer for only 32 days conducting an experiment to study the ionosphere.

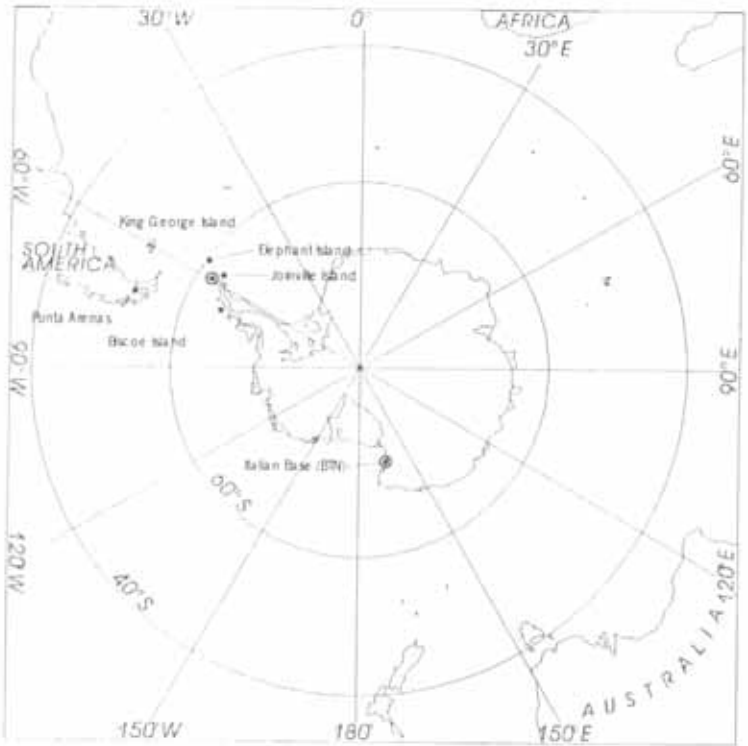

Figure 1 – Map of the Antarctic region showing the location of Ferraz Station and the Italian Base. The map also shows the location of the three automatic weather stations (AWS) and the city of Punta Arenas where PROANTAR runs meteorological and radon measurements.

During this same period two experiments were conducted in Atmospheric Science, onboard the Barão de Teffé, and the oceanographic ship W. Besnard, from the University of São Paulo (USP): one to acquire data to study the radioactive tracers in the atmosphere and aerosols, and other to study the Mesoscale meteorology, mostly for logistic purposes. The station remained closed for the winter only to open the next summer with some additional experiments such as the first balloon launching to study the gamma and X-rays radiation of cosmic origin on the upper atmosphere, and a data reception center for real time weather forecast by using satellites.

In the summer of 1984/1985 the station was enlarged to 33 modules. The first troposphere ozone, methane, carbon monoxide and carbon dioxide measurements in the region at Ferraz were added to the ongoing former experiments from the last two years. On board of the

Barão de Teffé a campaign of drifting buoys begun to study the coupling between surface ocean currents and the atmosphere.

In 1986 the first winter campaign occurred at Ferraz, with five experiments in the field of Atmospheric and Space Science to perform studies on geomagnetism, ionosphere, meteorology and atmospheric chemistry, some of them already started during previous summer campaigns.

Starting in the summer campaigns of 1986/1987 and 1987/1988 there was a second ship undertaking Antarctic research. She was the Oceanography Ship Almirante Câmara, which executed geophysical surveys in the Bransfield Strait and Bellinghausen Sea. More than 5.000 km of geophysical profiles for geomagnetism, gravimetry and reflection multi-channel seismology was acquired during this period.

In 1990 a scientific collaboration with the University of Magalhanes, located in the city of Punta Arenas, Chile, allowed for the begun of a series of monitoring of atmospheric radon and ozone profile measurements for this Subantarctic area. At this time, the enhancement in the research activities on atmospheric trace gases and aerosols in Ferraz consolidated the Brazilian research activities in this field of research as one of the leading for this area of King George Island.

The Barão the Teffé was substituted in 1995 by a more modern support and research ship, the Ary Rongel with an expressive increase in efficiency and security in the logistic operations. The Ary Rongel was a former Norwegian Polar Ship, the Polar Queen, constructed in 1981 acquired by Brazil and submitted to a process of enlargement in 1986 (Table 1). Up to two AS-355 Ecureuil helicopters (Brazilian Navy UH-13) are permanently on board to provide logistic support to scientific projects and logistic support to the station and refuges.

Table 1 - Brazilian Antarctic oceanographic and supply ship.

Name:	Ary Rongel
Owner:	Brazilian Navy
Place and year of construction:	Rieber Shipping A/S Norway, 1981
Propulsion:	2 engines Codad 2 Krupp Mak, 2200 HP, 1 Shaft
Gross tonnage:	3700 tons
Cruising speed:	12 knots
Maximum draft:	6.2 meters
Length:	75.2 meters
Breadth:	1300 meters
Crew and Researchers:	99
Autonomy:	150 days
Hull:	steel, ICE CLASS 1A1

In 1994, a collaboration begun between the University of Bologna (Italy) and INPE for the extension of the ongoing study on the radon atmospheric tracing at Ferraz and Punta Arenas

to the Terra Nova Bay (BTN) area – a study that has increased in weight as new interesting data are being acquired each summer campaign at BTN.

Today, the EACF has 64 modules, including lodges, laboratories, workshops, living rooms, small hospital, stores, kitchen, library, storehouses, communication room, a small gymnasium and a helipad. The built area of these facilities amount to approximately 2350m². This area is distributed as follows: the central building has 1390m²; the modules surrounding this main building sum up 110m², and the helipad has 840m². The EACF can shelter more than 40 people during summer and about 20 during winter. Seventeen fuel oil tanks supply diesel for the generator engines used to produce electricity. Water comes from two thaw lakes located in the Station vicinities. Even in winter, water can be extracted from below the frozen lake surface.

Complementarily, to allow the researches to be carried out in remote areas, four refuges were built: one in Nelson Island (Astrônomo Cruls - 62° 14'S and 055° 00'W), tone in the Elephant Island (Emilio Goeldi - 61° 05'S and 055° 20'W) and one in the King George Island (Padre Rambo - ordinates 62° 09.9'S and 058° 57.9'W). Each refuge can shelter six people for up to 60 days. Besides these research refuges, there are four remote meteorological weather station that collect and transmit standard atmospheric data by satellite via the ARGOS system: King George Island (62° S - 058° W); Joinville Island (63° S - 055° W); Biscoe Island (66° S - 066° W); and Elephant Island (61° S - 054° W).

The research Atmospheric Science at Ferraz is performed in four laboratories scattered around the main station at several distances, according to specific technical needs. The remotest laboratory, known as "Refúgio-2" is located at more than 3km from the mains station and is provided with solar panels and an wind power generator for provision of electric power. This site is used for geomagnetic experiments requiring ultra-low electromagnetic interference. The "Ipanema" laboratory is the second remotest site, located at about 1700m away from the station's main buildings in order to minimize the influence of the atmospheric pollution caused by the station's diesel electric power plant, and other activities such as garbage burning and motorized vehicles circulation. This is the place where all atmospheric sampling are taken, and real time measurements of atmospheric aerosols and gases are performed. The second farthest laboratory is the "Punta Plaza", located at about 700m from the main station, and were used in the past to host an experiment in ionosphere research using "riometers" that required very low levels of electromagnetic noise. Two other laboratories are located at shorter distances from the main station and are used in activities that require frequent presence of operators, such as the meteorology. These laboratories are provided with uninterrupted power supply fed by large battery banks, power stabilizers, temperature regulators, a 5 meters sampling tower, radio and telephone communication. All the routine station's activities (garbage burning, vehicle operation, helicopter landings, ships in the area) are recorded on a logbook in order to be considered when analyzing the data collected at this laboratory.

Brazilian Antarctic Operations are one year long. Each operation has a winter and summer period. The Brazilian Navy provides the logistic support to these operations, while the CNPq (Brazilian National Council for Research and Technological Development) provides the funding for research. In summer when the sea is not frozen, the Navy's supplying ship

"Ary Rongel' supplies the Station with provisions, fuel and all kind of materials and equipment. In winter, logistic support is provided using aircraft (C-130) from the Brazilian Air Force (FAB). They carry cargo to the Chilean runway "Presidente Eduardo Frei". From Frei the cargo is transported to the EACF by Chilean Air Force helicopters. The Brazilian Airforce (FAB) provides crucial support to PROANTAR. They operate 7 annual flights, using C-130 aircraft to transport equipment, material and personnel to and from Antarctica in summer and winter according to the time scale of Table 2.

Table 2 - Timetable for support flights to Ferraz starting from the city of Rio de Janeiro.

First Flight:	03 – 07 Dec/year-1
Second Flight:	26 – 30 Dec/year-1
Third Flight:	17 – 21 Jan/year
Fourth Flight:	28 Feb – 03 Mar/year
Fifth Flight:	15 – 19 May/year
Sixth Flight:	24 – 28 Jul/year
Seventh Flight:	25 Sep – 01 Oct/year

SHORT DESCRIPTION OF THE ONGOING PROJECTS

1) Aerosols and Atmospheric Radioactivity in the Antarctic Peninsula.

Principal Investigator: Enio B. Pereira, National Space Institute of Brazil - INPE/DGE, P.O.Box 515 - S.J.Campos, SP - Brazil 12201-970 - (enio@dge.inpe.br)

This project employs field-collected time-series data on atmospheric radon and aerosol to study the transport and dispersion of minor tropospheric constituents through the Antarctic continental border

A new atmospheric tracing technique has been developed based on the direct measurement of radon-gas, and is currently supplying time series data at three Antarctic sites, Ferraz, Punta Arenas and BTN. The study of the radiogeochemical cycle of radon in the atmosphere is accomplished by radiochemical analysis of ^{210}Pb deposited onto glass-fiber filters sampled by a high flowrate (1000 liter/min) pumping system. Supplementary data for radon flux from the ice-free terrain to the atmosphere is gathered by use of track-etching technique.

The project also provides real-time aerosol concentration data by operating all year round a condensation nuclei counter and by an Aethalometer for Black Carbon (soot) in Ferraz. Sampled filters are returned to Brazil for laboratory analysis. Continuos real-time measurements of Black Carbon were conducted at Ferraz between 1992 and 1997 by employing an aerosol absorption photometer. Simultaneous particle counting of aerosols with aerodynamic diameter larger than 0,014μm was made by using a Condensation

Nucleus Counter. The sampling site is located at about 2km from the principal station buildings in order to minimize the station's activity on the aerosol and BC data. The elemental composition of returned aerosol samples were performed by PIXE technique on stacked filters collected between 1985 and 1993.

Real time measurements of Black Carbon (BC) and aerosol particles between 1992 and 1998 averaged 6.5 ± 5.5 $ng.m^{-2}$ (range 0.1 to 40 $ng.m^{-3}$) and 2.2± 2.9 10^9 $particles.m^{-3}$ (range 0.02 to 71 × 10^9 $particles.m^{-3}$). Surges of BC up to a factor exceeding 5 are associated to the station's activities and ship's operation in the area. The total mass aerosols during summer averaged 3.78 $\mu g.m^{-3}$ for the fine mode (< μm) and 6.52 $\mu g.m^{-3}$ for the coarse mode (> 1μm). During the winter the fine mode average was 2.92 $\mu g.m^{-3}$ and 5.04 $\mu g.m^{-3}$. Three distinct sources for the local aerosols were discriminated based on the principal component statistics of the data: sea salt, soil dust and sulfates. The presence of Ni and Pb in the aerosols indicates a local impact of the station's activities on the local atmosphere.

Figure 2 depicts the time series of BC and aerosols after stripping the local sources. Both species exhibit a clear annual cycle but the BC concentration in the atmosphere presented a significant growth between July and September coincident with the biomass burning season in Brazil and Africa.

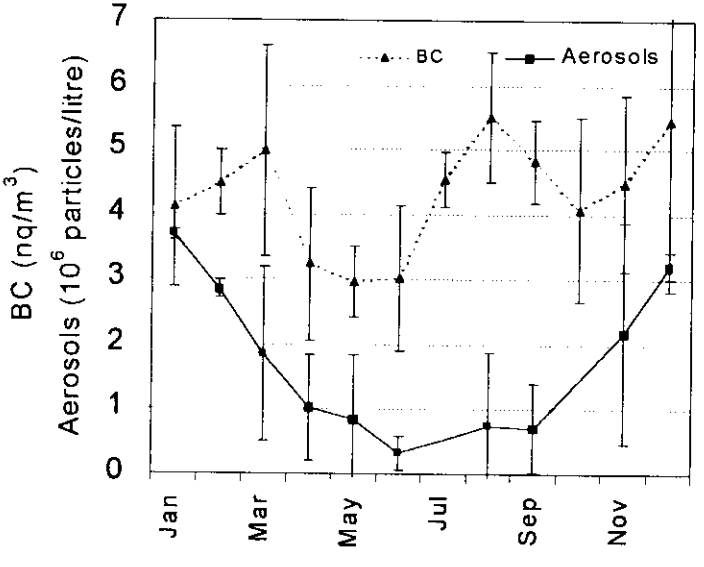

Figure 2 - Annual cycles for BC concentration and aerosol particle counting measured in Ferraz.

Concentration surges of radon are observed in Ferraz are associated with the warm sectors of deep cyclonic systems that pass between the Antarctic Peninsula and South America. These surges are generally characterized by an enhancement in ^{222}Rn as shown in the example of Figure 3. An accurate evaluation on the local contribution for the atmospheric radon revealed that although the ice-free terrain may explain the background radon at Ferraz, it cannot explain most of the large radon surges. Local radon flux to the atmosphere averaged $7.7 \pm 4.8 \times 10^{-2}$ atoms cm^{-2} s^{-1} for the ^{222}Rn which is very low compared to the emissions measured in other exposed terrain.

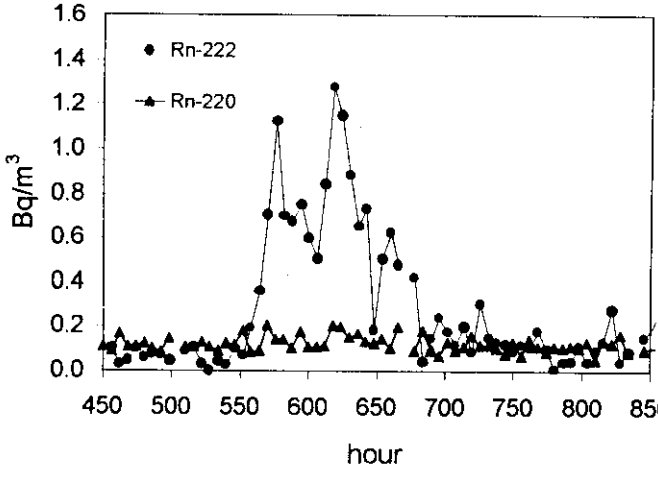

Figure 3 - Enhancement of the ^{222}Rn with respect to the ^{220}Rn activity due to the advection of air mass from South America in 1996 between 03/Aug to 14/Aug.

For the next two-year period the project is planning a field mission aiming at the study of the variation of radon, aerosols and Black Carbon along a profile between Rio de Janeiro (Brazil) and King George Island (Antarctic Peninsula) onboard the Ary Rongel Brazilian oceanography ship.

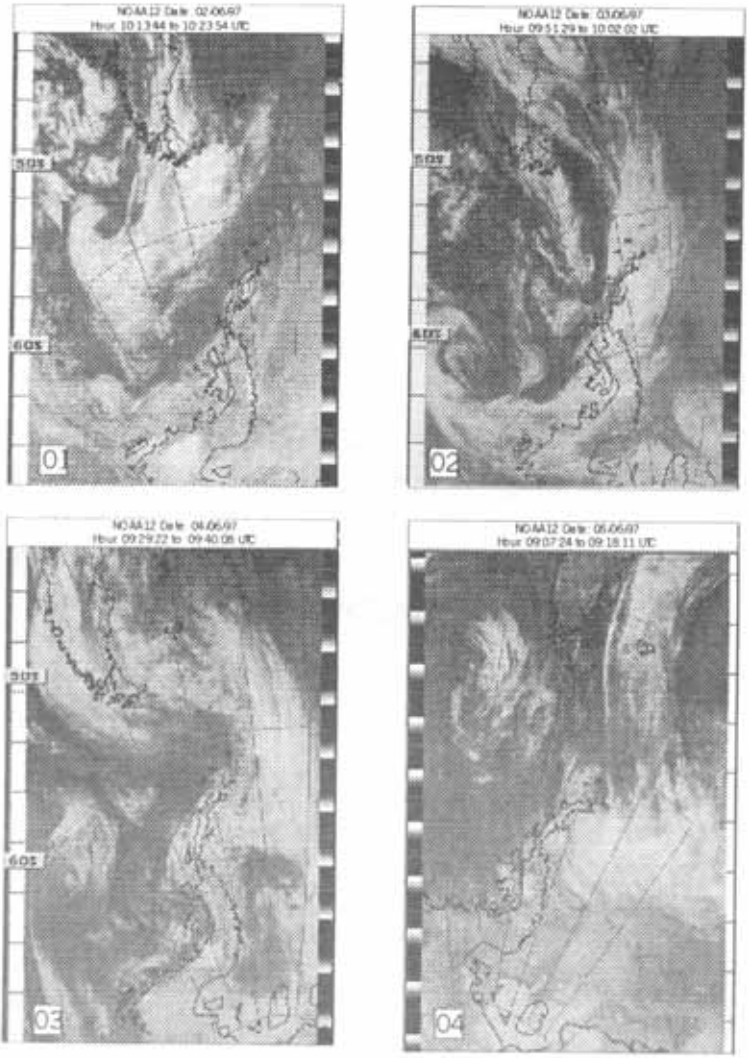

Figure 4 - Evolution of a cyclone observed by satellite responsible to the radon surges in Ferraz by advection of continental air from South America.

2) Meteorology at Ferraz Station.

Principal Investigator: Alberto W. Setzer, National Space Institute of Brazil - INPE/DSR, P.O.Box 515 - S.J.Campos, SP - Brazil 12201-970 - (asetzer@ltid.inpe.br).

This project aims at the supplying basic meteorological data related to the region of the North of the Antarctic Peninsula for atmospheric research and logistic operations. Brazilian meteorological research is related to the region of the north of the Antarctic Peninsula. The main current activities are: study of troposphere air mass; synoptic evaluation of extreme weather in Ferraz; regional pressure cycles; wind-chill measurements in humans; comparison of numerical weather forecasts and actual weather. The project operates a small unattended meteorological unit at Ferraz to provide the necessary support to field missions, and to provide bad-weather warnings. The project also operates automatic weather stations (AWS) in remote sites with direct data reception at Ferraz and also at the Brazilian Navy support/research vessel using the NOAA-ARGOS satellite system.

The project operates a wintering meteorology laboratory at Ferraz supplied with electronic weather sensors, data loggers, PCs, AVHRR APT and HRPT satellite image receivers, and HF/VHF radio, radio-facsimile and radio-teletype transceivers. Meteorological data are collected automatically every three hours and at other intervals under special needs; two weather charts and at least one APT image are stored daily. Data analysis follows meteorology and statistical procedures.

The four AWS are located at (see Figure 1):

King George Island (62° S - 058° W)
Joinville Island (63° S - 055° W)
Biscoe Island (66° S - 066° W)
Elephant Island (61° S - 054° W)

Since 1997 the remote AWS's collect data every second and store 10 min - averaged air temperature, wind speed and direction, and pressure. They are visited once a year for maintenance. Data is regularly received at Ferraz station and also accessed via satellite ARGOS/NOAA. Figure 5 shows the comparative annual variability of the monthly averaged wind speed and temperature at Biscoe, Ferraz and Joinville between 1997 and 1998. Joinville presents the highest monthly averaged wind speed registers (up to 15 m/s) and the lowest temperatures (down to –14 °C) than the station of Biscoe that is located further South.

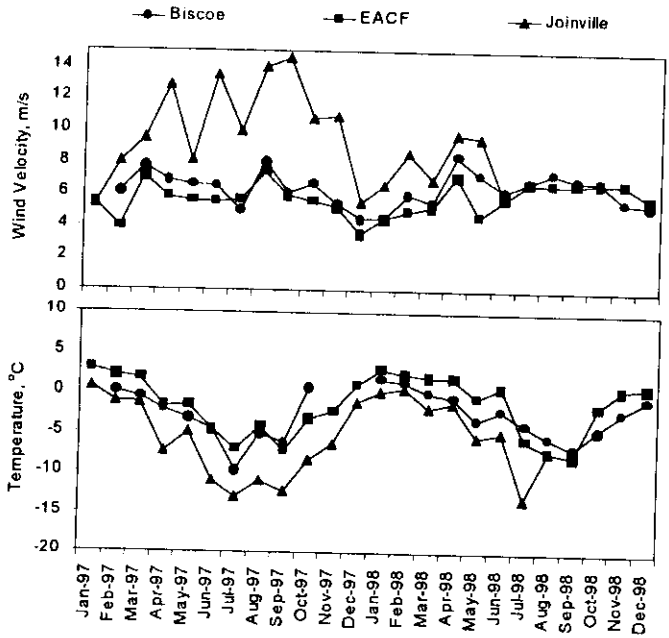

Figure 5 – Comparative averaged monthly variability of wind speed and temperature at three AWS's in the Antarctic Peninsula.

3) UV-B Radiation and Ozone in Antarctica.

Principal Investigator: Volker W. J. H. Kirchhoff, National Space Institute of Brazil - INPE/DGE, P.O.Box 515 - S.J.Campos, SP - Brazil 12201-970 - (kir@spd.inpe.br)

This project aims at the study of stratospheric Ozone and UV-B radiation (320 to 280 nm) both at the Antarctic Peninsula and at subantarctic regions. It also monitors the Ozone hole with particular emphasis on its impact on the South American continent and South of Brazil, using ozonesondes launched on balloons. Radiometers for broad and narrow band UV-B are employed. Total Ozone observations are also made by Brewer spectrophotometry. These observations are made at Ferraz (UV-B), in the city of Punta Arenas, Chile, and in Brazil. The ozonosondes are launched only during programmed field missions.

The UV-B is measured in Ferraz by radiometers (GUV) that measure the UV in four wavelengths 305, 320, 340, and 380 nm. UV-B measurements in Punta Arenas, Chile are made by Brewer spectrophotometers between 290 to 325 nm. UV biometers calibrated in MED (Minimum Erithema Dosis) are also employed due to the human-biological implications. Ozonosondes are launched only during programmed missions.

Figure 6 shows the representation of the ozone hole as seen in the city of Punta Arenas, Chile in October 1995. The plot shows the ozone variation as a function of the total ozone content measured by two different techniques: Brewer spectrophotometry and balloon soundings.

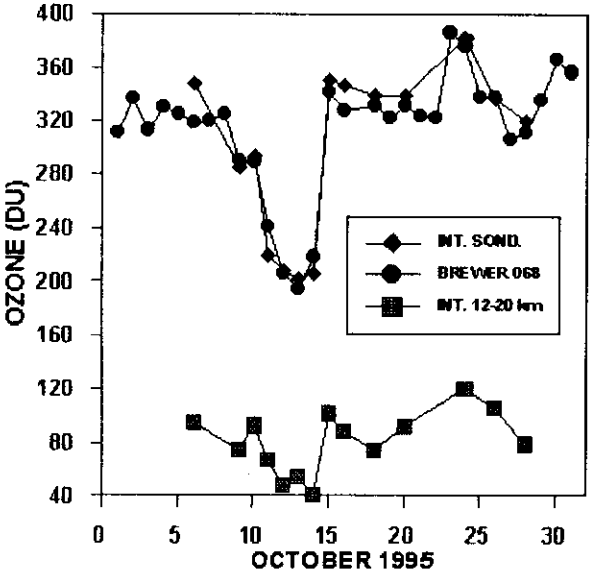

Figure 6 - Ozone hole over Punta Arenas, Chile in 1995.

Presently there a CD is available on request containing the data for the period 1992-1998. Data will be available in near future as daily index of UV. The correlation between the ozone and UVB can be seen in Figure 7 for the ozone hole event of 1998. UV-B data were measured by GUV radiometer, and the ozone is from the TOMS satellite.

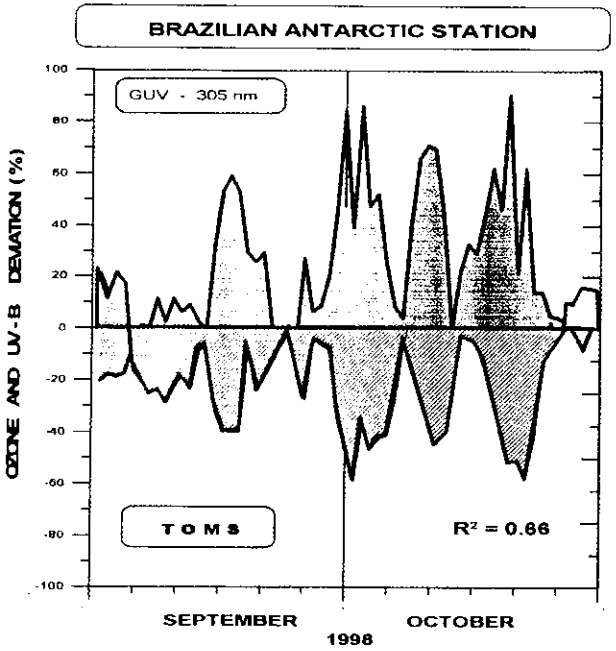

Figure 7 - Correlation between ozone and UV-B during the ozone hole event of 1998.

4) Study of the Greenhouse gases in the South Atlantic and Antarctica.

Principal Investigator: Plinio C. Alvalá, National Space Institute of Brazil - INPE/DGE, P.O.Box 515 - S.J.Campos, SP - Brazil 12201-970 - (plinio@dge.inpe.br)

This work aims at the study of greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), triclorine-fluormethane (CFC-11), and diclorinedifluormethane (CFC-12) in the South Atlantic.

It is a new project initiate the summer 1999-2000. Air grab are collected for laboratory analyses of CH_4 and CFC's, and real time measurements of CO_2 are performed onboard the Ary Rongel Brazilian oceanography ship between Rio de Janeiro (Brazil) and King George Island (Antarctic Peninsula).

During the period October/December of 1999, the project performed the first ocean campaign taking samples onboard the ship along the a profile of approximately 4,000 km route between the Brazilian city of Rio de Janeiro and King George Island. During this trip thirteen pairs of grab air samples were taken on stainless steel canisters by a pumping system, and taken back to Brazil for gas chromatography analyses of the greenhouse gases CH_4 and CFC's. CO_2 were real time analyzed by the infrared luminescence technique. A second campaign of sampling is in course (March/2000), in the King George Island-Rio de Janeiro trajectory.

5) VLF propagation at the Brazilian Antarctic Station.

Principal Investigator: Liliana Rizzo Piazza, Instituto Presbiteriano Mackenzie - CRAAE/CRAAM, Rua da Consolação, 896 - São Paulo, SP 01302-907 – Brazil - (lrpiazza@craae.mackenzie.br)

a) Trimpi events

The objective of this research project is to image spatial size and distribution of lightning-induced ionospheric disturbance over ~600 km baseline extending coverage of paths. Extended coverage of one of the most active regions on Earth, both geomagnetically ($2<L<3$, and near the South Atlantic Magnetic Anomaly) and geographically (conjugate to one of the most active thunderstorm centers). Observations of whistlers at Palmer with direction finding would allow investigation of role of ducted × non-ducted whistlers.

The Trimpi event is defined as an ephemeral perturbation on the VLF sub-ionosphere propagating signals due to an enhanced ionization patch generated by a burst of energetic electrons ($\geq$ ~ 40 keV) precipitated from the Van Allen radiation belts to the lower ionosphere, triggered by lightning. The classic Trimpi event at mid-latitudes ($2<L<3$) consists of a rapid (~1s) change in the amplitude and/or phase of the signal received from a distant VLF transmitter, followed by a relatively slower (~20-40s) recovery.

Trimpi events are jointly observed by two stations in Antarctica: Ferraz Station, L = 2.25 and Palmer Station, L= 2.4 (64° 46' S; 64° 03' W) under a collaboration between Brazil (INPE/CRAAE) and USA (Stanford University). The equipment employed in this research are 6-channel broadband amplitude VLF (9-90 kHz) receivers built at Stanford University coupled each one to two 1.7 m^2 Crossed Loops (N-S and E-W) antennas. Data automatically acquired by PC-type microcomputers and recorded onto CD for analysis.

Data acquisition started in January 1995 and is scheduled for 12h/day (00:00UT – 12:00UT). VLF signals recorded are NAA: 24.0 kHz; NPM: 21.4 kHz; NAU: 40.75 kHz NLK: 24.8 kHz; and ARG: 12.9 kHz. Figure 8(a) shows the NPM (Hawaii) 21.4 kHz – Ferraz Station (CF) propagation path. The amplitude is plotted in % FSR (full-scale range). The asymmetrical Trimpi events (rapid onset, slow decay) are clearly seen in Figure 8(b) throughout the 23 minutes interval observed on August 15, 1998.

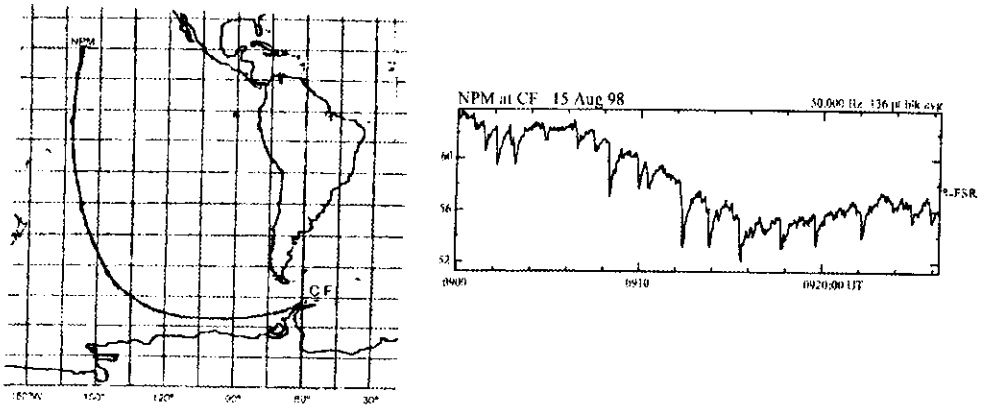

Figure 8 - Example of Trimpi plot - Narrow band. (a) NPM-CF propagation path (Cylindrical projection), and (b) examples of Trimpi events.

From April 96 to March 97 it was detected more than 4000 Trimpi events on the amplitude of NPM-Ferraz VLF propagation signal. The histogram of Figure 9 shows the seasonal variation observed at Ferraz Station.

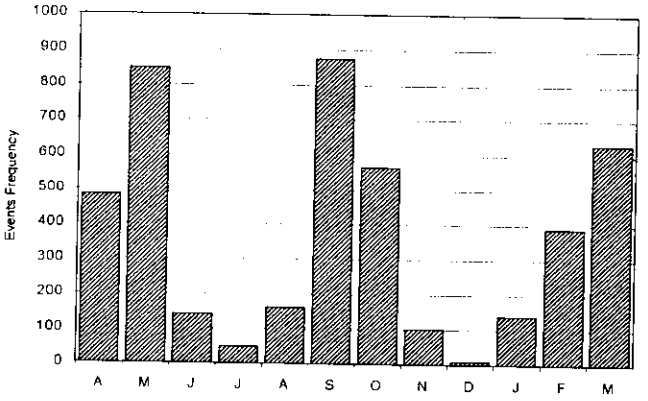

Figure 9 - Histogram of Trimpi events on the amplitude of NPM-Ferraz VLF propagation signal.

b) Gamma Ray flare

Using the equipment described above it was detected a very large event on August 27, 1998 at 10:22 UT. An extremely intense gamma ray flare ionized the exposed part of the earth's nightside upper atmosphere. The ionization level produced usually is found only during daytime. This was the first evidence of ionization in the earth's ionosphere by a star other than the Sun. The effect shows in Figure 10 were detected on NPM (Hawaii) – Ferraz

propagation path that was only partially in the dark. The recovery of the VLF amplitude indicated that the lower ionosphere was dominantly under the influence of the SGR 1900+14 gamma ray burst.

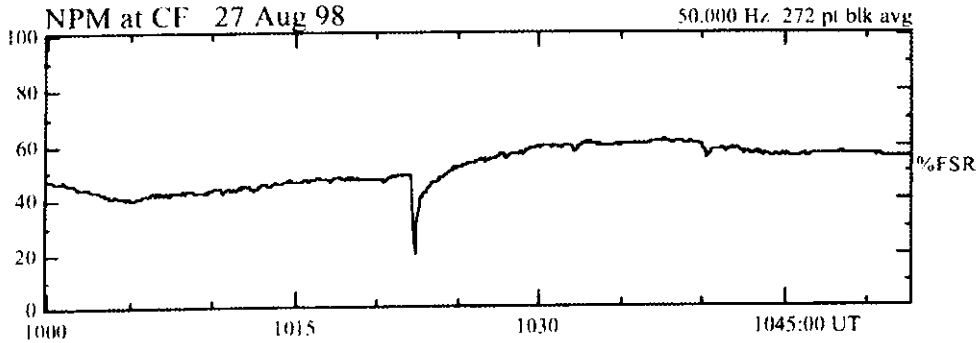

Figure 10 – The amplitude of NPM signal received at Ferraz Station (CF) on August 27, 1998 showing the effect of gamma ray flare.

6) Geomagnetic Research in Antarctica

Principal Investigators: Severino L. G. Dutra, National Research Institute of Brazil – INPE/DGE, C. Postal 515 – São José dos Campos, SP – Brazil, CEP 12201-970 – (dutra@dge.inpe.br); and José M. da Costa, University of Taubaté – UNITAU/DMF, Rua 4 de Março, 432 - Taubaté – SP – Brazil, CEP: 12020-270.

This project aims at the study of geomagnetic variations in the Antarctic region. The methodology includes the measurement of geomagnetic variations with ground equipment, as well as digital data recording and analysis. The equipment is operated continuously at the Ferraz Brazilian Antarctic Station. A high sensitivity, better than 0.1nT, ring core three-axis (H,D,Z) fluxgate magnetometer measures geomagnetic variations in the DC to 4mHz range, at each 2-min, 1-min or 30-sec interval, and a pair (X,Y) of magnetic coils measures variations in the 10mHz to 2.5Hz range at each 0.2s. Diesel generators provide the electric power for the fluxgate magnetometer from a distance of about 200 meters. The magnetic coils are installed at a most remote site (Refúgio-2), which counts with solar panels and a wind power generator for provision of electric power. The data analysis includes a search for dominant frequencies using Maximum Entropy Method-MEM and Fast Fourier Transform-FFT. The results are discussed taking account the interaction between the earth's magnetic field and the solar wind, as well as the dynamics of the radiation belts energetic particles.

Besides the continuous monitoring of the geomagnetic field variations at Ferraz, since 1984, the data analysis has revealed the recording of important global geomagnetic

phenomena as magnetic storms, as well as of space plasma localized phenomena associated with the occurrence of Pc1 (0.6–5s), Pc2 (5–10s), Pc3 (10–45s), Pc4 (45–150s) and Pc5 (300–600s) micropulsations. Some of these results are shown in Fig. 11 and Fig. 12, which display the plots of the geomagnetic diurnal variations observed at Ferraz with the fluxgate magnetometer for the periods of October 31-November 5, 1993 and February 23-26, 1994, respectively. Fig. 13 a-d also show the east-west and the north-south raw data measured with the magnetic coils at Ferraz remote site from about 1247 UT to 1610 UT on August 26, 1997. The dynamic spectra were calculated for Pc5 geomagnetic micropulsations observed during October 31–November 5, 1993 and February 23–26, 1994, and for Pc1, Pc2 and Pc3 micropulsations observed on August 26, 1997 from about 1247 UT to 1610 UT.

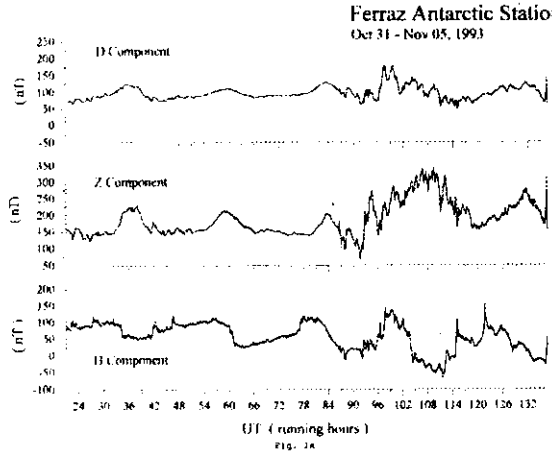

Figure 11 - Geomagnetic diurnal variation for Oct. 31-Nov. 05, 1993.

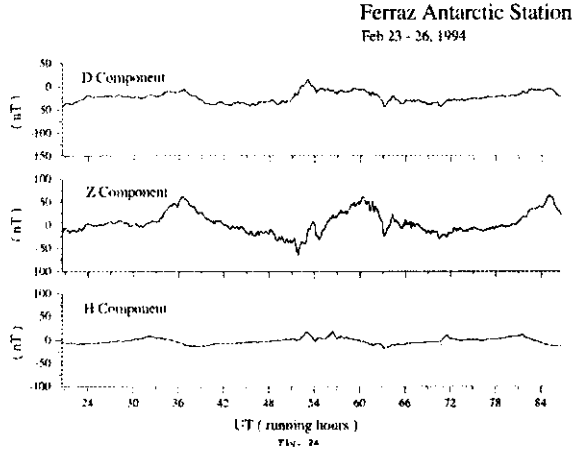

Figure 12 - Geomagnetic diurnal variation for Feb. 23-26, 1994.

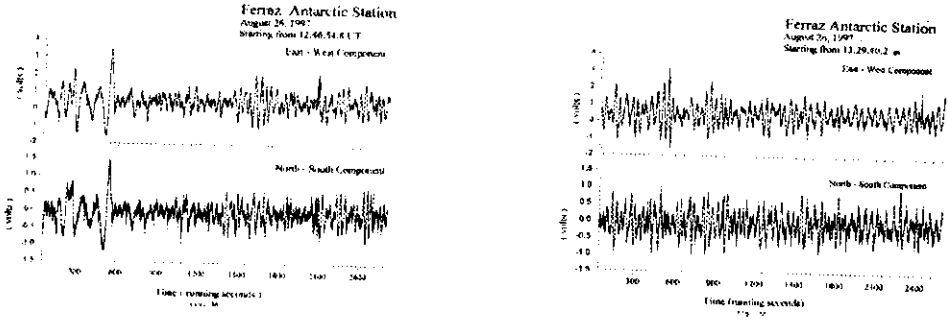

Figure 13 - East-West and North-South component variations from 1247UT to 1610UT on August 26, 1997.

The project plans the implementation of a new geomagnetic station at Punta Arenas by year 2001. It is expected that the simultaneous operation of Ferraz and Punta Arenas stations will allow the study of field line resonances at low geomagnetic latitudes.

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