

## THE PIRATA SOUTH WESTERN EXTENSION

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### 1. INTRODUCTION

The PIRATA project is a three-party initiative involving Brazil, France, and the United States to assemble a pilot array of moored buoys to monitor the physical processes in the interface between the atmosphere and the upper ocean over the tropical Atlantic. The array was designed to gather a comprehensive collection of data to understand the dominant modes of variability of the coupled ocean-atmosphere system over the tropical Atlantic on time scales varying from intra-seasonal to inter-annual and longer. The array was composed by 12 ATLAS systems during its pilot phase (1997-2000) and 10 systems during the consolidation phase of the project, which will last five years, ending in 2005/2006. Afterwards, the project will be evaluated to become a permanent contribution to the Global Ocean Observing System (GOOS).

During the establishment of the original PIRATA backbone it was anticipated that future regional extensions would be expected to further the scientific scope of the project and to improve the understanding and predictions of regional climates.

The scientific reasoning for the PIRATA SWE lies on three main phenomena: (a) the coupled interactions between the SW Atlantic SST and the South Atlantic Convergence Zone (SACZ), for which there are both observational and modeling evidence of a strong SST-cloud-solar-radiation-SST coupling; (b) the formation of a Southern Intertropical Convergence Zone (SITCZ), which is linked with horizontal gradients of SST and wind divergence between the cold tongue area over the eastern equatorial Atlantic and the southwestern equatorial Atlantic at 8°S, 30°W; and (c) the advection of eddies by the South Equatorial Current (SEC) into the region of western boundary currents system formed by the Brazil Current (BC), the Northern Brazil Current (NBC), and the Equatorial Under Current (EUC). Items numbered (1) and (2) above are likely to have a direct effect on regional climate variability in Brazil. Item (3), while is also likely to interfere on the local climate, is also relevant for the study of the global climate as it is linked to the Atlantic

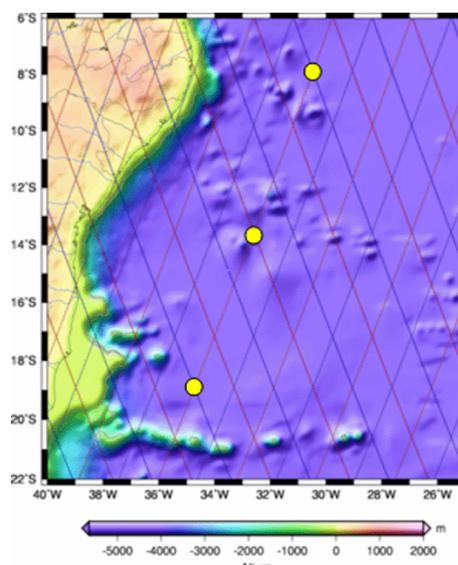


Figure 1 – Positions of the PIRATA SWE ATLAS systems (yellow circles) superimposed on SW Atlantic bathymetry and the altimetry satellites Jason (red lines) and T/Posseidon (blue lines) ground tracks.

Meridional Overturning Cell (MOC), a key element of the global climate.

On examining the dynamical/thermodynamical relations leading to the formation of these phenomena, it is hypothesized that one dimensional surface heat flux is the dominant mechanism modulating SST variability over the southwestern tropical Atlantic.

The proposed array of three ATLAS buoys (Fig. 1) follows a southwest-northeast orientation between approximately 19°S, 35°W and 8°S, 30°W, along a ground track of Jason altimetry satellite. This configuration will make it possible to compute the geostrophic advection of salt and heat by the SEC, thus allowing us to monitor the temporal variability of buoyancy advected into the region. Local measurements of T-S vertical profiles of the upper ocean will contribute to improve the heat storage anomalies estimates in the region, which along with

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## The PIRATA SW Extension

the inference of the heat exchanged with the atmosphere and advected by the SEC shall represent an important contribution to close the ocean heat balance over the region. Locally well resolved T-S profiles will contribute to calibrate sea surface height (SSH) estimations obtained regularly by altimetry satellites, thus contributing to identify and characterize the planetary scale ocean waves over the region.

The logistics to implement and operate the PIRATA SWE counts heavily on Brazilian resources (e.g. DHN's ship time and mooring expertise; INPE's data collection satellites and data streaming through PIRATA Brazil's home page; IOUSP's oceanographic laboratorial capabilities; FUNCEME's climate applications) and the time honored partnership with NOAA to build and maintain the necessary new ATLAS systems.

The establishment of the PIRATA SWE shall be a valuable contribution to understand not only the regional climate variability, but also its interconnections with the global climate. Combined with other international research projects already taking place over the SW Atlantic, the proposed extension shall help to determine the partition of salt and heat that recirculates over the South Atlantic and which is transported to the North Atlantic.

## 2. RESULTS

In order to investigate the usefulness of the PIRATA SWE data for climate and ocean studies over the southwestern Atlantic, the first month worth of temperature and salinity data was used to compare with a forced run of the Modular Ocean Model. The comparison shows a striking resemblance of vertical profiles of temperature (Fig. 2) over all three sites. On the other hand, PIRATA SWE salinity profiles reveals that South Atlantic is too fresh in the model simulations (Fig. 2).

The reasons for such discrepancies of the salinity field over the South and Southwestern Atlantic in the model simulation has not yet been diagnosed. Comparisons between observed and simulated T-S profiles over other equatorial and northern tropical Atlantic PIRATA sites (figures not shown) show a generally good agreement, exception made for temperature profiles over the eastern equatorial Atlantic, where the model thermocline is too diffuse and, consequently, the surface layer is too deep, resulting in strong warm SST bias over the region.

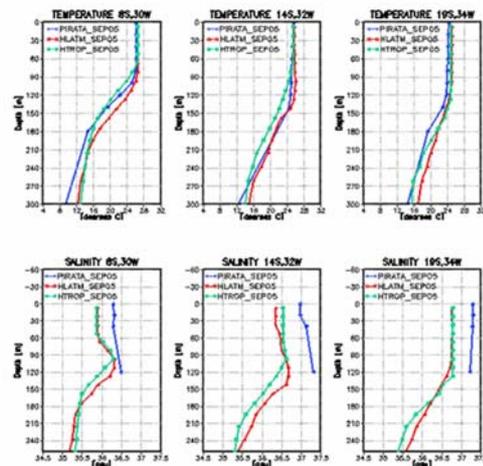


Figure 2 – Temperature (upper panels) and Salinity (lower panels) profiles at the three PIRATA SWE sites at 8°S, 30°W (leftmost column), 14°S, 32°W (center column) and 19°S, 34°W (rightmost column) for September 2005. PIRATA data in blue, MOM\_3 profiles in red and green. Y-axis is depth (meters); x-axis are temperature (°C) and salinity (upper and lower panels, respectively).

## 3. CONCLUSIONS:

All three ATLAS buoys of the PIRATA Southwest extension were successfully deployed in August 2005 by the Brazilian team of engineers from INPE engaged on the PIRATA Project and the officers from the Directorate of Hydrography and Navigation (DHN) of the Brazilian Navy on board of the R/V Antares. All instruments have been transmitting via both Service ARGOS and the Brazilian data collection satellites SCD, with near real-time decodification of the transmitted data at INPE. The data collected in near-real time are available via internet at CPTEC web page at <http://www.cptec.inpe.br>, as well as the NOAA PIRATA site at: [http://www.pmel.noaa.gov/tao/data\\_deliv/deliv-pir.html](http://www.pmel.noaa.gov/tao/data_deliv/deliv-pir.html)

The preliminary modeling work done with the first ever monthly values of observed T-S profiles at the PIRATA SWE sites indicate the usefulness of the data for detailed oceanographic and meteorological studies over the SW tropical Atlantic Ocean and South America.