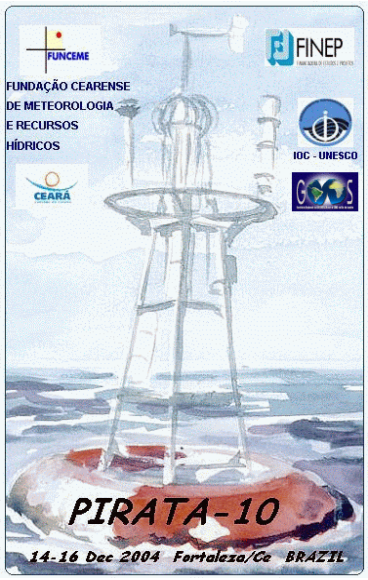
PIRATA-10 Meeting

13-16 December 2004

Hotel Luzeiros
Fortaleza, Cearà,
Brazil



REPORT OF THE MEETING

Introduction

This document contains the summary of the presentations, discussions and main conclusions of the PIRATA-10 meeting, which was held at Hotel Luzeiros, in the city of Fortaleza, Cearà, Brazil, days 14-16 December, 2004.

The meeting was hosted by Fundação Cearense de Meteorologia & Recursos Hidricos (FUNCEME), with the special invitation of the President of FUNCEME and the Secretary of the Science & Technology Administration of the Cearà's state. The event was sponsored by FUNCEME, FINEP, IOC-GOOS, Brazilian Marine, and Ceará State Government.

About 50 people attended the meeting, from 6 different nationalities.

The final agenda of the meeting is presented in the Appendix 1. The list of the participants is presented in Appendix 2.

Most of the presentations can be directly accessed on the PIRATA home page of FUNCEME (this page) by clicking on their code names (ex. **PIR10-ST01**).

DAY 1: December 14, 2004 - Morning
Chair: Antonio Divino Moura; *Rapporteur: Paulo Nobre*

Opening Ceremony

The meeting was opened by:
- Hélio Guedes de Campos Barros (Secretary of Sciences & Technology do Ceara, - SECITECE)
- Jáder Onofre de Morais (Universidade Estadual do Ceará - UECE),
- Francisco de Assis de Souza Filho (FUNCEME)
- Vice-Almirante Lúcio Franco de Sá Fernandes (Diretoria de Hidrografia e Navegação - DHN Marinha do Brasil)
- Jacques Servain (PIRATA-SSC)
- Paulo Nobre (CPTEC-INPE)
- Michael Johnson (PMEL-NOAA)
- Jacques Boulègue (IRD)

International and National Status and Supporting Institutions of PIRATA (original array)

PIRATA International Status: *Jacques Servain* (PIR10-ST01)
Introductory slides about the PIRATA birth and evolution; the program must be evaluated toward its continuation.
The agenda of the meeting was introduced.
PIRATA present array is shown.
PIRATA cruise schedule, 2001-2005: on the average, BR+FR: 45 days/year of ship time.
Status of actual array: 2 buoys lost in May 2004 (at 0°E and 10°W along 0°N) on the total of 10.
Real time data return varies from 36% (0°N-10°W) to 88% (6°S-10°W); average of 72% for the whole array. Data return plots were also shown for each variable.
PIRATA data requests increased from 4K in 2001 to 16K files delivered in 2004.
Total of 41 articles related to PIRATA published in international journals; 12 oral communications during Montreal AGU meeting 2004, Special Session PIRATA.
The need for the renovation of the MoU was noted.
Proposed PIRATA extensions: PIRATA-SEE, PIRATA-SWE; AOML/NOAA forthcoming ATLAS buoys over the N and NE Tropical Atlantic were also mentioned.
Dream: logistic basis in Natal using a dedicated ship to service the whole array.

PIRATA-Brazil Status: *Paulo Nobre* (PIR10-ST02)
Presentation of the main achievements of the Brazilian component of the PIRATA project during 2003-2004.
The synthesis of this presentation follows:
- 2003: PIRATA-BR-VI Oceanographic Commission (5 ATLAS buoys serviced with success); creation of the PIRATA Brazil National Committee: INPE, DHN, IOUSP, FUNCEME.

- 2004: PIRATA-BR-VII Oceanographic Commission (5 ATLAS buoys serviced with success); PIRATA BR Federal funding (PPA) established; Met. Station at SPSP Archipelago installed and operated by INMET, INMET joins in PIRATA-Brazil National Committee; ATLAS buoy data collected (using Brazilian SCD/CBERS and TIROS satellites), decoded by INPE and distributed at CPTEC Web page.
Upgrade of DHN's ship Amorim do Valle for ATLAS buoy operations.
Creation of the Climate & Ocean Research Laboratory at INPE/Natal/Fortaleza.

PIRATA-France Status: ***Bernard Bourlés*** **(PIR10-ST03)**

France maintains and monitor 5 ATLAS buoys over the central and eastern Atlantic; 12 French cruises were done during the whole of PIRATA project (from 1997).
PIRATA status in France: PIRATA is part of "Observatoire de la Recherche pour l'Environnement", funded at 63K Euros per year; Total Funding 2003: 71K Euros; 2004: 104K Euros.
Description of PIRATA-FR11, 11b, 12 and 13;
December 2004 cruise was canceled due to the lack of funding;
Ship time: 141K Euros for 2003 and 2004; 600 days of men work;
PIRATA-FR12 cruise: difficulties presented (custom, delays on transportation… cruise very hard and stressing, to prepare and rather hazardous); cruise cost: 90K Euros.
ADCP data at 0°N-23°W from Dec 2001 to Dec 2002; nothing in 2003;
Planned works done during mission EGEE/AMMA; Deploying 0°N-23°W ADCP, both upward (PIRATA data) and downward looking, 15 CTD in Gulf of Guinea, 116 XBTs.
Problems in Gulf of Guinea: fishing activity & vandalism; two equatorial moorings destroyed (May 2004) at 10°W and 0°E; lots of fishing lines, anemometers destroyed…
Research vessel time availability: R/V Antea out of order since fall 1999. PIRATA cruises and its scientific program have to be evaluated yearly by national programs and vessel time committees in France.
For 2005, IRD will pay 70K Euros in order to charter R/V Suroît.
Links with AMMA & EGEE: Sao Tomé Met station installed in October 2003, failed in December 2003; reinstalled in August 2004;
In the framework of operational oceanography in France: should merge with Coriolis, Mercator, Argo/Godae, TSgraphs/XBTR BOS networks, etc, in order to: involve IRD & Météo France, to get systematically attributed some vessel time; enlarge potential funding;
The scientific committee of Mercator/Coriolis endorses PIRATA-France.
Other perspectives possible thanks to PIRATA ATLAS moorings:
PCO2 measurements: 2005: tests in Brest, 2006 installation of 1st system at 6°S-10°W; 2007 at 4°S-38°W.

PIRATA-USA Status: ***Mike McPhaden***

ATLAS mooring provided: 10; 39 cruises days; PMEL person-days at sea:18;
Data delivery: User Requests: 1946 (2003), 2839 (2004); increase of 46%;
Files Delivered: 12,592 (2003), 13,559 (2004); increase of 8%; represents about 10% of TAO deliveries.

Data return: real time 71%, which represents 13% less than TAO (for the entire program), All sources: 78%, (10% less than TAO), mostly due to Gulf of Guinea problems;
Wind and rain are generally lower data return: easily vandalized; real-time and delayed mode data return different due to internal storage.
Data on GTS (salinity) will be available in the near future;
Argos disc crash on 7 October 2004: loss of PIRATA and TAO data from GTS for two weeks.
For 2005: support PIRATA cruises by BR and FR.
Replace 0°N-0°E and 0°N-10°W
Change Argos transmit winds from 8 to 16 hours/day.
Introduce grounded anemometers and shielded rain gauges to improve wind and rain data quality and quantity;
Provide 2 ATLAS mooring for the PIRATA-SW Extension (Brazil)
Provide ATLAS moorings for NOAA/AOML as part of TACE;
Plans for upgrade for 3 PIRATA sites (15°N-38W; 0°N-23°W; 10°S-10°W) as part of Ocean Sites for Interdisciplinary Environmental Studies (OceanSITES); Improved surface flux estimates; Interdisciplinary time series reference
Issues:
Shipping: equipment must return to PMEL at least 4 months before next cruise; At least 2 months required for shipping from PMEL.
Need to improve communications between PMEL and BR/FR contacts.
Ship time is a real issue and makes a real impact on the amount and quality of data
Cruise scheduling;
Training of Brazilian technicians: need to develop training program for Brazilian technicians.
Shipboard CTD data needed for timely processing for moored salinity data. Most recent available is from Jan 2003.
Data policy: free, unrestricted, and timely access (delayed mode data from ATLAS and ADCPs should be available on the PIRATA Web sites six months from the time that the data are recovered.
PMEL is testing sonic anemometers.
Loss of mooring and poor data return in Gulf of Guinea: consider alternatives in context of overall observational systems. What do we do in the GG?
PIRATA continuation after 2005: Does PIRATA + extensions = ideal PIRATA? Large areas of South Atlantic not covered.
Coordination of PIRATA extension. Funding, ship time, cruise staffing.
Accommodate and encourage piggyback projects: important to bring a larger community into the PIRATA framework
TAO transition: moving to NDBC.

Institutional Presentations

FUNCEME: ***Nilson Campos*** **(PIR10-ST05)**
FUNCEME is focused in climate applications.

Showing aspects of the interannual variability of rainfall over Ceará; annual cycle of Jaguaribe river flow;
Climate and forecast are in the blood of the Cearense.
FUNCEME created in this context: brief history of FUNCEME, from artificial nucleation of clouds to dynamical predictions of climate variations.
Then showing challenges to reach FUNCEME's goals, and the coming of the PIRATA project.
Describing PIRATA office at FUNCEME and PIRATA products at FUNCEME Web page

IOUSP: ***Edmo Campos***
Participation in PIRATA; training and education; also IOUSP has a center for calibration of oceanographic instruments; recent meeting with IOUSP Director resulted broader involvement of IOUSP in PIRATA. First sign of such participation will be sending IOUSP engineering to PMEL for training on instrument calibrations; IOUSP also can contribute to build oceanographic buoys, assimilating technical know how of ATLAS buoys construction and deployment.

INMET: ***Antonio Divino Moura***
Joined PIRATA-BR and PIRATA-SSC just recently. Installed Met Station at SPSPR in partnership with DHN. Soon will install tide gauge and water temperature sensors. Difference of Met station at SPSPR is that it is in actual real time data availability (at INMET Web page); Will include more people from INMET to make the program institutional.

IRD & Météo-France: ***Jacques Boulégue***
PIRATA France funding is 700K Euros/year. Due to a recent turmoil between some French researchers and the Ministry for Research, a degree of uncertainty now exists for the funding of international projects such as PIRATA. But new ways are being sought to secure French funding for PIRATA on a multiyear basis.
PIRATA is not very well conceived in France, because most of the money goes to Laboratories.
PIRATA/Coriolis (IRD, CNS, Météo-France, French Navy) qualify data as important.
Mercator is lobbing to have PIRATA into Coriolis, which will be good, because will attract the interest of agencies as Ifremer, which is still not part of PIRATA.
The problem of availability of ship time for servicing the PIRATA network: This is still not well secured on the long range. Within the next two years IRD has obtained an increase of ship time in the area of Gulf of Guinea. This is thanks to the special observation period of AMMA, devoted to the intensive study of the African monsoon. On the other hand, the R/V Antea will not be yet available in year 2005. She is now in Dunkerque harbour (North of France) ready for the installation of a new motor. The final works, especially devoted to the installation of equipments devoted to PIRATA will not be done before 2006. Due to the non availability of R/V Antea, IRD has proposed extra funding to rent ship time from Ifremer, so as to service the PIRATA network.
The assimilation of PIRATA data in Mercator is well underway thanks to Fabrice Hernandez who will present some results during this 2sd scientific meeting.

Both IRD and Météo-France are very willing to continue the support to PIRATA. We have also to raise the interest of other French agencies in participating to PIRATA, be it from the point of view of research or from the point of view of building an operational approach of oceanography.
It is also important that PIRATA partners have a voluntary polity to extent the set of partners to other countries bordering the Atlantic ocean. J. Boulègue stresses this point because of a some actual lack of interest from the African countries. NEPAD, the New Partnership for African Development is very willing to develop research and technology. Neither oceanography, nor climate related research seems to be among the priorities of NEPAD. It is important that IRD and its partners make efforts to convince NEPAD to consider some priorities related to ocean sciences and related climate research in the scope of a voluntary participation to programs such as PIRATA.
The final word is to express again the hope that the cooperation induced by PIRATA will continue and will be expanded, and to insure that IRD and Météo-France will do their best to secure PIRATA.
Next year is going to be very difficult for us, but we will try to find the needed funding for the next year's activities.

NOAA-OGP: ***Mike Johnson*** **(PIR10-ST06)**
NOAA remains very committed to the PIRATA project: contribution to the Global Observing System. For both research and operation activities;
Office of Climate Observation/OGP mission: build and sustain a Global Climate observation system.
Objectives: long term sea level change, ocean CO2, …
Required capabilities: global coverage, continuous satellite missions, data assimilation.
GOOS for climate: An effort of the proposed magnitude must be organized, integrated, and managed as a system in order to be effective.
Project Office structure described: International coordination is central; 59 members contributing; 18 Centers of expertise; 148 people involved in NOAA with the program.
NOAA support to PIRATA: Supply 2 ATLAS System / year for backbone, technical expertise, Argos data transmission, Data processing.
PIRATA-NE Extension: 2 ATLAS Systems per year (ship time is uncertain)
NOAA team: PMEL, OGP, AOML (developing) NDBC (developing)
NOAA is very committed to the PIRATA Project.

NDBC: ***Don Conlee*** **(PIR10-ST07)**
We are within NOAA (Mississippi), Has ~90 buoys, 60 coastal marine stations, 800+ VOS, ocean profilers, TAO Array and DART buoys.
Several kinds of buoys shown.
Upcoming expansions: ADCP and surface salinity to 14 buoys and 6 coastal marine stations, because hurricanes.
Planed 4 buoys at 14°N (6m buoys); possibility of synergy with PIRATA
Extensive calibration and validation capabilities;
QC data 24h/M-F/4-5 persons;

TAO Transition: smooth, customer should not notice the change (phased within 3+ years)
NDBC and PIRATA: when operational declared, the role of NDBC will set in.
We are an experienced marine observation organization, substantial in QC, calibration/validation and data communication (hourly/30min);
Looking forward to working with PIRATA partners.

IOC/GOOS: ***Janice Trotte*** **(PIR10-ST08)**
Milestones from the Rio de Janeiro IOC-GOOS office toward core elements of the tropical and South Atlantic observation systems.
PIRATA: time gauge in SPSP archipelago; ship time from a second vessel; help with preparing national meetings;
GLOSS: Complete review of National tide gauge network; need a complete upgrade on equipments in the regional domain;
Showed national network of tide gauges; but instruments must be replaced;
Next generation tide gauge installed in Salvador; providing data in real time; pictures shown.
Argo: Argentina has already deployed a few Argo floats; Brazil will follow on soon.
Ship's time for PIRATA and ISABP: Under severe constraints, Brazil secured oil for the missions this year.
DBCP/ISABP: 15 buoys deployed by Brazil, contribution from NOAA;
HEAT Transport variability in the upper structure of the South Atlantic: XBT high-density lines: BR: from Victoria to Trinidade island
Main objective of having IOC-GOOS/office in Rio de Janeiro is to increase communication and outreach; had a kick-off meeting in Buenos Aires,
Main characteristics: started from existing pilot activities; natural enhancements of communications among countries…
Also shown field projects: SACC,…
For the future: data on the GTS increasing, support for ship operations, international collaboration is essential for the success of this project in the region.

CLIVAR: ***Tony Busalacchi***
CLIVAR is the major program dealing with variability and predictability of the climate system.
Past year, highlight Baltimore (USA) meeting: 650 participants, 56 countries, 650+ posters, 35 oral presentations, 80+ students…
Key outcomes of CLIVAR activities: creation of sustained demands for global ocean and atmospheric observation,
St Raphael (France) Conference; Extension of buoy arrays into the Atlantic; Developing India climatology observing system; New focus on ocean climate re-analysis; Simulated model development; Routine operational seasonal forecast, forecast system, inter-comparison; Ensemble prediction; Experimental decadal predictions; Global change model scenarios underpinning IPCC; Focus on American monsoon system.
Science Foci: regional analysis of global model outputs; links to process studies and model improvement.
Ocean observation strategy including hydrography and carbon links.

Global view of CLIVAR: from global modeling & observation to regional, and vice versa
Management: …
Think globally, act regionally: Global observation, synergy …
CLIVAR Atlantic activity relevant to PIRATA.
Formation of the Global Synthesis and Observation Panel (GSOP).
Development of regional/basin climate metrics for climate monitoring and model assessment (NINO3, NAO); but what for the Atlantic, assessing how our models are doing.
OOPC has indicate coordination between PIRATA and TACE.
OOPC urged review of PIRATA
Atlantic Panel review of TACE asked: What have we learned from PIRATA?
CLIVAR Atlantic relevant to PIRATA: significant enhancement of sustained observation in the tropical Atlantic.
Major effort to reduce systematic errors in simulation of tropical Atlantic climate models used for seasonal prediction.
Research to understand better the fundamental ocean-atmosphere-land processes to control climate on the tropical Atlantic; Improvement of data assimilation system; Develop reliable method for seasonal forecast (PIRATA is relevant for all above.
PIRATA has made strides in the past but significant challenge loon ahead for the future.

DAY 1: December 14, 2004 - Afternoon
1st Chair: Tony Busalacchi; *Rapporteur: Edmo Campos*

A) Presentations of new PIRATA Web sites and discussions about the PIRATA Deliverable Products and PIRATA data policy

PIRATA Web site at FUNCEME: ***Jacques Servain*** **(PIR10-ST09)**
Presentation of the new PIRATA Web Site at FUNCEME, which provides PIRATA daily products retrieved from PMEL Web site (in Portuguese language). These products include more than 300 original graphics in different format (chosen by the user), and two representations of the tropical Atlantic dipole. All the original plots are monthly updated at FUNCEME. (www.funceme.br/DEMET/pirata/pirata.htm).
Question:
- Tony Busalacchi: Are the original plots regularly updated? R: yes, monthly.

PIRATA Web site at COI/DHN: ***Janice Trotte*** **(PIR10-ST10)**
Presentation of the new PIRATA Web site at COI/DHN (http://goos.io.usp.br/), with the help of colleagues from INPE and IOUSP. This site is yet under way.
Questions:
- Mike McPhaden: asking about the existence of a ways of tracking how many people has downloaded the data.
- Tony Busalacchi: asking bout who would be using the website (type of users, government, private sector, …).

PIRATA Web site at IRD-Brest: ***Bernard Bourlés*** **(PIR10-ST11 and PIR10-ST12)**

PIRATA on the Web and PIRATA deliverable products in France (http://www.brest.ird.fr/pirata/piratafr.html). Also includes data and graphics during PIRATA French and Brazilian cruises (ADCP, SST, SSS, CTD vertical profiles). Data for all French PIRATA cruises available; data for Brazilian PIRATA cruises available only through PIRATA-BR-V.

ADCP mooring at 0°N-23°W started from December 2001 to December 2002. Nothing in 2003. Redeployed in Feb 204. Will be retrieved and redeployed in May 2005. ADCP mooring at 0°N-10°W is not included in the PIRATA Data.

Tide gauge maintained by IRD since 1980s at São Tomé Island (0°N-6°E), and data available on the French PIRATA Web site.

Discussion on PIRATA Data Policy:

Bernard Bourlés: No problem for ATLAS data; problems with the two last Brazilian data cruises (ADCP and CTD). Problem with ADCP at 0°N-23°W.

How to define PIRATA data? Not precisely defined in the PIRATA MoU.

Exemple: cruises PIRATA/EGEE en 2005-2007 (high frequency XBT, sea surface sampling of C02, nutrients, 018 and C13 done by EGEE … are they must include in PIRATA?)

Questions:

- Mike McPhaden: Core/TAO data: ADCP, ship collected data during the PIRATA cruises, if not in real time in delayed mode. Data should be available within 6 months. Data not collected by other people is a grey area. Issues for other program, not PIRATA business.
- Tony Busalacchi: Should we come out from this meeting with a clear indication of what is PIRATA data.

Some ship data are likely to be and others not. It was proposed a session for discussing data policy.

B) Presentation of the Science and Implementation Plans of the PIRATA Extensions + Related Projects

PIRATA-SEE: ***Mathieu Rouault*** **(PIR10-ST13)**

Proposed ATLAS mooring sites: 5°S-8°E and 10°S-11°E. PIRATA-SEE white paper sent to PIRATA-SSC in June 2003. Three external good reviews (end 2003). Feasibility study report sent to BCLME. BCLME = 15 M US$ for 5 years.

Why PIRATA-SEE? Warm oceanic events off Angola are linked to floods in coastal Angola. When low oxygen nutrient with warm water penetrates in the upwelling system of the Benguella-Angola system (“Benguella Niños”) they have a negative impact on fisheries. Looked in different models (SST variability).

PIRATA-SEE Status: Waiting for PIRATA endorsement. Proposed a demonstration project. Presently do not have a ship. Had a workshop recently everyone was in favour.

Question:

- McPhaden: Science is good. Societal justification sounds well. Come back from Peru where they lost lots of money due to vandalism. Peruvians tried and had no

success in avoiding vandalism. Even in not upwelling region. What are the other approaches which do not require mooring? Think about alternatives.

PIRATA-SWE: *Paulo Nobre* (PIR10-ST14)

Objectives: increase skill of climate prediction in the region. Mechanisms to be studied : S-ITCZ, western Atlantic warm pool, Eastern Nordeste seasonal rainfalll predictability, SACZ-SST feedback process.

Questions:

- Tony Busalacchi: How advection will be computed? R: using geostrophic calculations.
- JacquesServain: Is there funds for buoys acquisition? R: Yes, partially, from Brazil.

Possible N and NE PIRATA Extensions: *Rick Lumpkin* + Claudia Schmidt

Overview of the motivation (TAV). Seasonal, interannual, decadal heat budget (advection, entrainment, surface heat fluxes)

Impact of PIRATA mooring on time series of temperature. Given an example: large error bars in the heat storage estimates, both in N and S tropical Atlantic.

Proposition: 4 additional ATLAS moorings : two along 20°N (40°W and 23°W), two south of 20°N along 23°W (at 15°N and 5°N); Repeat hydrography section along 23°W, across the equator. 2 deg resolution drifter program.

Questions:

- Jacques Servain: could they recover/redeploy mooring at 0°N-23°W? R: ??
- Tony Busalacchi: asking about ship time for the NEE.

TACE Program: Bill Johns (PIR10-ST15)

Reference: Tropical Atlantic science meeting in Oct 2005 at Venice.

Goal: to advance in the understanding of coupled ocean-atmosphere key processes (atmospheric structure and ITCZ response to SST, SST gradient mode, surface fluxes, Benguela Niño's, large oceanic circulation and its role in TAV, STC variability, …) and improve climate prediction in the tropical Atlantic.

A 5-year program.

Priority study region: Eastern central-equatorial Atlantic.

Modelling: high priority (mixed layer heat budget in upwelling regions, surbsurface heat content distribution / variability).

TACE should be strongly connected to PIRATA.

Next future: workshop in Feb 2005 at Miami.

Implementation: 2006.

MOVAR Program: Mauritio Mata and Mauro Cirano (PIR10-ST16)

Monitoring the Upper Ocean Thermal Variability between Rio de Janeiro and Trindade Island.

DAY 1: December 14, 2004 - Afternoon

2sd Chair: Bernard Bourlès; *Rapporteur: Mathieu Rouault*

Presentation of Scientific Papers (beginning)

- Decadal Variability of Shallow Cells and Equatorial SST in a Numerical Model of the Atlantic *(Antonio J. Busalacchi, Juergen Kroeger, Joaquim Ballabrera-Poy, Paola Malanotte-Rizzoli)* **(PIR10-SC01)**

Tony Busalacchi presented nine numerical model experiments done to study the decadal variability of tropical Atlantic. He compared the effect of remote forcing via subtropical cells to the local forcing of equatorial SST anomalies. Although SST response is dominated by local forcing, remote forcing seemed significant. Subtropical cells strength was correlated to SST with a 5 years lag and SST leading. Results also suggested a recent decrease in STC strength in both hemispheres.

- Intraseasonal Variability in the Tropical Atlantic (*Gregory R. Foltz and Michael J. McPhaden)* **(PIR10-SC02)**

Michael McPhaden presented evidence of a 40-70 days wind intraseasonal oscillation seen in PIRATA wind data and also in reanalysed climatological data for the trade winds of the northern and southern tropical Atlantic. Evidence was presented for the first time that the Madden-Julian Oscillation (MJO), which originates over the Indian Ocean, influenced tropical Atlantic surface winds between 10°N and 10°S. Those wind speed forced sea surface temperature through latent heat loss from the ocean. Michael also presented a comprehensive heat budget calculation done with PIRATA data.

- Quick Look at the Oceanic vs. Atmospheric Causes of the Seasonal Mixed Layer Heat Budget at PIRATA Network *(Jacques Servain, Flaviano F. Ferreira, Alban Lazar)* **(PIR10-SC03)**

Jacques Servain presented the trends of the oceanic vs. the atmospheric components of the seasonal mixed layer heat budget at PIRATA original sites, and PIRATA proposed extension locations, from the 0.5 degree resolution OPA model. The oceanic component was separated in 4 terms: horizontal and vertical advection, lateral diffusion and vertical turbulence. The importance of these terms are very different according the locations: the atmospheric forcing is dominating out of the equator; the oceanic terms are very important along the equator and in the regions of CCNE and in the PIRATA-SEE region; advection terms are balanced or not by other oceanic terms according the region.

DAY 2: December 15, 2004 - Morning
Chair: Bernard Bourlès; *Rapporteur: Mathieu Rouault*

Presentation of Scientific Papers (continue)

- The Northeast Tropical Atlantic: Present and Future Observing Network *(Rick Lumpkin and Claudia Schmid)* **(PIR10-SC04)**

Rick Lumpkin presented several scientific results pertaining to TAV. Of note was an animation of TRMM SST and drifter. He introduced a plan to extend PIRATA in the Northeast Tropical Atlantic. The main motivation was to extend the present PIRATA array in the main development region of tropical cyclones.

He announced that 40 days of the R/V Ronald H. Brown were secured for May-June 2006 along the 23°W section together with a drifter program and the high density AX08 repeat line.

- Propagation and Origin of Warm Anomalies in the Benguela Angola Upwelling System in 2001 *(Mathieu Rouault, Abderahim Bentamy, Chris Reason)* **(PIR10-SC05)**

The Mathieu Rouault's presentation was a study of the origin of warmer than average ocean conditions in the Benguela/Angola Current region in late austral summer 2001 from 10^{o}S to 25^{o}S. These coastal anomalies extended offshore by 1 to 4 degree and were not due to local ocean atmosphere interaction or relaxation of upwelling favorable southerly wind. They were remotely forced by ocean atmosphere interaction along the equatorial Atlantic. Satellite remote sensing and ocean models suggest that the relaxation of trade wind along the equatorial Atlantic triggered a Kelvin wave that crossed the basin within a month in early 2001. This was followed by a poleward propagation of abnormal sea level towards the coast of Angola and Namibia. This process would have induced an increased penetration of warm water in the Benguela Current upwelling system.

- High Resolution Satellite – Derived Turbulent and Radiative Fluxes over the Tropical Atlantic Ocean *(Abderahim Bentamy, Ludos-Hervé Ayina, Pierre Queffeulou, Jean-François Piollé, Kristina Katsaros, A. M. Nuñez, Pierre Leborgne, Hervé Roquet, W. Drennen, R. Pinker, Jacques Servain, Bruno Durand)* **(PIR10-SC06)**

Abderahim Bentamy kept us up to date with satellite remote sensing estimation of latent and sensible heat fluxes. Those fluxes were compared with estimate of the same parameter from PIRATA mooring and ERA-40. The resulting fields compared well with in-situ and numerical model analysis estimates. There was regional and seasonal bias. In conclusion it was important to maintain buoy measurements.

- Scientific Uses of the PIRATA Measurements in France (Bernard Bourlès) **(PIR10-SC07)**

Bernard Bourlés spoke about various subjects. The assimilation of PIRATA data in climate prevision models at Météo-France (about 2000 data assimilated every year). The use of PIRATA data for SST products validation and heat fluxes in the equatorial Atlantic and the Gulf of Guinea (a strong bias in Reynolds' SST, 0°5C and a bias of 0.1 C due to the effect of wind speed in TRMM TMI SST). A Study of the Equatorial Under Current termination in the Gulf of Guinea and at last first results from the newly installed IRD São Tomé Meteorological station

- Impact of PIRATA in the ECMWF Seasonal Forecasting System (Magdalena A. Balmaseda, Tim Stockdale, Arthur Vidard, David Anderson) **(PIR10-SC08)**

The talk was on the importance of TAV SST on seasonal forecasting and mentioned the impact of PIRATA in the ECMWF Seasonal Forecasting System

with coupled models. There were some problems at times in data assimilation of PIRATA. She also advised to enhance the near-equatorial array of ATLAS mooring.

- Numerical Simulations of Atlantic EUC at CPTEC (Emanuel Giarolla, Paulo Nobre, M. Malagutti) **(PIR10-SC09)**

Emanuel Gariolla et al. studied the Atlantic Equatorial Undercurrent (EUC) with ADCP PIRATA observations and simulations with GFDL Modular Ocean Model at CPTEC. PIRATA ADCP data at 0°N-23°W allowed a description of the EUC variability in 2002. The data was very important to calibrate a global–tropics MOM configuration, which is part of the coupled model at CPTEC.

- The Impact of Satellite Winds and Latent Heat Fluxes in a Numerical Simulation of the Tropical Atlantic Ocean during 1996-1998 (Hervé-Ludos Ayina, Abderahim Bentamy, Kristina Katsaros, A. Munes-Nunèz, Gurvan Madec, Anne-Marie Tréguier) **(PIR10-SC10)**

Ludos-Hervé Ayina demonstrated that the introduction of satellite winds and latent heat fluxes in a numerical simulation of the tropical Atlantic Ocean during 1996-1998 significantly ameliorated the results (ORCA model). Results were closer to observations than when model was forced with the fluxes of ECMWF.

- Coupled Modes of Variability in the South Atlantic: A comparison of Model Results with Observations (Edmo Campos, Roberto de Almeida, Reindert Haarsma, Reiner Bleck, Carlos Lentini) **(PIR10-SC11)**

Edmo Campo discussed coupled modes of variability in the South Atlantic and compared model results with observations. The coupling between MICOM and CCM3 successfully reproduced SST and SLP patterns of variability observed in COADS and NCEP-NCAR reanalysis data for the South Atlantic. There was indication of two modes of variability of the atmospheric South Atlantic Convergence Zone (SACZ). One of these modes was a result of remote forcing while the other was a local response to the oceanic forcing. The model showed significant modes of SST variability at inter-annual and inter-decadal time scales. The inter-annual mode was apparently correlated with ENSO while the inter-decadal is linked to variability of the model's thermohaline circulation.

- Impact of the PIRATA Data into the Mercator Operational System - The PERENE Proposal (Fabrice Hernandez, Yves du Penhoat, Rémi Cousin) **(PIR10-SC12)**

Fabrice Hernandez discussed the impact of PIRATA data into the Mercator operational system and the PERENE project. There was a need to improve the assimilation scheme. Nevertheless PIRATA corrects PSY1v2 model near the moorings but large differences remain. Far from PIRATA locations, the T/S improvements were not clear.

- Numerical Simulation of the SEC Bifurcation Off-Brazil with a Nonlinear Terrain-Following Coordinate Model (Moacyr Araujo, Marcus Silva, Doris Veleda, Jacques Servain, Pierrick Penven) **(PIR10-SC13)**

Moacyr Araújo presented a numerical simulation of the SEC bifurcation off-Brazil with a nonlinear terrain-following coordinate model developed at IRD. The regional Ocean Model System - ROMS seemed to be able on reproducing the general features of the seasonal transfer of heat and oceanic mass at different sectors of the subsurface tropical Atlantic near Brazilian edge.

- How Well do we Understand the Extratropical South Atlantic SST Variability? (Alberto Piola) **(PIR10-SC14)**

Alberto Piolla summarized the knowledge on extratropical South Atlantic SST variability. There was a need for measurement in the South Atlantic to improve the knowledge of large scale atmospheric changes over tropical and subtropical South America. In particular measurements were needed at 35°S-40°W in the South Atlantic Convergence Zone and also in the proposed SW extension area.

- Very Preliminary Results on the Validation of Solar Heat Flux Estimates over the Tropical Atlantic Using PIRATA Data (Leo Siqueira, Paulo Nobre) **(PIR10-SC15)**

Paulo Nobre presented preliminary results on the validation of solar heat flux estimates over the tropical Atlantic using PIRATA data versus ISCCP estimate. There was a bias of 90 to 40 $W.m^2$ at 8°N-38°W and 15°N-38°W, the latest location bias being greater in boreal winter.

DAY 2: December 15, 2004 - Afternoon
Chair: Paulo Nobre; *Rapporteur: Janice Trotte*

PIRATA follows up

AOWG Report: ***Mike Johnson*** **(PIR10-ST17)**

M. Johnson presented the "Atlantic Observations Working Group (AOWG)" Report, after being circulated among members of the Working Group. The AOWG has been established in February 2003, under the auspices of the PIRATA Resources Board (PRB), with the motivation to evaluate ship time needs for PIRATA and other South Atlantic observing system elements, in the long term.

Members of AOWG were:

- Edmo Campos and Janice Trotte, from Brazil;
- Guy Caniaux and Gerard Eldin, from France; and
- Chris Beaverson, Geoffrey Fuller and Mike Johnson, from the USA.

The elements assessed by the WG (low cost, system-wide needs, operational efficiency, long-term solution etc.) were considered against different scenarios, such as maintaining the status quo, augmenting ship time by the USA, or by other countries, an all-purpose dedicated ship, or a converted ship that could perform PIRATA array maintenance but also deploy drifting equipment.

The approach taken for the TAO array in the Pacific was the conversion of a US Navy ship to help service the full array.

A rough annual cost comparison has also been reported, for the different possibilities. A summary of ratings reveal that:

a) Better data return is needed, especially for the eastern side of array, that may require an increase in maintenance frequency very shortly;
b) The NOR-50 prospectus seems very difficult to be implemented, politically speaking;
c) The best near term solution is likely to be a converted ship, which option rated highest, but just barely; and
d) There is a need to better view the future of PIRATA and other project requirements in the region.

It has been agreed that the option considering the "status quo" has been grossly underestimated, since it did not take into consideration maintenance of ships in the long term. Those estimates should therefore be updated as appropriate.
The option of considering other countries ship time is to be avoided, as it probably would lack engagement in the long term.
The capacities to serve PIRATA, wherever they come from, must consider the possibility of contribution to other operational projects, and as a complement to PIRATA, such as Argo, on a regular basis.

PIRATA After 2005?

A special session on "Open Questions" for PIRATA after 2005 has taken place.
The main questions presented were:

1) Is the actual backbone the best configuration for scientific purposes and prediction?

There is a possible need to address new scientific questions for PIRATA. The project has the limitation of being too narrow in addressing scientific issues to achieve. PIRATA needs a large matrix of science and measurements to compose the overall scientific questions. Needs a broader scale strategy.

2) There should be a PIRATA Review made by CLIVAR and OOPC in 2005 (early 2006), to evaluate the scientific meaning of the original array versus its proposed extensions and whether a reconfiguration of the array is needed.

Formal review process of PIRATA should be done in accordance to the timeframe envisaged for the discussions regarding the renewal of the PIRATA MoU.

3) What are the prospects for real time transmission of tide gauge data at SPSP and Atol das Rocas?
4) And the Met buoy originally planned for 0°N-44^{o}W?
5) Will the PIRATA MoU be renewed after it expires in February 2006?

Yes. An amendment to the present agreement should be made during the present session, via a Letter of Expression from participating nations to continue collaborating for PIRATA implementation.

6) How are ADCP data treatment and flow going?
7) What about maintenance of the two equatorial buoys in the Gulf of Guinea in 2006-2007? Feasible still?
8) What about training for Brazilian engineers onboard the 2005 PIRATA-BR Cruise and further cruises?
9) What is to be considered PIRATA data and what are the respective ownership?

It was agreed that PIRATA-SSC will develop guidelines for the submission of project proposals to be developed jointly with the PIRATA project.

9) What is the desirable configuration for the PIRATA array in the long-term timeframe with regard to vertical resolution?

Further to those specific issues, it was agreed that a list of requirements should be drawn still during the meeting, for PIRATA-SSC but mostly PIRATA-RB consideration and eventual initiatives.

Several elements concerning PIRATA were also laid down, such as:

a) the presently proposed extensions are focusing in very specific regional processes;

b) there are new developments for data collection regarding ATLAS moorings, such as ocean currents coupled with the ATLAS mooring;

c) PIRATA vertical array in the Western side is not resolving salinity data needs; there is a strong influence from the Amazon ouflow. In general, high vertical resolution of up to 08 subsurface salinities is not enough. Salinity is labour-intensive data processing and most of the times a costly issue.

d) with the merging of NDBC and PIRATA, sampling strategy should be discussed together.

Report of the First Session of the CLIVAR GOOS Indian Panel (23-27 Feb 2004): *Mike McPhaden*

M. McPhaden explained that a draft strategy for the Indian ocean moored buoy array is in process. It proposes 35 surface moorings for primary measurements – wind, air temp, relative humidity, SST, 10 ocean temperature intervals down to 500 m.

The proposal encompasses the USA, Japan, India and South Africa. Indonesia could be a player, Australia wants to join.

It seemed clear that the “coalition” is not in place to set up the array.

It was noted that the PIRATA review should take into consideration the experience driven from the Indian ocean exercise, by linking CLIVAR and GOOS to the extent possible and to profit from the existing coalition in place. GOOS has officially been approved in that region. Similarly, there is a proposed GOOS Regional Alliance being worked out for the Tropical Atlantic, under the leadership of DHN (Brazil).

The IOC/UNESCO Rio de Janeiro GOOS office has offered to coordinate actions towards PIRATA review in 2005, along the same lines of what has been done in the Indian ocean.

PIRATA-Brazil Laboratory for Climate and Ocean Research at INPE-Natal/Fortaleza: *Paulo Nobre* (PIR10-ST18)

P. Nobre presented the news regarding the proposed INPE-led laboratory in Brazil, in support to PIRATA operational and scientific activities, and based on the existing capacities in the region.

The Laboratory institutional framework and relationship with other national institutions has been presented. The Lab would encompass activities carried out by more than one institution.

The Oceanic Buoy Laboratory at INPE/Natal will be devoted to logistics and marine operations, sensor calibration and buoy engineering. They also posses satellite

tracking capabilities and currently support software development for decoding signals from antennas, in partnership with local universities.
There are plans for capacity building activities for INPE and IO-USP engineers on ATLAS buoy electronics, sensors, and communications design.
Of the first activities within the Lab one will be leading the way to a fully-Brazilian PIRATA cruise in 2005, under the supervision of a PMEL technician only.
Other initial plans include upgrading the IO-USP laboratory for sensor calibration and also upgrading DHN ship "Amorim do Valle" to service ATLAS buoys, especially those of the SW Extension.
INPE also possesses a lab dedicated to satellite monitoring for continental application located in Fortaleza, Ceará. The group has been engaged in discussing climate and ocean project developments, with emphasis to developing a pool of researchers in Atlantic climate and oceans for the region. It has a more educational approach to the project and would be fully based on research activities there.
The efforts made by INPE with regard to setting up the Lab matches well with Governmental efforts to integrate all the existing resources in the country so as to further develop meteorological and large-scale oceanographic observations in the South and Tropical Atlantic.
It became clear that the local climate community would greatly benefit from this initiative, to be highly commended by the PIRATA community.

DAY 3: December 16, 2004 - Morning
Chair: Jacques Servain; *Rapporteur*: Bernard Bourlés

Workshop to Evaluate what is Needed for the Continuation of PIRATA

This session was planed on the morning of the last day of the meeting. Actually, instead to be an open session (with voluntaries) as initially planed, the PIRATA-SSC decided that they rather had to meet in a closed session, in order to have an internal discussion about the main organization of PIRATA and to obtain first a global agreement within the PIRATA-SSC itself in respect to the program. Were present: Jacques Servain, Tony Busalacchi, Mike McPhaden, Janice Trotte, Edmo Campos, Paulo Nobre and Bernard Bourlès. We note that Serge Planton (Météo-France, France) and Shang-Ping Xie (Univ. Hawaii, USA) could not attend for the second consecutive time to the meeting. Furthermore, since the last meeting and the resigning of João Lorenzetti and Mike McPhaden for some reasons, that have not to be detailed in this report, the first point was obviously to think about the reorganization of the SSC, and consequently it has been first discussed about the (re)composition of the PIRATA-SSC. The US representative (Tony Busalacchi) proposed the coming back of Mike McPhaden, and the new incoming by Rick Lumpkin (NOAA/AOML) to substitute (with his agreement) Shang-Ping Xie; the Brazilian representatives proposed Divino Moura to substitute João Lorenzetti. No change proposed on the French side. After a frank, but very useful, discussion concerning the reasons of the resigning by João Lorenzetti and Mike McPhaden in 2003 and the coming back of this later, some potential explanations funded on the cultural differences and interpretations of the way to use some words and

sentences between Latin and Anglo-Saxon people, debate is over and finally, the new PIRATA-SSC is approved. Divino Moura accepts to be Chairman, and Bernard Bourlès agrees, after some hesitation, as already being involved in EGEE/AMMA and CLIVAR-Atlantic committees, to be vice-chairman but for one year only (until PIRATA-11).
So, the present PIRATA-SSC is composed of 3 Brazilian, 3 French and 3 US representative as follows:

- Edmo Campos
- Divino Moura (Chair)
- Paulo Nobre
- Bernard Bourlés (Vice-Chair)
- Serge Planton
- Jacques Servain
- Tony Busalacchi
- Rick Lumpkin
- Mike McPhaden

The involvement of Coriolis/Mercator is evoked to find a partial issue to the under-representation of French community in PIRATA (despite its strong involvement in the field…).
Then the SSC takes the decision to endorse and support the PIRATA-SE and PIRATA-SW extensions of the PIRATA network, proposed by South Africa and Brazil respectively, after having passed through the required review phase. The North and North-East extension proposed by NOAA/AOML is discussed. While it seems scientifically justified, at now no scientific proposal has been presented to the PIRATA-SSC in order to be evaluated, and it is thus decided the SSC to write a letter to Bob Molinari in order to ask him if this N-NE extension proposal is planed as part of the PIRATA network, and if yes that this should be done in agreement to the PIRATA guidelines (ie. first approved by the PIRATA-SSC and then by external reviewers).
The problem of the PIRATA cruises data is raised and it has been decided that one main interlocutor in France and Brazil has to be designed to fix the data exchanges and distribution from each country in charge of the ATLAS buoys maintenance. These persons would be Jacques Grelet (IRD) and Celso Thomaz (CPTEC) in France and Brazil respectively.
Then science issues have been raised, mostly concerning the vertical resolution of the sensors. It has been suggested that conductivity/salinity (at 10 and 60m), temperature (at 10m) and current (at 10m and 60m) should be added on each PIRATA ATLAS mooring. Due to the cost, three ATLAS location will be supported in a first step, say at 15°N-38°W, 0°N-23°W and 10°S-10°W, as three reference sites of OceanSITE.
An important aspect of the discussion has consisted in the “mind opening” of PIRATA to other Atlantic going on programs, and principally to the CLIVAR Atlantic community and the TACE program in progress. It is clearly said that closer relationship between PIRATA and TACE has and needs to be established. PIRATA has to show how it can contribute to TACE and to the other hand TACE has to indicate to PIRATA how it can efficiently contribute to the scientific questions recently raised concerning the tropical Atlantic climate. The PIRATA-SSC however clearly regrets that TACE is mostly oriented toward the eastern tropical Atlantic,

and strongly suggests TACE to consider also the western and mostly the southern tropical Atlantic basins. For example, observation holes exist in the southern Atlantic basin and the way to fill this data lack has clearly to be addressed by TACE in the framework of PIRATA. The SSC consequently decides to send a letter to Bill Johns, the TACE representative at the PIRATA-10 meeting, in order to suggest to TACE to consider the willing of the PIRATA community to be more supportive and to contribute to the overall goals and objectives of CLIVAR endorsed programs. In this way, it is evoked the possibilities to enhance the vertical resolution of T and S sensors on the PIRATA ATLAS buoys and also to install some current sensors in the mixed layer.

For the continuation of PIRATA, it seems clear that this program has first to be evaluated. It is suggested the next PIRATA meeting to be held in October 2005 in France, in Toulouse, where is Météo-France, along with the Mercator team and the LEGOS laboratory. Key members of CLIVAR Atlantic Panel (e.g. Martin Visbeck) and of OOCP (e.g. Ed. Harris) would be invited in order to proceed after this meeting to a scientific evaluation of PIRATA from it very first days. What have been done since 1997? Is PIRATA a success for science, for operational oceanography and meteorology? What would be the scientific issues for its continuation? How, and with who, to continue PIRATA? After this meeting and the PIRATA evaluation, the early 2006 would be dedicated to write a new PIRATA document (MoU) that should be proposed by the PIRATA-SSC to get a renewal of the endorsement of PIRATA by CLIVAR.

DAY 3: December 16, 2004 - Afternoon
Chair: Edmo Campos; *Rapporteur: Jim Todd*

Final discussions & recommendations
Report not available

Appendix 1

PIRATA-10 Meeting

13-16 December 2004
Hotel Luzeiros
Fortaleza, Ceara, Brazil

AGENDA OF THE MEETING

December 14

1) 08:30-09:00: Registration, Coffee

09:00 – 12:30: Chair: D. Moura; *Rapporteur: P. Nobre*

2) 09:00-09:15: Opening ceremony
3) 09:15-12:30 (including a 30' Coffee Break)
   International and National Status (original array):

- Introduction, Status of PIRATA international (J. Servain)
- PIRATA-Brazil: Status and national report (P. Nobre)
- PIRATA-France: Status and national report (B. Bourles)
- PIRATA-USA: Status and national report (M. McPhaden)

National and International Institutions supporting PIRATA:

- DHN (Cmg A. L. da Costa Ruiz)
- IOUSP, FUNCEME
- INMET (D. Moura)
- IRD & Météo-Fance (J. Boulègue)
- OGP/NOAA (M. Johnson)
- US NOAA/NDBC (D. Conlee)
- IOC/GOOS (J. Trotte)
- CLIVAR (T. Busalacchi)

14:00 – 17:00: Chair: T. Busalacchi; *Rapporteur: E. Campos*
(including a 30' Coffee Break)

4) PIRATA on the Web and PIRATA deliverable products
   - PIRATA-USA: PMEL (M. McPhaden)
   - PIRATA-Brazil: FUNCEME (J. Servain) and DHN/COI (J. Trotte)
   - PIRATA-France: IRD (B. Bourles)

- Discussion on PIRATA Data Flow (B. Bourles)

5) Presentation of the Science and Implementation Plans of the PIRATA Extensions + Related Projects

- PIRATA-SEE (+ 5' discussion) (M. Rouault)
- PIRATA-SWE (+ 5' discussion) (P. Nobre)
- NOAA Prospectus (+ 5' discussion) (R. Lumpkin)
- TACE (B. Johns)
- MOVAR Project (M. Mata)
- First open discussion on the adequacy between the PIRATA original array, the 2-PIRATA-Extended Projects, and Related Projects

17:00 – 18:00: Chair: B. Bourles; *Rapporteur: M. Rouault*

6) Scientific Papers related to PIRATA:

a. Decadal variability of shallow cells and equatorial SST in a numerical model of the Atlantic (T. Busalacchi)
b. Intraseasonal variability in the tropical Atlantic (M. McPhaden)
c. Quick Look at the oceanic vs. atmospheric causes of the seasonal mixed layer heat budget at PIRATA network (J. Servain)
d. Interannual to decadal SST variability in the South Atlantic (E. Campos)

19:30: Cocktail on R/V Antares

December 15

09:00 – 12:30: Chair: B. Bourles; *Rapporteur: M. Rouault*
(including a 30' Coffee Break)

6bis) Scientific Papers related to PIRATA - Continue

e. Scientific uses of the PIRATA measurements and link with São Tomé instruments (B. Bourles)
f. PERENE: Impact of PIRATA data into the Mercator System (F. Hernandez)
g. Impact of PIRATA data into the ECMWF System (M. A. Balsameda)
h. Numerical simulation of the South Equatorial Current bifurcation off-Brazil with a nonlinear terrain-following coordinate model (M. Araujo)
i. Numerical simulations of Atlantic EUC at CPTEC (E. Giarolla)
j. Origin, development and propagation of warm anomalies in the Angola-Benguela Current (M. Rouault)
k. High resolution satellite-derived surface turbulent and radiative fluxes over the tropical Atlantic Ocean (A. Bentamy)

l. The potential contribution of the satellite winds and latent heat fluxes in the dynamics of the tropical Atlantic Ocean (H-L Ayina)
m. On the validation of solar heat flux estimates over the Tropical Atlantic (P. Nobre)
n. Last minute talks

14:00 – 18:30: Chair: P. Nobre; *Rapporteur: J. Trotte*
(including a 30' Coffee Break)

7) PIRATA Follows Up:
- AOWG Report (M. Johnson)
- PIRATA after 2005?

20:00: Optional Dinner

December 16

On invitation only

09:00 – 10:30 : Chair: M. Johnson; *Rapporteur : J. Trotte*

8) PIRATA Resources Board (PRB) Meeting

10:30-11:00: Coffee Break

A) Volunteers

11:00-12:30: Chair: J. Servain; *Rapporteur: B. Bourles*

9) Workshop to evaluate what is needed for the continuation of PIRATA

14:00 – 17:00: Chair: E. Campos; *Rapporteur: D. Moura*
(including a 30' Coffee Break)

10) Final Session
a. Report of the PRB Meeting (M. Johnson)
b. New PIRATA-SSC Memberships and Proposals for PIRATA-11
c. PIRATA recommendations to co-sponsoring organizations (CLIVAR, IOC, etc.)
d. Final Discussions & Recommendations

11) Closing Ceremony

Appendix 2

PIRATA-10 Meeting

13-16 December 2004
Hotel Luzeiros
Fortaleza, Ceara, Brazil

LIST OF PARTICIPANTS

NAMES	INSTITUTION	TELEPHONE NUMBER AND E-MAIL
ABDERRAHIM BENTAMY	IFREMER	abderrahim.bentamy@ifremer.fr
ALBERTO PIOLA	SHN / UBA (ARG)	5411-4301-2590 apiola@hidro.gov.ar
ALEX ANDRE COSTA DA SILVA	LOFEC / UFPE	acostasil@yahoo.com.br
ANTONIO BUSALACCHI	ESSIC / UMD	tonyb@essic.umd.edu
ANTONIO CARLOS SANTANA DOS SANTOS	UFC / FUNCEME	85-3384-6056 santana@funceme.br
ANTONIO CHARLES SILVERIO	UFC / UECE	(85) 3288-9904 silverio@fisica.ufc.br
ANTONIO DIVINO MOURA	INMET / MAPA	(61) 344-3333 diretor@inmet.gov.br
ANTONIO FERNANDO GARCEZ FARIA	DHN / R/V ANTARES	(55) 21 99181526 comtenocant@dhn.mar.mil.br
ANTONIO GERALDO FERREIRA	FUNCEME	+55 (85) 3431846 geraldo@funceme.br
ARTHUR LOBO DA COSTA RUIZ	GNHo / DHN	(21) 26138347 ruiz@gnho.mar.mil.br
BERNARD BOURLES	IRD	33-2-98224665 bernard.bourles@ird.fr
BIL JOHNS	RSMAS	wjohn@rsmas.miami.ca
CARLOS M. MARTINEZ	FCIEN / UDELAR	(5982) 5258618 ext. 7151 carmar@glaucus.fcien.edu.uy
CLAUDIA SCHMID	NOAA / AOMIL	1 305 361 4313 claudia.schimid@noaa.gov
DAVID FERRAN MONCUNILL	FUNCEME	david@funceme.br

DON TOMAS CONLEE	NOAA / NDBC	1 288 688 1753 don.conlee@noaa.gov
EDMO CAMPOS	IOUSP	
EMANUEL GIAROLLA	INPE	emanuel@cptec.inpe.br
FABRICE HERNANDEZ	IRD	fabrice.hernandez@mercator-ocean.fr
FERNANDO ALBERTO GOMES DA COSTA	CHM / DHN	(21) 2613.8024 fernando@chm.mar.mil.br
FLAVIANO FERNANDES FERREIRA	FUNCEME	(85) 3433-1835 flaviano@funceme.br
FRANCIS LACERDA	ITEP / LAMEPE	(81) 327243664365 francis@itep.br
JACQUES BOULEGUE	IRD	dme@paris.ird.fr
JACQUES SERVAIN	IRD	(085) 88291098
JAMES F. TODD	NOAA / OGP	30-427-2089 james.todd@noaa.gov
JANICE ROMAGUERA TROTTE	DHN / IOC UNESCO	2126138013 janice@dhn.mar.mil.br
JOAO BOSCO VERÇOSA LEAL JR.	UECE	(85) 32992804 jblealjr@uece.br
JOHN KERMOND	NOAA / OGP	(301) 4272089 x:137 John.Kermond@noaa.gov
JOSE MARIA BRABO ALVES	FUNCEME	(85) 43 33 18 45 brabo@funceme.br
JOSE NILSON B. CAMPOS	FUNCEME	(85) 34331810 nilson@funceme.br
JOSÉ SIDOU ALBUQUERQUE	UECE	Josesidou@yahoo.com.br
KENNETH MOONEY	NOAA / OGP	1-304272089
LUCIO FRANCO DE SÁ FERNANDES	DHN	(21)26138001 lucio@dhn.mar.mil.br
LUDOS HERYÉ AYINA	IFREMER	lhaina@ifremer.fr
MAGDALENA AFONSO BALM ASEDA	ECMWF	44-118-9499112 balamaseda@ecmwi-int
MANOEL JOZEANE MAFRA DE CARVALHO	INPE	(84) 2314733 manoel@crn.inpe.br
MÁRCIA HELENA DE C. RAMOS.	DHN	(21) 2613-8086 marcia@dhn.mar.mil.br
MARCOS AURELIO F. DOS SANTOS	INPE	(84) 2314733 marcia@dhn.mar.mil.br
MATHIEU ROUAULT	UNIV. CAPE TOWN (SA)	21 650 3607 rouault@oceanuct.ac.za
MAURICIO M. MATA	FURG	53-2336879 dfsmata@furg.br
MICHAEL JOHNSON	NOAA / OGP	1 301 427 2089 mike.johnson@noaa.gov
MICHAEL MACPHADEN	NOAA / PMEL	1-206-526-6783 michael.j.mcphaden@noaa.gov
MOACYR ARAUJO	LOFEC / UFPE	81.3441.9458 / 2126-8225 moa@ufpe.br
PAULO NOBRE	CPTEC / INPE	(12) 3186-8425 pnobre@cptec.inpe.br
RAUL FRITZ BECHTEL TEIXEIRA	FUNCEME	(85) 3433-1845 fritz@funceme.br

RICK LUPKIN	NOAA / AOMIL	1 305 3614513 rick.lumpikin@noaa.gov
STEPHEN R. PIOTROWICZ	NOAA	+ 17035880850 steve.piotrowicz@noaa.gov