PIRATA-16 SSG meeting report

(Fernando de Noronha, March 17, 2011, Brazil)

This PIRATA SSG (Steering Scientific Group) meeting was held during the PIRATA/TACE/TAV meeting organized at Fernando de Noronha in Brazil, where about 35 people attended. Exceptionally (and for the first time), and along with the PIRATA PRB (PIRATA Resources Board) members, several invited people attended to this SSG meeting. Attending people were:

SSG member participants:
Moacyr Araujo (UFPE, Brazil); Bernard Bourlès (IRD, France; co-chair); Peter Brandt (IFM-GEOMAR, Germany); Hervé Giordani (Météo-France, France); Fabrice Hernandez (IRD, France); Rick Lumpkin (NOAA/AOML, USA; co-chair); Michael McPhaden (NOAA/PMEL, USA); Paulo Nobre (INPE, Brazil); Domingos Urbano (INPE, Brazil).
Absent: R. Saravanan (Texas A&M University, USA).

PRB member participants :
Candyce Clark (NOAA/CPO, USA), Paulo Nobre (INPE, Brazil; Pdt); Joel Poitevin (Météo-France) ; Janice Trotte-Duha (DHN, Brazil).
Pierre Soler (IRD, France) was absent and represented by Yves du Penhoat (IRD, France)

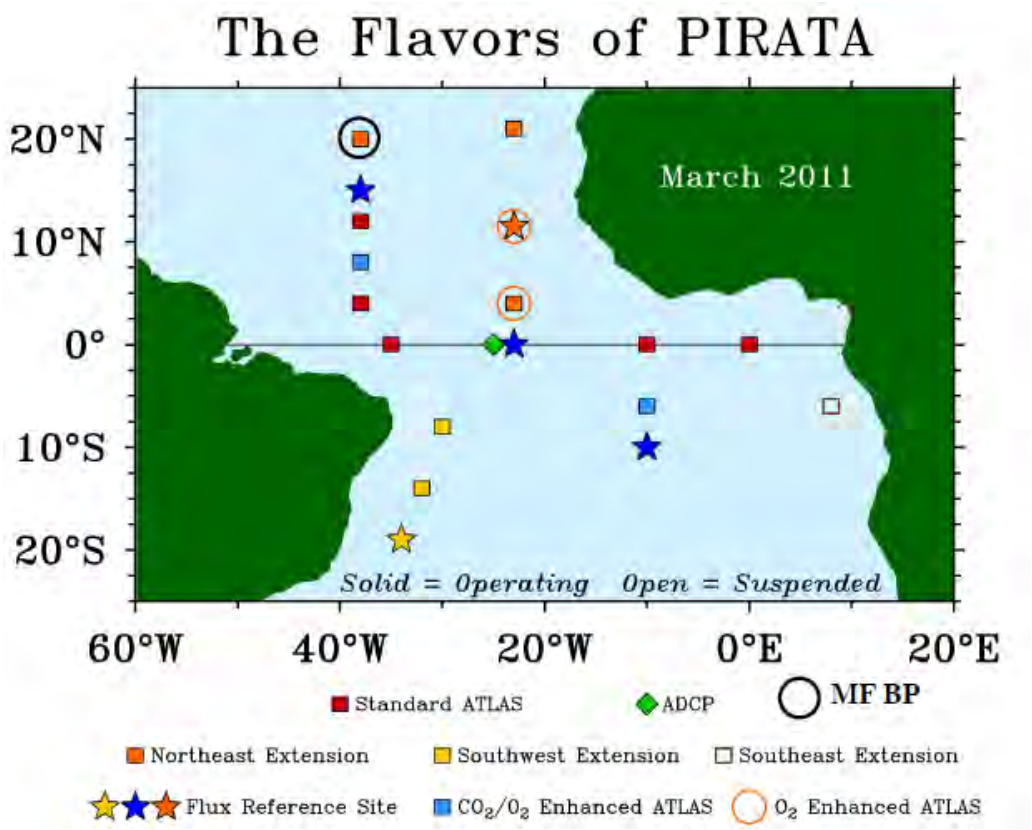
Invited people:
Roberto de Almeida (INPE, Brazil); Jacques Grelet (IRD, France); Nathalie Lefèvre (IRD, France); Robert L.Molinari (Clivar Int., UK); Rodolfo Paranhos (UFRJ, Brazil); Regina Rodrigues (UFSC, Brazil); Rodrigo Obino (DHN, Brazil).

This report summarizes, in the first part, the different presentations done about global and national PIRATA status, data policy and PIRATA dedicated numerical experiments with MERCATOR and, in the second part, the main items and recommendations issued from the discussions. The last page contains a summary for the PIRATA PRB.

Global and national programmatic reports

1) NOAA/PMEL report and plans: a general overview (Mike McPhaden)

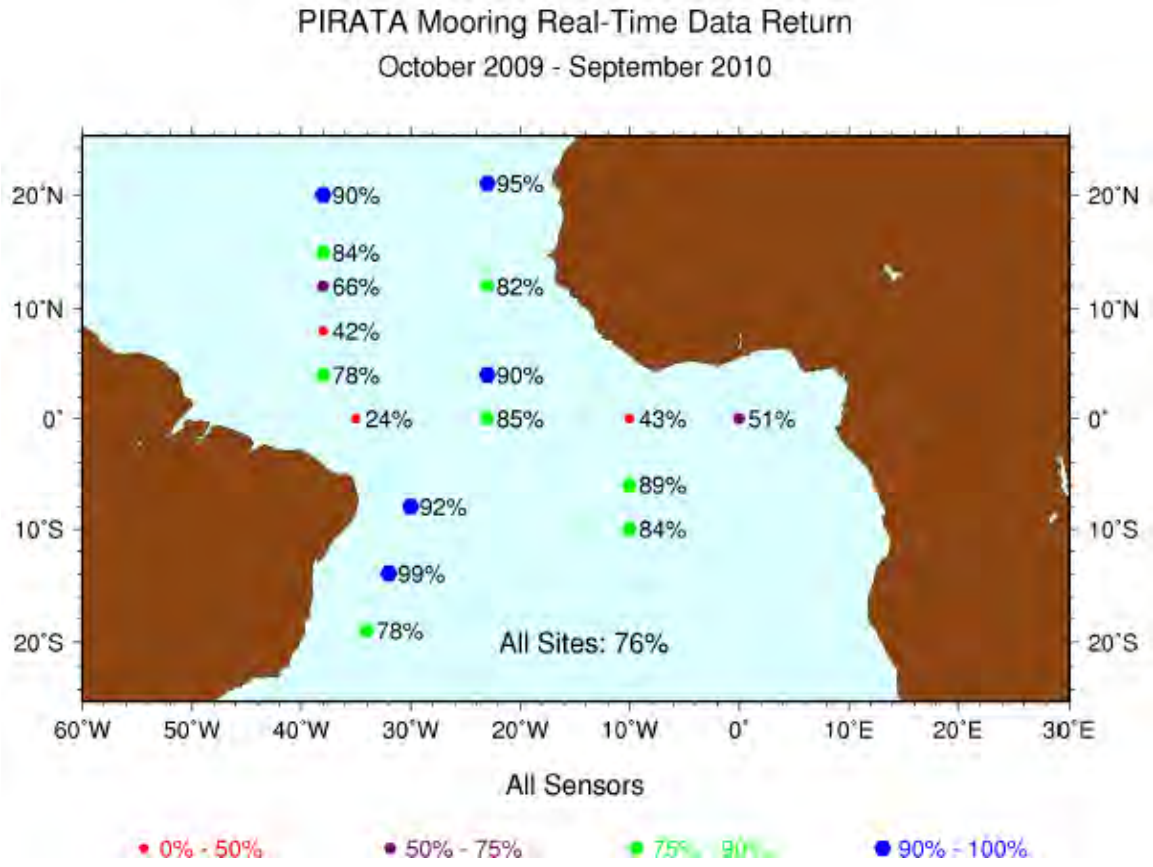
Michael McPhaden presented an overview of the types of observations being collected by the PIRATA array (see figure below). Five sites are "flux reference" sites (the more recent one is at 12°N-23°W), two are enhanced for O2, and one with barometric pressure (20°N-38°W; contribution Météo France). Two are enhanced with CO2 sensors (PI: N.Lefevre, IRD/LOCEAN).



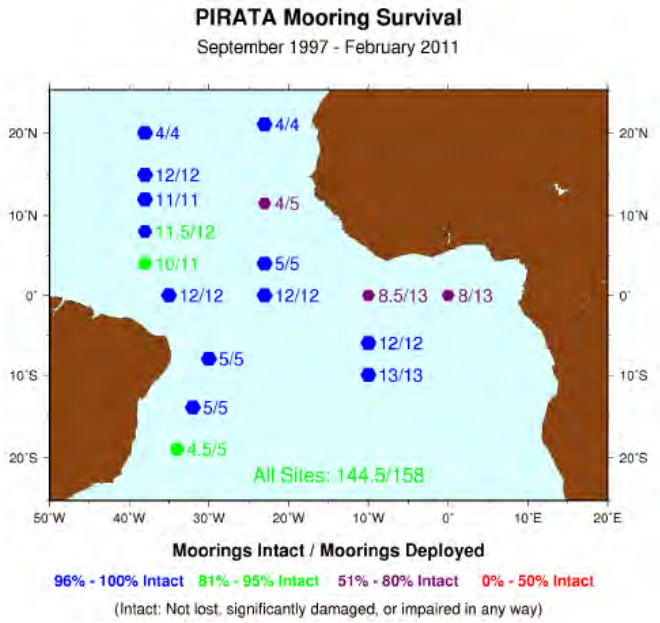
In 2010 (March 2010 – February 2011), PMEL contributed to the following activities:
- 17 ATLAS moorings operations during the three following cruises (99 days at sea):
  - US R/V RON BROWN (Apr–May 10): 27 days
  -Brazil R/V ANTARES (Jul–Sep 10): 37 days
  -French R/V ANTEA (Sep-Oct 10): 35 days
- PMEL Person-days at sea: 54 (2 people) on the R/V RON BROWN.

The overall near-real time data return in FY2010 from all PIRATA sensors was 76%. The over data return rate for delayed mode was 80%. For individual sensor types, delayed mode data was distributed as follows: 91% for air temperature, 86% for SST, 85% for T(z), 75% for winds, 93% for relative humidity, 76% for rain, 83% for shortwave radiation, 73% for salinity, 33% for currents (at seven sites), 80% for longwave radiation (at four sites), 99% for air/atmospheric pressure (at six sites).

Data return rates, both real-time and delayed mode were the fourth best year ever for the PIRATA program, in spite of transmission problems (e.g. data transmission stopped on January 29 at 20°N-38°W) and vandalism (buoy at 0°E-0°N vandalized in April 2010; see below). The distribution of real time data return by site, from October 2009 to September 2010, is shown in the following figure.



Over the 14 years of PIRATA (1997-2010), the ATLAS mooring data return rate (all sensors and all sites) is 82% that is an excellent result (also if compared with the very first PIRATA years return rates -1997-2001- and vandalism and suppressed sites along 10°W). 158 moorings have been deployed (September 1997 – February 2011), with ~144.5 recovered (including "half recoveries", where the buoy is recovered without the mooring and subsurface sensors; see figure). This is an overall performance rate comparable to the TAO array in the Pacific.



52,564 PIRATA data files were delivered through the PMEL web site during the FY10, ie a little bit lower than in 2009 but much lower than 2008 (2008 was an exceptional year, possibly due to the AMMA experiment in West Africa, with a lot of demands for validation/numerical experiments). It is however noticed that PIRATA data files are also available through ftp since 2007, and that the number of files via ftp has consequently increased, while decreasing through the web. Thus, the total (web+ftp) number of delivered files is almost constant (2009 & 2010) and around 84,850.

Mike McPhaden recalls the recovery of the 0°-0° ATLAS buoy in April 2010 by the R/V RON BROWN, at the beginning of the PIRATA NE cruise. This buoy, deployed in July 2009 during the PIRATA FR19 cruise, began drifting on April 20, 2010 and recovered on April 27, 2010. This buoy has been redeployed on September 19, 2010 during the PIRATA FR20 cruise, i.e., 5 months later so inducing a consequent data loss.

About current measurements obtained from the ATLAS buoys, Mike McPhaden presented an inter-comparison done between different types of currentmeters and an ADCP deployed in 2008-2009 at 23°W-0°N (Sontek, Nortek and RDI DVS point-Doppler current meters and a 600kHz RDI Sentinel ADCP). As already mentioned during the PIRATA 15 meeting, the Sontek current meters provide accurate data but with poor performance with time (too unreliable). The ADCP 600kHz provided biased data in 2008-2009 due to acoustic reflections from other current meters (1/3 of the data have been improved thanks to an interpolation processing), but allowed to confirm the rather good data obtained through this system and the Nortek Aquadopp. The Nortek Aquadopp will be implemented on the new PMEL T-Flex mooring, when proven to replace the Sontek at PIRATA sites.

The PIRATA SSG is informed that the Tropical Moored Buoy Implementation Panel (TIP) is establishing a Technical Coordination Group, whose aim is to define a set of measurement standards for TAO/TRITON, PIRATA, and RAMA as more ATLAS-like and TRITON-like moored buoy systems are introduced. This group would also establish procedures for exchange of technical and logistical information, and PIRATA members will be included in this group (Paul Freitag, PMEL, will be Technical Coordinator).

In October 2010, PMEL welcomed Luiz Nonnato (Brazil) in support of the development of the ATLAS-B mooring system by the University of Sao Paulo. Subjects of discussion included mooring design, fabrication, procurement, instrumentation, data processing and distribution. Interaction has continued via email since his visit. The possibility of Brazil supplying anchors for PIRATA moorings has been suggested (see also “Brazil status” below).

In the framework of two specific operations (see also “French and German status” below), PMEL will provide two Real Time ADCP (Sentinels) for their deployments during the next PIRATA FR21 cruise at 0°-10°W (300kHz, 55m range, 1m resolution) and 10°S-10°W (600kHz, 35m range, 0.75m resolution) along with 6 TC sensors bought by IRD to be added at 6°S and 10°S at 10°W. Real Time ADCP and their data transmission via Iridium have been previously tested in the Lake Washington (Jan. 2011).

Mike McPhaden described the ATLAS update projects, which aim to update PMEL's ATLAS with more modern, commercially available components.
One system is the PICO system (Easy to Deploy TAO). It is mostly an oceanic measurements system, but additional atmospheric sensors will be added. With 3 year planned endurance, it can provide up to 8 CTD profiles per day and is vandalism-resistant.
A second system the Tropical Flex (T-Flex), which is planned to replace progressively the classical ATLAS buoys, and thus is an ATLAS update. This effort is currently focusing on adapting new electronics to existing mooring hardware, and involves many updates and changes. One major improvement will come from switching to Iridium transmissions, which will allow hourly transmission of subsurface data (this is currently only sent as a daily average in real-time transmissions over ARGOS). Prototype sensors were calibrated at PMEL or by vendors. Multi-month testing was conducted both in Lake Washington and at PMEL, including sensor inter-comparisons, Iridium telemetry, subsurface inductive modems, internal memory and firmware setup options. First two systems were planned for deployment in March 2011 in the Indian Ocean, as part of the RAMA network, alongside two classical ATLAS buoys.

Mike McPhaden also presents a contribution of PIRATA to the NASA funded SPURS program (SPURS=Salinity Processes in the Upper Ocean Regional Study), planed from boreal spring 2012 to spring 2013. In this context, the 20°N-38°W site will be enhanced with meteorological/flux sensors along with TC sensors at 5m and 30m depth. These enhancements are scheduled to commence during the next 2011 PIRATA NEE cruise. NASA and LOCEAN will provide partial support to enhance this site for SPURS.

Also, Mike McPhaden underlines the problem of vessel time in USA, due to budget shortfall inducing a delay of the next PIRATA NEE cruise. The last PIRATA NEE cruise were achieved in May 2010. After being initially scheduled in February/March 2011, the next PIRATA NEE cruise is now unofficially planned for August 2011 (see also "USA status" below)… Such a delay will result in additional loss of data, mostly at 20°N-38°W that does not work from January 2011!

Finally, PMEL plans for 2011 include:

- Continue to support PIRATA core activities: provide mooring equipment, support PIRATA cruises, and continue data processing, web display and data distribution;
- Staff PNE Cruise on French SUROIT in May 2011;
- Continue scientific analysis of PIRATA data;
- Continue engineering development;
- Add real-time current profiling at 0°, 10°W and 10°S, 10°W (one year duration);
- One person onboard the PIRATA FR21 cruise (May 2011);
- Enhance salinity at 0°, 10°W (one year duration);
- Enhance salinity at 6°S, 10°W and 10°S, 10°W (with IRD);
- Add Flux measurements at 20°N, 38°W (one year duration for SPURS);
- Development and testing of new mooring systems.

2) French activities and plans (Bernard Bourlès)

The French component of the PIRATA array includes 5 ATLAS buoys of the backbone, plus 1 ATLAS for the PIRATA SEE (from 2006 to 2007, and possibly in the future; see below), along with a subsurface ADCP mooring at 0°, 23°W since 2001, and at 0°, 10°W since June 2006 as part of AMMA, PIRATA-France and CLIVAR/TACE. PIRATA France also maintains a meteorological station (deployed in 2003 as part of AMMA; now included in PIRATA) and a tide gauge at São Tomé.

After 2009, 2010 was again an important year for PIRATA in France, due to important reforms and reorganization of the national observatories. Changed in 2010 from "Research Observatory for Environment" (ORE) to "Service d'Observation et d'Expérimentation, sur le long terme, pour la Recherche et l'Environnement" (SOERE), PIRATA is now (from January 2011) a "Service d'Observations –Océan/Atmosphère" (SO-OA), and part of a larger SOERE (that includes other observatories as "Sea Surface Salinity", "ARGO" and the CORIOLIS monitoring of delayed time ocean data sets). Note that the CO2 program (PI: Nathalie Lefevre) also got the SO-OA label in early 2011.

A convention for the PIRATA maintenance has been established between IRD & Meteo-France for the 2008-2012 period. PIRATA is mainly supported by IRD and Météo France but also by the "Observatoire Midi-Pyrénées" (OMP, as IRD/LEGOS is part of it), and occasionally by CNRS/INSU for material investments (thanks to the SOERE label). Bernard Bourlès insists on the fact that the PIRATA MoU (Memorandum of Understanding signed between Brazil, USA and France) and the IRD-Météo-France convention are of prime importance for PIRATA in order to be supported by national organisms (through funding and vessel time). In addition, the recongnition of PIRATA as part of CORIOLIS allows ensuring the needed yearly vessel time dedicated to PIRATA (about 45 days).

Fundings since 2003 (*vessel time & salaries & laboratory infrastructures not taken into account*):

	METEO FRANCE	IRD	ORE & SOERE INSU	O.M.P./U.P.S.	**Total:**
2003:	22,430 €	38,000 €	11,287 €	0 €	71,717 €
2004:	22,430 €	67,000 €	20,317 €	0 €	109,747 €
2005:	22,430 €	105,000 €	18,900 €	0 €	143,330 €
2006:	22,430 €	50,000 €	2,300 €	0 €	74,730 €
2007:	22,430 €	50,000 €	0 €	5,000 €	77,430 €
2008:	22,430 €	49,000 €	0 €	5,000 €	76,430 €
2009:	40,000 €	49,000 €	0 €	5,000 €	94,000 €
2010:	40,000 €	45,000 €	20,000€	5,000 €	110,000 €
2011:	40,000 €	45,000 €	15,000 €	???	100,000 € min.

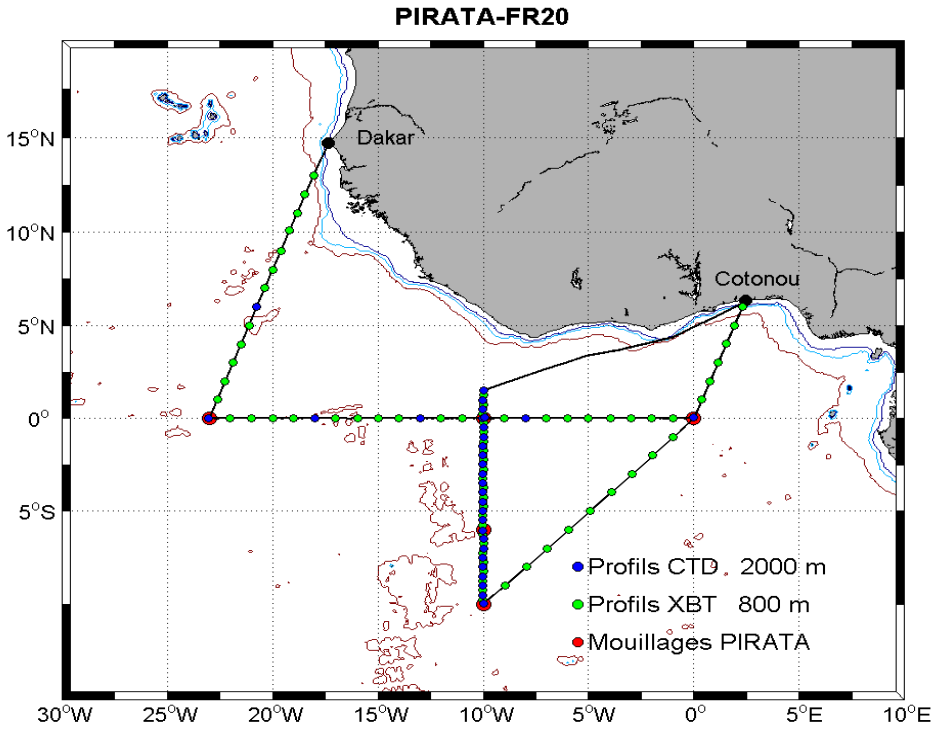
The additional ORE/SOERE resources in 2010-2011 allowed to PIRATA France to:
- buy a new LADCP Quartermaster, cable and releaser for the ADCP moorings (mainly for the 10°W-0°N one, where old 300kHz ADCP are used that do not allow the full sampling of the deeper part of the Equatorial UnderCurrent…).
- purchase 6 additional TC sensors to NOAA/PMEL in early 2011.

Also note the important cost increase of the material transports (by sea -containers- and plane –acoustic releases and sensors after each cruise-).

French costs in 2010:
Vessel time: 40 days of R/V ANTEA (at ~11k€/day) => 440 k€
Technical support, cruises, transports etc… (ie working funds) => 85 k€
Total: 525 k€ (ie around 680k$) (without salaries)

2010 Engineers/Technicians PIRATA dedicated time (estimated):
- PIRATA FR20 (J.Grelet, F.Roubaud, R. Chuchla, S.Hillion, D.Dagorne): 160 days
- cruise preparation, cruises data treatment etc. (J.Grelet, F.Roubaud) : 35 days
Total: 195 days

The last cruise PIRATA FR 20 was conducted from September 15 (Cotonou) to October 21, 2010 (Dakar) by the R/V Antéa, representing 35 days at sea (but 45 days of vessel time… see below).



The following data were collected:

- 31 CTD/LADCP casts
- 76 XBT profiles (every ½ degrees along transits and 10°W)
- 8 Apex Argo profilers deployed along 10W at 10S, 6S, 2S and along O°N at 8°W, 13°W, 18°W, 23°W
- Retrieving of the ADCP mooring at 10°W-Equator.
- 3 SVPC (PacyficGyre) surface drifters at 10W-2S, 23W-0°N, 20°W-6°N.
- Replacement of the CO2 system at 6°S-10°W.
- water samplings (S, O2, nutrients)
- TSG along the track line.

The following problems were noted:

- Delay in the PMEL material transportation (*for some initial reasons -ie: tube delivery delay-, several induced and consecutive delays of shipment made that the container arrived on September 13 instead of mid-August! Thanks to negotiations with the transit agent in Cotonou who well knows IRD & PIRATA cruises now as done from 2005 in Cotonou-, customs formalities have been done in 2 days only and the cruise departure done on September 15, so with one week delay…*). Such a delay induced a consequent over cost of the cruise (Air France: 9k€ + 15k€ for additional days at the port). IRD and PMEL will do their bests (along with IRD transit agents) to avoid any similar problem in the future.
- In spite of repair in spring 2010, the RDI VM-ADCP failed again during the 1st day of the cruise. The beamformer card has been changed in emergency during the mid-cruise call at Cotonou, but no ADCP measurements could be acquired during the 1st leg.
- Two new RDI LADCP (Workshorse) also failed during the cruise (but replaced by spares; so no data loss…). This illustrates some major problems encountered with RDI manufacturer these last years…
- Batteries failure on the ADCP mooring at 10°W-0°N inducing a one-year registration only instead of two! (current measurements in 2008-2009 only).

On São Tomé Island (0°N, 6°E), the meteorological station has been maintained since October 2003, with data transmission through the GTS from October 2006. An autonomous ONSET thermometer was installed in 2005 to measure SST. A tide gauge station had been maintained by IRD since the 1980s, measuring pressure, atmospheric pressure, SST and SSS. No dedicated mission was carried out since April 2009, for replacement of sensors, material (mast), the ONSET thermometer and the tide gauge that is no more operational. A dedicated mission will be organized as soon as a new tide gauge will be chosen (choice between a radar system or another one developed by CNRS in France) and bought (20k€). At now, sensors and data are only maintained by a local technician at São Tomé (committed through a convention with IRD).

The ADCP mooring at 0°, 23°W is monitored thanks to IFM-GEOMAR since 2006. A new ADCP (bought by IRD) was deployed in November 2009 and the mooring will be replaced in May 2011 during the next MERIAN cruise (see also "German status").

Then Bernard Bourlès presented the next PIRATA FR21 cruise, scheduled in May-June 2011. Following some of the AMMA-International/PIRATA/TACE/TAV recommendations (2009/2010) recalled during the last PIRATA 15 meeting, and due to TACE collaborations, this cruise will include several additional operations and has been adapted accordingly. It will be done from the R/V SUROIT in spring, in order to be simultaneous to the IFM-GEOMAR MERIAN cruise dedicated to the onset of the equatorial upwelling.
Thus, the following activities are planned:

1) The 5 ATLAS buoy replacement is planned.
2) 3 Gliders (2 to IFM-GEOMAR, 1 to INSU/CNRS) will be deployed.
3) Retrieving of 4 TACE ADCP moorings (2 at 0°E and 2 at 10°W ; PI: Bill Johns).

4) Addition of 6 TC sensors on ATLAS buoys; vertical resolution for TS will be with 9 depths at 0, 5, 10, 20, 40, 60, 80, 100, 120m at 10°W: 6°S and 10°S (two of them not telemetered: at 5m / 6°S and 100m/10S)
5) addition of 2 HR real time RDI sentinels at 10°W (0°N and 10°S) (by PMEL: one PMEL scientist onboard during the 1st leg)
6) Deployment of 5 SVP-BS drifting buoys (PI: Gilles Reverdin)
7) Deployment of 6 ARGO profilers (APEX)
8) Replacement of the CO2 system at 6+S-10°W.

Bernard Bourlès also noted the following issues:

- In the next years, PIRATA FR cruises have to be platforms for other experiments, eg process studies (mainly: one experiment is planned around 10°W-0°E for vertical velocity assessment, maybe along with turbulent air-sea fluxes measurements with an instrumented mast; radio soundings are planned for MeghaTropiques satellite measurements validation) But such operations will need special vessel time demands (additional days). The possibility to obtain yearly the R/V SUROIT is far to be ensured… and the 7 days additional days available from two years, and justified by the PIRATA SEE buoy replacement at 6°S-8°E, are not systematically guaranteed for the next years!
- Due to time availability, the test of the fish repellent system (NEOTEK) that was announced in 2009 has not been implemented…
- Funds are needed for old material replacement (tide gauge, releaser, ADCP, cable for moorings, etc…), that regular yearly supports by IRD & Meteo-France cannot cover.

Finally, Bernard Bourlès also noted number of other lab activities supporting PIRATA, including two new theses (one between France/IRD and Benin; other one in Brazil/UFPE from April 2011) carried out by African students who successfully attended the new UNESCO Master 2 in Physical Oceanography and Applications launched in 2008 at Cotonou (Benin) between University of Abomey Calavi (Cotonou), Université Paul Sabatier (Toulouse) and IRD.

3) ***News of the PIRATA Southeast Extension (Bernard Bourlès)***

Bernard Bourlès got some news several weeks ago from Mathieu Rouault about the PIRATA SEE. According to Mathieu Rouault (who is no more in charge of PIRATA SEE), one scientist of University of CapeTown (Mike Roberts) will submit a new proposal with the PIRATA SEE committee in order to re-initiate the project. At now, a 2nd ATLAS buoy (needed to re-deploy the 6°S-8°E site) is still not funded.

As mentioned during the last PIRATA 15 meeting, a proposal has been suggested by the oil company Total (http://www.total.com), to collaborate with PIRATA in implementing a site that could possibly become the next SEE. Total is primarily interested in real time current and wave information at 7°26'-7°29'S / 11°30'-11°40'E (ie southeast of the initial location and within i) shallower waters, ii) Economic Exclusive Zone of Angola). After some mail exchanges between Valérie Quiniou (contact at Total) and Mike McPhaden (contact at PMEL), then between Valérie Quiniou and Bernard Bourlès, Total could provide their special instrumentation & RT transmission (wave, currents), the ship support and eventually pay for an ATLAS buoy for this site.

4) Brazilian PIRATA status

a) general activities and plans (Paulo Nobre)

Paulo Nobre presented a summary of the Brazilian 2010 activities, which included:

- PIRATA BR-XII and SWE-V cruises [July to September 2010] with underway CO2 monitoring. During these cruises, a new Underway CTD (uCTD) was used, and CTD station were carried out with a higher spatial resolution;
- ATLAS sensors and electronic shipped to PMEL;
- Archipelago St Peter-St Paulo met & tidegauge stations were maintained;
- The archipelago Fernando de Noronha tide gauge bought and tested (will be deployed soon, around May-June 2011);
- Updated the http://pirata.ccst.inpe.br PIRATA website with hydrographical data
- Maintained collaborations with Nathalie Lefèvre (IRD/LOCEAN) for pCO2 at ANTARES and maintenance of CO2 sensors at 38°W-8°N;
- Developped a proposal of ATLAS-B (PI: Edmo Campos, see below).

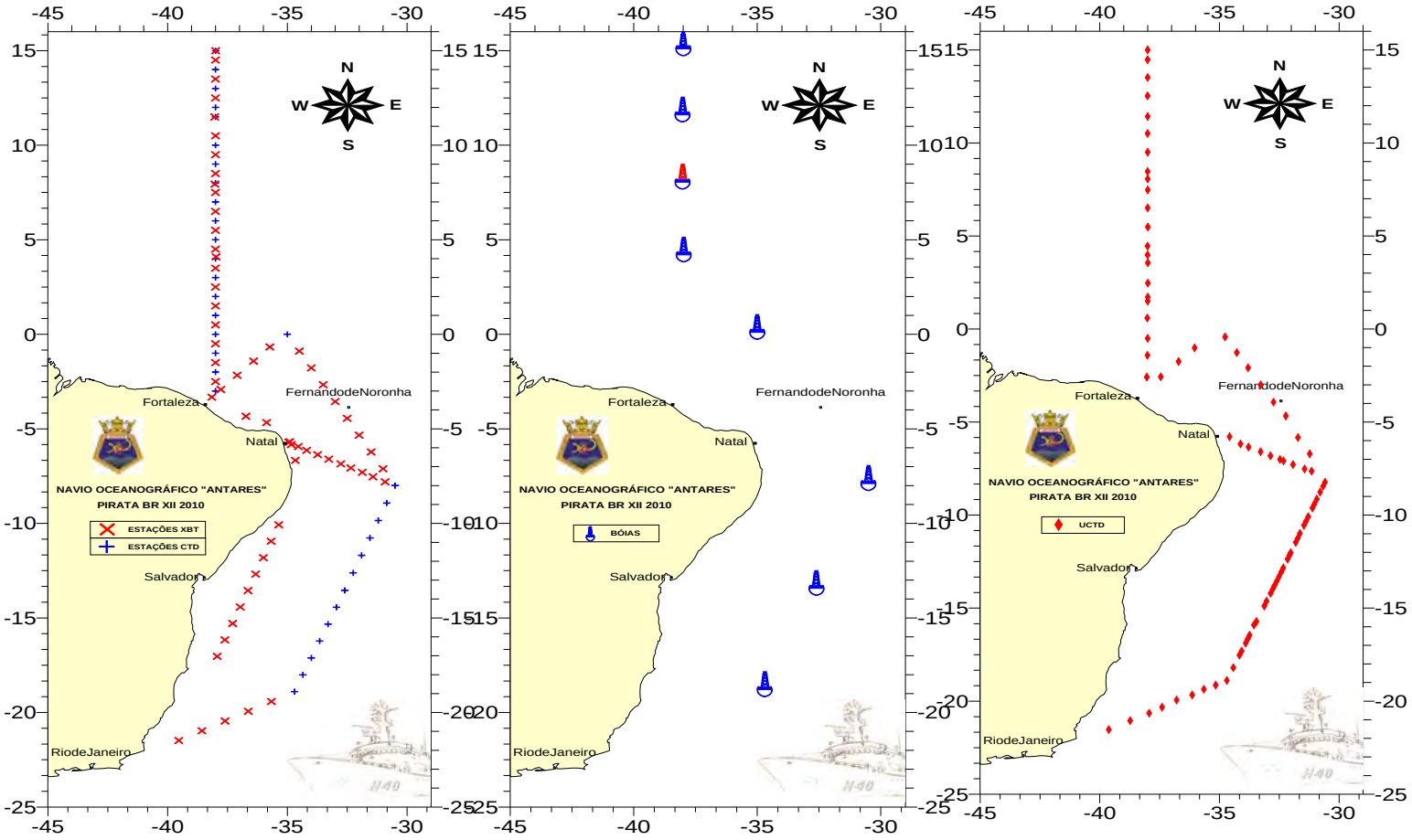
The PIRATA BR costs in 2010 were:

- 350 k$ for instrumentation (650 committed for 2011);
- 1,500 k$ for ANTARES vessel time (36 days)

Then, Paulo Nobre presented in more details the ATLAS-B project (Construction and Mooring of an Atlas-like Buoy in Brazil), head by Edmo Campos (IOUSP). Brazil is constructing a Prototype of the Atlas Buoy (ATLAS-B) for monitoring the South Atlantic Convergence Zone and the mixed layer in a regional with intense cyclogenetic activity (e.g. the Catarina storm in 2004). The buoy is planned to be moored at 28°S, 42°W. Repeat hydrographic section, together with current-meter mooring, will be carried across the Brazil Current. This work is being carried out in close cooperation with PMEL. It is expected that the buoy first sea test will be carried on at the second quarter of 2011. Meteorological (air temperature, humidity, barometric pressure, rain and wind) and oceanographic parameters (water temperature, salinity and pressure) will be sampled at the same levels as in the PIRATA buoys. Buoy should be deployed till the end of 2011.

b) Brazilian cruises (Rodrigo Obino & Domingos Urbano)

Rodrigo Obino (commandant of the R/V ANTARES, DHN), presented in detail the last PIRATA BR XII & SWE-V cruises (July to September 2010; see figure below). In addition to the 8 ATLAS buoys maintenance (8 deployed, 7 recovered), many operations and measurements were carried out during the three legs of the cruise, e.g. 34 CTD-O2, 85 uCTD casts (see below), 65 XBT, ADCP, TSgraph, EMS-A, GEBCO sounding, 207 DO and salinity analysis, continuous pCO2, filtration for plancton and nutrients analysis, 10 drifting buoys -one by UFPE-, 34 radiosoundings,.... Underway pCO2 was collected in collaboration with Nathalie Lefèvre (IRD/LOCEAN), who will embark the next PIRATA BR-XIII for pCO2 at ANTARES and maintenance of CO2 sensors at 38°W, 8°N.



The PIRATA PIRATA BR XII & PSWE-V cruise trackline (left, with XBT & CTD stations), position of the ATLAS buoys (middle) and uCTD casts (right).

Rodrigo Obino listed the main problems encountered during the cruise:

- real wind from EMS-A not reliable;
- loss of configuration of the Tsgraph;
- presence of fishing nets/lines around mooring line;
- flooding of the ANTARES wet laboratory;
- frequent interruptions on sanitary system and air conditioning system (inducing 2 additional days at Fortaleza for repair).

Then, Rodrigo Obino listed the perspectives for the R/V ANTARES:

- Installation of new ADCP ;
- Lateral station adaptation ;
- Installation of Traction winch & reposicioning of 10030 winch;
- Substitution of the Tsgraph;
- Installation of an EMITER station;
- Substitution of the Hydrographic Ecosounders;
- Change of the satellite communication system.

For the comfort onboard, other works are planned on the ANTARES, ie: reform in wet lab, floors change in dry lab, galley and two internal corridors (=> cost: 120k$) plus engines' overhauls, maintenance of auxiliafy systems, air conditioning system, sanitary system, fresh water system, communication system and scientific systems (=> annual cost: 3,800 k$; proportionnal cost: 1,500 k$).

Domingos Urbano presented some results obtained with a new uCTD (underway CTD) that has been experienced during the last PIRATA BR XII cruise. He proceeded to inter-comparisons between CTD and uCTD measurements obtained during different operations (simultaneous uCTD and CTD casts, sensors change between uCTD and CTD etc…). All comparison experiences demonstrated that uCTD and CTD measurements are identical with a perfect superimposition (correlation coefficient varying from 0.9998 to 1!) and that uCTD is a very reliable material (allowing profiles down to 500m depth at 10knts).

The 2011 cruise PIRATA Brazil XIII of the R/V Antares was scheduled in from April 8 to June 2, 2011 and will represent 40 days at sea; it has been rescheduled to mid July – mid September, 2011.

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c) GOOS Brazil context (Janice Trotte-Duhà)

Janice Trotte-Duhà presents an overview of the GOOS (Global Ocean Observing System) program in Brazil. She recalls the importance of PIRATA in GOOS/Brazil and presents other components of this program, ie mainly:

- Drifting buoys: in close collaboration with NOAA/AOML, 75 SVP and 25 SVP-B buoys have been launched in 2010;
- Argo profilers: 4 deployed in 2010;
- Tide gauges: 12 installed along the Brazilian coasts and Islands;
- Fixed buoys: (on plateforms or coastal): 8;
- Wave ride sensors: 4 to be implemented;
- High density line between Rio and Trinidad Island (22°S);
- TransAtlantic cruise I in 2009 (to monitor ocean CO2 in the south Atlantic): done along two transects at two different latitudes between Brazil and Africa, and many operations (CTD, XBT, radiosoundings, SVP, ARGO…).

Janice Trotte-Duhà presents the ATLAS-B as an important future component of this observing system. She announces the next IBSA (India, Brazil South Africa) OCEAN meeting that will be held in Brazil in 2011 and recalls that data area accessible through the GOOS/Brazil website (http://goosbrasil.org).

5) PIRATA in the context of JCOMMobs (Candyce Clark).

Candyce Clark, member of the PIRATA PRB is chair of the JCOMM Observations Coordination Group (JCOMM = WMO-IOC Joint technical Commission for Oceanography and Marine Meteorology; WMO= World Meteorological Organization; IOC = Intergovernmental Oceanographic Commission), and works at the U.S.-NOAA Climate Program Office. She presented to the PIRATA SSG the role of JCOMM coordination that presently links internationally six global *in situ* implementation programs, namely DBCP (Data Buoy Cooperation Panel), ARGO, OceanSITES, GLOSS (Global Sea Level Observing System), SOT (Ship Observations Team), and IOCCP (International Ocean Carbon Coordination Project).

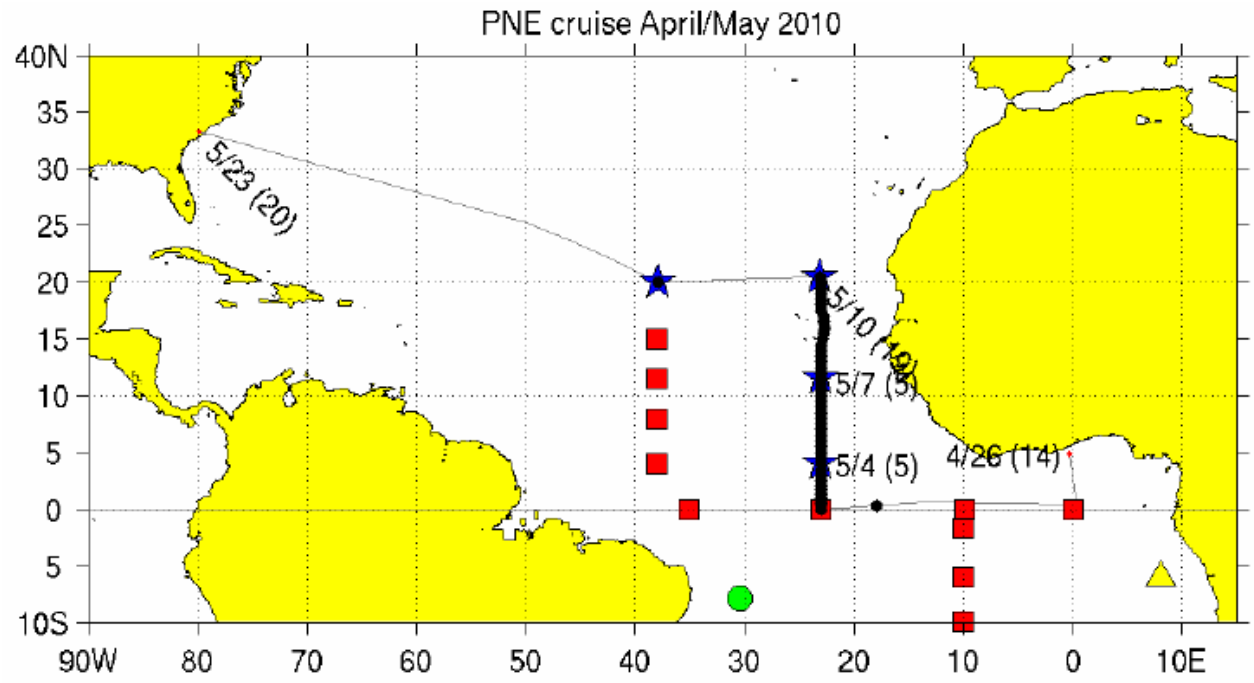
Candyce Clark presented the initial goals of the Global Ocean Observing System for Climate. The system, which was 30% "complete" in 2000, has reached its present status of 62% complete (October 2010; 72% for the global tropical moored buoy network, ie PIRATA, TAO and RAMA: 119 moorings were initially planned). Funding is a key issue for each network… (see: www.osmc.info / www/jcommops.org**)**

6) US NOAA/AOML report and plans (Rick Lumkin).

Rick Lumpkin presented the results of the 2010 PNE cruise and future plans.

The following activities were conducted during the 2010 PNE cruise:

- Recovery of the 0°-0° ATLAS buoys (went adrift on April 20).
- Tube and Sensors swap at the 23°W-0°N ATLAS buoy (This French backbone site had failed within weeks of being replaced, and was added to the cruise plan days before the cruise began).
- PNE ATLAS operations: replacement of all four sites at 4°/11°11°30'/20°30'N-23°W; 20°N-38°W.
- 48 CTD/LADCP casts were collected, at all five ATLAS sites and along 23°W (46 profiles), cutting through the oxygen minimum zone of the North Atlantic.
- 72 XBTs were deployed (2009 drop rate experiments submitted in JAOT by Goni et al.)
- 11 ARGO profilers deployed
- ADCP, TSG, and underway meteorology was collected along the trackline.



Cruise track of the R/V *Ronald H. Brown* during the 2010 PNE cruise (black), between Ghana and Charleston, 26 April through 22 May, with CTD stations (black points along 23°W), PNE mooring sites (blue stars), and the PIRATA backbone sites (red squares) superimposed.

This 2010 PNE cruise was also an opportunity for specific measurements and operation in the framework of the AEROSE project (trans-Atlantic Aerosol and Ocean Science Expeditions; Howard Univ. /NESDIS). So, Rick Lumpkin listed all the ancillary data obtained during this PNE cruise, including AEROSE observations:

- Shipboard ADCP, TSG, meteorological observations
- 75 Vaisala RS92 Rawind sonde launches, 19 with ozone sondes
- Continuous measurements of ozone, carbon monoxide and sulfur dioxide
- Surface-level aerosol mass and number distribution characteristics
- Continuous radiometric broadband flux measurements (SW, LW)
- Air samples taken for biological (fungi, bacteria), chemical (total organics, heavy metals, cations and anions, and elemental analysis), and physical characteristics.

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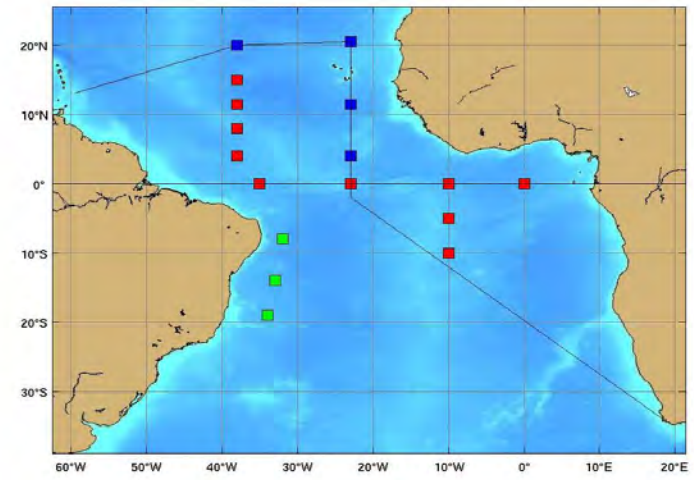
Aerose data are available at ftp/web servers at NESDIS and NOAA/ESRL/PSD

Rick Lumpkin explains the problem encountered concerning the next PNE2011 cruise. Initially scheduled on the R/V Ronald H. Brown in February-March 2011, the cruise has been postponed until August 2011 due to lack of NOAA funds for FY11 ship time ((the combined PNE and CLIVAR cruises will draw upon FY12 funds; FY12 starts September 2011). Alternatives were considered with input from Bernard Bourlès (e.g., chartering the French R/V SUROIT), but this was also not possible due to lack of NOAA funding. So, the PNE 2011 is now expected (from mid-August to mid-September between US to CapeTown; Chief scientist: Rick Lumpkin, NOAA/AOML), with minimum ship time, solely dedicated to ATLAS buoy recovery/redeployment at 4 PNE sites (no extra time for CTD section, PNE backbone repair, etc.). In the framework of SPURS (see above "NOAA/PMEL report"), the 20°N-38°W buoy will be upgraded with additional TC sensors and meteorological/flux sensors.

Paulo Nobre offered INPE's UCTD to be used during the next PNEE cruise in September 2011, in order to avoid the loss of CTD data of the upper ocean between the mooring positions.

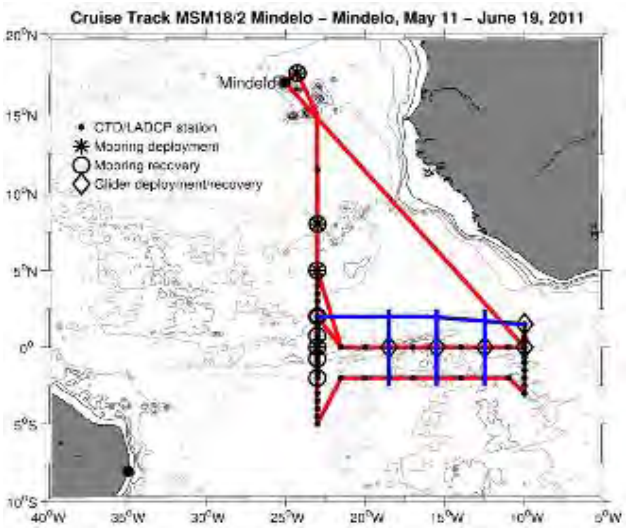


Possible cruise track of the R/V *Ronald H. Brown* during PNE2011, Barbados to Cape Town. The cruise may instead be Charleston, SC to Cape Town.

Rick Lumpkin also recalls that he regularly maintains/updates the PIRATA bibiography list, which is distributed at the PIRATA Northeast Extension web page. He reminds everyone to check periodically and to send any updates to him.

7) German observations linked to PIRATA (Peter Brandt).

Peter Brandt presents the IFM-GEOMAR cruises scheduled in 2011. The first cruise onboard the R/V MERIAN (MSM18/2, May 11 - June 19 2011; Brandt, Dengler and Krahmann) is dedicated to observations during the onset of equatorial upwelling. The following operations are planned: CTD-O_2/lADCP (partly to bottom), microstructure stations, glider swarm experiment using up to 10 gliders/one microrider, underway CTD, air-sea freshwater flux measurements, mooring replacements, O_2, CO_2, N_2O measurements.



This cruise will be simultaneous with the PIRATA FR21 cruise (see below "French status"). All gliders deployed during both cruises will be retrieved during the MSM/18/3 cruise (June 22 - July 21 2011; Arne Körtziger) mostly dedicated to bio-geochemical studies in the Gulf of Guinea (from Mindelo in CapeVerde to Libreville in Gabon)

Peter Brandt presents some results obtained :
- with a Glider/MicroRider at 0°N-23°W during a 8 days experiment carried out in November 2009.
- with a Short-term Mooring (high sampling rate of 1200kHz ADCP) on top of the 0°-23°W ADCP mooring

Then, Peter Brandt, after explaining the general context of their programs in Gernany, i.e. the SFB 754: Climate –Biogeochemistry Interactions in the Tropical Ocean, 1st phase of which was from 2008 to 2011, informs that a second phase is expected that will allow additional operations in the Tropical Atlantic by IFM-GEOMAR until 2015 (dedicated to Oxygen and Current Changes along 23°W). Main goals of this 2nd phase are:
- Improve our understanding of ocean dynamics responsible for the generation of latitudinally alternating zonal jets and equatorial deep jets and their effect on the oxygen distribution ;
- Quantify hydrographic and current variability within the Oxygen Minimum Zone and associated lateral oxygen fluxes with a particular focus on the role sub-mesoscale processes.

In this context, observing system along 23°W are planned to be continued for the second phase, with enhanced observations of eddy mixing processes near 5°N. Thus, the present IFM-GEOMAR 23°W-0°N current-meters mooring could be maintained until 2015/2016, with the PIRATA shallow ADCP in collaboration with PIRATA France. Three MERIAN/METEOR cruises are planned (in Oct/Nov 2012, early2014 and late 2015).

PIRATA data policy:

Three presentations were done by invited people from France and Brazil. Two dedicated to data acquisition/processing tools and web database, one to other kinds of measurements that could be acquired thanks to the PIRATA platform.

1) Data processing at IRD-Brest (Jacques Grelet).

Jacques Grelet works at the "Unité de Services" IMAGO of IRD (Brest), that is in charge of many aspects of PIRATA France. He first presented some tasks done at the US IMAGO ("ISO 9001 certified" laboratory in 2009) in the framework of PIRATA, i.e. mainly all the logistical aspects of the PIRATA cruise (inventory and preparation of equipment in relationship with PMEL, shipment organization, participation to the cruises, data acquisition etc…) and the maintenance of the new French PIRATA web site (redone in 2009, with easy access to information, cruises reports and figures, data, technical documentations).

Then, Jacques Grelet presented data processing tools he developed. The same Information System is used for acquisition onboard (Unix share), backup and copy on USB disk, and data-processing at lab. This system contains 1 folder per cruise with data raw (*important to save and keep them*), data-processing (*1st processing onboard*) and data-final (*after calib/valid steps; sent to Coriolis*). It is very easy to switch from cruise to cruise, regular backups done on Unix system, and the creation of new standard cruise skeleton is very easy (Unix scripts). Scripts exist for data extraction (*one script per instrument*) and there is an identical data structure for all data types (XBT, CTD, ADCP…). Output may be in ASCII or XML files *(meta-data)*, NetCDF with ARGO convention, with scripts for transformation to OceanSITES. Visualization tools are available (Matlab with datagui) and products delivery easy on board during the cruises (*maps, sections, scatters*), but without interactive quality control and validation at this step.

A Quality Control has been developed for TSgraph data (TSG-QC), with Matlab softwares (external correction from samples, CTD, ARGO, sensors drift correction…). This TSG QC is used by CORIOLIS and other labs (LEGOS, LOCEAN…). Source codes are free. No standard validation softwares exist for other data types (CTD, XBT, Meteo Data…) but for ADCP. Jacques Grelet developed standardized Matlab library and tools for visualizing data sets, to import/export data *(ASCII – NetCDF OceanSITES)*, plugins for specifics processing, and sharing source codes *(subversion svn).*

Then, Jacques Grelet presents "DB Oceano", a web database application (Java J2ee). DB Oceano is easy to deploy, used to load PIRATA files to db-oceano database, to manage profiles, trajectory and time-series… Presently with a NetCDF Convention OceanSITES 1.2, CF 1.4, public web access and Opendap / Thredds will be done in a next step.

To conclude, Jacques Grelet indicates that such generic tools for visualization & calibration could be useful for PIRATA cruises data, and that OceanSITES format could also be used in order to get all PIRATA cruises data with the same format.

2) Data Base at INPE (Roberto de Almeida).

Roberto de Almeida presented a DataBase with a common format he developed at INPE (see: opendap.ccst.inpe.br). Such a DB (serveur pydap/3.0) allows access to different types of data and different kinds of data visualization (profiles, sections…). Roberto presented an example of PIRATA application ("PIRATA data display and delivery"), as would be directly done from the web page: i) selection of the PIRATA cruise (with view of the trackline); ii) selection of the data/sensor (with view of the locations of the measurements along the cruise trackline); iii) selection of the profiles/location for wished plots; iv) visualization of the plots. Access and downloading of the requested data set are easy.

3) Sensors of interest for biological oceanography (Rodolfo Paranhos).

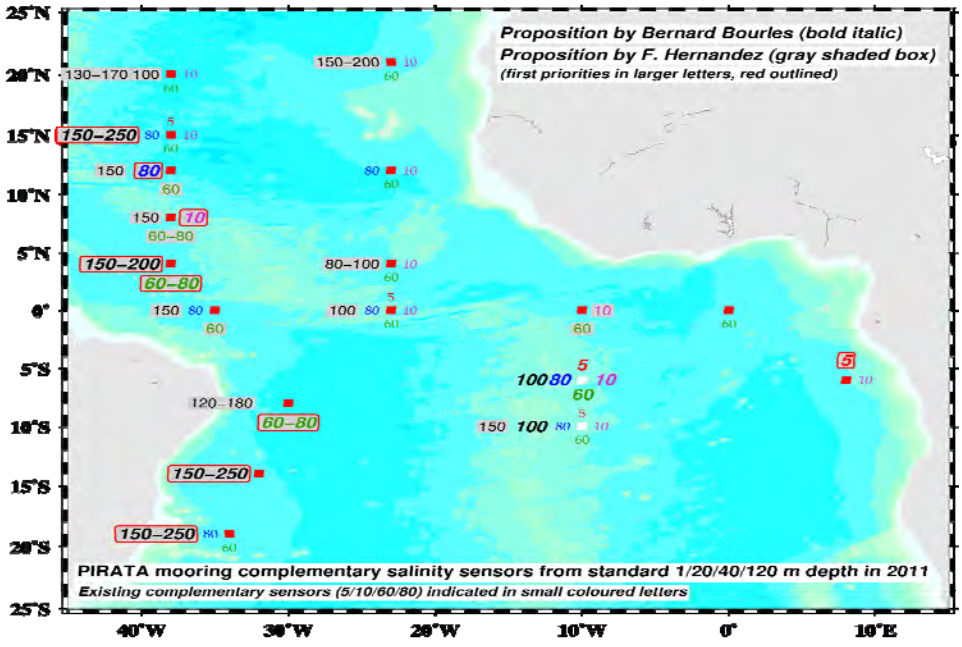
Rodolfo Paranhos (UFRJ, Brazil) underlines the importance of several parameters that are very needed in the purpose of many studies on marine biological processes. Some parameters could be easily measured, eg: dissolved O2 (Optode), pCO2, Chlorophyll-a or other pigments, nitrate… Some others could be in a near future thanks to specific apparatus, e.g. flow cytometry (Sea Flow) and Environmental Sample Processor (an advanced robotic laboratory for microrganisms indentification). If PIRATA could be a platform for some measurements, questions raises about: costs, size, power consumption, data processing requirements and…who will be in charge?

Pirata dedicated numerical experiments *(Fabrice Hernandez)*

Fabrice Hernandez presented results of an analysis done from numerical experiments, in agreement with PIRATA 15 meeting recommendations concerning the need of additional sensors. By using Mercator simulations, Fabrice Hernandez addressed the issue of additional salinity sensors impact (on existing moorings) for operational oceanography. Objectives are i) to identify at PIRATA existing moorings at which depth salinity sensors could reduce model errors, and ii) to analyse impact of PIRATA salinity observations on Mercator's assimilation system. By using ORCA12 simulation (no assimilation) and Glorys2v1 recent ocean reanalysis, and by comparison to PIRATA salinity data, Fabrice Hernandez well precise that this study is model dependant, but can however bring interesting information on salinity gaps due to too weak vertical resolution of data in areas of strong signal (eg extrema or strong vertical gradient). Thus, the the point is: "*if the model shows some salinity signal, where should be adequately positioned a salinity sensor to eventually correct it*…". After explaining the used method and presenting the ORCA 12 runs, Fabrice Hernandez applied his analysis to the different PIRATA ATLAS buoys sites.

To summarize, his results strongly suggest adding salinity sensors (ie Conductivity…) at depths where strong variability is observed and not well reproduced by the model, ie (as summarized in the figure below):

- in the upper layers in the NW (Amazon River influence, mainly at 8°N-38°W where a pCO2 sensor is present; such a result reinforces the Nathalie Lefèvre suggestion, as wishing additional salinity sensors around 5 & 10m depth), and in the East & SE (6°S-8°E, 0°N-10°W; and mainly 6°S-10°W also where a pCO2 sensor is present; such a result also confirms the interest of adding salinity sensors at this location, as will be done in 2011 by IRD during the Pirata-Fr21 cruise).
- between 50 and 100m in areas where Central Waters are present, ie in the NW, SW;
- if possible, below 100m depth (from 130 to 200m) in particular locations where strong bias are observed due to vertical gradients.



Discussion items

The discussion was very "open" but unfortunately done rapidly due to short remaining time after all the presentations…

First item concerned the PIRATA cruises data, and the need (already discussed during the last PIRATA SSG meetings) of a centralized data source in a uniform format. The presentations and works done by Jacques Grelet and Roberto de Almeida show that this step can now be achieved in the near future, and it is suggested that they, along with Rick Lumpkin (PNE data) and Domingos Urbano (BR and PSW data) work on this issue (data uniform format, centralization, easy visualization, data portal etc…). Once done with PIRATA cruises data, and for other fixed stations PIRATA data (current moorings, meteorological stations, tide gauges), one could think to also consider other public data (from Germany, AMMA, historical… in the same area of interest). Also possible links between the different Data Bases (eg; TACE data, AMMA data etc.. already accessible via their web pages).

During the last PIRATA 15 meeting, it was decided to write two 2-pages rationales: a first one about scientific justifications to add a new PIRATA site in the central South Atlantic, a second one about scientific justifications for more temperature and salinity sensors, along with other eventual sensors (flux, currents). Presently, for understandable reasons of worldwide funds crisis, the first one has even not been drafted (funding for buoys and vessel time?)… On the contrary, the second one has been drafted (mail exchanges between Bernard Bourlès, Domingos Urbano, Fabrice Hernandez, Moacyr Araujo…), and additional sensors already planned to be deployed as early as 2011 (see previous presentations summary)!

Presently, it was rather suggested to think about a long term strategy by asking: "how should/could be the PIRATA network be in 10 years?". Such suggestion, concretized through a rational (detailed document), would also take into account most of the present scientific questions (most of them raised thanks to PIRATA) about mixing processes, turbulence, barrier layer, and also to consider other types of measurements (biogeochemistry, tracers…) and international programs (eg. ARGO, IOCCP…).
The rationale about additional sensors has to be finalized, that will include the justifications for the need of current data at the flux reference site at 19°S-34°W, for salinity sensors at 8°N-38°W close to the surface etc. and maybe biogeochemistry in the Western region influenced by Amazon River discharge. The next Summer School "Continental Ocean Exchanges" scheduled in October 2011 in Brazil could be interesting in this way to further these ideas.

Vessel time was discussed again, mostly due to the 2011 PIRATA PNE delay and uncertainty… The PIRATA PRB will be notified of this major issue (endangered vessel time dedicated to PIRATA), inducing a consequent data loss. It is presently recalled that all organisms are committed through an MoU that clearly specifies that ship time has to be provided for all moorings maintenance.

The reorganization of “Systems of Observations” in France will be pointed out to the PRB, as it could have some consequences on PIRATA France (material replacement, tide gauge in Sao Tomé, vessel time for PIRATA SEE…). Same for human resources in France (fewer and fewer scientists working on Tropical Atlantic, and uncertainties in engineers/technicians positions that could contribute to PIRATA in the close future…). Also, PIRATA should be attractive for PhD and post doc positions!

The PIRATA SEE remains a major issue for PIRATA SSG, without any precise information from the PIRATA SEE Scientific Committee… Presently, the concerned area (Southeastern tropical Atlantic) is a key area for bias in coupled models, connections between tropical and equatorial basins and modes of variability in the TA (refer to PIRATA/AMMA/TACE-CLIVAR/TAV recommendations…).
Although Total Oil Company opens perspectives of interest, scientific issues (locations relative to climatic problematic) and the problem of deploying an ATLAS buoy within Angolan EEZ (EEZ have always been avoided until now for evident reason of long duration sites & time series!) are still to be discussed … But the EEZ is a major reason for avoiding such a location, and the PIRATA SSG suggest to ask Total to study the feasibility for a position off the Angolan EEZ…
So, PIRATA SSG has to underline its real interest for this area and to push the PIRATA SEE to react. Peter Brandt will mention this issue during the “Workshop on Coupled Ocean-Atmosphere-Land Processes in the Tropical Atlantic“ CLIVAR meeting organized at Miami just following the PIRATA-16 meeting. A way could be to find other contributors for buying a 2nd ATLAS buoy in order to realize such a SEE at short term, with vessel time and logistics that could be ensured by PIRATA France.

About the PIRATA meeting next year: it should be organized by France. Some suggested organizing the meeting in Africa where capacity building actions are done (Benin or Cape Verde), but this would be rather difficult and with the risk of too few attendees. Peter Brandt recalls that 2012 is the last year for TACE. So, as done these last three years (from the Karlsruhe meeting in 2007), we wish to organize a common meeting PIRATA/TACE, with a large attendance. French colleagues will check where it could be organized.

Last discussion was about the PIRATA SSG composition. While all agreed with the present composition, one eventual problem is the contribution of Paulo Nobre to both the PIRATA SSG and the PIRATA PRB. Paulo Nobre clearly indicates that he is definitely member of the SSG. Paulo and the PRB will be sensitive to potential conflict of interest situations; if and when they arise, Paulo will recuse himself from those specific PRB discussions.

Report from the PIRATA Science Steering Group (SSG) to the PIRATA Resources Board (PRB).

(Fernando de Noronha, March 17, 2011, Brazil)

The PIRATA SSG notices that PIRATA is going rather well, with excellent collaborations between all partners, an efficient 2010 year (in spite of a few but unavoidable problems) and an excellent total data return (82% for the entire period from 1997). In 2011, specific observations (with gliders) will be collected in the central and eastern Equatorial Atlantic during a common operation and simultaneous cruises scheduled in May-June by Germany (MERIAN cruise by IFM-GEOMAR) and France (SUROIT PIRATA FR21 cruise by IRD), in order to get observations during the onset of the equatorial upwelling.

The PIRATA SSG insists on the problem of endangered vessel time dedicated to PIRATA (referring to the 2011 PIRATA PNE delay and uncertainty)… It is important to note that any canceled delayed, or even shortened cruise induces consequent and irremediable data losses, very prejudicial for the PIRATA time series. It is presently recalled that all organisms in charge of PIRATA cruises are committed through a MoU that clearly specifies that ship time has to be provided for maintenance of all moorings.

PIRATA France informs the PIRATA SSG about the reorganization of "Systems of Observations" and the problem of human resources in France, that could have some consequences on PIRATA operations. The MoU is of prior importance in such a context. It is also noticed that PIRATA should be more attractive for PhD and post doc positions!

The PIRATA SSG decided to implement a centralized and unified "PIRATA ancillary data" web portal. All data (from cruises, meteorological stations, tide gauges, ADCP moorings) on this page must be a uniform in format. This effort will be carried out in collaboration by Jacques Grelet (IRD) and Roberto De Almeida (INPE), along with Rick Lumpkin (NOAA/AOML), Peter Brandt (IFM-GEOMAR) and Domingos Urbano (INPE).

The PIRATA SSG noticed that, from the two rationales envisaged during the last PIRATA 15 meeting (the first one concerning additional buoy in the South Atlantic, the second one concerning additional sensors on the buoys), due to international economical context, only the second one has been drafted. It recommends thinking about a longer term strategy by drafting a document to provide a vision of the future entitled "PIRATA 2020" (taking into consideration other kinds of measurements, additional sites & instrumentation…).

As initiated as early as 2011 for some particular sites, the PIRATA SSG recommends additional TC sensors where possible (and notably at 5 & 10m at the 8°N-38°W site influenced by Amazon River discharge) and current data at the flux reference site located at 19°S-34°W. The PIRATA SSG also welcomes the contribution of NASA to enhancing the 20°N, 38°W site for the SPURS experiment.

The PIRATA SSG notices the absence of any news from the PIRATA SEE scientific committee and/or contact. Due to the scientific importance of the Southeastern Tropical Atlantic (real high priority), the PIRATA SSG recommends that actions to be taken in order to re-deploy as soon as possible an ATLAS buoy in this area (i.e. to find other potential partners susceptible to buy a 2nd ATLAS buoy!). The Total Oil Company proposal is kept in mind, but the deployment of any buoy in an Exclusive Economic Zone (in this case, Angola's) is a real issue that has to be considered.