PIRATA-18 meeting report

(Venice, Italy, October 22-25, 2013)

The 18th PIRATA meeting was held during the PIRATA-Tropical Atlantic Variability (TAV) meeting organized in Venice, Italy by NOAA/PMEL and Ca'Foscari University of Venice (see http://www.dais.unive.it/~tav-pirata/tav-pirata.html). About 50 people attended this meeting, in which scientific presentations were held during specific sessions on Tuesday through Thursday, October 22-24. A PIRATA-dedicated session was held on Friday, October 25 in the morning, after a preliminary meeting of the SSG on Wednesday, October 23 in the afternoon. The PIRATA PRB meeting was held at the end of the dedicated PIRATA session.

Attendees:

SSG member participants:

Bernard Bourlès (IRD, France; co-chair); Rick Lumpkin (NOAA/AOML, USA; co-chair); Michael McPhaden (NOAA/PMEL, USA); Paulo Nobre (INPE, Brazil); Moacyr Araujo (UFPE, Brazil); Ramalingam Saravanan (Texas A&M University, USA), Peter Brandt (GEOMAR, Germany); Hervé Giordani (Météo-France/CNRM, France), and Domingos Urbano (INPE, Brazil).

Fabrice Hernandez (IRD, France) was absent and excused, and provided some information by e-mail.

PRB member participants :

Paulo Nobre for INPE (Brazil; Pdt); Guy Caniaux, representing Météo-France (France); Bernard Bourlès representing IRD (France), Saraiva Nogueira representing DHN (Brazil).

Candyce Clark for NOAA/CPO (USA) was absent and excused, and provided input on renewing the MoU by e-mail.

See below about PRB members changes.

The first part of this report summarizes the issues discussed within the SSG discussion on Wednesday, October 23, while the second part covers the presentations of the PIRATA-dedicated session on Friday, October 25 including the global and national PIRATA status reports. The main items and recommendations issued from the discussions during the PIRATA SSG meeting are then summarized, and the final page contains a summary for the PIRATA PRB.

A summary of all action items decided at this meeting is presented at the end of this meeting report.

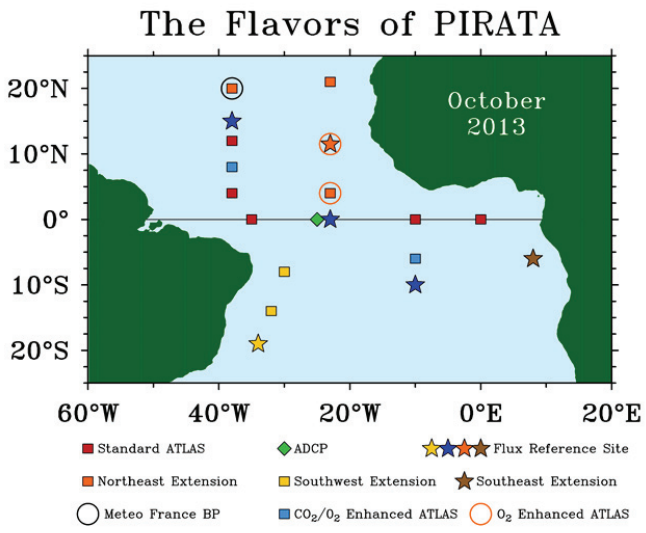
First SSG discussion:

A PIRATA SSG (closed) discussion was held on Wednesday 23rd in the afternoon in order to address more administrative issues, some of them raised during the previous 2012 meeting. The following topics were discussed:

- ***Renewing the Memorandum of Understanding (MoU)***: the current MoU will conclude on July 2014. As suggested during the last meeting held at Kiel in September 2012, all members agreed to extend and renew the existing MoU in its present form or with little modification. Candyce Clark sent a draft amendment for an Annex IV which could be added to the current MoU and its three existing amendments, to renew the MoU for another five years. This Annex could be sent to each of the organizations involved in the MoU signature. All MOU members present agreed with the contents of this Annex (with one typographical error in the Annex, the end date of the MoU, corrected) and

agreed to send the MoU and new Annex as soon as possible to their respective PIRATA MoU institutions for formal signature (ie, NOAA, INPE, IRD and Meteo-France).

- ***"PIRATA in the Future" and "achievements and perspectives" documents***: these documents were considered and discussed during the two last PIRATA SSG & PRB meetings. At present the need for such documents is not perceived as urgent. Considering the present PIRATA situation (successful and on a solid basis), there is no pressure to create a PIRATA-focused document. More important in the near future is an overview dedicated to the integrated observing system in the Atlantic, which would cover more than just PIRATA. As new observing systems now exist (e.g. Argo), a PIRATA-only perspective would not be particularly relevant; in other words, PIRATA should be presented in relative terms along with other observations. The SSG thinks that such a document would be relevant for OOPC/CLIVAR, ten years after their PIRATA evaluation done in 2006 (see the OOPC/CLIVAR PIRATA document), i.e., in 2016. Such a document will have to show the progress from 2006, and how PIRATA contributes (through several different ways) to tropical Atlantic observations and monitoring. It would document advances and observational needs (expansions and additions needed to the current observing system), and describe our continued advances in understanding since 2006. The SSG also believes it is prudent to wait for the conclusion of the Tropical Pacific Observation System evaluation by OOPC in 2014. However, the SSG has to begin rather soon such a document that will be an important challenging work.
- ***Proposed extensions and "piggyback" observations***: the SSG recalled that principal investigators of proposals have to send a letter of intention to the PIRATA SSG (as done in the past for extensions, CO_2 sensors, or more recently for turbulence sensors by Jim Moum) that evaluate the relevance and feasibility of the proposed effort, keeping in mind that such operations cannot change the terms of the MoU and PIRATA commitments.
- ***SSG composition***: Brazilian colleagues informed the SSG that Domingos Urbano (INPE, Brazil) will retire from the SSG and be replaced by Edmo Campos (IOUSP), who is well aware of PIRATA and is the lead PI of the ATLAS-B mooring system in Brazil. There were no other changes.
- ***PRB composition***: Guy Caniaux noted that Joël Poitevin will be replaced by Marc Ponteau for Meteo-France; Paulo Nobre noted that Janice Trotte-Duhá will return to the PRB and replace him. Bernard Bourlès noted that nobody has been nominated yet to replace Pierre Soler for IRD.
- ***The next PIRATA SSG/PRB annual meeting***: the next meeting should be *a priori* organized in Brazil, probably in Recife. To avoid any "shutdown induced issues" related to the US fiscal year ending at the end of September, it is suggested this meeting to be held in September or November (i.e., avoiding October). It was also noted that the participation of representative(s) from the EU-PREFACE program and from African partners is needed and strongly desired.



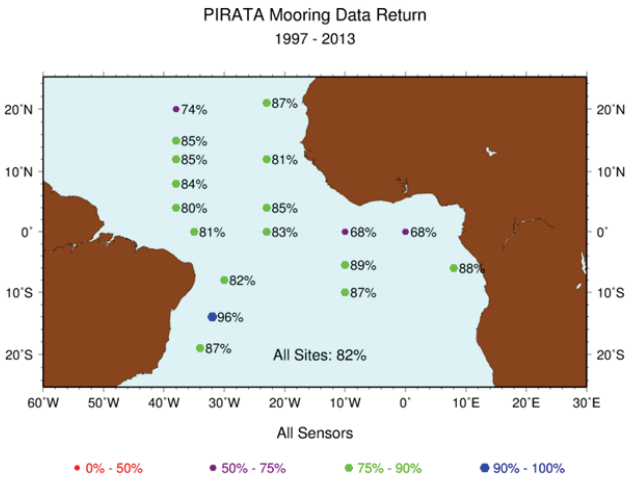
PIRATA dedicated session:

1) **NOAA/PMEL overall report (Mike McPhaden)**

Mike McPhaden presented the current flavor of the PIRATA buoy network, including the new

PIRATA southeastern extension flux reference site deployed in June 2013 during the French PIRATA-FR23 cruise (see figure). He illustrated the now long-term PIRATA data time series with some parameters' evolution at the 4°N-38°W buoyHe showed the present status of the deployed moorings, and the trajectory of the 4°N-38°W buoy that went adrift on October 1st 2013. A Brazilian Navy vessel is presently on the way to recover it.

The Real Time (RT) data return during the last US fiscal year (Oct 2012-Sep 2013) is 78% for all sites, lower than previous recent years due to postponing of the Brazilian and US cruises (both initially scheduled for fall 2012 but conducted in winter and spring 2013). The RT data return per sensor has improved for near-surface currents, and remains good for LW/SW radiation, humidity and atmospheric pressure. However, the data return was not as good for rain, being at the lower limit of acceptability.



The overall Delayed Mode (DM) data return was 77%. The global (1997-2013) data return for all buoys was 82% (see figure) and still shows relatively low values for the two equatorial buoys in the Gulf of Guinea (68%), due to vandalism (which has been weak these last years). This remark also applies for the PIRATA mooring survival rate at these sites (11 and 11.5 out of 16 deployed).

Field work during the US fiscal year (Oct 2013-Sep 2013) involved 74 PMEL person-days at sea, with 143 days at sea across all partners. Data files delivered through the web increased strongly in 2013, mostly explained by individual requests (the 2008 extremum is mostly explained by the AMMA experiment).

The 20°N—38°W buoy was enhanced for the Salinity Processes in the Upper ocean Regional Study (SPURS) field campaign. Met sensors were added to bring the site to full flux status (NASA funding), and T/C modules were added at 5m and 30m (French funding; PI: G. Reverdin). A new T-Flex system was deployed very close to the 20°N-38°W ATLAS buoy for data comparison (ATLAS/T-Flex).

McPhaden described the improvements of the T-Flex buoys, e.g. new modular design, off-the-shelf electronics, and transmission through Iridium instead of Argos. Because of their modular design and increased bandwidth, T-Flex moorings offer near-real time data transmission for new instrumentation far more easily than was possible with ATLAS moorings. At present, two T-Flex tests have been completed and 5 are ongoing. The first ATLAS/T-Flex comparison results produced very comparable data. Implementation of these buoys will begin in 2014, initially in the Indian Ocean. Atlantic phase-in will require that French and Brazilian engineers/technicians receive training of a few days to a week at PMEL. This is not urgent but imminent, and must be planned in 2014. McPhaden also noted the successful implementation of the first Atlas-B system by Brazil, which is producing excellent data return.

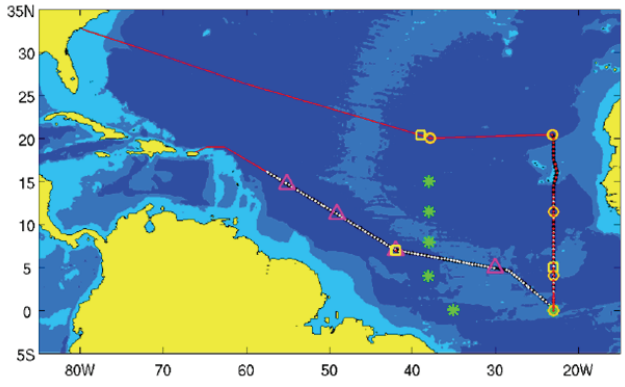
To conclude the PIRATA overview, McPhaden listed particular issues that are discussed below (see discussion chapter) and presented three recent PMEL publications relevant for PIRATA.

Finally, McPhaden presented the present Global Tropical Moored Buoy Array and the major issues currently facing the TAO network. In June 2012, NOAA retired the vessel dedicated to TAO (RV *Ka'imimoana*) without a plan for its replacement. As a consequence, ship time and data return for TAO decreased dramatically, and is now below 40% and dropping. Because the National Weather Service (NWS), which is responsible for TAO, has its primary mission focused on weather (not climate), decisions to address funding cuts associated with sequestration (about 10% for NWS) have struck climate-focused projects like TAO particularly severely. This problem has affected buoys with the longest ocean climate time series (more than 30 years), and the scientific community has to be will informed and be very concerned about this major issue, which has the potential to impact PIRATA in the near future. Partly in response to the TAO situation, an international workshop entitled 'The Future of the Tropical Pacific Ocean Observing System' will be help at Scripps, CA USA in January 2014 that will need representation from key organizations such as OOPC, CLIVAR Pacific, GOOS, IOCCP, and PIRATA. It was suggested that the chair or co-chair of the PIRATA SSG (B. Bourlès or R. Lumpkin) should be invited to attend this meeting and represent PIRATA. A significant impact of the ship time problem in the Pacific is that the R/V *Ronald H. Brown* will leave the Atlantic Ocean to operate in the Pacific to service TAO (and other projects)in 2014—2015.

2) NOAA/AOML PIRATA Northeast Extension (PNE) report (Rick Lumpkin)

Rick Lumpkin explained why the PNE 2012 cruise, initially scheduled in August 2012 aboard the R/V Ronald H. Brown, was postponed to January 2013 (failure of the starboard propulsion motor) and the consequences of this delay on the ATLAS buoys (sensors failure at various sites, and compete failure at one site). He noted vandalism on the ATLAS buoy at 20°N-38°W, the site supporting the SPURS experiment.

The January PNE 2013a cruise ("a" because two cruises will be carried out in 2013) was conducted on the R/V *Ronald H. Brown* from January 8 to February 12, 2013 (see figure). In addition to the replacement/deployment of the 4 PNE buoys, the 23°W-0°N buoy was repaired, and a T-Flex buoy was deployed at 20°N-38°W, <5 miles from the ATLAS buoy. Oxygen sensors were added at 300m, 500m on 4°N-23°W and 11.5°N-23°W sites.



The oceanographic/hydrographic team for the PNE2013a cruise consisted of five personnel from AOML, CIMAS and Texas A&M University. During this cruise, 50 CTD casts, most with LADCP, were conducted to a depth of 1500 m. 120 UCTD casts and 313 XBT/XCTD casts were also conducted. A new UCTD system from OceanScience was used that proved to be far more robust than the previous generation. XBT/XCTD casts included multiple casts concurrent with CTD for fall rate verification in collaboration with Sippican. Uncalibrated CTD data were transmitted in near-real time on the GTS, and calibrated CTD data were relayed to PMEL and served on the PNE web page in delayed mode.

In addition, 4 Argo floats were deployed, and underway ADCP, pCO2 and TSG measurements were collected. Three hydrophone moorings were deployed and two were recovered (PI: Bob Dziak, PMEL) in order to monitor seismic activity. Six people from Howard Univ., NOAA/NESDIS, and Hampton University were also onboard in the context of AEROSE, the atmospheric component of PNE. These personnel launched 111 Vaisala sondes, 24 Ozone sondes, and measured aerosol optical depth, downwelling shortwave and longwave, surface O_3 and NO-NO_x , particle counts, and collected biological samples. AEROSE data are available on ftp/web servers at NESDIS and NOAA/ESRL/PSD.

The PNE 2013b cruise is scheduled aboard the *Ron Brown* from November 11 to December 8, 2013 and from Barbados to Recife (Brazil).

Because the R/V *Ronald H. Brown* will be in the Pacific in 2014-2015 for TAO, charter solutions are being looked into to perform the PNE 2014 cruise. This cruise should ideally be done between August and November. Different charter options have been envisaged and at present the most likely solution is with the R/V *Ocean Stalwart* (Stabbert Maritime, under long-term contract with Cepemare Environmental Services), the vessel also used to service the Brazilian part of PIRATA. Lumpkin discussed a number of other possibilities for PNE2014, including the R/Vs *Endeavor* and *Antea* (not optimal due to their small size/endurance), *Le Suroit* (prohibitive due to the high cost quoted to NOAA), *Knorr* (expensive but a possibility, and optimal in terms of size/endurance), and three other possibilities (R/Vs *Alpha Crucis*, *Seward Johnson* and *Gyre*). Lumpkin noted that other options/suggestions/propositions are welcome.

Lumpkin concluded by mentioning the PIRATA PNE webpage maintained at AOML (http://www.aoml.noaa.gov/phod/pne/) which includes the PIRATA bibliography, to be regularly updated. He reminded all present to send PIRATA references to him for addition in the bibliography. At present, there are 13 PIRATA publications for 2013.

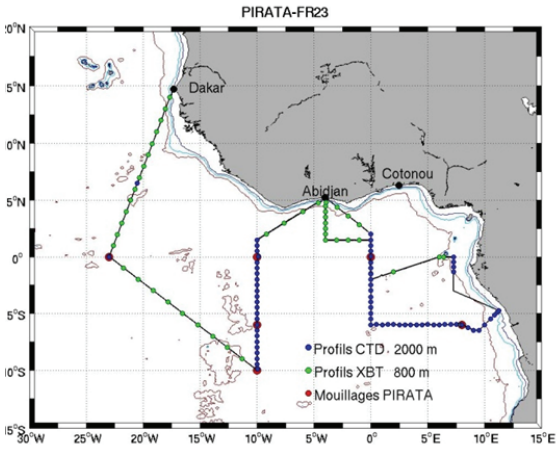
3) **French report (Bernard Bourlès)**

Bernard Bourlès first noted the national status of PIRATA as it is recognized as a national observatory (Système d'Observation Océan-Atmosphère) as part of a larger SOERE (Service d'Observation et d'Expérimentation, sur le long terme, pour la Recherche et l'Environnement CTDO2) dedicated to ocean operational observations (PIRATA, SSS, ARGO, CORIOLIS). Such a SO label is important for endorsements of national programs and/or research institutions, plus potential funding support for material and vessel time. Thus, the vessel time is ensured yearly (thanks to the "Observatory" status) and PIRATA cruises have been successfully conducted in 2012 (scientific evaluation every four years). Since 2011, all cruises are carried out with the R/V LE SUROIT.

PIRATA is supported by IRD, Météo-France and also by the Observatoire Midi-Pyrénées (Toulouse University; as PIRATA mostly help by IRD/LEGOS, part of the OMP*)* and occasionally by INSU/CNRS. In 2013 the contribution by Météo-France was 30k€, by IRD 49k€, by OMP 4.2k€, and by INSU/CNRS 20k€, for replacing some material (mooring buoyancy, releases, Argos material, etc). The cost for vessel time was about 1M€ in 2013 (43 cruise days plus 23 transits days, i.e. 68 days of vessel) and 80k€ / year for each cruise technical support, material transport, missions, i.e. a total of about 1.1M€/year (salaries not taken into account). The total engineers/technicians dedicated time was about 170 days in 2013.

The 2013 PIRATA-FR23 cruise was conducted from May 9 to June 20, from Dakar (Senegal) to Abidjan (Côte d'Ivoire) (see figure).

The usual operations were:
- 72 CTD-0_2/LADCP profiles (0-2000m)
- 55 XBTs
- 6 profilers (Arvor) deployed (ARGO/CORIOLIS)
- 3 SVP-BS deployed (INSU; G. Reverdin)
- CO_2 sensors replacement at 6°S-10°W (IRD; N. Lefèvre)
- Sea surface water samplings (CO_2, nutrients, pigments, and also C13)
- underway ADCP, meteo and TSG measurements.



In addition to the replacement of the 5 buoys at 23°W-0°N, 10°W-0°N,6°S,10°S and 0°E-0°N, this cruise was used to successfully deploy the PIRATA SEE at 6°S-8°E on June 13rd, 2013.
As it was done in two legs only (for the first time), this cruise was also the opportunity to collect a CTDO2/LADCP section along the 0°E and 6°S sections and off Congo.

The vertical resolution of the 6 Argo profilers deployed in the undersampled South-East of the Gulf of Guinea was increased to 1m in the 0-100m upper layer, and to 5m from 100 to 200m.

All CTD and XBT profiles were transmitted in quasi-real time through GTS from the vessel (CTD vertical resolution reduced to 5m). SSS are also sampled/measured all along the trackline for TSgraph calibration and the "SSS observation service".

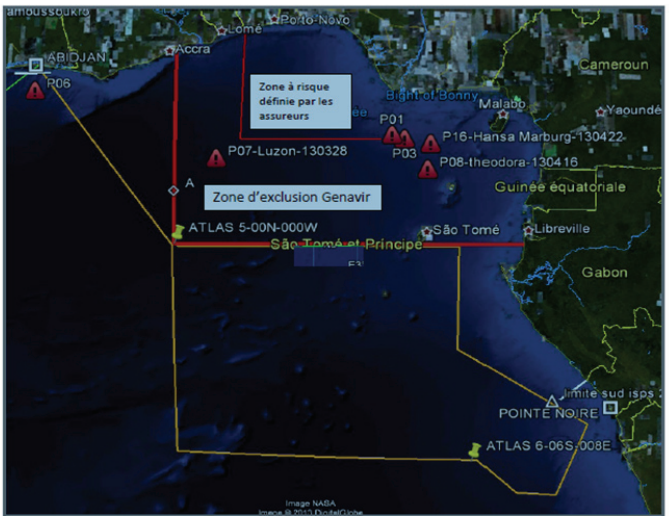
About other operations under French responsibility, Bernard Bourlès mentioned that:

- the two ADCP moorings at 23°W and 10°W will be replaced in April-May by GEOMAR and IRD respectively;
- the tide gauge in São Tomé (offline since late 2010) will be replaced on October 28-30, 2013 during a running mission. A full new system was purchased in 2012 and built in 2013 at INSU-Brest;
- due to doubtful scientific relevance and funding issues, the meteorological station in São Tomé (offline since August 2010) will no longer be replaced and thus is no longer part of the observation network.
- No major vandalism activity has been noticed for several years in the Gulf of Guinea and the data return for these buoys is now rather good.

A full ATLAS buoy system for PIRATA SEE will be bought in 2014 through the EU-PREFACE program to help maintain this site over the long term. In the interim, the buoy presently deployed will be replaced in 2014 thanks to NOAA/PMEL funding.

The pCO_2 time series acquired at 6°S-10°W also shows very good results, and preliminary results for 2013 at 8°N-38°W seems good with no drifts detected (input by Nathalie Lefevre). For this buoy, data for previous years will be more carefully checked once calibrated SSS data becomes available.

Bernard Bourlès next presented the major challenges caused by increased piracy activity in the Gulf of Guinea. Due to piracy, going to Benin is no longer allowed, and thus cruises are partly carried out from Côte d'Ivoire since 2011. In response to the increasing piracy actions in 2012 and early 2013, work north of 2°N and east of 0°E was no longer allowed for security reasons in March 2013, requiring changes in the PIRATA-FR23 program. Then, an attack that occurred off the Principe Island (North-East of São Tome) in early April 2013, causing a limitation of work south of the equator in the east, required a second change in the PIRATA-FR23 program (see figure; red line surrounds the forbidden zone; the 0-0 buoy is at its south-west corner). It has been clearly specified that if any new attack occurs off Abidjan (as occurred in February 2013), this port could no longer be used in subsequent months unless reinforced by local/regional navy for security. Thus, the PIRATA-FR24 (currently scheduled from April 9 to May 22, 2014) cruise plan will strongly depend upon this issue. If the ship cannot go to Abidjan, the unique possible port of call is Pointe-Noire (Congo-Brazzaville). In this case, and due to the 18-19 days endurance of the R/V LE SUROIT, a full CTDO2/LADCP section at 10°W will not be possible.



During the PIRATA FR24 cruise two additional operations could be carried out:

- If funded by the French national research agencies, atmospheric measurements (radiosondes, high frequency meteo, H_2O isotopes) could be collected, mostly across the developing SST front in the north-west of the Gulf of Guinea (PI: G.DeCoëtlogon, LOCEAN).
- If all required material is gathered (possible contribution by Bill Johns, RSMAS), an ADCP mooring could be (re)deployed at 0°E-0°N close to the ATLAS buoy. This mooring is planned in the framework of the EU-PREFACE and would continue to collect some measurements collected during TACE. All material is available at IRD, and an LADCP could be bought thanks to the EU-PREFACE funding in 2014.

- Bernard Bourlès then presented some <u>work carried out or conducted in France in collaboration with CORIOLIS and SOERE CTDO2</u> (contributions by Gilles Reverdin, Sylvie Pouliquen, Emilie Brion, Antoine Grouarzel, Thierry Carval).

  One issue concerns the "real" ATLAS buoys position provided in the Delayed Mode (DM) files accessed through ftp. Presently, only "site" (nominal) position appears in DM data files (ftp) (Argos daily position is available in "real time mode"). An analysis about the potential bias when buoys are moving has been conducted. This study concluded with the following requests to improve the value of the DM files:
  - add daily position in the DM data files *(OCEANsite format, via GDAC).*
  - add, at least, indication on the buoys status (deployment, drift…) in the DM data.
  - Transmit data even when the buoys are drifting, as data may still be used if position is provided in DM.

Mail has been exchanged with Paul Freitag (NOAA/PMEL) about this issue, and exchanges have to be continued to resolve this issue. Note that for operations, it is possible to gather info from both RTM and DTM (GDAC and ftp) to determine the position, as done for the CORIOLIS Data Base in France.

A second issue concerns the "real" depth of the T/C data in the DM files. Presently, subsurface data are provided at their "nominal" depth. But vertical migrations, albeit small (+/- 5m), can occur inducing spurious cooling/warming signals for water masses (a signal higher than the data error bar). This may appear *a priori* mostly in the equatorial band due to large vertical shears there; comparisons with Argo profilers indicate "significant" differences. This potential problem motivated the addition of a P sensor at 10°W-0°N at 100m depth in May 2013. This sensor will be used to compare the impact of pressure variations on the data, and results will dictate if there is an eventual need of additional pressure sensors.

Bernard Bourlès presented a list of PhD students, 7 at present related to PIRATA with French supervisors, and recent publications (17 at least in 2012-2013). He mentioned the issue of not enough manpower (mostly engineers/technicians) in France, impacting data treatment, validation and distribution. One bit of good news however was the recruitment of Julien Jouanno at IRD/LEGOS, who will join our Tropical Atlantic community starting December 1st, 2013. Bourlès then listed some issues to be discussed (see discussion chapter below).

Finally, Bourlès presented some inputs by Fabrice Hernandez about PIRATA and operationnal oceanography in France. Upgrade of Mercator Océan operational system (1/12°global forecasting system running daily) was achieved. About the global ocean reanalysis in Europe, and based on ¼° resolution, several products are now available on monthly basis on the MyOcean2 webserver. In the framework of the CLIVAR/GODAE GSOP intercomparisons project, these reanalyses together with more than 20 others global products are being intercompared. These intercomparisons for the tropical Atlantic should be published in 2014. Tropical array mooring impact studies on operational systems have been performed by UK-Met and Mercator Océan for short periods (1 month). One month is too short for real assessment, but this has been performed in parallel with the operational run (which will give an idea of data impact in real time).

A new initiative is ongoing with Pacific CLIVAR (Tony Lee et al) to measure the impact of the TAO-TRITON array. In France, a national initiative for 2014-2015 has been launched to assess the impact of the full tropical observing system, quantify relative interest of each component AND the atmospheric observations (PI A. Ganachaud), for ocean operation systems, for coupled systems, and for climatologies.

4) Brazilian report (Paulo Nobre)

Paulo Nobre's presentation was in three parts.

A) ***PIRATA status and national report***:

The October 2012 cruise was cancelled due to mechanical failures of the R/V *Antares*. Subsequently, the BR14 cruise was completed in Mar-Jun 2013 with the R/V *Ocean Stalwart* (a private vessel leased by the Brazilian company CP+, with 180,000 litres of oil provided by

CIRM/PETROBRAS). During this cruise (18 people onboard), all 8 ATLAS mooring systems were replaced, along with the CO_2 sensor at 38ºW-8ºN. Data QC and calibration were done onboard during the cruise, using WHOI software. In addition to hydrographic measurements (CTD-O_2, ADCP, UCTD), radiosondes were launched along 38ºW, 4 times daily.

In 2013, 2 ATLAS system recovery emergency operations were needed :

- 14ºS-32ºW: to replace electronics tube; the batteries and electronic failures were notified by PMEL a few days after deployment. Import authorization from PMEL for the replacement of the electronic tube was obtained in a record 24h, then sent by DHL in three days and delivered to the ship in four days in contrast to the three months typically required (!). This collaborative effort showed that it is now sometimes possible to deal with customs in an efficient way!
- 4ºN-38ºW: adrift from Oct 1st, rescue mission with DHN's R/V *Cruzeiro do Sul* in October 2013, during the same week as the meeting. The "adrift" alert was given on Oct 18 by PMEL, and the R/V sailed on Oct 22nd. The delay in notifation was associated with the partial US government shutdown, one of many impacts of the shutdown. For more on the shutdown, see the discussion chapter.

The 8 ATLAS site calibrated CTD casts from 2006 to 2013 were sent to PMEL by the M. Araujo team at Recife. PIRATA BR cruise data are available at http://pirata.ccst.inpe.br.

The R/V *Cruzeiro do Sud* has been equipped with an A-frame. She is the 2nd DHN ship that is now PIRATA-capable. Also, an underway pCO_2 system from General Oceanics was purchased to operate permanently onboard the R/V *Antares* by INPE-CNPq. The 2014 PIRATA BR15 cruise is scheduled for May-June 2014 with the R/V *Antares*.

Total cost dedicated to PIRATA in Brazil in 2013 is about $2M, $500K for instrumentation and $1.5M for the R/V *Ocean Stalwart* (30 days shiptime).

The ATLAS-B system has been completed and moored (see below).

Paul Nobre noted that a brand new oceanographic ship is currently under construction in China. Also, six articles were published recently (4 in 2013, 2 in 2012).

B) ***ATLAS-B report*** (information via Edmo Campos):

Paulo Nobre noted motivations for the ATLAS-B project, linked the SACZ monitoring. The ATLAS-B system (a clone of the TAO/PIRATA ATLAS buoy) was entirely assembled in Brazil. The first one has now been deployed for a 6 month test. ATLAS-B includes 2 microCATs at 300 & 500m (one stopped transmission after 40 days), in compliance with OceanSITES recommendations. ATLAS-B "Guariroba" was deployed at 28.5°S-44°W, and data should be available very soon on the GTS, at ftp.io.usp.br/abmon/ATLAS-B. Nobre expressed the desire that this site could be maintained as a PIRATA/Brazil pilot program, and could potentially become part of the international PIRATA program.

C) ***INPOH report*** (information via Janice Trotte- Duhá):

This presentation noted the need for enhancing national oceanographic studies over the South and Tropical Atlantic from Brazil, motivated how Brazil needed a National Institute for Ocean Research, and presented some inputs about the National Remote Laboratories and the acquisition of a new generation Research Vessel. The marine zone of Brazil was first described, along with the geographical dimensions

of scientific knowledge in the South and Tropical Atlantic. The relevance of the south Atlantic to Global Climate (e.g. via the Agulhas leakage) was also noted, along with the Atlantic-Indian "supergyre".

These issues motivated the creation of INPOH (National Institute for Ocean research and Hydroways), a concerted decision of the Brazilian state to incorporate the oceans into its sustainable development long term strategy. Expected results of INPOH are i) incorporating the oceans as an axis of national development; ii) providing a robust tool for the execution of ocean projects under CIRM and others deemed strategic for the country; iii) generating national competence for Brazil's participation on international fora about the oceans; and iv) implementing a policy of free ocean, atmosphere and river data access.

In the context of INPOH, a brand new research vessel is currently under construction in China, purchased by Brazil, in partnership between government and the private sector in Brazil. This vessel will be 78m length, with 60 days endurance, will be able to welcome about 40-50 scientists onboard, with 2 wet labs and 3 dry labs.

5) PIRATA SSG open discussions:

During the French national presentation, the issue was raised about the partial US government shutdown in early October, its consequences and potential impacts. The SSG is well aware that NOAA is not responsible for such a bad situation for research, but regrets that the shutdown resulted in closure of the PMEL PIRATA website (preventing access to DM data, despite NOAA's PIRATA MoU commitments) and hopes that operational issues such as real time data assimilation were not affected as Argos data was still distributed through the GTS (it is currently unknown if Iridium GTS insertion would be interrupted by a hypothetical future shutdown). The SSG hopes that the shutdown will not have serious impacts on the PNE cruise scheduled for November and FR&BR cruises material preparation, etc. The SSG also noted that the shutdown resulted in an 18-day delay before PMEL informed the Brazilians that the 4N-38W had gone adrift.

The following issues were discussed in open session:

- ***Vessel time in US (TAO impacts) and other countries***: the SSG discussed how to deal with potential vessel time availability problems. The problem of NOAA vessel time to maintain TAO will impact PIRATA in 2014 & 2015 due to the relocation of the R/V *Ronald H. Brown* to the Pacific, and the subsequent need to charter a vessel in the Atlantic. France (B. Bourlès) will check with IFREMER/Genavir to see if the chartering price for the R/V LE SUROIT can be negotiated at a lower rate than that quoted for outside agencies. All people present were invited to inform Rick Lumpkin if they have any other options that could be proposed, beyond the eight vessels he presented.

- ***The growing issue of piracy***: An attack this week in the region is a troubling sign that piracy in the Atlantic may continue to escalate. For now, piracy in the tropical Atlantic is mostly contained in the northeastern Gulf of Guinea, and could impact PIRATA if a new attack occurs off Abidjan as this port would then no longer be allowed, resulting in less time for operations during PIRATA FR cruises. This decision if this port can be used would be made by the French government and IFREMER.

- ***Additional measurements (C sensors, pressure, ADCP, flux, etc):*** It was noted that all full-flux reference sites have additional T/C sensors to resolve the mixed layer, and adding sensors to other PIRATA sites would add scientific value to the data there. Regarding the priority of which sites to upgrade in principle, suggestions made by Fabrice Hernandez during the last PIRATA meeting could be revaluated. However, the main problem is still potential funding and resources and PIRATA cannot at present commit to add sensors. If funding is available within PIRATA members, the location of additional sensors should be decided in a common way.

- ***Adding real (rather than nominal) position and depth to Delayed Mode FTP data files:*** This point was raised by Bernard Bourlès and linked to work conducted by the CORIOLIS Data Center in France. This could be discussed offline, directly between CORIOLIS and PMEL (exchanges have already been initiated with Paul Freitag). Mike McPhaden will send a paper

published about 15 years ago which assessed the depth issue to Gilles Reverdin. The real depth and results after the recovering the additional pressure sensor at 100m at 10°W-0°N will also help to estimate the potential impacts.

- ***Delays in obtaining CTD calibration and ATLAS T/C sensors calibration:*** This is no longer an issue, as Brazil sent T/C calibrated files recently.

- ***Any other potential (and possible) extensions***: the panel asked if there is potential to extend the PIRATA array with EU-PREFACE collaboration, but PREFACE is not planning any additional ATLAS-style moorings. As discussed during the Wednesday session, there is no potential at present due to limited resources and vessel time. Brazil, however, noted a possibility to fund a new buoy (as proposed last year by Paulo Nobre for the PIRATA SEE, but not currently needed due to EU-PREFACE funding for this site). Also, when ATLAS-B will be operational, it could be proposed to add one in a more southern position. These buoys' data could also be available to PIRATA internationally (if PMEL/NOAA agrees to host on its site). However, we are still constrained by ship time, ships of opportunity and piracy. Mathieu Rouault (Univ. CapeTown) mentioned potential vessel time with Angola, Namibia and South Africa that could be used for the SEE extension in the future, but these countries first need to be convinced to involve/commit. This could potentially be realized in the context of the EU-PREFACE program and further discussions are needed; a PREFACE/PIRATA meeting in CapeTown could be envisaged in 2015. The southern and southeastern areas are of main importance and there is the strong need for atmospheric observations to be collected during cruises (clouds, aerosols, etc).

- ***Data management and a centralized data source in a uniform format (NetCDF)***: Regarding other (non-buoy) PIRATA cruise data & parameters (e.g., nutrients) and ADCP mooring data, Brazil proposed to create a data center for non-buoy data, and while unable to do so this year is still committed to doing so. Questions were raised about the availability of CO_2 and O_2 data, collected as piggyback projects on PIRATA moorings. Moacyr Araujo will check with Nathalie Lefevre regarding the CO_2 data. Rick Lumpkin noted that Peter Brandt (GEOMAR) has already provided O_2 data collected at two of the PNE mooring sites. The SSG also discussed if all data (cruises, related programs, etc) could be centralized. It was agreed that it is easier to make clear linkages from the PIRATA webpage to other programs' websites where data are available and maintained/updated (e.g., TACE for ADCP moorings data; GEOMAR, where data are made available 3 years after collection, etc.). After data is finalized it makes sense to distribute the mooring data from the PMEL site. An example is mooring data collected as part of TACE, which Bill Johns (Univ. Miami) noted would be logical to serve from PMEL's PIRATA site and would be a natural place for researchers to look for these data. Mike McPhaden noted that adding data to the server would be straightforward, assuming that the data has been quality controlled and is offered in standard format (standard frequency, depths, etc.) Regarding data format, the generation of CTD data in NetCDF format is not a problem as this is already done in the US and France, and could be easily done in Brazil (for example with Matlab code written by R. Lumpkin). Other parameters (e.g., nutrients) should be added and made available, at least on the PIRATA FR cruises webpage (although there is the issue of manpower for data management).

- ***PIRATA & other programs/proposals***. Potential piggyback sensors on ATLAS moorings:

    - Jim Moum's proposal for adding ***microstructure measurements*** was agreed to last year. J. Moum plans to submit a proposal for funding to NSF in February 2014 and a recommendation letter has been sent to him by the SSG chairmen in summer 2013. If funded, turbulence sensors could be added at 23°W-0°N and 10°W-0°N in 2015. The SSG considered the idea of adding additional sensors at other sites and to ask to Jim Moum for the price of these sensors, if he could be responsible for data treatment and data sharing with PIRATA members/collaborators.
    - Another proposal has been recently sent by Frederic Whorisky (Dalhousie University, Canada) concerning ***acoustic tracking of marine life***. This proposal was disseminated among SSG members during the meeting. Acoustic sensors are technically trivial to add on PIRATA moorings. The SSG has to take this proposal into consideration, in order to provide a clear response. In particular, Paulo Nobre noted the potential for DHN concerns if the technology could potentially be used for submarine detection. A pilot deployment of these sensors will be conducted at a PNE site during the PNE cruise in November, and potentially during the French 2014 cruise. The SSG is currently evaluating the proposal to determine if a formal external review is necessary, although in the past this was limited to extensions that potentially required PIRATA MoU changes.
    - Another proposal concerns ***CO_2 and ocean acidification*** mooring time-series in the equatorial Atlantic on the existing PIRATA array, proposed by NOAA/PMEL (Adrienne Sutton). Issues exist about its funding and certification. Exchanges need to be established to clarify some issues and best positions to deploy sensors (Moacyr Araujo will contact A. Sutton). It is possible that the ideal sites will not be on the PIRATA moorings; this is still being evaluated.
    - A final proposal regards ***moored aerosol collectors***. PI Gregory Foltz (AOML) is seeking funding for these instruments from NOAA, in collaboration with PMEL. The aerosol collectors would be on moorings separate from the PIRATA moorings, and would be deployed during a future PNE cruise (potentially as soon as 2016).
    - More generally, the SSG agrees that external proposals such as these need to be discussed/evaluated within the SSG (as done earlier for CO_2, extensions, turbulence, etc.). If there is no major problem (e.g., technical, financial, material shipping), then these proposal offer opportunities to make PIRATA more valuable via additional observations in the tropical Atlantic and linkages to a broader community.

- ***Capacity building***: Paulo Nobre suggested revising discussions initiated in Kiel in 2012, to promote students in the field of Atlantic climate and oceanographic research. Could PIRATA and the PIRATA SSG make a coordinated effort to send students to Brazil, France and the US for this? This topic was discussed with P. Chang, R. Saravanan, and others, who noted that there are existing ways to enlist new students and encourage international exchanges of students, for example the NSF-funded "Study Abroad" program. Nobre wondered if we could list institutions that could welcome students from interested/concerned countries to get grants, and if PIRATA (through the PIRATA website) could offer such opportunities. This question remains open, as it would require considerable effort to maintain successfully.

6) PIRATA PRB closed discussion:

This closed discussion was held with all present members of the PIRATA SSG and PRB.

First, all parties quickly agreed with the strategy of extending the MoU via addition of the proposed Annex IV with a corrected date for the end of the current MoU. All will transmit the amended MoU to their agencies for approval.

The next issue raised in this discussion was related to ship time. Ship time for 2014 has been guaranteed by PIRATA partners. Rick Lumpkin noted that NOAA is planning to use charter funds for the PNE 2014 cruise, and that the MoU is invaluable leverage to secure these funds.

Can, and should, the PRB raise the issue of problems caused by the US government partial shutdown to NOAA? This was discussed, with the conclusion that the answer is "No". Real-time data flow from the moorings onto the GTS was not interrupted during the shutdown; this operational GTS insertion of Argos data is done by CLS outside of the US government. (It is not clear if this will be the case in the future, as Iridium data insertion may not be done outside of the government; this will need to be reassessed when the pathway for Iridium GTS insertion is defined.) The PRB agreed that PIRATA mirror sites could be reestablished in order to serve the delayed mode QC data for research purposes. Doing so requires Brazil and France to provide the software to operate these mirror sites. There has been a full mirror site in Brazil before, but not in France.

Brazil noted that it is short of sensors for its ATLAS-B mooring, and is owed money from NOAA for a buoy that Brazil purchased. They asked if these funds could be used to purchase sensors. Those present did not know the status or amount of these funds, and it was determined that this question would need to be asked directly to Candyce Clark in a private discussion between Brazil and the US.

Regarding T-Flex implementation: this will be progressive, perhaps by prioritizing sites equipped with O_2 sensors or other data (such as acoustic data) not currently able to be transmitted in RT by Argos-equipped ATLAS buoys. Training of a few days to one week (to be evaluated by PMEL) of French and Brazilian engineers at PMEL will be needed in 2014, as T-Flex buoys are different from ATLAS in some key aspects (transmission, wind sensors, etc.). This training would be most efficiently conducted if both French and Brazilian engineers could visit PMEL during the same time period. Also, it is possible that PMEL technicians could embark on FR/BR cruises for the initial T-Flex deployments.

The group discussed the need for a single one-stop shop for PIRATA shipboard data, and requested that Rick Lumpkin create such a site at AOML. Lumpkin agreed to create one for all CTD data in standard format (NetCDF with headers corresponding to the French files, now also used by the US). This page could eventually serve other non-mooring data and could be cross-linked with the PMEL page (and potential mirrors) serving the mooring data.

The PRB&SSG support Jim Moum's proposal for turbulence measurements, and considered if other turbulence sensors could be funded by PIRATA partners, assuming Moum could handle the additional data processing and QC demands from additional sensors. This could help Moum in acquiring NSF funds, as it would represent added value at no cost to NSF. Mike McPhaden will contact Moum to determine the cost of the sensor and verify his interest in this collaboration. The PRB reiterated its concerns about data policy and availability: all data collected as part of PIRATA, including piggyback efforts, should (eventually, after QC) be made publicly available.

Brazil reminded members that Janice Trotte- Duhá will return as a member of the PRB. Because IRD presently does not have representation on the PRB, the PRB needs to send correspondence to the appropriate people in IRD to stress the importance of them nominating a member as soon as possible. Also, DHN will have to be strongly acknowledged for its efficiency and rapidity, regarding its response to the adrift buoy.

Finally, Mike McPhaden asked for a one-page report of the PIRATA discussion for the TAV website. Such a document is also helpful for our guests in Venice to justify the room use.

October 30th, 2013

Bernard BOURLES and Rick LUMPKIN

PIRATA-18 Action Items:

The following items first identify who is to act, then summarized the action. Additional details can be found in this report.

- ***All SSG/PRB members***: send the MoU and new Annex as soon as possible to their respective PIRATA MoU institutions for formal signature (ie, NOAA, INPE, IRD and Meteo-France).
- ***Brazilian SSG/PRB members***: organize next PIRATA meeting in September or November (i.e., avoiding October and possible US government shutdown). Act to encourage participation of representative(s) from the EU-PREFACE program and from African partners; invite Frederick Whorinsky to present about acoustic sensors on PIRATA moorings.
- ***M. McPhaden***: Contact organizers of 'The Future of the Tropical Pacific Ocean Observing System' workshop to request that Bernard Bourlès or Rick Lumpkin be invited to represent PIRATA.
- ***B. Bourlès***: check with IFREMER/Genavir to see if the chartering price for the R/V LE SUROIT can be for the PNE2014 cruise at a lower rate than that quoted for outside agencies.
- ***All SSG/PRB members***: let R. Lumpkin know of any new opportunities for PNE2014 charter.
- ***CORIOLIS, PMEL***: continue discussion on adding real position and depth to delayed mode data.
- ***M. McPhaden***: send paper published ~15 years ago that assessed the impact of depth variations to Gilles Reverdin.
- ***M. McPhaden***: contact Jim Moum to explore possibility/feasibility of additional turbulence measurements on PIRATA sites, should additional PIRATA funding be identified.
- ***R. Lumpkin***: create "one-stop shop" for PIRATA CTD data that presently exists in standard NetCDF format.