

## **The PIRATA Project; Highlights during 2007-2008**

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During 2007-2008, the PIRATA Array of moored systems over the tropical Atlantic presented an above long term average data return, with all its present 17 ATLAS systems (10 backbone moorings since 1998; 3 SW extension moorings since 2005; 4 NE moorings since 2007) transmitting data in near-real time collected by the ARGOS system and distributed via GTS. All systems measure shortwave, air temperature, sea temperature and salinity at multiple depths, wind speed and direction, rain, and humidity.

Four of the moorings (6S, 10W; 0N, 23W; 11.5N, 23W, and 15N, 38W) became full-flux capable reference sites since 2007, with the added sensors for longwave and barometric pressure on each buoy. Also, fixed depth current meters were installed on these as well as the PIRATA NE extension ATLAS systems. In addition, the 0N 23W upward-beaming ADCP continues to collect data, which is retrieved annually by the French (in collaboration with German) cruises.

PIRATA Northeast Extension: ATLAS moorings at 4N, 11.5N and 20.5N, 23W; and at 20N, 38W. These moorings are serviced approximately once per year, with complementary hydrographic observations, a dense hydrographic line along 23W to 1500dbar, and opportunistic oceanic (drifter, floats, XBTs, thermosalinograph, ADCP) and atmospheric (sondes, ozonesondes and direct turbulent fluxes) measurements.

During the PNE 2007 cruise, AOML personnel conducted hydrographic casts along 23W, at the PNE site 20N, 38W, and at the Brazilian PIRATA backbone mooring site 11.5N, 38W, and deployed drifters, floats and XBTs. PMEL personnel supervised the recovery and deployment of the PNE moorings. Collaborators with NOAA/ESRL, NOAA/NESDIS, Howard University and the University of Miami collected a broad suite of observations including atmospheric dust, humidity, and ozone profiles, direct air-sea flux measurements, and sea surface skin temperatures.

During the 10 year period: 1998-2007 the overall data return of the array was 81%, what places the PIRATA array close to the data return average of the TAO array over the tropical Pacific Ocean. Also, the number of data files delivered by the PIRATA web site grew from 132 in 1999 to 61,494 files in 2007, totaling 170K files during the existence of the PIRATA array.

Presently, pCO<sub>2</sub> and O<sub>2</sub> sensors are collecting data at the PIRATA sites 8N, 38W (since March 2008) and 6S, 10W (since June 2006), as part of a French PI (Nathalie Lefevre, IRD/LOCEAN) research on Atlantic Ocean CO<sub>2</sub> cycle (see: <http://www.lodyc.jussieu.fr/CO2tropiques/>).

On the eastern Atlantic, the Sao Tome meteorological (since 2003) and tide gauge (since 1980, part of GLOS) stations received routine maintenance procedures by the French. The Met station, installed in 2003, is transmitting its data via GTS since October 2006. The station also measures and transmits (in delayed time) SLP, SST.

On the western Atlantic, Saint Peter and Saint Paul Archipelago received the visit of a technician from INPE, which shall install INPE's automatic met station and tide gauge station during the next cruise to the archipelago during October 2008. Fernando de Noronha Island automatic met station is operational since its installation in 2004 and routine maintenance done by the Laboratory of Meteorology of Pernambuco – LAMEPE.

#### **PIRATA cruises:**

- ∇ PIRATA FR16 cruise: May 19-June 01, 2007; Dakar, Senegal to Cotonou, Benin
- ∇ PIRATA FR17 cruise: June 4-July 5, 2007; Cotonou to Cotonou
- ∇ EGEE 6 cruise: Sep 1-27, 2007 (3 legs + TACE ADCP at 10W); Cotonou
- ∇ PIRATA BR-X Cruise: March-April 2008 (3 legs): Natal to Fortaleza; pCO<sub>2</sub> sensor installed at 15N, 38W.
- ∇ PIRATA BR SWE-III Cruise: Mar/2008 (two legs, Rio de Janeiro-Salvador-Natal); Auxiliary data: CTD stations, daily atmospheric radiosounding, continuous ship mounted ADCP measurements.
- ∇ PIRATA FR18 cruise: Sep 1-Oct 6, 2008 (3 legs): ATLAS, TACE ADCPs 10W-0.45N, Egee/Pirata Fr ADCP 10W-0N

### **PIRATA Meetings:**

- ∇ Brest, France, March 2007, PIRATA SSG meeting
- ∇ Karlsruhe, Germany, November 2007, back to back with AMMA and TACE annual meetings
- ∇ Natal, Brazil, February 2008.
- ∇ [forthcoming]: Toulouse, France, February 2009, back to back with TAV meeting.

### **Other Works:**

Information about the PROPAO program in the Gulf of Guinea:

3 years program funded by the French Foreign Affaires Ministry to support scientific programs dedicated to West African climate and societal impacts of climate changes, linked to AMMA/Egee.

Regional Program of Physical Oceanography in West Africa, involving Nigeria, Benin, Togo, Ghana, Côte d'Ivoire and France (IRD/LEGOS; B.Bourlès in Cotonou/Benin for this purpose). Goals:

- ∇ to maintain an autonomous coastal network of temperature sensors ;
- ∇ establish a regional data bank for studying coastal SST, upwelling, links with local & regional climate and resources, and coastal environment (erosion...);
- ∇ Formation and capacity building: a regional Master in Physical Oceanography created in 2008 at the Cotonou University (Chaire Unesco).

### **Peerreviewed Publications:**

2008

Bourlès, B., and Coauthors, 2008: The PIRATA Program: History, Accomplishments, and Future Directions. *Bull. Amer. Meteorol. Soc.*, August/2008 (Cover Story).

Brandt, P., V. Hormann, B. Bourlès, J. Fischer, F. A. Schott, L. Stramma and M. Dengler (2008), Oxygen tongues and zonal currents in the equatorial Atlantic. *J. Geophys. Res.*, in press.

- Foltz, G.R., and M.J. McPhaden, 2008: Impact of Saharan dust on tropical North Atlantic SST. *J. Climate*, in press.
- Lebel, T., and Coauthors, 2008: The AMMA field campaigns: Multiscale and multidisciplinary observations in the West African region. *Annales Geophys.*, submitted.
- Lefèvre, N., A. Guillot, L. Beaumont, and T. Ganguy (2008) , Variability of fCO<sub>2</sub> in the Eastern Tropical Atlantic from a moored buoy. *J. Geophys. Res.*, 113, C01015, doi:10.1029/2007JC004146.
- Urbano, D. F., R. A. F. De Almeida, and P. Nobre, 2008: Equatorial Undercurrent and North Equatorial Countercurrent at 38°W: A new perspective from direct velocity data, *J. Geophys. Res.*, 113, C04041, doi:10.1029/2007JC004215.

## 2007

- Balmaseda, M.A., D.P. Dee, A.P. Vidard, & D.L.T. Anderson, 2007: A multivariate treatment of bias for sequential data assimilation: Application to the Tropical Oceans. *Q. J. Roy. Meteor. Soc.*, 133(622), 167179.
- Clayson, C. A., and D. Weitlich, 2007: Variability of tropical diurnal sea surface temperature. *J. Climate*, 20, 334352.
- Etienne, H., and M. Benkiran, 2007: Multivariate assimilation in Mercator project: New statistical parameters from forecast error estimation. *J. Mar. Sys.*, 65(14), 430449.
- Vidard, A., D. L. T. Anderson, and M. Balmaseda, 2007: Impact of ocean observation systems on ocean analysis and seasonal forecasts. *Mon. Weather Rev.*, 135(2), 409429.
- Yu, L., R.A. Weller, 2007: Objectively Analyzed airsea heat Fluxes (OAFlux) for the global ice free oceans. *Bull. Amer. Meteor. Soc.*, 88(4), 527539.