

PIRATA

*Pilot Research moored Array in the Tropical Atlantic
(1997 - 2008)*

*Prediction & Research moored Array in the Tropical Atlantic
(2008 - ???)*

Tripartite Programme

- FRANCE (IRD & Météo-France)
- BRAZIL (INPE & DHN)
- USA (NOAA/PMEL & AOML)

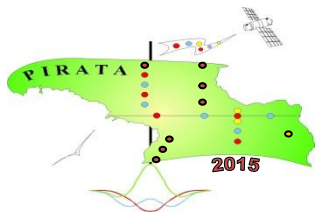


Photo: A.Kartavtseff

Co-Chairs of the PIRATA Steering Scientific Group:

Bernard Boulès (IRD/LEGOS-France), Moacyr Araujo (UFPE/LOFEC, Brazil)



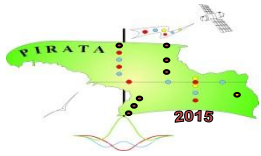


Why PIRATA ?

PIRATA is motivated by fundamental scientific issues but also by societal needs for improved prediction of the climatic variability and its impact on the regional hydro-climates and, consequently, the economies of the adjacent land masses (e.g. West Africa, North-Eastern Brazil, the West Indies and the United States...).

=> Scientific goals of PIRATA :

- 1) improve the description of the intra-seasonal to inter-annual variability in the atmospheric and oceanic boundary layers in the tropical Atlantic (air sea fluxes, SST, heat content...);
- 2) provide a set of data useful for developing and improving the predictive models of the ocean-atmosphere coupled system;
- 3) document interactions between tropical Atlantic climate and variability outside the region, (e.g. ENSO, NAO etc...);

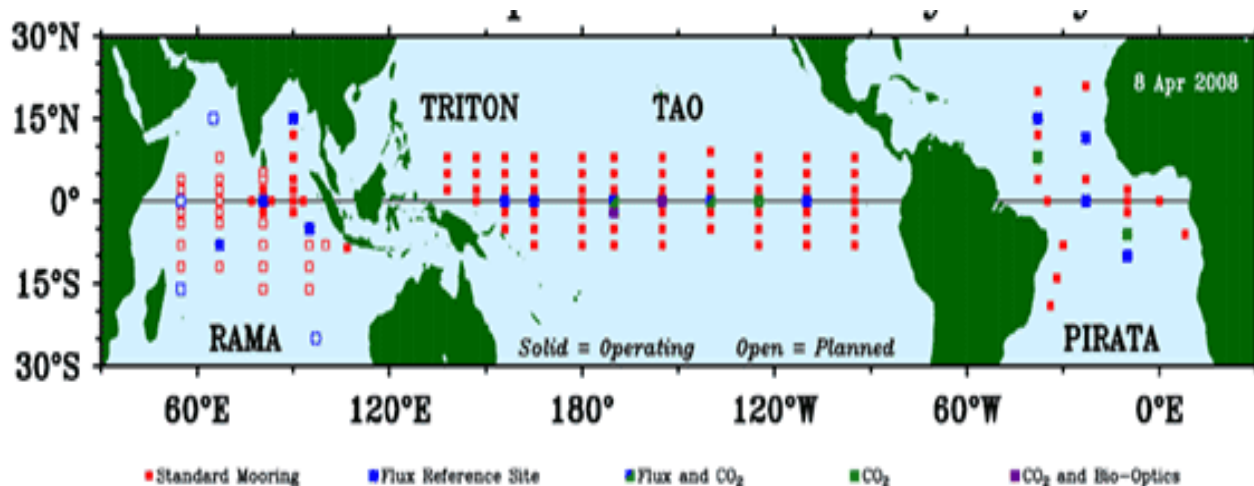


to meet these scientific objectives:

=> design, deploy, and maintain an array of moored oceanic buoys
 + collect and transmit a set of oceanic and atmospheric data, via satellite in real-time,
 (monitoring and study of the upper ocean and lower atmosphere in the TA).

=> What is PIRATA ?

PIRATA is a multinational observation network established in 1997 by Brazil, France and United States of America, to improve our knowledge and understanding of ocean-atmosphere variability in the tropical Atlantic.
 = Atlantic contribution to the Global Tropical Moored Buoy Array



Evolution of PIRATA :

1) 1997-2001: “Pilot phase” : backbone array fully implemented :

- 10 “ATLAS” type moored buoys
- one current meter mooring at 0°N, 23°W :

1st MoU signed in 2001

2) 2002-2006: “consolidation phase” :

⇒ to allow for a meaningful demonstration that the data would contribute significantly to both scientific research and operational applications

3) 2006: formal review and endorsement by CLIVAR & OOPC :

⇒ extension of the consolidation phase till February 2008

4) From 2008: “sustained phase”:

⇒ SW & NE extensions (begun in 2005) added to the PIRATA backbone

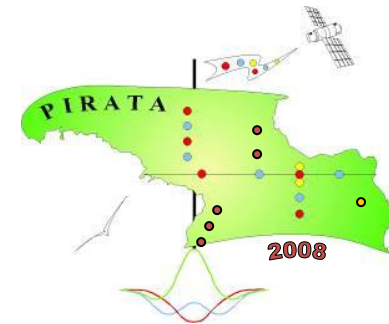
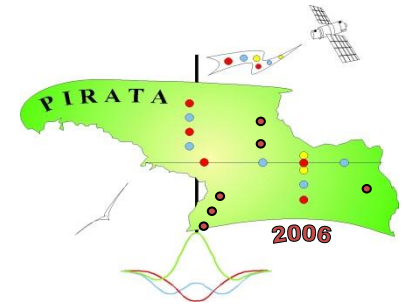
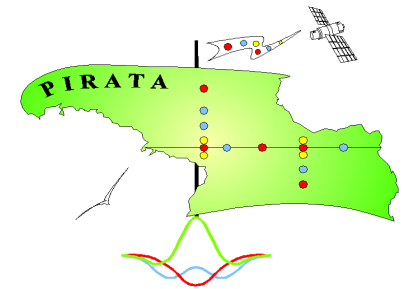
⇒ Test of the SEE extension in 2006-2007

Pilot Research moored Array in the Tropical Atlantic

⇒ *Prediction and Research moored Array in the Tropical Atlantic*

Also met stations & tide gauges...

+ MoU regularly extended/renewed from 2001 (last extension signed in July 2014)



PIRATA ATLAS buoys:

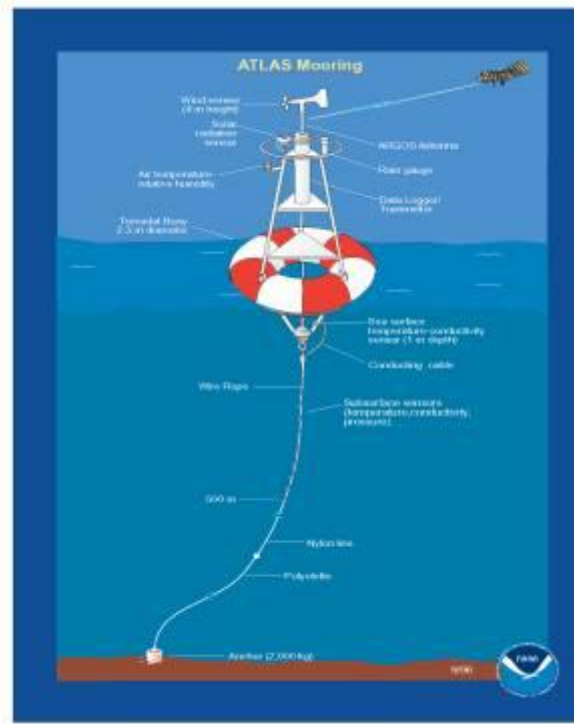
Measured Parameters :

Atmosphere:

- wind (direction, speed)
- relative humidity
- air temperature
- precipitation
- incident radiation

Ocean:

- temperature
(11 levels from surface to 500m)
 - salinity
(4 to 9 levels between 0 & 120m)
 - pressure (at 300 & 500m)
 - surface currents at 4 sites
- **Daily averaged data transmitted in real time by Argos;**
 - **High frequency data (10mn) available after servicing operations**

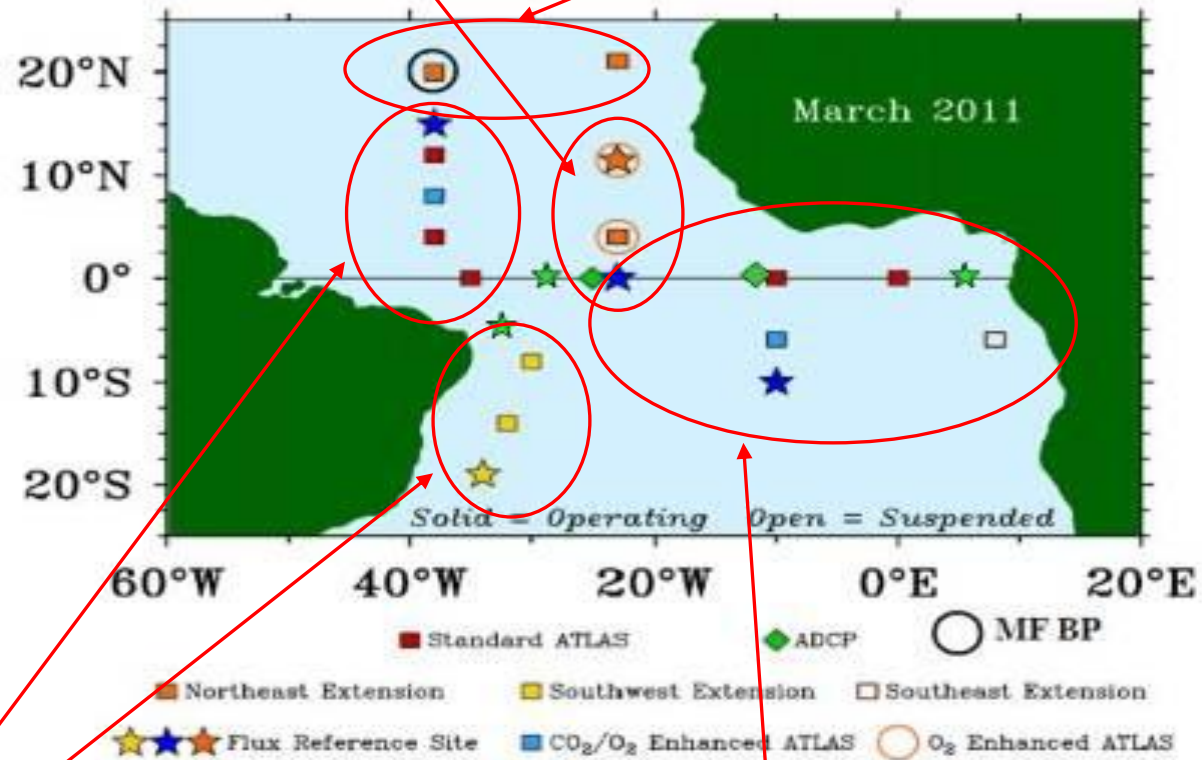


PIRATA network servicing:

Maintained by USA : 4 Atlas buoys : 2 deployed in 2006, at 4N & 11N/23W, 2 at 20N/23W & 38W deployed in 2007

18 ATLAS buoys from 2013

=> Yearly servicing



Maintained by Brazil: 8 Atlas buoys
5 from 1998,
3 as the PIRATA SWE from 2005

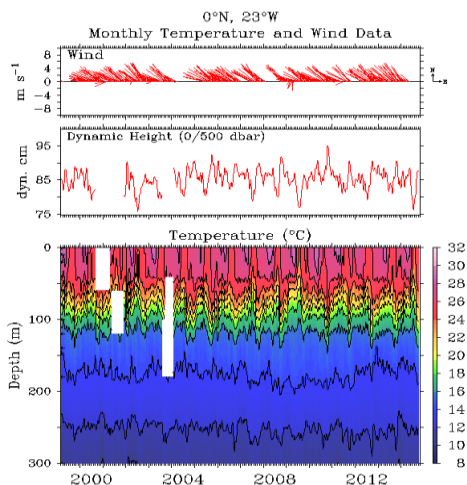
Maintained by France : 6 Atlas buoys
5 from 1997
+ At 23°W-Equator : surface ADCP mooring since 2001;
Buoy at 6S-8E deployed in 2006 - 2007
(test period for a Southeastern Extension by South Africa & BCLME) then from 2013, thanks to the contribution of The EU PREFACE programme (purchase of a 2nd ATLAS buoy)
Contribution by US & Germany for 23W-Eq site from 2006.



Examples of PIRATA ATLAS time series (6 buoys east of 23° W)

Eq-23° W

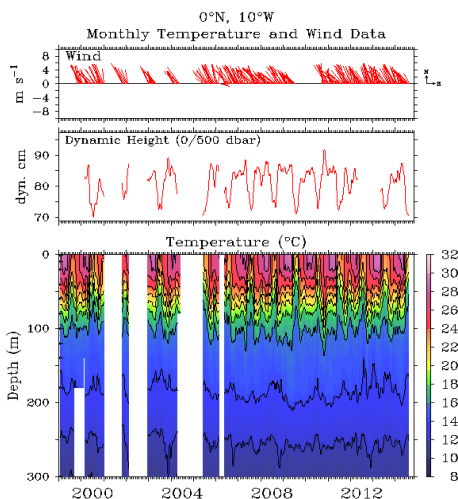
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TAO Project Office/PMEL/NOAA

Eq-10° W

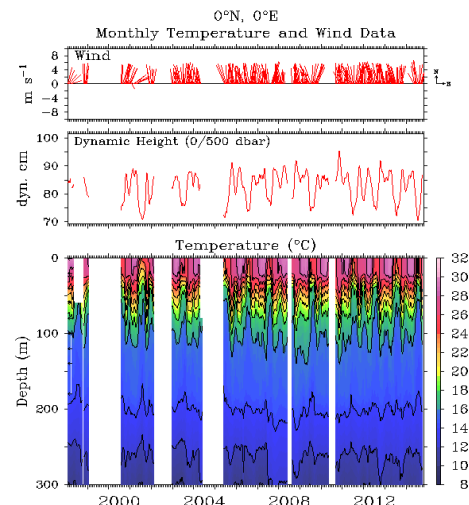
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Eq-0° E:

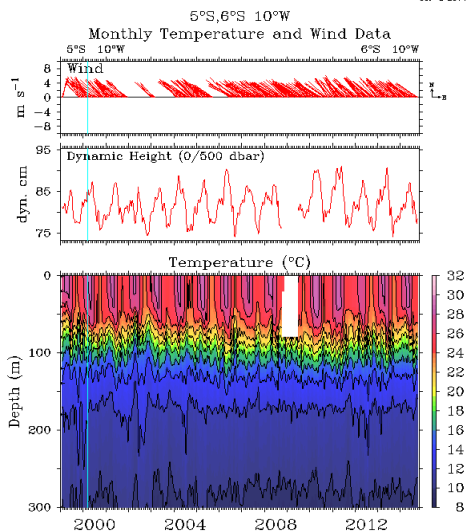
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6° S-10° W

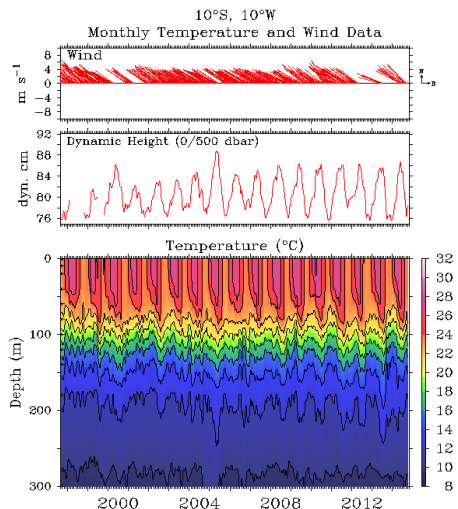
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10° S-10° W

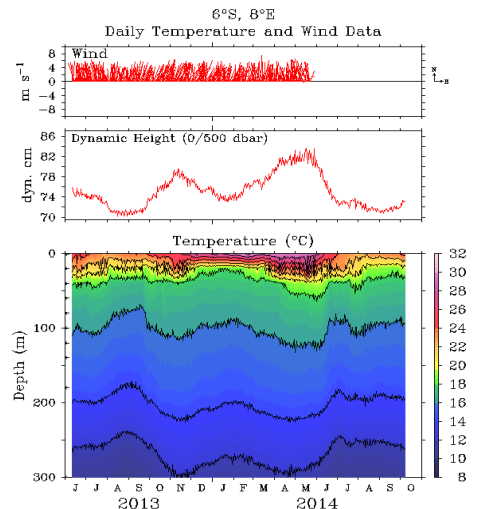
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6° S-8° E:

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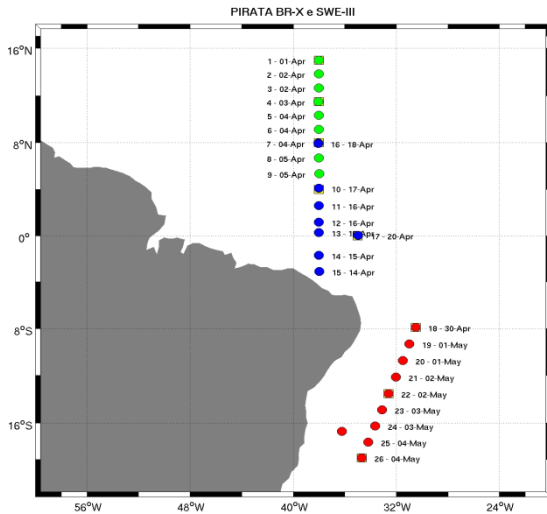


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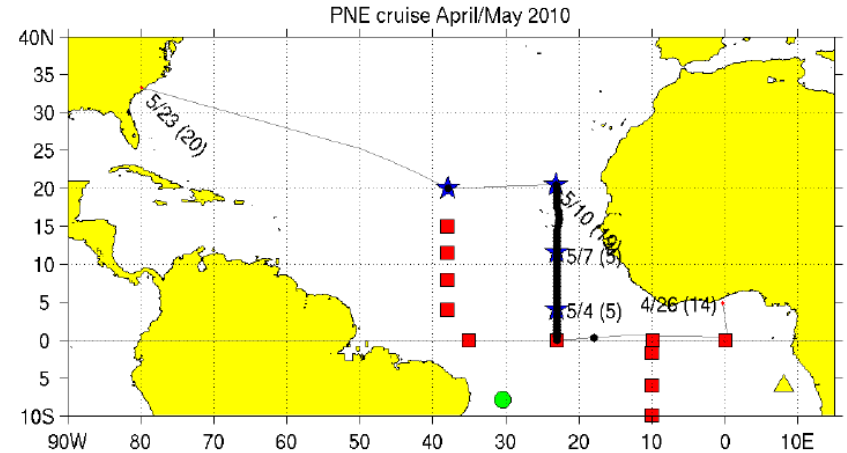
Gaps either due to piracy activities (mostly 0 and 10W-Eq; none from 2008) or sensors failure

YEARLY CRUISES => repeated sections (ctdo2/ladcp...)

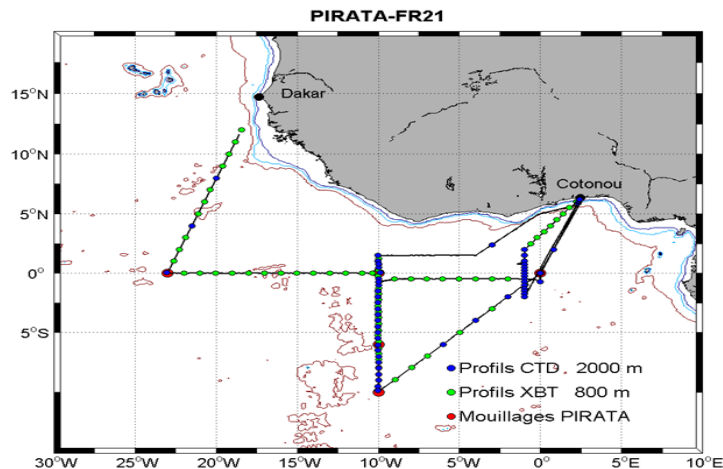
38°W section: Brazilian cruises



23°W section: US cruises (+ German cruises, etc..)



10°W section: French cruises



Yearly cruises = OPPORTUNITIES for:

ARGO profilers deployment

SVP-S deployment

Quasi real time data (CTD, XBT) for operational services

Gliders experiments (Pirata-FR in 2011, with GEOMAR)

Contribution to AMMA, TACE/CLIVAR (ADCP moorings)

Atmospheric measurements (Radiosoudings...)

PIRATA & PREFACE

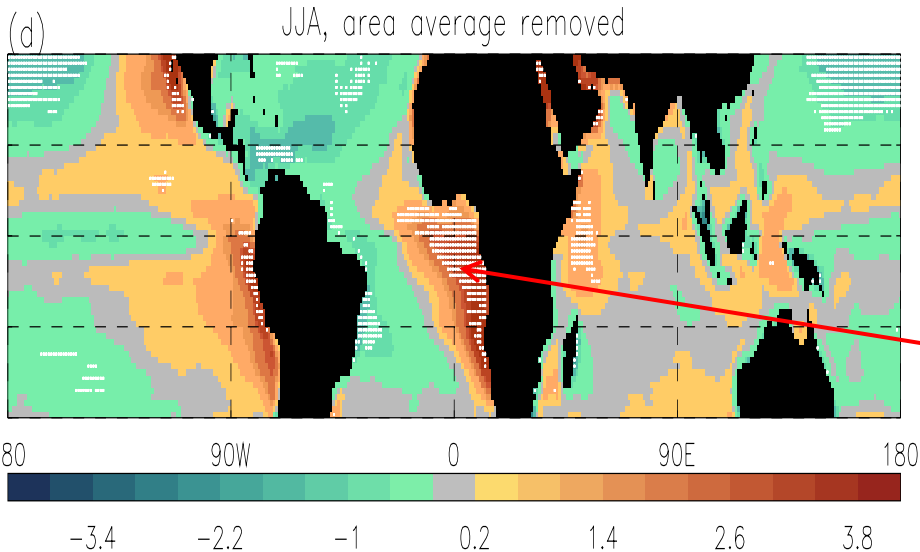
South Eastern Extension (6S-8E off Congo)=>

- 1 ATLAS buoy funded by South Africa in 2005
=> One year test deployment in 2006-2007
- EU PREFACE program allowed to purchase a 2nd ATLAS buoys
needed for its implementation on the long term
=> implemented from June 2013 (Vessel time ensured by France)

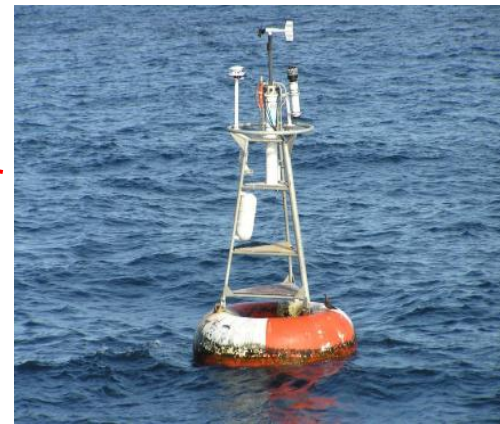


Summer (JJA) Sea Surface temperature bias pattern for CMIP5

White stipples indicate where models are consistently wrong



Toniazzo and Woolnough, 2013



Other operations/observations :



Contribution to a NSF program by J.Moum (Oregon Univ.):

=> 5 turbulence sensors (Chipods) installed at 23W and 10W-Equator (from 20 to 80m)
from 2015 for 5 years. (2 already installed in 2014 for one year)

Contribution to the acoustic Ocean Tracking Network (for Dalhousie University, Canada, F. Whoriskey)

=> addition of OTN at 200m depth on each ATLAS lines -to follow sea mammals- in 2014

PIRATA & AtlantOS

PIRATA contribution to the EU H2020 AtlantOS program (1st kick off meeting in June 2015):

=> addition of Classical sensors (T/C, current, flux) to some particular sites (IRD)

=> addition of one CO₂ sensor at PIRATA SEE (IRD)

=> addition of O₂ sensors along 23W at 300m & 500m (GEOMAR)



AtlantOS



PIRATA contributions to Tropical Atlantic Climate and Ocean Science

- ⇒ PIRATA data sets are increasingly valuable for more weather and climate forecasting.
- ⇒ PIRATA became a major Atlantic contribution to the global ocean observation system in support of climate (eg, GODAE, ARGO, GOOS, GOSUD, OceanSITES, AMMA, TACE, VAMOS, PREFACE, AtlantOS).
- ⇒ The PIRATA array and its extensions constitute the main backbone of the Tropical Atlantic Observing System
- +
- ⇒ PIRATA other observations (ADCP moorings, tide gauges...) & PIRATA yearly oceanographic cruises are sources of a large number of measurements along same sections & time series, + platform for “piggy-back” measurements (eg CO₂);
- ⇒ PIRATA also constitutes an important tool & context for :
 - international cooperations,
 - capacity building in developing countries (eg in Africa: regional Master 2 in Benin dedicated to “physical oceanography & applications”, PhDs, training at sea...) now in collaboration with UFPE (Recife, Brazil)

