

Prediction and Research Moored Array in the Tropical Atlantic - PIRATA

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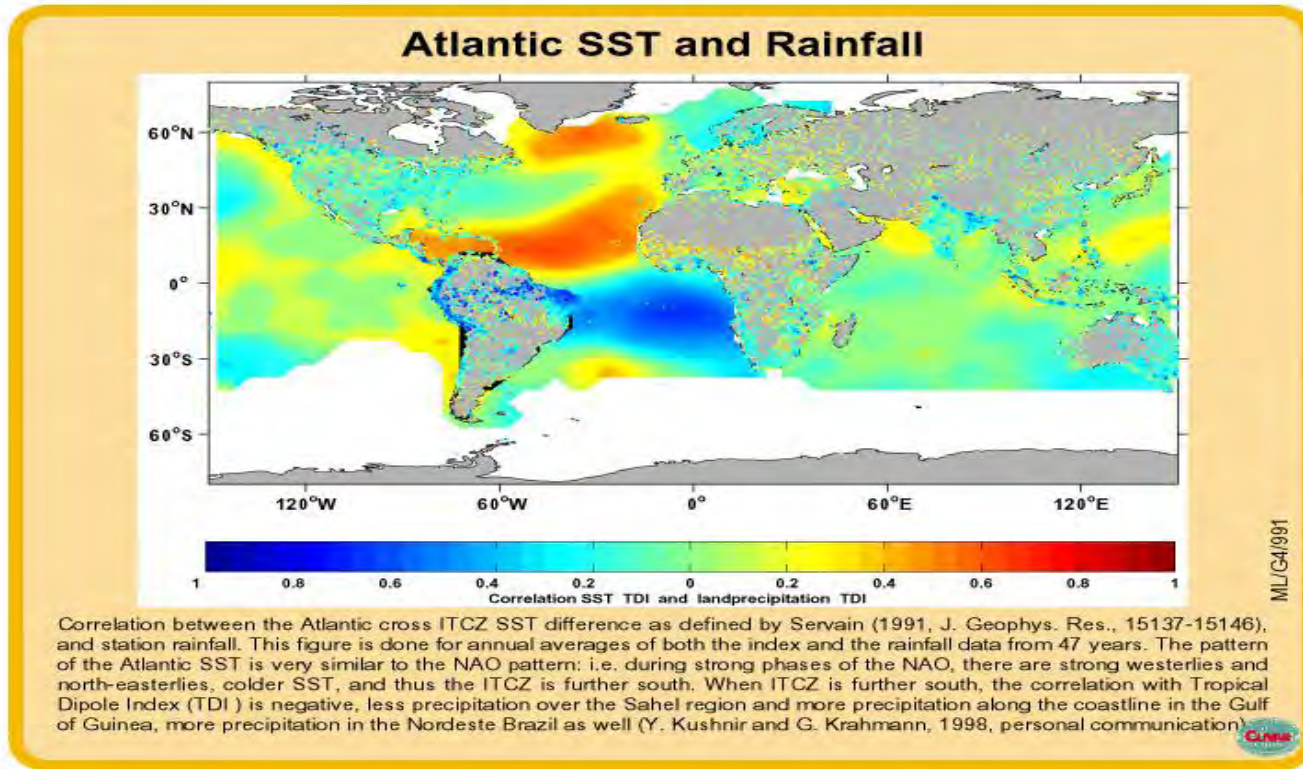
⁸NOAA/PMEL, USA;

⁹CPTEC-INPE, Brazil;

¹⁰TAMU, USA.



→ Why tropical Atlantic ?



The variability of the ocean–atmosphere system in the tropical Atlantic, from intraseasonal to multidecadal time scales, strongly influences regional variations in rainfall, and consequently the economies of the adjacent continental regions. For example, variations in the intertropical convergence zone (ITCZ) affect rainfall and droughts in Africa (West African monsoon) and northeastern Brazil & SST in the NETA important for tropical cyclogenesis.

Initiated in 1995-1996.... (by US, FR & BR colleagues)



PIRATA-1 Meeting

February 1996

Natal, Brazil

The Historic PIRATA' Birth

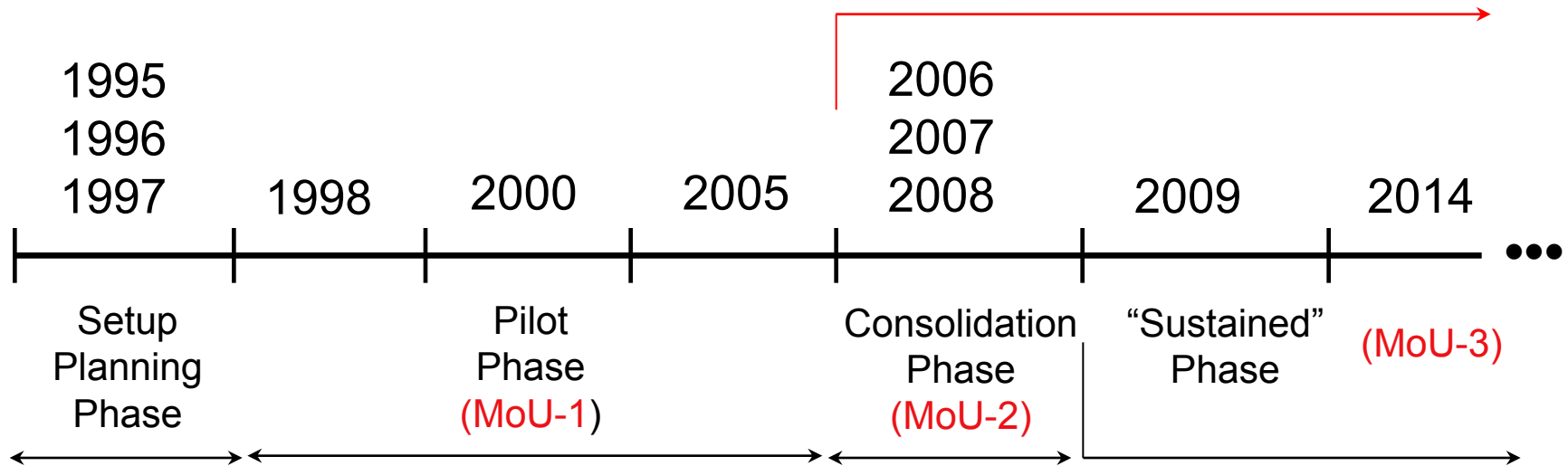
1st ATLAS buoy deployed on Sept 11, 1997 at 0°N-10°W

PIRATA: several “phases”:

From *Pilot Research moored Array in the Tropical Atlantic* to *Prediction and Research moored Array in the Tropical Atlantic*



CLIVAR-WCRP & OOPC endorsement



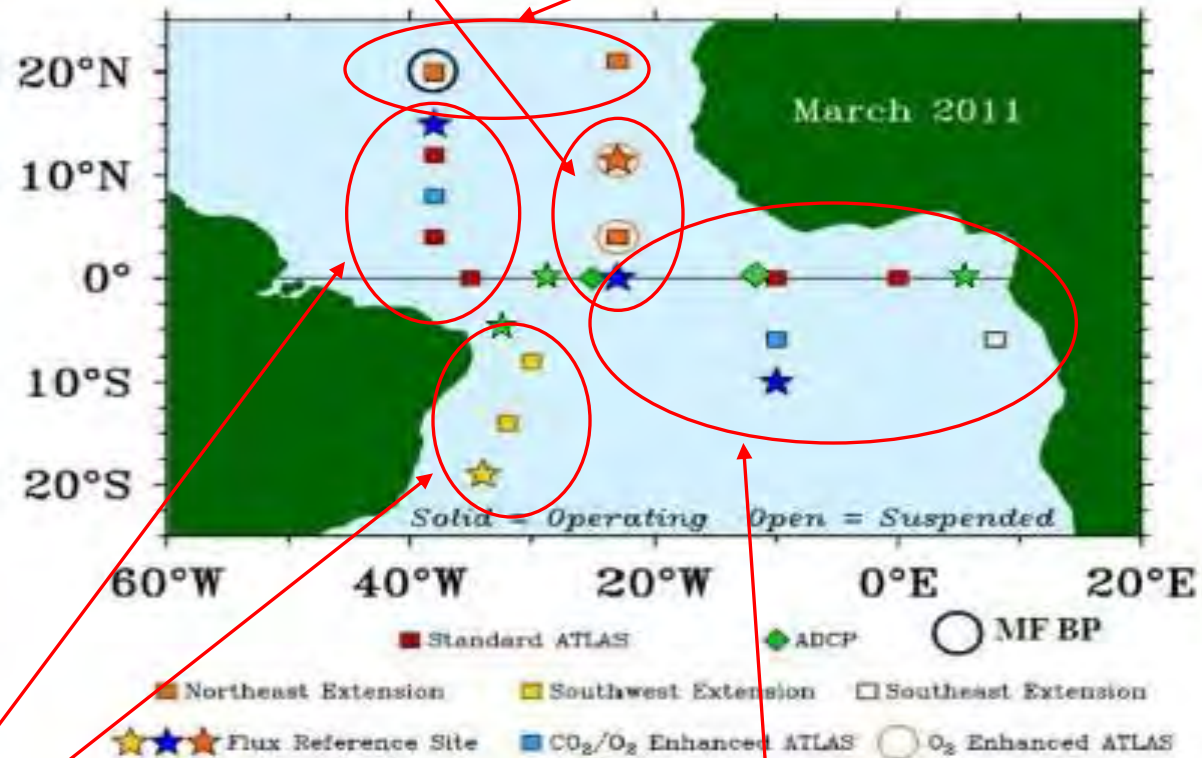
Commitments through the MoU very important...



PIRATA network servicing:

18 ATLAS buoys
from 2013

⇒ Yearly servicing
from Research
Vessels



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



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

Maintained by France: 6 Atlas buoys from 2013 (5 from 1997)
+ At 23°W-Equator : surface ADCP mooring since 2001
(serviced by GEOMAR from 2006);
+ at 10°W-Equator: surface ADCP mooring since 2006

- 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)

How works PIRATA ?



PIRATA structure & responsibilities sharing:

- 1) **PIRATA Resources Board:** => committee with one representative of each organism
=> 1 from NOAA/USA ; 1 from INPE ; 1 from IRD/France & 1 from Meteo-France/France

=> *Major tasks:*

To coordinate resources that may be applied to the Program;

*To encourage scientific and technological initiatives in the participating countries
to meet the objectives of PIRATA;*

To report on its activities to the Heads of the institutions providing resources.

- 2) **PIRATA Steering Scientific Group:** 3 members of each initial country (Br, Fr, USA)
+ 1 of Germany (GEOMAR, from 2008).

=> *Major tasks :*

- *To ensure accomplishment of the scientific and technical objectives ;*
- *To coordinate the technical and logistic support necessary to maintain the array;*
-
- *To invite collaborations with other nations and institutions...;*
- *To cooperate with international organizations ;*

(To report regularly to the PRB,..)

PIRATA data: ATLAS buoys and cruises data

ATLAS data => Real time & Delayed time:

- PIRATA ATLAS data return over the period 1998-2013:

~>82% in average

- PIRATA files delivered over the period 1999-2013:

Through website & ftp : noticeable increase

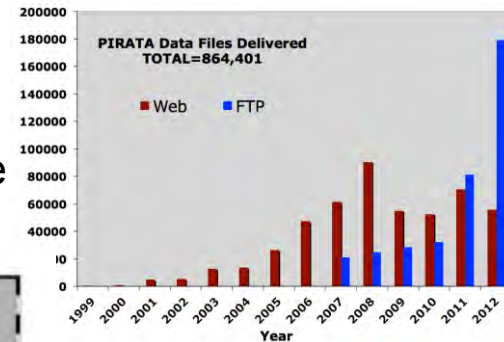
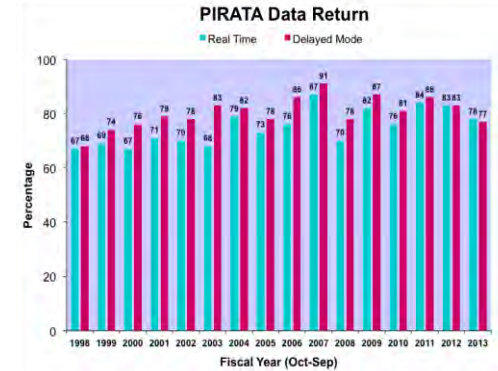


Open Data Policy

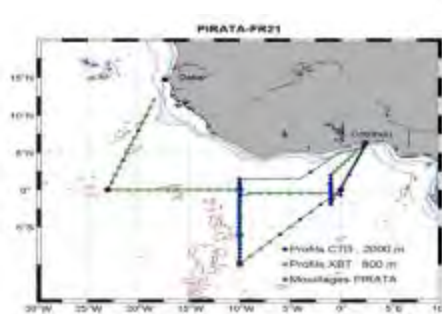
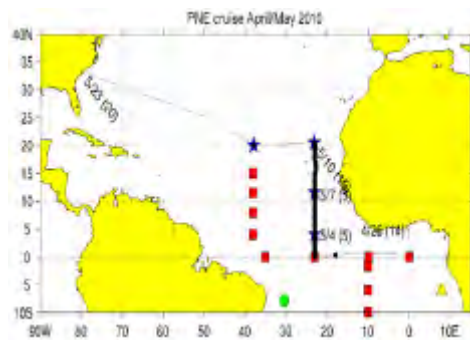
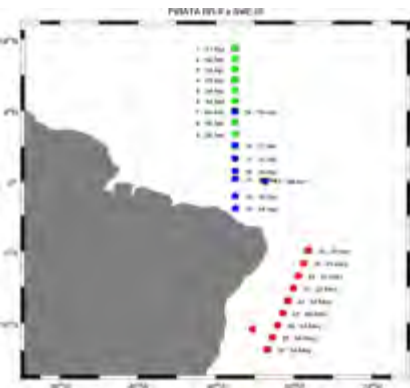
YEARLY CRUISES => repeated sections (ctdo2/ladcp...)

38°W section: Brazil 23°W section: USA

10°W section: France



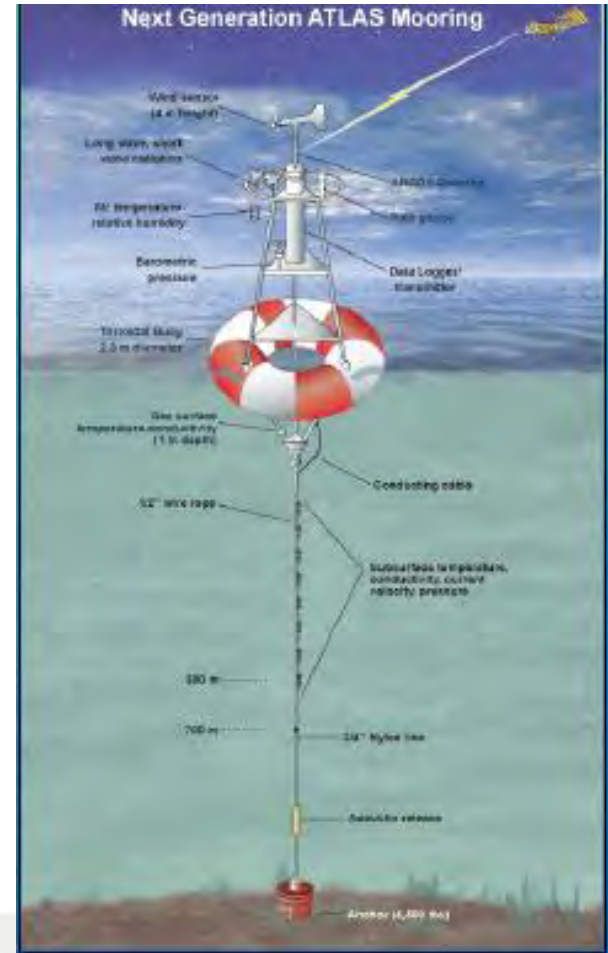
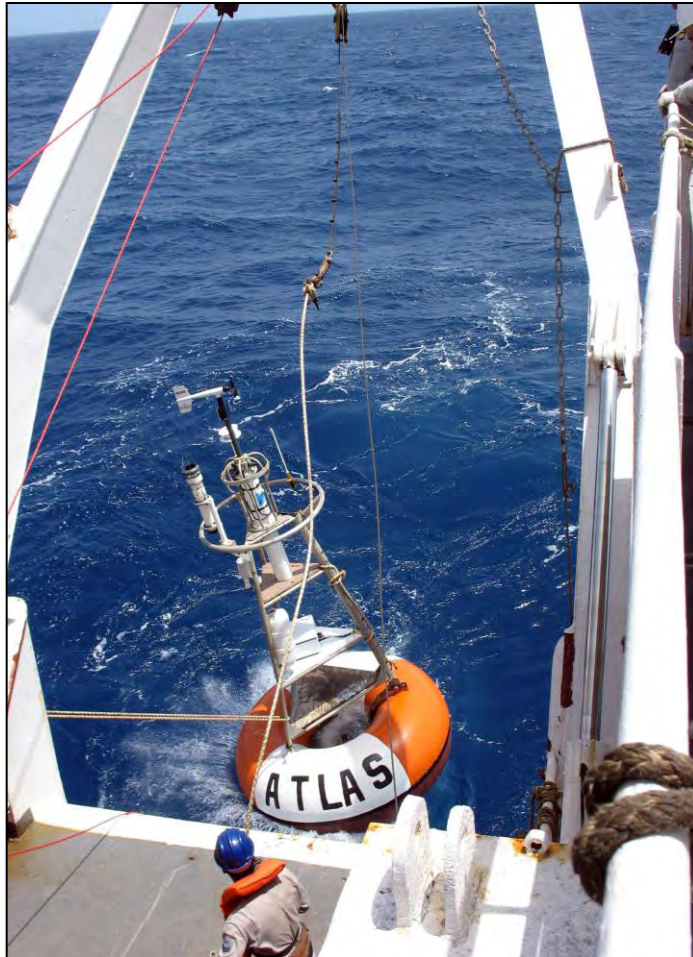
~150 vessel days



Yearly cruises = OPPORTUNITIES for: Deployment of ARGO profilers; surface drifters; CTDO2 & XBT: with possible transmission in quasi-real time for operational services Atmospheric measurements (Radiosoundings...) + « piggy-back operations »!



PIRATA





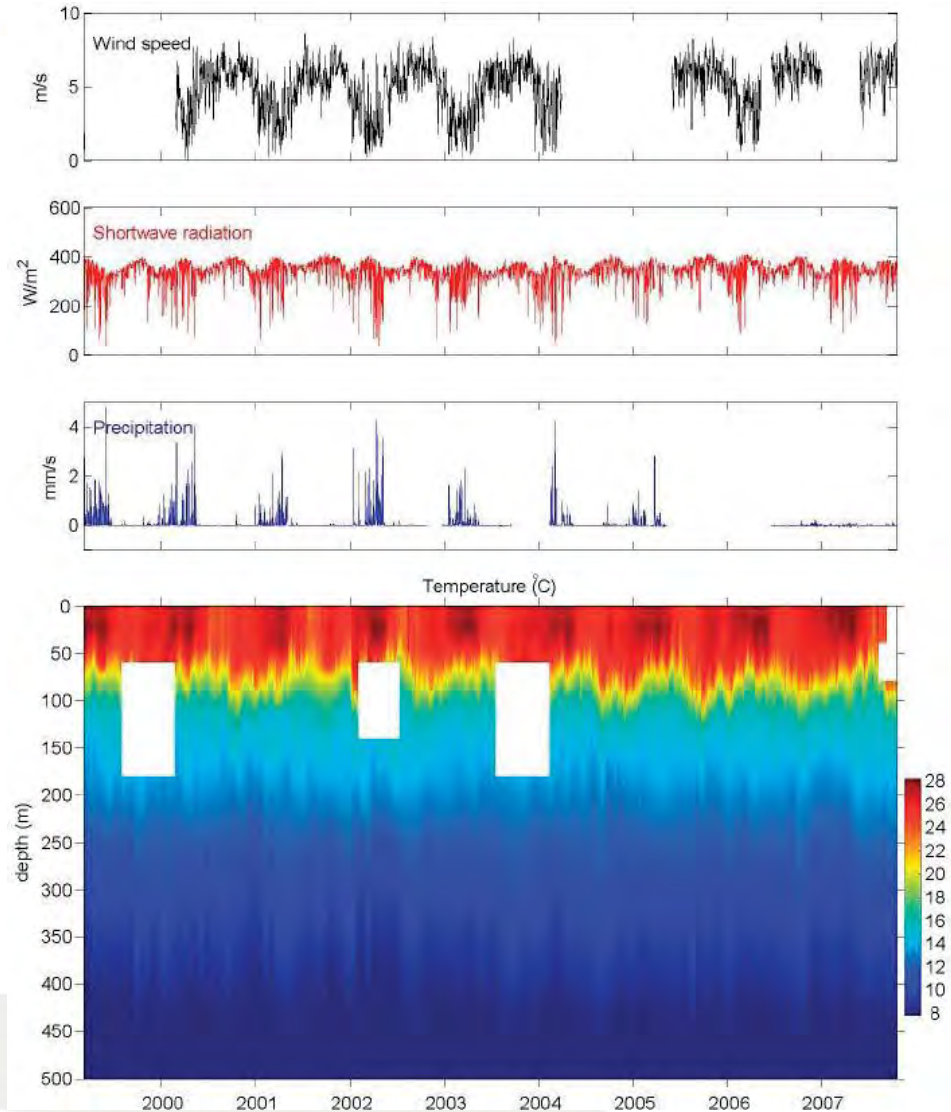
PIRATA

Meteorological data:

Tar, Rain, RH, W, SWR, LWR,
Patm

Oceanographic data (0-500 m):

T(z) (11 levels), S(z) (5 levels),
Currents



US NOAA/PMEL TAO / PIRATA /RAMA website:

<http://www.pmel.noaa.gov/pirata/>

- ⇒ Information about ATLAS buoys (sensors, status, data calibration processes...)
- ⇒ Plots
- ⇒ Access to data



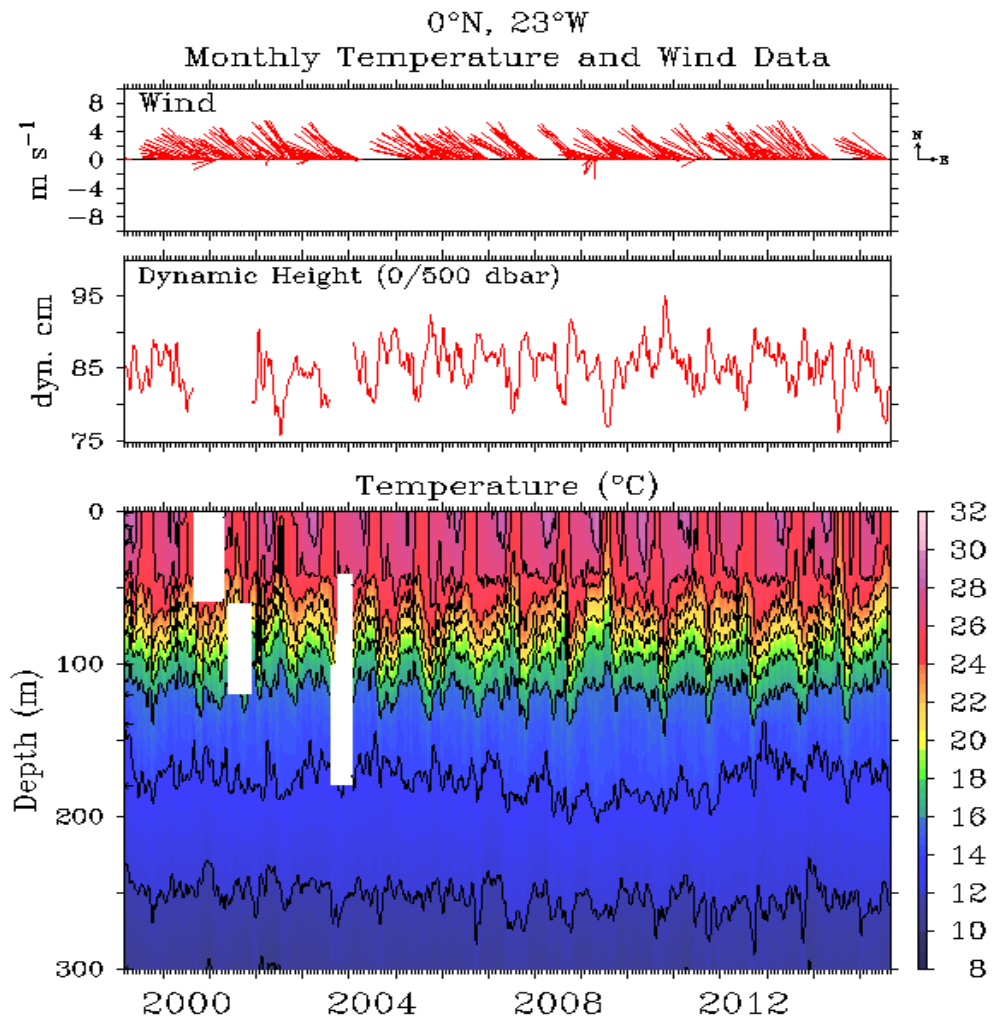
Prediction and Research Moored Array in the Atlantic (PIRATA)

PIRATA is a program designed to study ocean-atmosphere interactions in the tropical Atlantic that affect regional climate variability on seasonal, interannual and longer time scales. The [array](#) was originally developed in the mid-1990s and has undergone expansions and enhancements since 2005 to improve its utility for describing, understanding, and predicting societally relevant climate fluctuations. PIRATA has been implemented through multi-national cooperation in support of [CLIVAR](#), [GOOS](#), [GCOS](#), and [GEOSS](#). Financial, technical and logistic support are provided by France ([IRD](#) in collaboration with [Meteo-France](#), [CNRS](#) and [IFREMER](#)), Brazil ([INPE](#) and [DHN](#)) and the USA ([NOAA](#)). Data are freely available for research and operational applications via the World Wide Web and the [Global Telecommunications System](#).



Eg: some parameters evolution from 1997 at 23°W-0°N (real time data)

Aug 18 2015



US NOAA/PMEL TAO / PIRATA /RAMA website:

http://www.pmel.noaa.gov/tao/data_deliv/deliv.html

=> FREE and easy access to buoys data (Real time & Delayed time)

The screenshot shows the NOAA TAO/PIRATA/RAMA Data Delivery website. At the top, there is a navigation bar with links: Home, Project overview, Data display, Data delivery, El Niño & La Niña, and Site map. Below this is the title "T·A·O Data delivery" and a search box labeled "Find". A section titled "Learn about PIRATA" features three buttons: "TAO/TRITON (Pacific)", "PIRATA (Atlantic)", and "RAMA (Indian)". Below these is a world map showing buoy locations with latitude from 20°N to 20°S and longitude from 100°W to 80°E. Text below the map explains how to select mooring sites. A section for "Mac OS X Users" recommends Safari. The main interface includes buttons for "All", "Equator", "West", "East", and "Reset". There are dropdown menus for "Data" (Sea Surface Temp), "Averaging" (Daily), "Start date" (1997 SEP 11), and "End date" (2015 AUG 24). There are also dropdowns for "Structure" (files by site), "Format" (ASCII), and "Compression" (None). At the bottom, there are buttons for "Availability", "Clear", and "Deliver".

To select mooring sites, you may click individual sites on the map above, draw a rectangle around a group of sites, or use the blue buttons below. Solid squares show where there are data.

Mac OS X Users: Safari is recommended [Problems?](#)

[All](#) [Equator](#) [West](#) [East](#) [Reset](#)

Data: Sea Surface Temp
Averaging: Daily
[High Res Window](#)

Start date: 1997 SEP 11
End date: 2015 AUG 24

Structure: files by site
Format: ASCII
Compression: None

[Availability](#) [Clear](#) [Deliver](#)

Try our combined [Display and Delivery Page](#) which includes more comprehensive data and features, like the ability to download what you view

[Problems?](#) [Mac OS X Users: Safari is the recommended browser](#) [Non-JAVA Version](#) [HTML Version](#)
[FTP Access](#) [Acknowledgment for use of TAO/TRITON, PIRATA, and RAMA data](#)

US PNE PIRATA website:

<http://www.aoml.noaa.gov/phod/pne/cruises.php>

=> Information about cruises

⇒ Easy access to in situ Pirata cruises data sets

⇒ Pirata related reports & documents (SSG...).

⇒ PIRATA BIBLIOGRAPHY (peer reviewed paper references)



PIRATA Northeast Extension Tropical Atlantic Observations for Climate and Weather

NOAA AOML
Physical
Oceanography
Division

NOAA AOML PhOD PNE Cruises

quick search

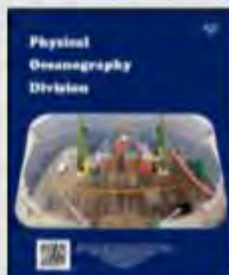
Popular topics

Go

PIRATA Northeast Extension

- About PIRATA
- Tropical North Atlantic
- PNE Cruises
- Data and Products
- PIRATA Publications
- Related Projects

PhOD project report

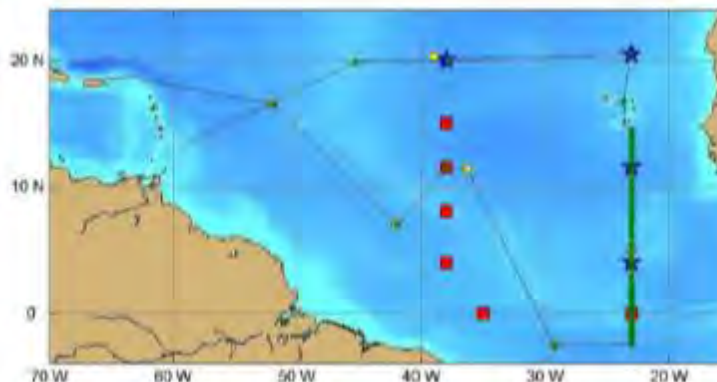


Cruises

2014 PNE Cruise

The 2014 PNE cruise was conducted from 28 December 2014 to 12 February 2015, Bridgetown, Barbados to San Juan, Puerto Rico, aboard the UNOLS R/V Endeavor. The chief scientist of PNE 2014 was Rick Lumpkin (NOAA/AOML). During this cruise, the four PIRATA Northeast Extension buoys were serviced and a T-FLEX mooring was deployed within five miles of the PNE mooring at 4N-23W with 10 point acoustic current meters to study upper ocean shear (lead PI Renellys Perez). An experimental washer system was installed at the 11.5N-23W site to clean dust off a second shortwave radiometer. 51 CTD stations were conducted, most of them along 23W. Five subsurface hydrophone moorings deployed in an NSF-funded project were also recovered. Due to ship space constraints, the AEROSE team was not able to participate in this cruise.

- Cruise report
- Cruise data



PIRATA PNE cruises data:

<http://www.aoml.noaa.gov/phod/pne/data.php>



www.aoml.noaa.gov/phod/pne/data.php

pirata pne aoml

Les plus visités

NOAA AOML PhOD PNE Data

quick search ... Popular topics: Go

PIRATA Northeast Extension

About PIRATA
Tropical North Atlantic
PNE Cruises
Data and Products
PIRATA Publications
Related Projects

PhOD project report

Physical Oceanography Division

PIRATA Northeast Extension
PNE Data and Products

Moored buoy data is quality controlled and distributed by PMEL's TAO Project Office.

2014 (Dec 2014-Feb 2015) PNE Cruise Data

CTD data have been corrected to bottle salinity and oxygen measurements, and are accurate to 2.2e-3 psu and to 3.3e-2 ml/l. They can be downloaded here in NetCDF and ASCII formats.

2013b PNE Cruise Data

CTD data have been corrected to bottle salinity and oxygen measurements, and are accurate to WOCE standards. They can be downloaded here in NetCDF and ASCII formats.

2013a PNE Cruise Data

CTD data have been corrected to bottle salinity and oxygen measurements, and are accurate to WOCE standards. They can be downloaded here in NetCDF and ASCII formats.

2011 PNE Cruise Data

CTD data have been corrected to bottle salinity and oxygen measurements. Due to a failure of the Autosal on the Ronald H. Brown, salinity values were not reliably calculated for the first five casts; all casts were calibrated according to salinometer results from samples drawn at the final station, and the salinity accuracy is likely not to WOCE standards. Oxygen accuracy was unaffected and is to WOCE standards. The data can be downloaded here in NetCDF and ASCII formats.

Brazilian PIRATA website:

<http://www.pirata.ccst.inpe.br/>
/

=> Information about cruises

⇒ Easy access to in situ Pirata cruises data sets

⇒ Pirata related reports & documents (SSG...).



[Home](#) [About](#) [Southwest Extension](#) [Data download](#) [Documents](#) [Contact](#)

PIRATA



The Prediction and Research Moored Array in the Tropical Atlantic (PIRATA) is an international observing network to improve both knowledge and understanding of the ocean-atmosphere system along the tropical Atlantic Ocean. Launched in the framework of the international program CLIVAR (CLimate VARiability and predictability), PIRATA operates by an array of moored buoys supported financial, technical and logistically by France (IRD) in collaboration with Météo-France, CNRS and IFREMER, Brazil (INPE and OIN) and the USA (NOAA). For more information, see [about PIRATA](#).

Southwest Extension

The PIRATA Southwest Extension project is an effort to expand the PIRATA array of tropical Atlantic ATLAS moorings into the southwestern sector of the Tropical Atlantic Ocean. Links below provide access to data from the extension, published articles and more information about the PIRATA project:

Data

Data from yearly maintenance Brazilian oceanographic cruises are available for download through [here](#).

Documents

Articles and reports from the yearly cruises are available for download as PDFs.

The screenshot shows a web browser window with the URL pirata.ccst.inpe.br/data-2/. The page features the PIRATA logo and a navigation menu with links for Home, About, Southwest Extension, Data download, Documents, and Contact. The main content area is titled "Data download" and highlights the "2014 – PIRATA BR-15 Cruise". Below this, there is a map of the South Atlantic Ocean showing the cruise track with red triangles and squares. A link for "Cruise Report (Portuguese)" is provided. The "2013 – PIRATA BR-14 Cruise" is also listed with a similar map. To the right, a "Data" section explains that only data from Brazilian maintenance cruises is available, including CTD, ADCP, Radiosondes, and XBT. A section titled "Other PIRATA data resources" lists partners: GOOS – Brazil, Ifremer – IRD, NOAA – ADML – PNE, and NOAA – PMEL – TAO (via GTS).

Data download | PIRATA

pirata.ccst.inpe.br/data-2/

Pirata

Home About Southwest Extension **Data download** Documents Contact

Data download

2014 – PIRATA BR-15 Cruise

PIRATA BR-15 - 2014

20°N
10°N
0°
10°S
20°S

50°W 40°W 30°W 20°W 10°W 0° 10°E

▲ PIRATA 2014
■ PIRATA 2013

[Cruise Report \(Portuguese\)](#)

2013 – PIRATA BR-14 Cruise

PIRATA BR-14 - 2013

20°N
10°N
0°
10°S
20°S

50°W 40°W 30°W 20°W 10°W 0° 10°E

▲ PIRATA 2014
■ PIRATA 2013
★ CTD

Data

Here are available only PIRATA data retrieved during the Brazilian maintenance cruises, that includes CTD, ADCP, Radiosondes and XBT. All data can be freely accessed, except for XBT, which distribution is under development.

Other PIRATA data resources

There are other PIRATA data distributors partners, which have different data from the ones here presented.

- » GOOS – Brazil
- » Ifremer – IRD
- » NOAA – ADML – PNE
- » NOAA – PMEL – TAO (via GTS)

French PIRATA website:

<http://www.brest.ird.fr/pirata/>

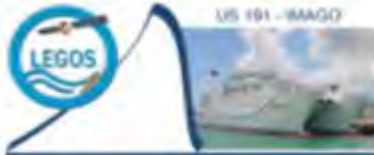
or

<http://www.ifremer.fr/ird/pirata/>

=> Information about cruises

⇒ Easy access to in situ Pirata cruises data sets

⇒ Pirata related reports & documents (SSG...).



PIRATA Prediction and Research Moored Array in the Tropical Atlantic



PIRATA France

- Welcome
- About PIRATA
- PIRATA-FR Cruises
- São Tomé Island
- French team

Project resources

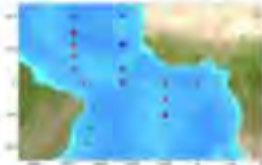
- Data and Products
- Reports and Publications
- PIRATA links

Contact

- Contact Information



About PIRATA



The PIRATA project is a joint effort between Brazil, France and the United States to collect oceanic and meteorological observations in the tropical Atlantic.

The experimental program PIRATA (initially « Pilot Research moored Array in the Tropical Atlantic » and named « Prediction and Research Moored Array in the Tropical Atlantic » from 2008) has been implemented in 1997 in the Tropical Atlantic Ocean (Servain et al. 1998). It has been launched in the framework of the international program CLIVAR (CLImatic VARIability and predictability) and implies scientific teams from three countries: France (IRD, in charge of coordination and oceanic cruises, **Météo France**, with contributions by **IFREMER** and **CNRS/INSU**), Brazil (**DHN** and **INPE**) and USA (**NOAA/PMEL**). Financial supports for the program are from the **IRD**, **Météo France**, and **Observatoire Midi-Pyrénées/Université Paul Sabatier**.

[More...](#)

News !

PIRATA status

[French national report & status 2011-2014](#)

Last PIRATA FR24 cruise in April-May 2014



The last PIRATA cruise from Dakar-Senegal to Abidjan (Ivory Coast)

[PIRATA-FR24 cruise summary \(in english\)](#)

IRD news: [PIRATA-FR244 cruise](#)

Last PIRATA FR25 not documented yet...

=> on: http://www.brest.ird.fr/pirata/pirata_cruises.php

The screenshot shows a web browser window with the URL www.brest.ird.fr/pirata/pirata_cruises.php. The page features a left-hand navigation menu with sections: "Les plus visités", "Project resources" (containing links for São Tomé Island, French team, Data and Products, Reports and Publications, and PIRATA links), and "Contact" (containing Contact information). The main content area is titled "Cruise data" and includes a link to a "Report of data collected during PIRATA cruises Vol-1 1997-2003 (In French), PDF format to print 37 Mo, to visualize 2,7 Mo". Below this is the "2014 PIRATA-FR24 Cruise" section, which states: "PIRATA-FR24 cruise was conducted aboard the N/O Le Suroit on April 9 – May 22 from Dakar (Senegal) to Abidjan (Ivory Coast)". It also includes links for "Cruise Report (summary in english)" and "Cruise data".

PIRATA-FR24

The map displays the cruise track for PIRATA-FR24 in the Gulf of Guinea region, spanning from 30°W to 15°E longitude and 15°S to 20°N latitude. The track is marked with colored lines and dots: blue for CTD profiles at 2000 m depth, green for XBT profiles at 800 m depth, red for PIRATA moorings, and yellow for hydrophone mooring. The track starts at Dakar, Senegal, and proceeds southwards, then eastwards towards Abidjan, Ivory Coast, and back southwards. Key locations labeled on the map include Dakar, Abidjan, and Cotonou.

- Profils CTD 2000 m
- Profils XBT 800 m
- Mouillages PIRATA
- Hydrophone mooring

New PIRATA-FR S-ADCP data treatment:

Work done by Gaëlle Herbert (refer to her presentation), funded by PREFACE.
All 2007-2015 cruises SADCP data treated through the CASCADE software.

Publication:

G. Herbert, C. Kermabon, J. Grelet, B. Bourlès, French PIRATA cruises S-ADCP data processing, Mercator Ocean—Coriolis Quarterly Newsletter - Special Issue, #52-May 2015

only for cruises from 2007...

Data archiving and data access

The set of SADCP processed data from these 8 PIRATA oceanographic cruises are made available on the [ftp website: ftp://ftp.ifremer.fr/ifremer/ird/pirata/pirata-data/](ftp://ftp.ifremer.fr/ifremer/ird/pirata/pirata-data/). For each cruise, different files are available:

- NetCDF data files - Raw data and processed data (date/time, latitude, longitude, depth, horizontal and vertical absolute current, navigation data...).
- UNIX tar files containing figures (section map, images and vector plots of the sections).
- Report which contains information about data collection, quality checks, processing procedures applied to data and problems encountered with the data.

go to: adcp/sadcp_cascade

The files are also archived and directly downloadable on the SISMER portal (under Data access http://www.ifremer.fr/sismer/index_UK.htm)

New PIRATA-FR TSgraph data treatment

- French Research vessels have been collecting thermo-salinometer (TSG) data since the early 2000 to contribute to the Global Ocean Surface Underway Data (GOSUD) programme.

- Water samples are taken on a daily basis by the crew and later analysed in the laboratory.

(coll. IFREMER, IRD, CNRS, SHOM... in the frame of CORIOLIS).

= > **delayed mode processing of the 2001-2013 dataset almost achieved!**

(at now, only for PIRATA cruises done from Ifremer Vessels, ie Atalante & Suroit; Antéa soon!)

=>

Data available on:

ftp://ftp.ifremer.fr/ifremer/doi/gosud_tsg_frenchVessels_2001to2013/GOSUD_TSG_FRV_DM_201502.zip

These data will also be made available through the Pirata-Fr data website •

Other operations/collaborations/observations from NOW to the FUTURE :

Contribution to CO₂ parameters measurements (PI: N.Lefevre, IRD/Locean)

- from 2006 : 2 French « Carioca » systems at 8N-38W & 6S-10W transmitting in real time
- sea water sampling analysis during some Pirata cruises.

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- from 2014

Contribution to a USA/NSF program (PI: J.Moum, Oregon Univ.):

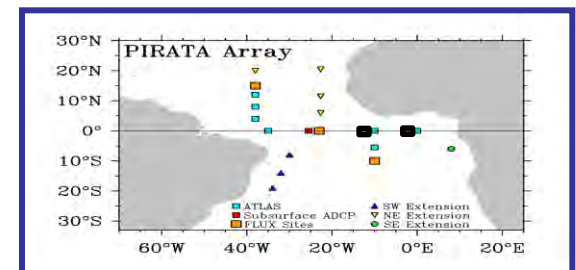
- 5 turbulence sensors (Chipods) installed at 23W and 10W-Equator (from 20 to 80m) from 2015 for 5 years. (2 already installed in 2014 for one year)

Involvement/Contribution to the EU PREFACE (FP7-ENV, from 2013):

- Atlas SEE; ADCP mooring at 0-0...

Involvement/Contribution to the EU AtlantOS program (H2020, from 2015):

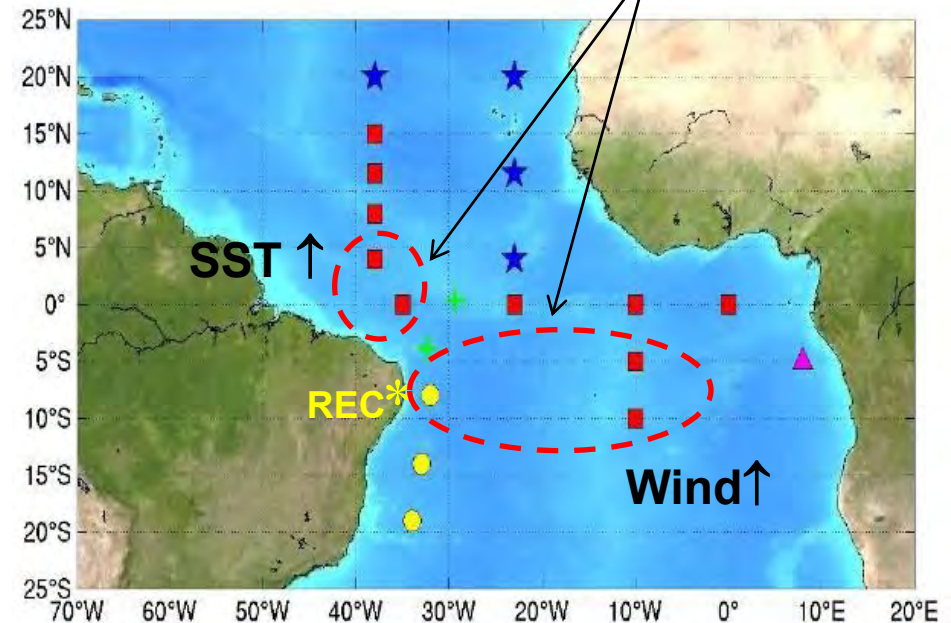
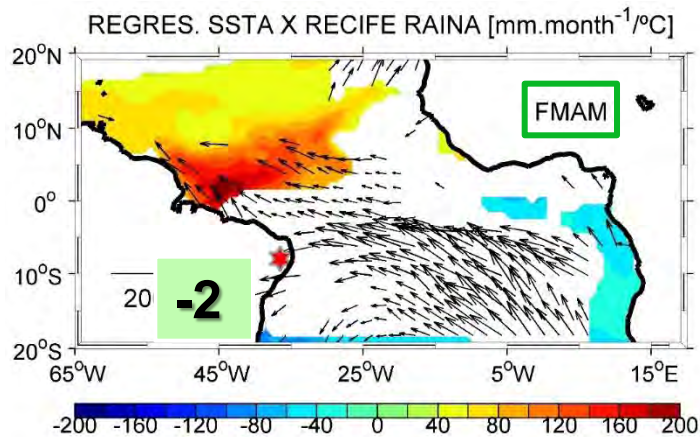
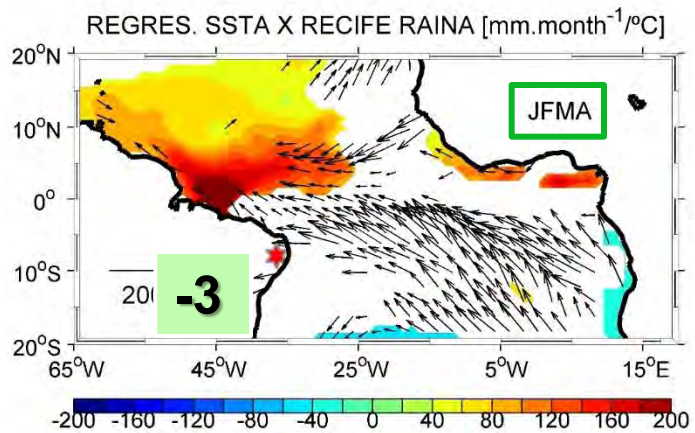
- addition of Classical sensors (T/C, current, flux) to some particular sites (IRD)
- addition of one CO₂ sensor at PIRATA SEE (IRD)
- addition of O₂ sensors along 23W at 300m & 500m (GEOMAR)



→ Environmental and societal impacts

1. Extreme rainfall events

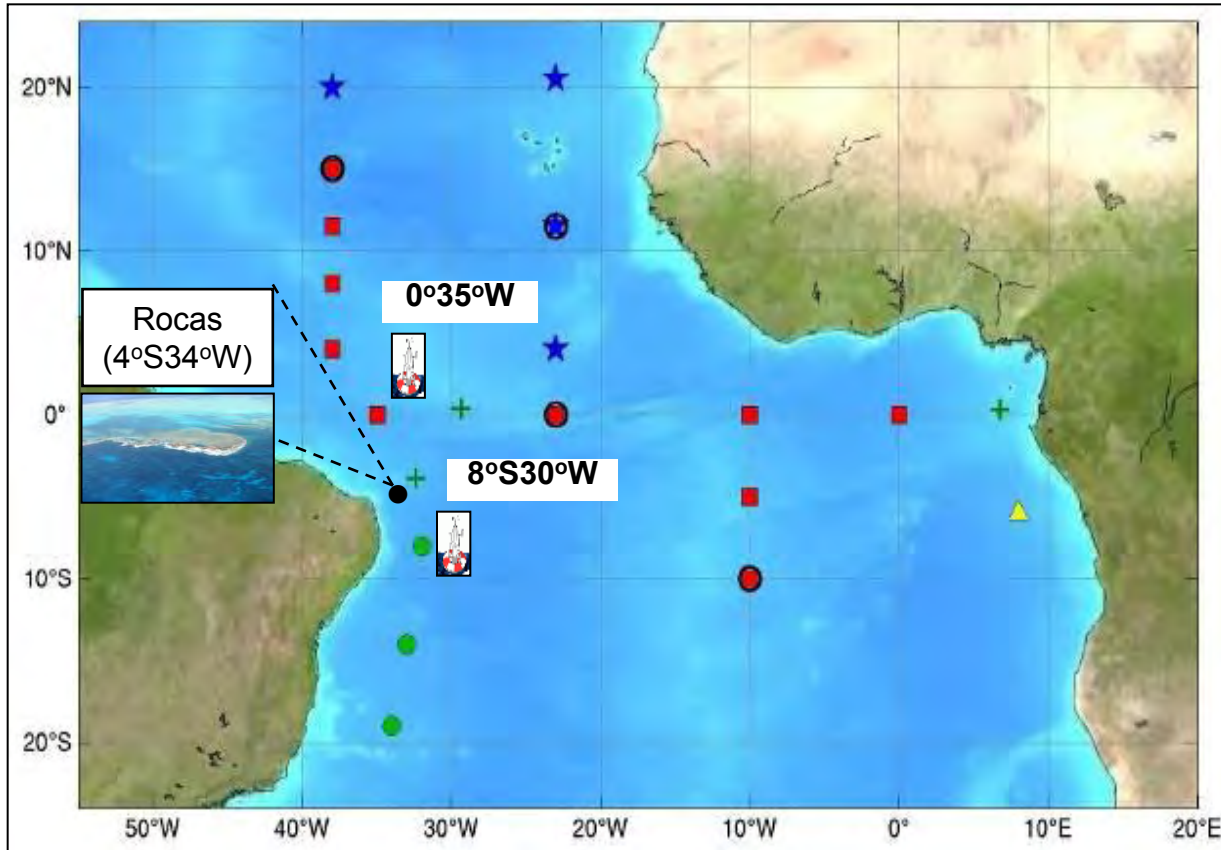
Recife rainfall (ENEB)



→ Environmental and societal impacts

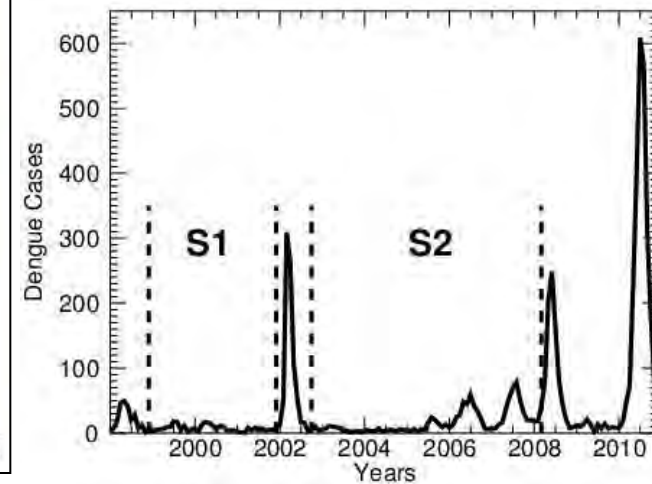
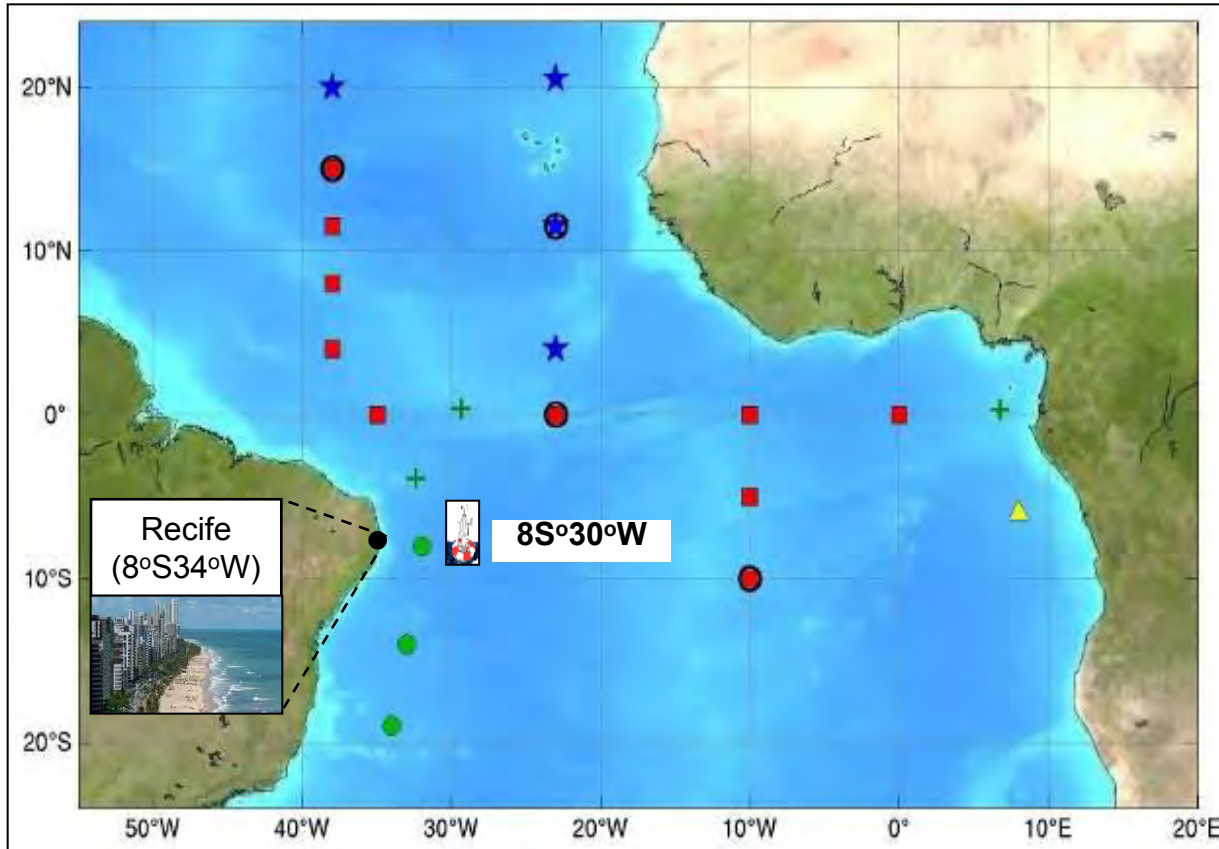
2. Coral reefs bleaching

SST ↑




→ Environmental and societal impacts

3. Tropical diseases (dengue)



Capacity building in Africa related to PIRATA & collaborations with UFPE/Brazil & UCT/South Africa









INTERNATIONAL CHAIR IN MATHEMATICAL PHYSICS AND APPLICATIONS (ICMPA)
UNESCO CHAIR IN MATHEMATICAL PHYSICS AND APPLICATIONS
 established in 2006 at the University of Abomey-Calavi (Republic of Benin)
UNITWIN/UNESCO Chairs – Twinning networks and university networks



University of Abomey-Calavi

MULTI-UNIVERSITY MASTER'S DEGREE AND DOCTORAL TRAINING PROGRAMME IN PHYSICAL OCEANOGRAPHY AND APPLICATIONS

Considering the needs of capacity building in environmental sciences, climate and coastal environment, a regional master in **“Physical Oceanography and Applications”** is being organized by the International Chair of Mathematical Physics and Applications (ICMPA-UNESCO Chair) of the University of Abomey-Calavi at the Faculty of Sciences and Technology, involving the following universities, research institute and organizations:

<p>Intergovernmental Oceanographic Commission (IOC) of UNESCO</p> <p>Mr Justin Ahanhanzo, Coordinator and Team Leader, Intergovernmental Oceanographic Commission of UNESCO (IOC/UNESCO) UNESCO, 1 Rue Miodin, 75732 Paris Cedex 15, France Tel: +33 1 45 68 36 41 Fax: +33 1 45 68 58 10/12/13 E-mail: j.ahanhanzo@unesco.org http://ioc.unesco.org</p> 	<p>Paul Sabatier University (France)</p> <p>Prof. Nicholas Hall, Laboratoire d'Etudes en Géophysique et Océanographie Spatiales (LEGOS), 18 Avenue Edouard Belin, 31401 Toulouse cedex 9, France Tel: +33 5 61 33 29 19 Fax: +33 5 61 25 32 05 E-mail: Nick.Hall@legos.obs-mip.fr</p> 	<p>University of Abomey-Calavi (Benin)</p> <p>Prof. Mahouton Norbert Hounkonnou, International Chair of Mathematical Physics and Applications (ICMPA-UNESCO Chair), 072 B.P. 50 Cotonou, Republic of Benin, Tel: +229-21 58 61 27/ +229 95 06 26 89 Fax: +229-21 31 31 38 E-mail: norbert_hounkonnou@icpma.net or hounkonnou1@yahoo.fr</p> 	<p>Institut de Recherche pour le Développement (France)</p> <p>Dr Bernard Bourles, Laboratoire d'Etudes en Géophysique et Océanographie Spatiales (LEGOS) Centre de Recherches Mathématiques et Océanologiques du Bénin (CRHOB), Représentation IRD de Cotonou, 08 BP 841 Cotonou, Republic of Benin Tel: +229 21 30 03 54 / + 229 90 08 94 56 Fax: +229 21 30 88 60 E-mail: bernard.bourles@ird.fr</p> 	<p>Total (France)</p> <p>Mme Valérie Quimou-Raam: TOTAL S.A. DGEPT/DO/TEC/GEO – 21E09, Tour Copérola, 2, Place Jean Millier, La Défense 6 - Cedex 45 92078 Paris La Défense, France Tel: +33 1 47 44 34 83 Fax: +33 1 47 44 49 48 E-mail: Valens.Quimou@total.com</p> 
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Official languages: English and French. English is the preferred choice, though, given the international attendance

INITIATED IN 2008

M2 SCIENCE OF THE OCEAN, ATMOSPHERE AND CLIMATE

INTERNATIONAL MASTER'S PROGRAM IN Physical Oceanography and Applications
COTONOU, BÉNIN

PARTNERS AND FINANCES

The Master's program was launched in 2008 in Benin, as a joint operation between the French research institute IRD, the UNESCO International Chair in Mathematical Physics and Applications (ICMPA) with the University of Abomey Calavi, Cotonou, Benin, the University of Toulouse (UPS) and the energy company Total.

The host organisation ICMPA supply the foundation for our instruction, and lecturers from outside Benin deliver their courses in the form of one or two-week intensive study periods. Specialist lectures are given by IRD scientists and the continuous presence of IRD research staff and a local permanent office in Benin is of crucial importance to the maintenance, stability and day to day running of the program. The University of Toulouse has been a core partner since the start of the diploma, providing lecturers, and from the academic year 2011-12 the diploma has been jointly offered by the two universities.

Total provide instruction on applied aspects of ocean science and offshore development. Our program has recently been reinforced with the addition of lecturers from the Federal University of Pernambuco, Recife, Brazil, and the offshore service company Fugro GEOS, from England.

Financial support was initially provided by IRD over the period 2008-2010. From 2009 the financial support was progressively adopted by Total who currently underwrite all our running costs. Our principal expenses are travel and lodging for visiting professors along with logistics and grant support for students.

We require approximately €50,000 per year to maintain this formation program. We are currently seeking new sources of finance to maintain our activity into the near future.

Since 2008, our Master's program has brought together students from all over West Africa to study the physics, chemistry and biology of the ocean. It is the only formation on the African continent that specialises in physical oceanography and its applications. We cover a broad range of topics, from ocean circulation theory to offshore installations. Our instructors include professors from the two host universities, researchers from France and Brazil and industrial partners from France and England. Successful students receive "M2" level diplomas from the universities of Cotonou and Toulouse. Many of our students have gone on to doctoral research training in Africa, Europe and North and South America.

IRD Institut de recherche pour le développement

TOTAL COMMITTED TO BETTER ENERGY

FUGRO


UFPE

LEGOS


UNIVERSITE PAUL SABATIER TOULOUSE
UNIVERSITE D'ABOMEY CALAVI COTONOU

- Joint operation between IRD, the UNESCO International Chair in Mathematical Physics and Applications with the University of Abomey Calavi, Cotonou, Benin, the University of Toulouse (UPS) and then (from 2009) the energy company Total.
- Students from all over West Africa to study the physics, chemistry and biology of the ocean.
- Only formation on the African continent that specialises in physical oceanography and its applications.
- Diploma jointly offered by the two universities of Toulouse (Fr) & Cotonou (Bénin).

- 66 students formed (Benin, Ivory Coast, Cameroon, Togo, Ghana, Senegal, Nigeria)
- Of the 50 students for which we have information, all are either in employment or further education:
- 25 (at least) continued in PhD: in France, Brazil (UFPE), South Africa (UCT), Germany (GEOMAR), Canada, Cameroon, Benin....



Natacha Djath - Togo
Natacha comes from Agbodji in Togo and joined us after completing a formation in physics in Lomé. She went on to model the Solomon Sea as part of her PhD studies in Grenoble, France. She is now working in Toulouse using satellite data to shed further light on the complex ocean circulation patterns around Indonesia.



Sandrine Djakour - Ivory Coast
After her Master's studies in Cotonou, Sandrine completed a PhD in Cotonou and Brest, in cooperation with the University of Cape Town. She developed a high resolution regional ocean model of the Gulf of Guinea to study coastal upwelling. She has now returned to her native Ivory Coast and is expecting a university position in Abidjan in the near future.


module	course	Hrs	ECTS	establishment
General Competences	English	20		Rugiers
	Special Topics: presentations, campaigns etc.	10	3	IHROB, UFPE, NICMR...
Topics in Oceanography	Physical Oceanography	20		ICMPA / IRD
	Ocean Geochemistry and Tracers	25	6	UPS
	Remote sensing and satellite data	25	5	UPS
Fluid Mechanics and Turbulence	Fluid Mechanics	10		ICMPA
	Turbulence	20	3	UFPE
Waves and Ocean Dynamics	Differential Equations, Vibrations and Waves	10		ICMPA
	Dynamical Oceanography	25	6	UPS
Coastal and Interactive Processes	Waves, Tides and Tropical Dynamics	25	5	UPS
	Coastal Oceanography	20		UFPE
Commercial Applications	Coupled Physical-Biochemical Processes	25	6	UPS
	Sedimentary and Littoral processes	20		IRD
Commercial Applications	Oceanography for the Offshore industry	20		Total Professors Associés
	Offshore Field Development	20	6	Total Professors Associés
	Commercial ocean measurements	20		Fugro GEOS
Scientific Applications	Statistics and Probability Theory applied to Climatology	25	5	ICMPA / IRD
	Programming / Matlab	15	6	GOLFOCEAN
Project	Modelling and data assimilation	25		IRD
	Research Project		24	

ORIGINS AND OBJECTIVES


The Master's program in physical oceanography and applications grew from a need for capacity building in the West African region in support of research programs in oceanography such as PIRATA (maintenance and observation of moored data arrays), AMMA-EGEE (the oceanic component of the African monsoon) and PROPAO (regional collaborative network for coastal measurements). It has since grown into a unique regional education program with students from Benin, Togo, Nigeria, Ivory Coast, Cameroon, Senegal and France. Each year we provide instruction to about ten students on all aspects of physical oceanography, from the basic dynamics of ocean currents, waves and tides to the action of ocean circulation on geochemistry, biology and sediments including coastal erosion. We also cover commercial applications such as offshore field development. Our objective is to form the new generation of ocean scientists (some of whom will progressively take over the running of the program) and to build capacity in local institutions and for research and commercial collaborations. We also aim to raise consciousness at all levels concerning the important environmental challenges presently facing the region and strongly influencing future growth and development.

KEY FACTS


- We are the first international diploma in Oceanography to be twinned between an African and a European university.
- We can claim the first Master level qualifications in physical oceanography delivered to women in West and Central Africa.
- Over the last 7 years we have instructed 66 students from 8 countries of which 25 are either currently studying for or already gained a PhD. Of the 50 students for which we have information, all are either in employment or further education.
- Our doctoral students have spread to four continents, working in Benin, Ivory Coast, Cameroon, Senegal, South Africa, France, Germany, Canada and Brazil.
- Our master's program is regularly assessed and is currently evolving into an international cooperation between Benin, France, Brazil and the UK, continuing to reinforce north-south links and developing south-south partnerships.



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Casimir de Alata - BENIN
Casimir comes from Savalou in Benin. He followed the Master's course in its inaugural year and after obtaining the diploma he went on to PhD studies jointly in Toulouse and Cotonou. He is now an expert on Atlantic surface salinity, with four first-author papers, and is currently working in Brest. Casimir has joined our teaching staff.



Aubains Hounsou-Gbo - BENW
Aubain was the first of three of our students who have crossed the tropical Atlantic to work in Brazil at the Federal University of Pernambuco, Recife. He submitted his PhD this year on April 8, 2015 and is now continuing in Brazil in a postdoctoral position, contributing to the PIRATA observing network and investigating the role of the Tropical Atlantic ocean in climate variations in the Nordeste region of Brazil.

TOTAL STOPS ITS SPONSOR IN 2015
IRD WILL ENSURE IN 2015-2016... (last week info!)
=> BUT NOT ENSURED AFTER 2016... => 50k€/year needed!