

PIRATA

(PredIction and Research moored Array in the Tropical Atlantic)

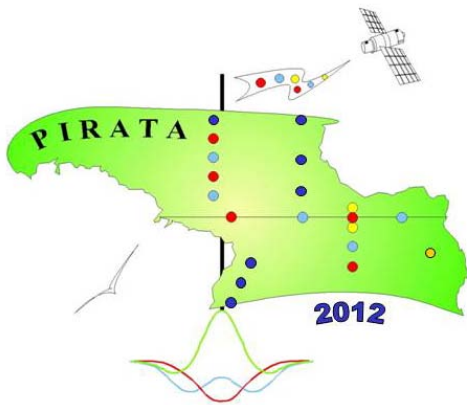
French national report & status



- *A few recalls & french cruises*
- *PIRATA status in France (S.O.)*
- *About the PIRATA FR 21&22 cruises*
- *Scheduled cruise in 2013*
- *PIRATA SEE status...*
- *Other activities since PIRATA 16*
- *Perspectives*

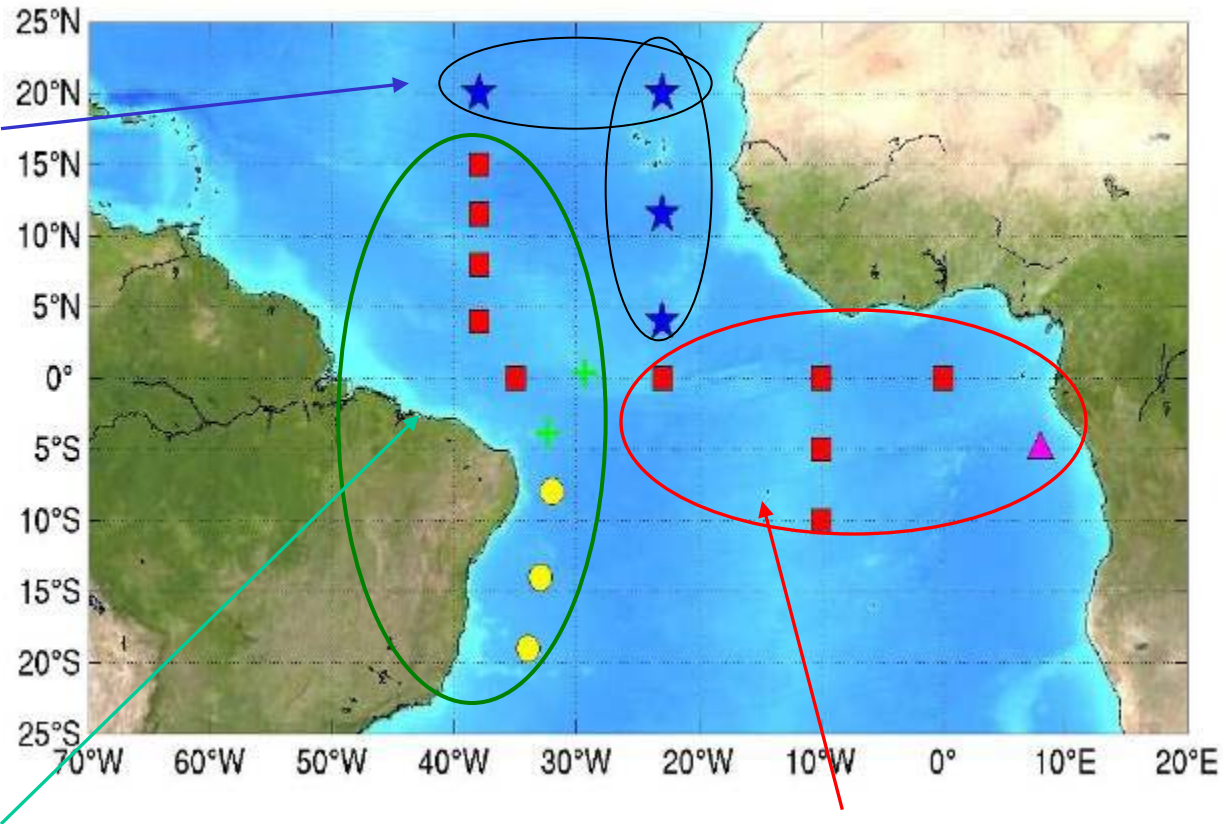
Members in FRANCE of the PIRATA-SSG:

- *Bernard BOURLES (IRD-LEGOS&CRHOB, Cotonou; resp..ORE PIRATA in France; co-chairman of the PIRATA SSG)*
- *Fabrice HERNANDEZ (IRD-LEGOS, Toulouse)*
- *Hervé GIORDANI (Météo-France, CNRM, Toulouse)*



Recall : PIRATA present network

Maintained by USA:
4 Atlas buoys



Maintained by Brazil: 8 Atlas buoys

Maintained by France : 5 Atlas buoys:
+ 1 Atlas for Pirata SEE (from 2006 to 2007, and from ???)
+ At 23° W-Equator : surface ADCP mooring since 2001
+ at 10° W-Equator : surface ADCP mooring since June 2006 as part of AMMA, PIRATA-France & TACE.

=> 17 buoys yearly serviced from 2007 !

PIRATA status in France : « SO-AO (Service d'Observations Océan-Atmosphère) »

Until 2010 PIRATA = « Research Observatory for Environment »

Changed in 2010 as « SOERE: Service d'Observation et d'Expérimentation, sur le long terme, pour la Recherche et l'Environnement » BUT change again in 2011 as ORE-OA (Observatoire Pour la Recherche et l'Environnement – Océan/Atmosphère) as part of a larger SOERE (CTDO2) dedicated to ocean operational observations (PIRATA, SSS, ARGO, CORIOLIS).

⇒ Yearly national evaluations (for INSU) PIRATA : (positive...)

⇒ « **SO label** » important for endorsements of national programs and/or research organisms + potential funding support for material + vessel time...

+ Convention for the PIRATA maintenance established between IRD & Meteo-France renewed in 2012 for 4 years. This convention IRD/MF + international MoU ARE absolutely needed!

⇒ 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



PIRATA status in France : « Observatoire de la Recherche en Environnement »

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

	METEO FRANCE	IRD	ORE & SOERE INSU	O.M.P./U.P.S.	Total:
2003:	22,430 €	38,000 €	11,287 €	0 €	71,717 €
2004:	22,430 €	67,000 €	20,317 €	0 €	109,747 €
2005:	22,430 €	105,000 €	18,900 €	0 €	143,330 €
2006:	22,430 €	50,000 €	2,300 €	0 €	74,730 €
2007:	22,430 €	50,000 €	0 €	5,000 €	77,430 €
2008:	22,430 €	49,000 €	0 €	5,000 €	76,430 €
2009:	40,000 €	49,000 €	0 €	5,000 €	94,000 €
2010:	40,000 €	45,000 €	20,000 € (exceptionnal)	5,000 €	110,000 €
2011:	40,000 €	45,000 €	15,000 € (exceptionnal)	4,500 €	104,500 €
2012:	30,000 €	45,000 €	5,000 €(exceptionnal, CTDO2)	4,200 €	84,200 €
					+ exceptionnal inputs by LEGOS: 8,000 €=> 92,200 €

- Relative increase in 2010&2011 due to the additional INSU contribution to buy new ADCP & mooring materials along with additional conductivity sensors
- LEGOS contribution in 2012 for a new tide gauge acquisition in 2012...
- But significant relative decrease in 2012 if compared to 2009!
=> Potential future problems due to consequent transports & missions costs...

Actual French contribution to PIRATA in 2011&2012 (for cruises) :

Total costs in 2011 & 2012:

- vessel time : 134 days (67= 45 cruises +22 transits / year) of R/V SUROIT (at ~13,5k€/day)
=> 1,8 M€
(paid by IRD as contribution to the national oceanographic fleet)

- technical support, cruises, transports etc... (ie working funds)
- => 160 k€
(paid by IRD & Meteo France)

Total: almost 2 M€(i.e. 1M€/year in mean) (*without salaries...*)

2011&2012 Engineers/Technicians PIRATA dedicated time (estimated) :

- participation to cruises (days at sea) :

- PIRATA FR21 (J.Grelet, F.Roubaud, R. Chuchla, S.Hillion, D.Dagorne) : 160 days

- PIRATA FR22 (J.Grelet, F.Roubaud, R. Chuchla, F. Baurand) : 160 days

- cruises preparation, cruises data treatment etc. (J.Grelet, F.Roubaud, F. Baurand) : 35+55 90 days

**Total: 410 days
(~200/y)**



French PIRATA dedicated cruises : 23 french cruises from 1997 to 2012

CRUISE NAME	DEPARTURE DATE	ARRIVAL DATE	VESSELS NAME	Nb Days
PIRATA-FR1	September 9, 1997	September 16, 1997	Antéa	8
PIRATA-FR1b	January 30, 1998	February 3, 1998	Antéa	4
PIRATA-FR2	October 30, 1998	November 10, 1998	Antéa	11
PIRATA-FR3	January 23, 1999	February 1, 1998	Antéa	9
PIRATA-FR4 (EQUAL99)	July 13, 1999	August 21, 1999	Thalassa	39
PIRATA-FR5	October 25, 1999	November 8, 1999	Antéa	14
PIRATA-FR6	March 8, 2000	March 19, 2000	Le Suroit	11
PIRATA-FR7 (EQUAL00)	July 23, 2000	August 21, 2000	Thalassa	29
PIRATA-FR8	November 17, 2000	December 3, 2000	Atalante	16
PIRATA-FR9	October 20, 2001	November 11, 2001	Atalante	22
PIRATA-FR10	December 6, 2001	December 21, 2001	Atalante	15
PIRATA-FR11	December 17, 2002	January 3, 2003	Le Suroit	17
PIRATA-FR12	January 28, 2004	February 20, 2004	Atalante	23
PIRATA-FR13	May 24, 2005	June 2, 2005	Le Suroit	13
PIRATA-FR14 (EGEE1)	June 7, 2005	June 23, 2005	Le Suroit	16
PIRATA-FR15 (EGEE3)	May 24, 2006	July 6, 2006	Atalante	39
PIRATA FR 16	May 19, 2007	June 1, 2007	Antéa	14
PIRATA FR 17 (EGEE5)	June 4, 2007	July 5, 2007	Antéa	31
PIRATA FR 18	September 2, 2008	October 5, 2008	Antéa	33
PIRATA FR 19	June 13, 2009	July 24, 2009	Antéa	44
PIRATA FR 20	September 15, 2010	October 21, 2010	Antéa	40
PIRATA FR 21	May 1, 2011	June 16, 2011	Le Suroit	45
PIRATA FR 22	March 3, 2012	May 2, 2012	Le Suroit	45

=> ~ 600 days at sea

=> Vessels time availability in France

From 2006 to 2010 the PIRATA-FR cruises were carried out with the IRD R/V ANTEA

From 2011, the PIRATA-FR cruises are carried out with the IFREMER R/V LE SUROIT

ANTEA:

*35m length, 10 scientists, 3 moorings onboard
3 legs per PIRATA cruise.*



LE SUROIT:

*56m length, 14scientists, 3-4 moorings onboard
3 legs per PIRATA cruise but safe & comfortable*



VESSEL TIME PROCESSES:

Yearly vessel time demand forms to fill in order to get vessel time;

Vessel time demand evaluation every 4 years => **evaluation in 2012.**

Vessel costs increase (fuel etc.) ...

BUT PIRATA international commitments -MoU- + efficient contribution to ARGO/GODAE
(CORIOLIS/MERCATOR) acknowledged as part of CORIOLIS+ SO OA labels

=> **yearly vessel time ENSURED**

What have been done in 2011 « on the field » ?

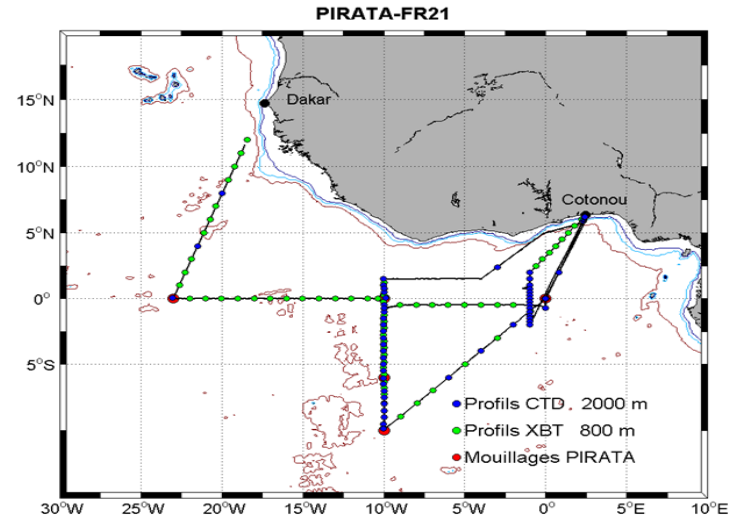
PIRATA FR21 cruise:

May 1, June 16 2011

(from Cotonou in Benin to Dakar in Senegal)

3 legs:

- 47 CTD-02/LADCP profiles
- 84 XBTs
- 6 profilers (Arvor) deployed (*ARGO/CORIOLIS*)
- 5 SVP-BS deployed (*INSU; G.Reverdin*)
- CO2 sensors replacement at 6° S-10° W (*IRD; N.Lefevre*)
- Sea surface water samplings (*CO2, nutrients, pigments*)

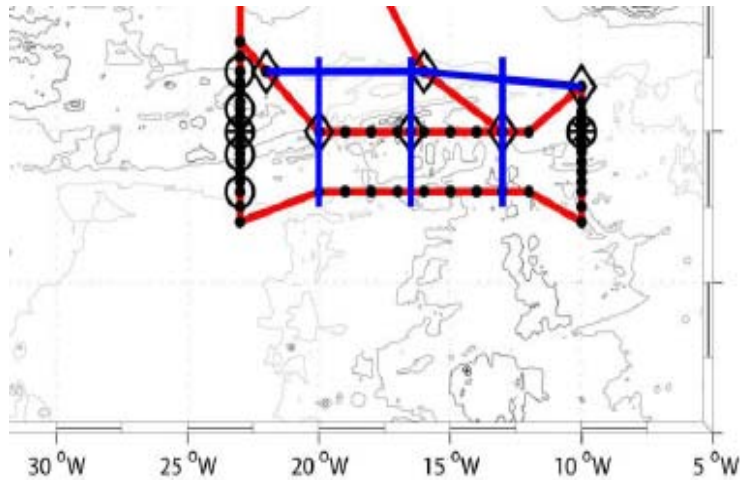


Special cruise:

- Quasi simultaneous with IFM-GEOMAR cruise between 23° W & 10° W
- 3 glider deployments (2 from IFM-GEOMAR, 1 from INSU) (+ 6 other gliders by IFM-GEOMAR)
- Retrieving of the 4 RSMAS ADCP moorings (*contribution to TACE; PI: B.Johns*)
- Earlier than previous ones (to be there during the equatorial upwelling/cold tongue onset)
(*Amma & Tace recommandations...*)
- Additional TC sensors at 2 ATLAS moorings
=> vertical resolution for TS with 9 depths at 0, 5, 10, 20, 40, 60, 80, 100, 120m at 10° W-6° S & 10° S
- Addition of 2 HR real time RDI sentinels at 10° W (0° N and 10° S) for a 1 year test
(*by PMEL: one scientist of PMEL onboard*)
- + 2nd leg with 9 M2 west African students (Master 2 Cotonou) training on board

What have been done in 2011 « on the field » ?

IFM-GEOMAR cruise : May 11-June 19, 2011

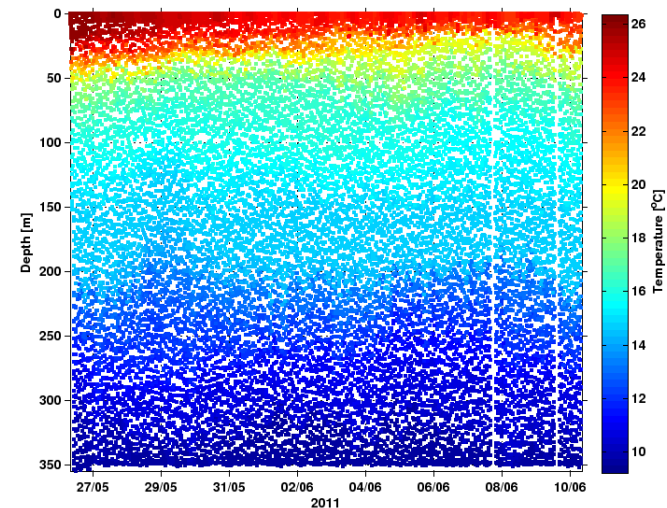
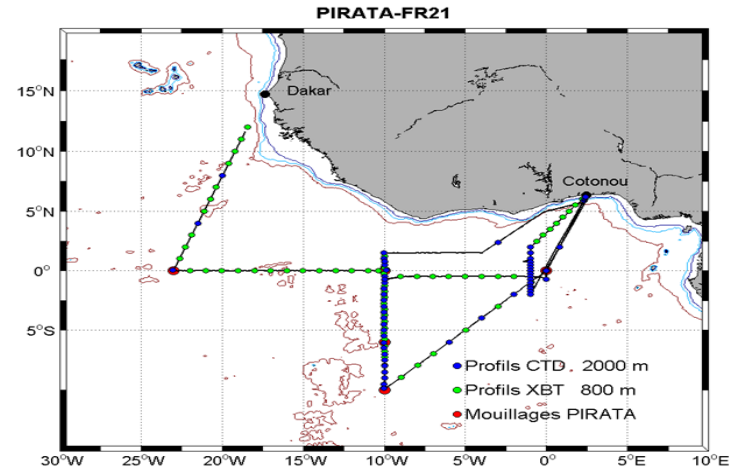


6 Gliders between 2° S and 2° N
at 13° W, 16° 30' W and 20° W
(one from Eq to 2N, one from Eq to 2S)

All gliders recovered in July
by IFM-GEOMAR (2nd cruise)

Temperature from the glider
around 10° W-0° N
⇒ Cooling from 5/27 to 6/10
⇒ SST: 27° C -> 22° C
⇒ Thermocline :
50m -> 20m depth

PIRATA FR 21 cruise : May 1-June 16, 2011



Courtesy P.Brandt & M.Dengler

What have been done in 2012 « on the field » ?

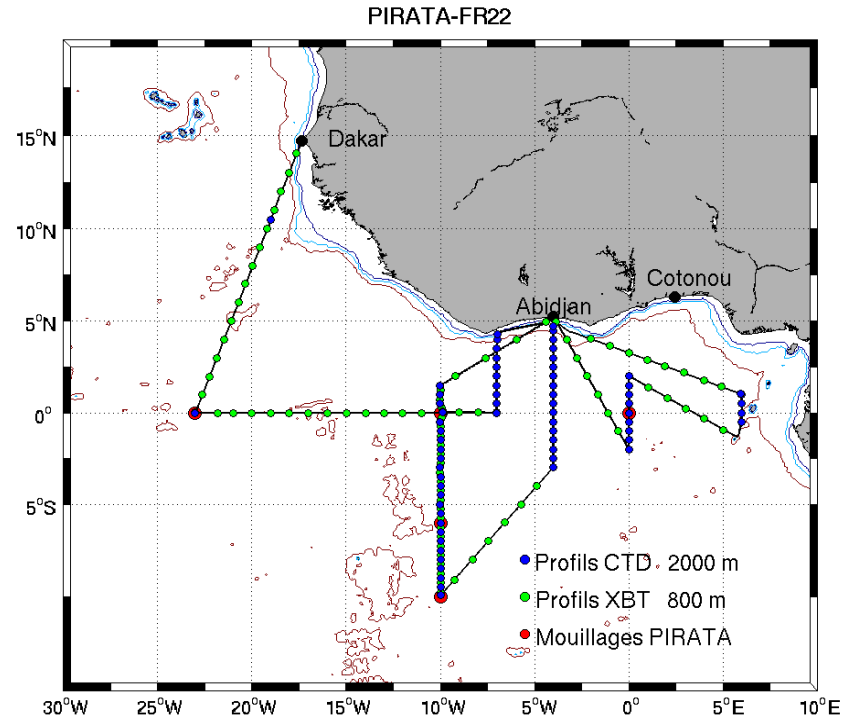
PIRATA FR22 cruise:

March 19 – May 2, 2012

**(from Dakar in Senegal to Abidjan in Côte d'Ivoire)
(due to “pirate” activities off Nigeria, Benin &
Togo... => for security reasons!)**

3 legs:

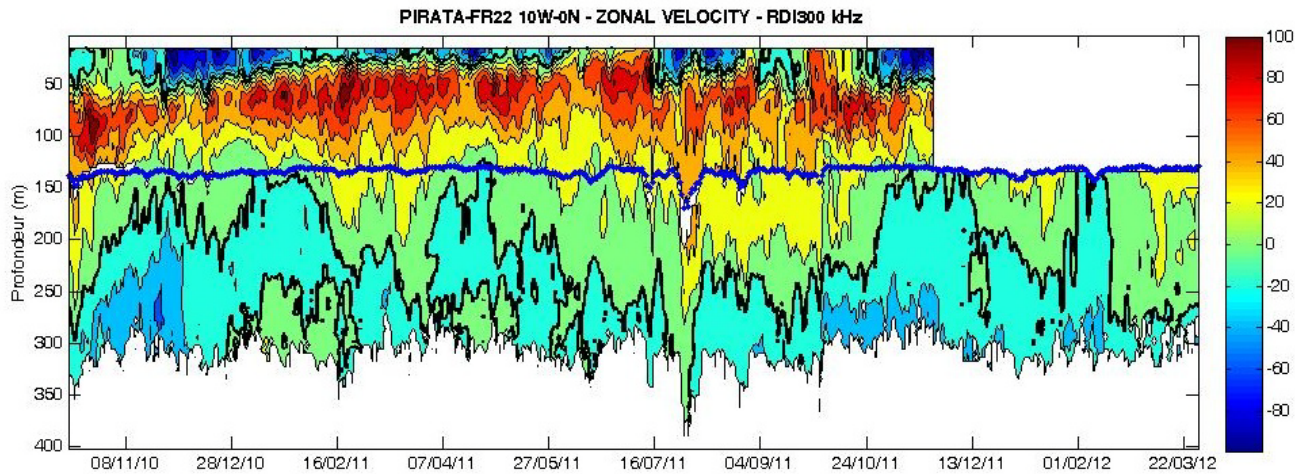
- 68 CTD-02/LADCP profiles (0-2000m)
- 86 XBTs
- 8 profilers (Apex) deployed (*ARGO/CORIOLIS*)
- 5 SVP-BS deployed (*INSU; G.Reverdin*)
- CO₂ sensors replacement at 6° S-10° W (*IRD; N.Lefevre*)
- Sea surface water samplings
(CO₂, nutrients, pigments, O₁₈, C₁₃)



10° W ADCP mooring replaced: new ADCP deployed (same as 23° W)
5 SADCP + 2 CTD sections at 7° W & 3° W off Côte d'Ivoire
2 CTD/LADCP cross-equatorial sections at 0° E & 6° E



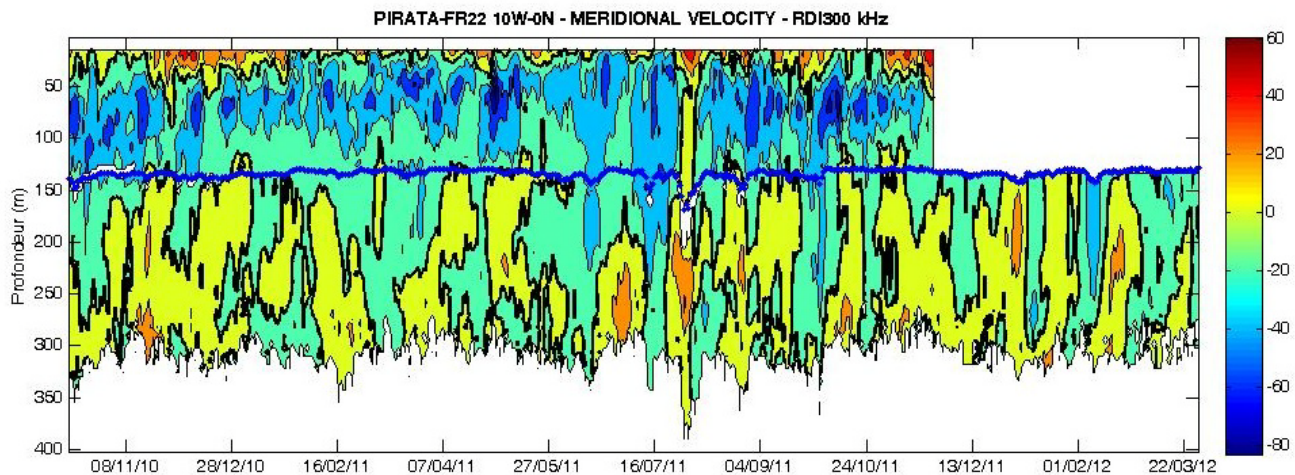
What have been done in 2012 « on the field » ?



10° W-0° N ADCP mooring from Nov 2010 to Apr 2012:

- Upper ADCP battery failure in Nov 2011...

U
&
V



- Blue line: depth of the 2 ADCP

- Replaced by 1 ADCP at 300m depth

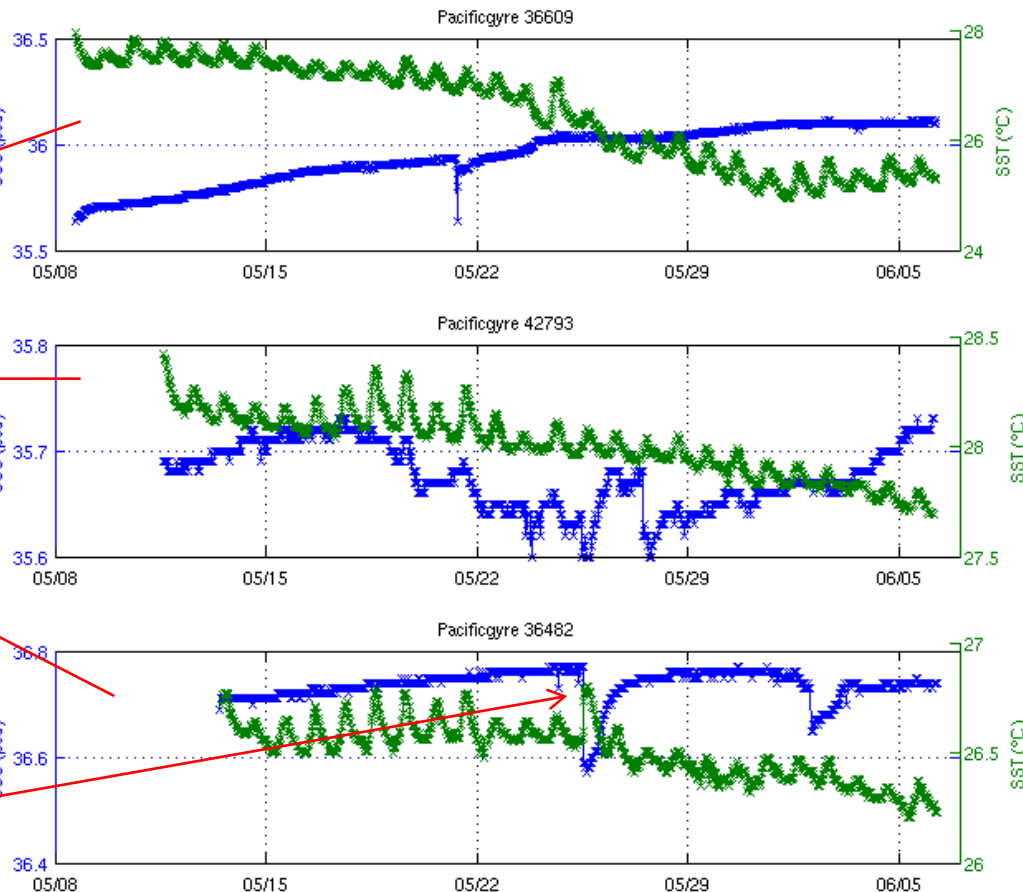
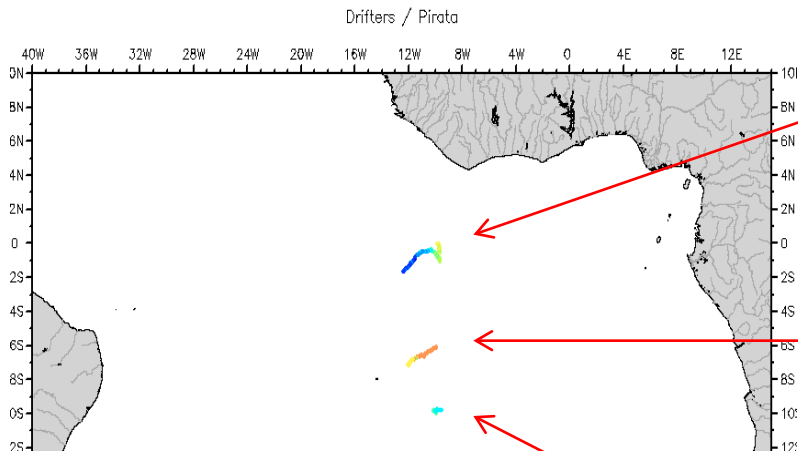


(R.Chuchla)



What have been done in 2012 « on the field » ?

1st (one month) data from SVP-BS PacificGyres:
May 8 – June 5, 2012:



SST diurnal cycle

1 rain event \Leftrightarrow SST increase...

Courtesy G.Reverdin



What have been done in 2012 « on the field » ?

PIRATA FR21 & FR22 CTD-02 calibration:

2011 : calibration of CTD sensors achieved by Seabird in mid 2012 => calibration in process (done at Cotonou by Rémy Chuchla) !

2012: Still waiting for calibration coefficient...

=> Will be sent asap to NOAA/PMEL (at least 2011 ones).

What about São Tomé Island : tide gauge and meteorological station?

São Tomé Island (0° N, 6° E)

1) Meteorological station from October 2003

- DATA transmission through the GTS from October 2006.
- Autonomous ONSET thermometer installed in 2005 (=> SST)

2) Tide gauge maintained by IRD since 1980s.

- Pressure, Atm. pressure + SST & SSS.
- Part of GLOOS / GPS positioned (in December 2002)

Nothing has been done from 2009 (but local interventions for data retrieving –by local technicians-)

1) Major problems with the tide gauge from Aug 2010 (tide gauge itself + Argos transmission): => To be fully replaced by a new (and different / INSU) system...

=> new full tide gauge system funded; will be replaced in 2013

2) Major problems with the meteorological station from late 2010...

=> Due to funding issues AND scientific relevance (few feedbacks on these data And wind biais (topographic effect)

THE MET STATION WILL NOT BE REPLACED

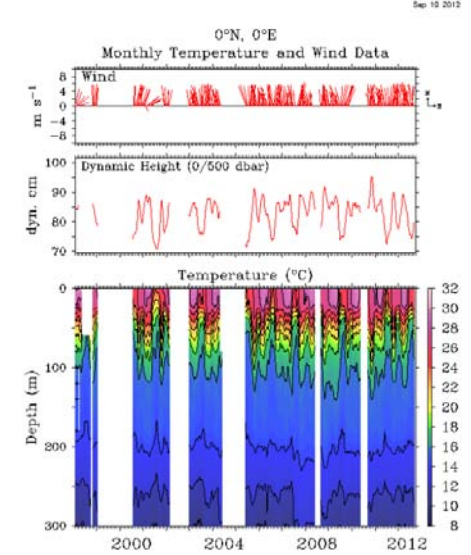
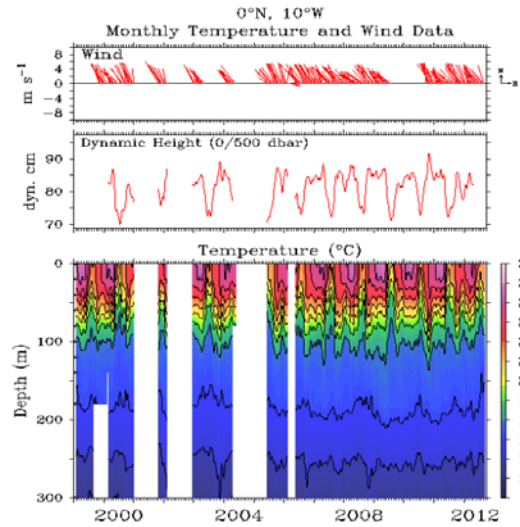
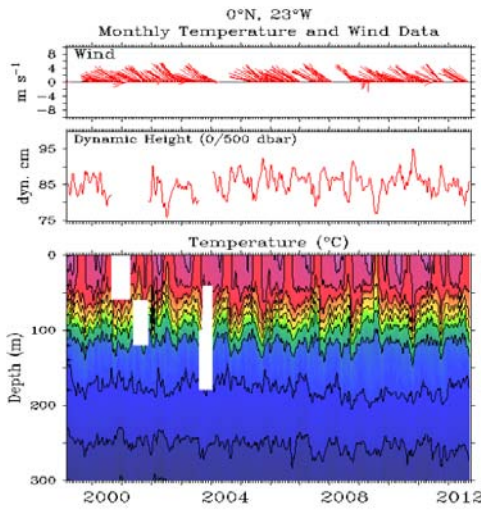


PIRATA ATLAS time series east of 23° W: rather successful 2011/2012 years



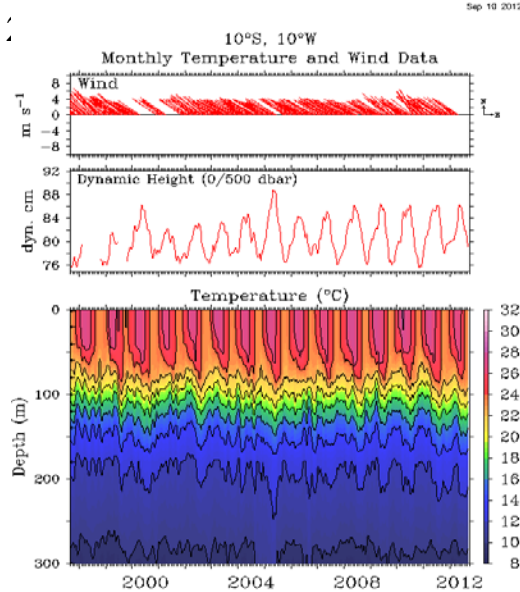
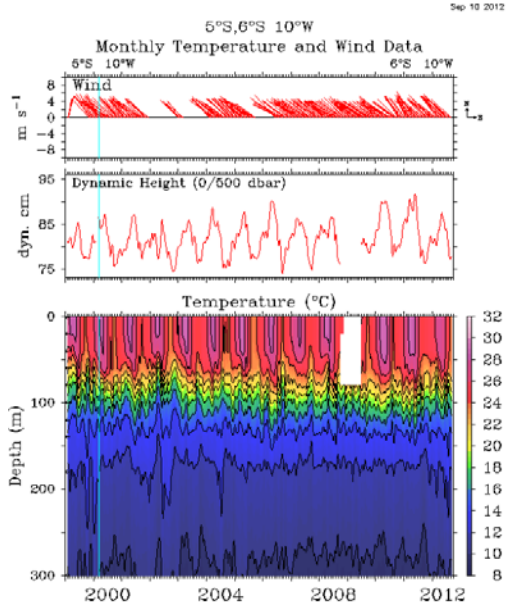
Eq-23° W: no major pb in 2011-2012 Eq-10° W: no pb in 2011-2012

Eq-0° E: no pb in 2011-2012

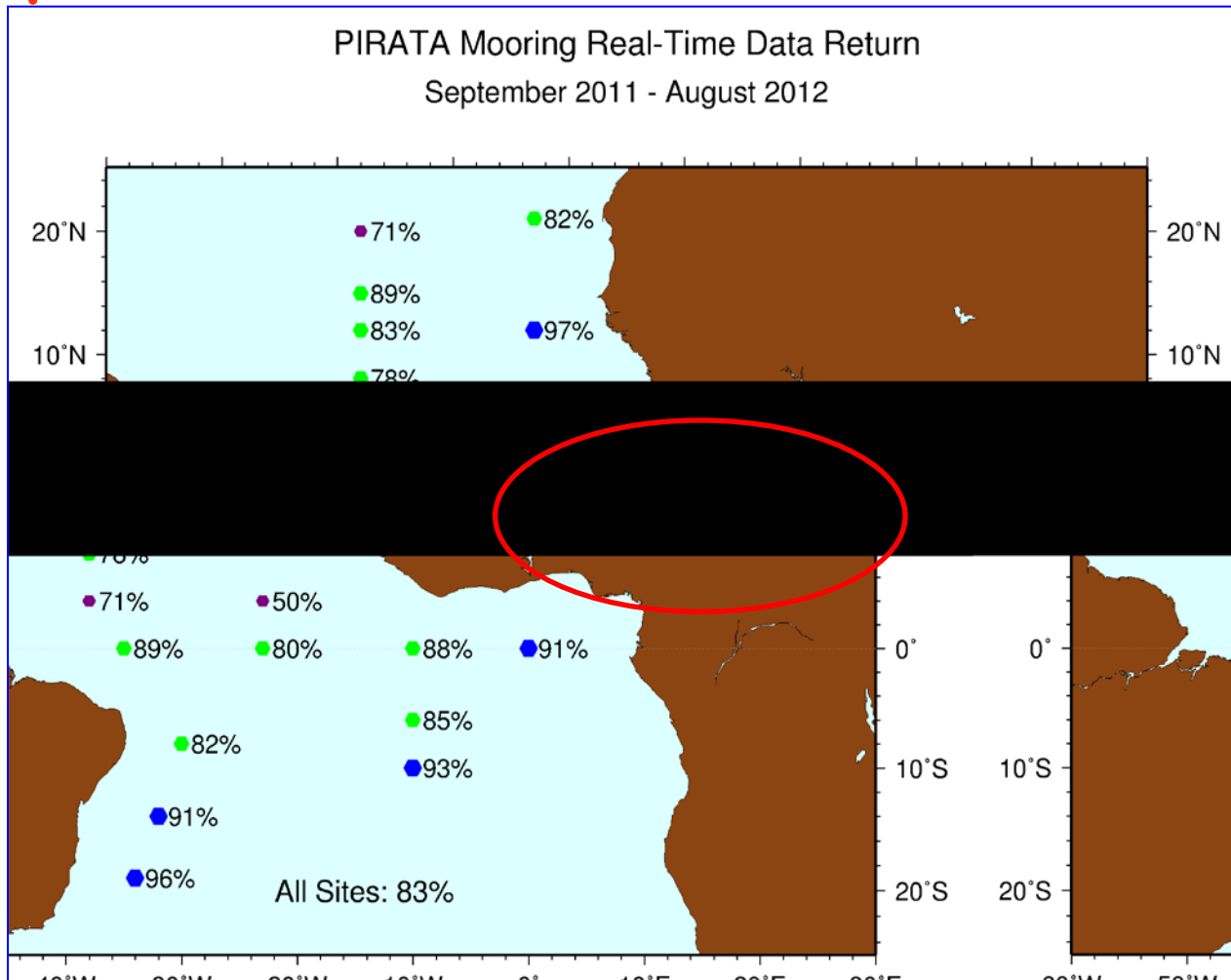


6° S-10° W: no pb in 2011-2012

10° S-10° W: no pb in 2011-



PIRATA ATLAS time series east of 23° W: rather successful 2011/2012 years



1st time that all the 5 eastern sites are all over 80%!

eg 91% at 0-0...

(real time only!)

Courtesy M.McPhaden, Sept. 2012

Next PIRATA FR cruises in 2013 etc...

PIRATA FR23 funded & scheduled in May-June 2013
(45 days with the SUROIT)

Pirata cruises have to be platforms for other experiments,
to be carried out in the framework of the CLIVAR-Atl/AMMA2/PIRATA
recommendations... *(but induces special vessel time demands
for additional days, if needed!)*

Three main operations could be done during the next cruises/years:

- Process studies (vertical velocity?....)
- Satellite measurements validation (Salinity, Precipitation)
- Add Chi-Pods sensors (turbulence) at 23° W & 10° W-Eq
(PI: Jim Moum)

- Satellite measurements validation:

-1) Salinity: SMOS...

- Surface drifters with conductivity sensors
(already begun from 2010 with SVPC drifters deployment)

2) Precipitation: MeghaTropiques (water vapor)

- Radio soundings (2013 or 2014?)

The estimate of the vertical velocity is a crucial point to validate numerical models with respect to their differences in the vertical motions in the eastern equatorial Atlantic. Specific in situ experiments should be encouraged through i) the definition and implementation of a currentmeter mooring arrays (4) around 10° W-Eq, ii) a particular cruise around this area (with “grid-like” trajectory).

Once the PIRATA SEE implemented, such a particular experiment is to be encouraged in the Congo-Gabon upwelling area in order to estimate the thermal balance and the advections at a very local scale. This could be achieved through cruises making an hydrological survey (a “grid-like” trajectory) over a specific zone (for instance including an Atlas buoy).

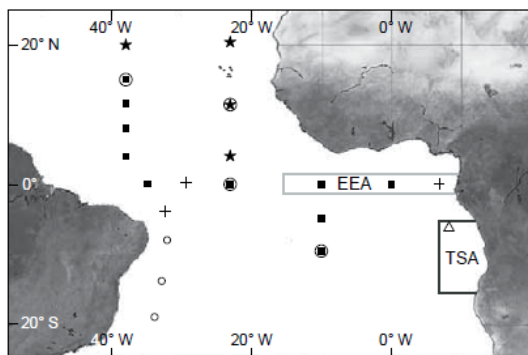
*About 8 day experiment with
0-500m CTD/LADCP profiles every
 $\frac{1}{4}^{\circ}$ in latitude/longitude around the buoy*



⇒ What about the PIRATA South Eastern Extension ???

⇒ *major priority & issue for CLIVAR/TAV/PIRATA...: SST bias!!!*

- 1) 1 ATLAS buoy funded by South Africa (PI: M. Rouault) in 2005
⇒ One year test deployment in 2006-2007



Rouault et al., 2009)

- 2) Need a 2nd buoy for the SEE maintenance...
- NO FUNDING WAYS FROM 2008!!!!

⇒ Potential funding of a 2nd ATLAS buoy through an EU proposal ???

(EU project PI: Keenlyside; WP PI: Brandt & Bourlès)

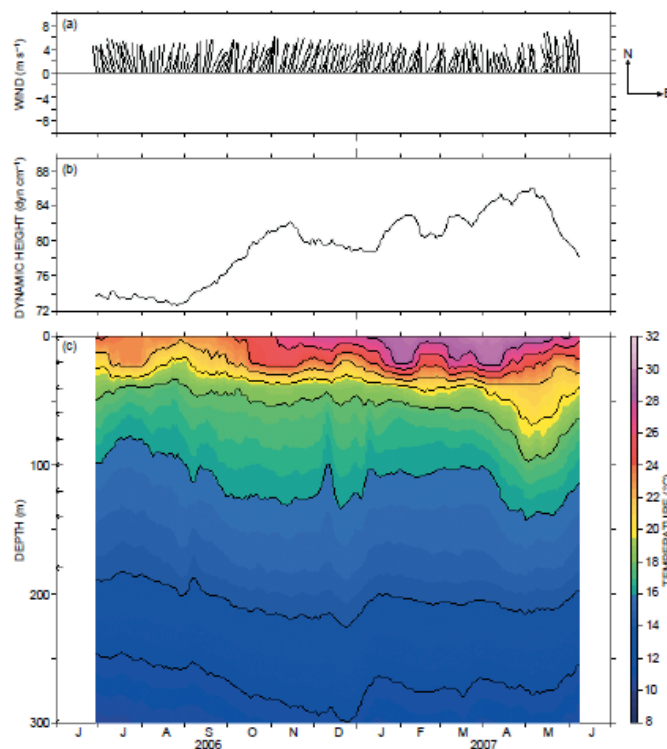


Figure 4: (a) East Equatorial Atlantic daily averaged vector wind data, (b) tropical South-East Atlantic estimated derived dynamic height (0-500 dbar) and (c) upper ocean temperature (0-300 m) from 27 June 2006 to 9 June 2007, measured at the PIRATA-SEE ATLAS buoy (6° S, 8° E) (adapted from PMEL/NOAA PIRATA website: <http://www.pmel.noaa.gov/pirata/display.html>)

Note: *Vessel time already available in France (2009 MoU...) but if buoy at 6° S-8° E!!!!*

⇒ *If PIRATA SEE wished/located more south, additional vessel time (& funding) needed...*

⇒ **OTHER suggestions WELCOMED!**

What have been done in 2012 « in the labs » ?

French PIRATA website:

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

⇒ More information

⇒ Easier access to data sets (cruises, Sao Tome...)

⇒ Reports & documents

Thanks to Jacques Grelet (2009 up to now!)



What have been done (and going on) in 2012 « in the labs » ?

PhD Thesis: 7 (to our knowledge...)

- a) One thesis will begin in Oct 2012 at Meteo-France: bias on coupled model CNRM-CM5 in Trop. Atl.
- b) One thesis -at MERCATOR and Meteo-France - defended in February 2012: Stephane Law-Chune (high resolution processes in the upper layer off Angola from Mercator results): *co-funded by Meteo-France & Region Midi-Pyrénées*.
- c) One PhD thesis in Abidjan/Côte d'Ivoire (*IRD & University Abidjan*): E.Toualy coastal upwelling in the north of the Gulf of Guinea; defense planed by Dec. 2012)
- d) One PhD thesis in Cotonou & Toulouse (IRD& University of Abomey Calavi): Casimir Da Allada, salinity in the tropical Atlantic; from sept 2010 (SEE POSTER)
- e) One PhD thesis began in 2011 in Brazil by a Beninese student (Master 2 Cotonou) at Univ. of Recife (granted by FACEPE) ‘tropical Atlantic climate’.
(SEE POSTER by Aubains Hounsou Gbo)...
- f) One PhD thesis began in 2012 in Brazil by a Beninese student (Master 2 Cotonou) at Univ. of Recife (granted by FACEPE) ‘CO2 fluxes in Western Trop Atl’.
- g) One PhD in Cotonou from 2010 by a Nigerian student (Master 2 Cotonou): Olubunmi Nubi Oyoola: Nutrients in the Gulf of Guinea Equatorial area at Univ.of Cotonou & Lagos

What have been done (and going on) in 2012 « in the labs » ?

French contribution to publications with peer reviews in 2011 & 2012: 15 (at least)

- Brandt, P., G. Caniaux, B. Bourlès, A. Lazar, M. Dengler, A. Funk, V. Hormann, H. Giordani, and F. Marin : Equatorial upper-ocean dynamics and their interaction with the West African monsoon. *Atmos. Sci. Let.*, **12**, 24-30, doi:10.1002/asl.287, 2011.
- Cabanes, C., A. Grouazel, K. von Schuckmann, M. Hamon, V. Turpin, C. Coatanoan, S. Guinehut, C. Boone, N. Ferry, G. Reverdin, S. Pouliquen, and P.-Y. Le Traon, 2012, The CORA dataset: validation and diagnostics of ocean temperature and salinity in situ measurement. *Ocean Sci. Discuss.*, **9**, 1273-1312, 2012.
- Caniaux, G., H. Giordani et J.L. Redelsberger, M. Wade, B. Bourlès, D. Bourras, G. de Coëtlogon, Y. du Penhoat, S. Janicot, E. Key, N. Kolodziejczyk, L. Eymard, J. Jouanno, A. Lazar, M. Leduc-Leballeur, N. Lefèvre, F. Marin, H. Nguyen, et G. Parard: Les avancées d'AMMA sur les interactions océan-atmosphère. Accepté à *La Météorologie*, 2012.
- Da-Allada C. Alory G., du Penhoat Y. Kestenare E., Durand F., Hounkonnou N., 2012 : Seasonal mixed-layer salinity balance in the tropical Atlantic Ocean: mean state and seasonal cycle. *J. Geophys. Res.*, submitted.
- Giordani, H., and G. Caniaux : Diagnosing vertical motion at the equatorial Atlantic, *Ocean Dynamics*; **61**:1995–2018, DOI 10.1007/s10236-011-0467-7, 2011.
- Giordani, H., G. Caniaux, and A. Voldoire : Intraseasonal mixed layer heat budget in the Equatorial Atlantic during the cold tongue development in 2006. Accepted to the *J. Geophys. Res.*, 2012
- Hummels, R., M. Dengler, and B. Bourlès, Seasonal and regional variability of upper ocean diapycnal heat flux in the Atlantic Cold Tongue, accepted to *Progress in Oceanogr.*, 2012.
- Jouanno, J., F. Marin, Y. Du Penhoat, J. Sheinbaum and J.-M. Molines, Seasonal heat balance in the upper 100 m of the equatorial Atlantic Ocean. *J. Geophys. Res.*, **116**, C09003, doi:10.1029/2010JC006912, 2011a.
- Jouanno, J., F. Marin, Y. Du Penhoat, J.-M. Molines, and J. Sheinbaum: Seasonal modes of surface cooling in the Gulf of Guinea. *J. Phys. Oceanogr.*, **41**, 1408-1416, 2011b. Wade, M., G. Caniaux, and Y. DuPenhoat : Variability of the mixed layer heat budget in the Eastern Equatorial Atlantic during 2005-2007 as inferred from Argo floats. *J. Geophys. Res.*, **116**, C08006, doi:10.1029/2010JC006683, 2011b.
- Jouanno J. Marin F., du Penhoat Y. and J.-M. Moline, 2012 : Intraseasonal modulation of the surface cooling in the Gulf of Guinea. *J. Phys. Oceanogr.*, in revision
- Kolodziejczyk, N., F. Marin, Y. Gouriou, H. Berger and B. Bourlès, Equatorial Undercurrent and Subtropical water masses during boreal summer / fall in the Gulf of Guinea, in revision for *J. Geophys. Res.*, 2012.
- Lefevre N. and Merlivat L., Carbon and oxygen net community production in the eastern tropical Atlantic estimated from a moored buoy. *Sous presse dans Global Biogeochemical Cycles*, 2012
- Lefèvre, N., G. Caniaux, and S. Janico : Increased CO₂ outgassing in January-March 2010 in the tropical Atlantic following the 2009 Pacific El Niño. Submitted to the *J.G.R.*, 2012
- Lellouche, J.-M., O. Le Galloudec, M. Drévillon, C. Régnier, E. Greiner, G. Garric, N. Ferry, C. Desportes, C.-E. Testut, C. Bricaud, R. Bourdallé-Badie, B. Tranchant, M. Benkiran, Y. Drillet, A. Daudin, and C. De Nicola, 2012, Evaluation of real time and future global monitoring and forecasting systems at Mercator Océan. *Ocean Sci. Discuss.*, **9**, 1123-1185, 2012
- Scott, R.B., C. N. Barron; M. Drevillon; N. Ferry; N. Jourdain; J.-M. Lellouche; E. J. Metzger, M.-H. Rio; O. M. Smedstad: Prediction of surface drifter trajectories in the Equatorial Atlantic: a multi-model ensemble approach, *Ocean modelling*, in revision, 2012.



Thanks for your attention...