April 2006

Chapter 8

Oceanic campaigns and measurements from open Ocean (EOP and SOP)

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1 Scientific justification and objectives

The oceanographic observations of AMMA will support the land and atmospheric measurements during the three observing periods; Long term Observing Period (LOP), Enhanced Observing Period (EOP), and Special Observing Period (SOP). Detailed scientific rationale for these data is given in both international and national AMMA documents (e.g., French API, EU, US). Specifically, the TT6 aims to provide needed measurements for:

- the study of processes that determine seasonal to interannual variability of observed sea surface temperature (SST), sea surface salinity (SSS), mixed layer depth and heat content, in the Tropical Atlantic and in the Gulf of Guinea, and their linkage with West African land surface conditions;
- the study of processes that determine the seasonal evolution of the cold tongue - Inter Tropical Convergence Zone (ITCZ) - West African Monsoon (WAM) system.
- the study of both ocean and atmosphere boundary layers and air-sea exchanges;
- the validation of models, satellite data and products.

2 Observing strategy

2.1 Overall Strategy

The overall strategy is mainly based on (1) the acquisition of in situ measurements in the eastern Tropical Atlantic and the Gulf of Guinea (GG) and (2) the integration of these data to characterize the air-land-sea monsoon system during the three observing periods of AMMA (and thereby resolving different timescales ranging from annual to interannual):

For the LOP and EOP observations, the measurements will be principally collected through existing sustained observing networks and acquisition programs (e.g., PIRATA ATLAS buoy network, the Voluntary Observatory Ship (VOS) expendable bathythermograph (XBT) networks, surface drifters of the Global Drifter Program, and the ARGO and CORIOLIS operational programs). LOP/EOP measurements will also be acquired through oceanographic research vessels, coastal stations, tide gauges and the meteorological station at São Tome Island (Eq-6°E). These measurements will be enhanced by additional observations directed at specific monsoon questions. For the SOP WAM process studies, a large number of additional oceanic and meteorological measurements will be collected as presented in details below.

The different types of measurements (lagrangian, eurelian, synoptic, surface and subsurface, high frequency acquisition etc…) and the different measured parameters (currents, hydrology and even tracers) should allow obtaining the most complete necessary data sets for the process studies.

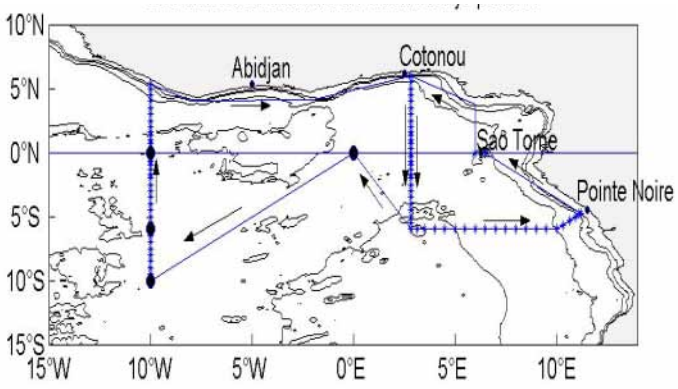
Maps and list of measurements

The oceanic measurements will be described using the framework of the AMMA Observing Periods (i.e., the EOP, LOP and SOP). We first present the oceanographic cruises planned in the framework (or closely linked to) of AMMA in France, US, Germany and Senegal, before mentioning a few cruises that are of large interest for AMMA and for which collaborations are underway. Then, other international programs or instruments already deployed in the tropical Atlantic are briefly presented

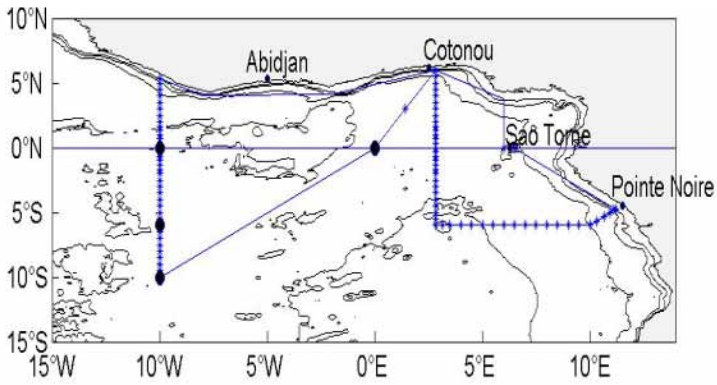
2.2 The Cruises

2.2.1 EOP/SOP French cruises: Observation period

French EOP and SOP 3 EGEE cruises:



French SOP 1 EGEE cruise:

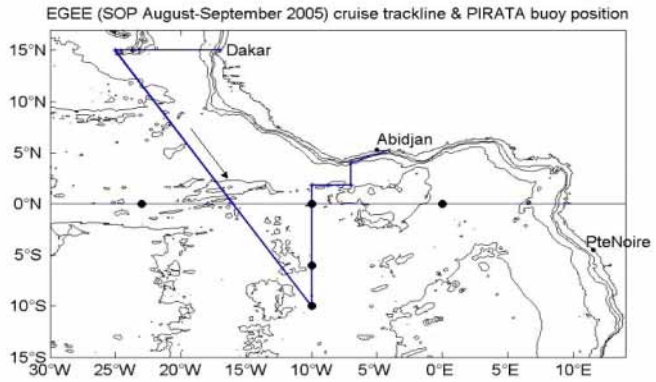


In order to assess interannual and seasonal variability, six EGEE cruises in the Gulf of Guinea are planed in the framework of AMMA-France, with two cruises per year scheduled during the three EOP AMMA years (2005-2007). In order to sample the GG during contrasting climatic situations, the cruises will be carried out in boreal spring-summer (monsoon setting, in phase with the equatorial upwelling onset, i.e. around end of May to July), and boreal fall (late monsoon, end of equatorial upwelling, the ITCZ going back to its southernmost position, i.e. around September-October). The repetition of the cruises during these two opposite seasons during all three years will allow assessment of seasonal and interannual variability. To achieve this objective, the same tracklines will be repeated with particular attention directed at the 10°W meridional section, which has been occupied several times during previous PIRATA and EQUALANT cruises.

Presently (March 2005), the three first EGEE cruises are funded and scheduled. EGEE 1 and EGEE 2 will be carried out with the R/V LE SUROIT in June (June 6 - July 4) and September (September 3 – October 1) 2005 respectively, and the EGEE 3 cruise, during the first phase of the SOP, will be carried out in June (May 25 - July 7) 2006 with the R/V L'ATALANTE. Maintenance (or replacement) of the PIRATA ATLAS moorings located in the Gulf of Guinea (see black dots on the maps above) will also be conducted during these cruises. The section located south of Benin will complete the SOP terrestrial radio-soundings line planned from Benin and Niger, at 2°50'E. During EGEE 3 (SOP 1 campaign), this section will be occupied in coordination (and simultaneously) with measurements from aircrafts (see also TT8 for more information). This cruise will document the pre-onset and onset of the monsoon offshore, with particular

attention directed at surface fluxes, oceanic turbulence and advection of humidity. Atmospheric turbulence measurements will be collected using a turbulent flux measurements system. These atmospheric measurements of radiative and turbulent fluxes will provide observations similar to those obtained with the instrumented mast, positioned in the front of the R/V, during the EQUALANT 1999 cruise. This system will provide oceanic flux measurements for comparison with observations obtained from different methods (i.e., inertio-dissipative, correlation and bulk). Radio-soundings will also be launched from the vessel.

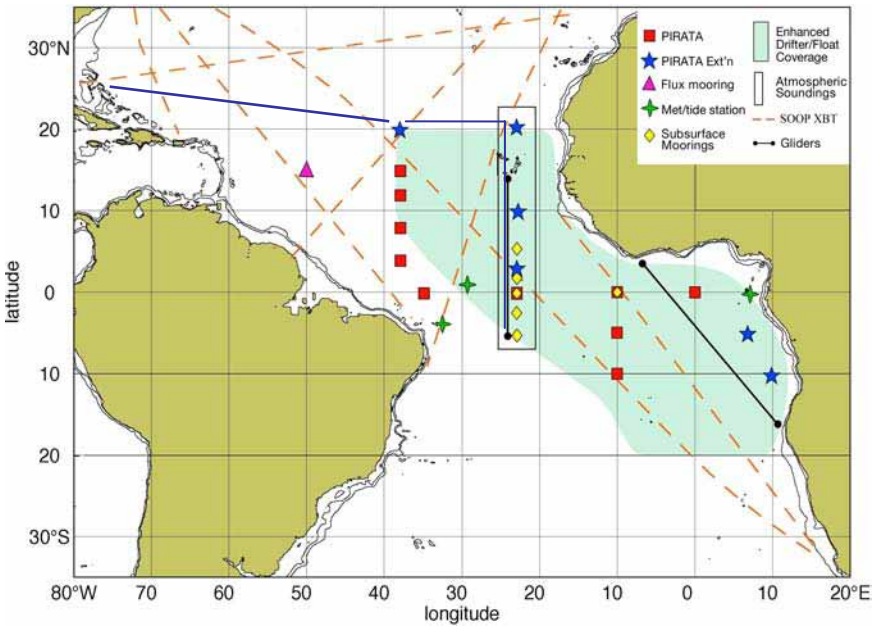
In addition to classical current (SADCP and LADCP) and hydrological (T,S,O2) measurements, surface drifters (coll. NOAA/AOML) and ARGO/CORIOLIS profilers will be deployed during each cruise. PIRATA ATLAS buoys will also be maintained during the cruises. Turbulence measurements, by IFM-GEOMAR colleagues and Helium measurements, for upwelling rate estimates by colleagues from the University of Bremen will also taken during some of the cruises.



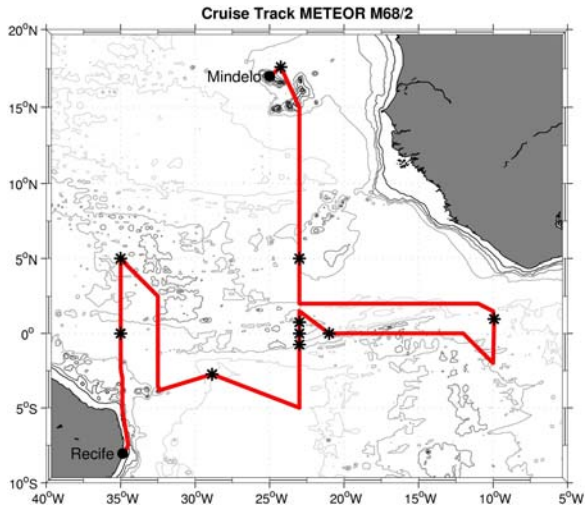
During the SOP 3 EGEE 4 cruise, occupations of both a Dakar-Cape Verde section and a Guinea Dome cross-section (right) was an option. The realization of short cruises from the Senegalese R/V ITAF DEME, if funded, could provide part of needed information needed in this area (see below).

2.2.2 SOP I U.S. Cruise (with implications for EOP and LOP cruises)

This cruise is scheduled for May-June 2006. During this cruise, in addition to classical current and hydrological measurements in the upper ocean layers, 2 ATLAS buoys will be deployed at positions along 23°W to be determined but in the vicinity of the blue stars in the figure at right. In addition, surface drifters (all equipped with SST sensors and some with wind and atmospheric pressure sensors) and ARGO profilers will be deployed in the green shaded area to the right. Support will also be requested for two other ATLAS moorings to be deployed in 2007 (i.e., implying yearly cruises to the region to maintain the ATLAS buoys). These ATLAS buoys along with the ones located along 10°E will collect data in both the ocean and atmosphere boundary layers and the variability on both sides of the ITCZ during all the phases of the WAM.

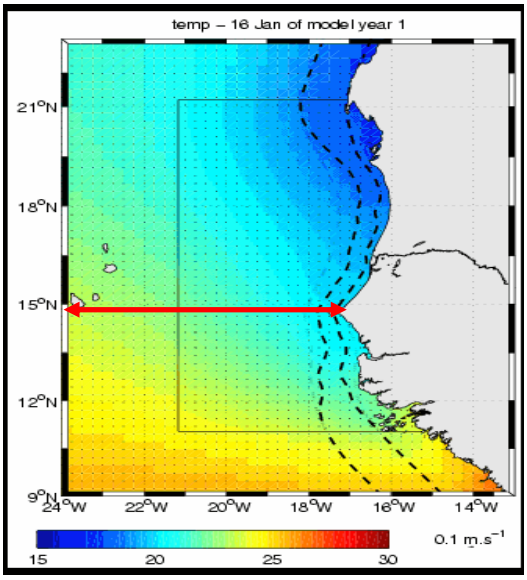


2.2.3 SOP-I German Cruise:



A German cruise by IFM-GEOMAR with R/V METEOR is funded and scheduled from June 6 – July 9 2006, in the framework of a German CLIVAR-TACE contribution. Main part of this cruise will be the deployment of a current meter mooring array consisting of 5 moorings near 23°W at the equator as well as intensive microstructure measurements in the equatorial region. The observations will provide estimates of transport and water mass variability of the flow toward the eastern upwelling regions (cold tongue) and to document intraseasonal, seasonal and interannual variability in the central equatorial Atlantic. During the cruise twice-daily radio-soundings will be performed. The cruise will also be used to deploy ARGO profilers from the German ARGO program

2.2.4 SOP Senegalese cruises:



Several 5-day cruises are proposed in the framework of the oceanographic component of the AMMA-Senegal project. These cruises could be conducted using the R/V ITAF-DEME of CRODT/ISRA, in collaboration with the French AMMA/EGEE program. The French program would partly found the vessel chartering. Three cruises are planed at about one month interval from Dakar to Cap-Vert to survey the ocean boundary layer with CTD and XBT profiles, and could be also opportunities for surface drifter and profiler deployments.

The AMMA dedicated or linked oceanographic cruises are summarized in the following table:

CRUISE NAME	STATUS	COUNTRY / VESSEL	DATE	AREA
EGEE 1	Funded / Scheduled	FRANCE / LE SUROIT	June 2005	Gulf of Guinea
EGEE 2	Funded / Scheduled	FRANCE / LE SUROIT	September 2005	Gulf of Guinea
EGEE 3	Funded / Scheduled	FRANCE / L'ATALANTE	May-July 2006	Gulf of Guinea
METEOR 68/2	Funded / Scheduled	GERMANY / METEOR	June-July 2006	Equatorial Atlantic
US AMMA	Funded / Scheduled	USA / RON BROWN	May-June 2006	North East Tropical Atl.
EGEE 4	Funded / Proposed	FRANCE / ANTEA	September 2006	Gulf of Guinea
SENEGAL AMMA 1	Proposed	SENEGAL / ITAF DEME	May 2006	North East Tropical Atl.
SENEGAL AMMA 2	Proposed	SENEGAL / ITAF DEME	July 2006	North East Tropical Atl.

SENEGAL AMMA 3	Proposed	SENEGAL / ITAF DEME	September 2006	North East Tropical Atl.
EGEE 5	Proposed	FRANCE / ANTEA	June 2007	Gulf of Guinea
EGEE 6	Proposed	FRANCE / ANTEA	September 2007	Gulf of Guinea

The list of instruments and associated measurements obtained during the field campaigns is summarized in the following table:

Measurements \ cruises	EGEE EOP	EGEE SOP	US SOP	German SOP***	Senegalese SOP
Hydrology (CTDO2)	YES	YES	YES	YES	YES*
Currents (S-ADCP and/or L-ADCP)	YES	YES	YES	YES	NO
Continuous SST and SSS (TSG)	YES	YES	YES	YES	NO
Temperature profiles (XBT)	YES	YES	YES	NO	YES*
Salinity profiles (XCTD)	YES	YES	NO	NO	NO
Surface drifters deployment (SST)	YES**	YES**	YES	??	??
Surface drifters deployment (wind & sea level pressure)	YES**	YES**	YES	??	??
ARGO profilers deployment (T&S profiles)	YES	YES	YES	YES	YES*
Sea water samples for analysis (S, O2, and nutrients)	YES	YES	YES	YES	YES
Ocean microstructures (turbulence)	YES ***	YES ***	??	YES	NO
Helium (air and ocean) for upwelling rate estimate	YES (partly) ****	YES ****	NO	YES****	NO
Meteorological measurements (classical station -eg BATOS-)	YES	YES	YES	YES	YES
Atmospheric microstructures & air sea fluxes (turbulence)	NO	YES	NO	NO	NO
Radiosoundings (from vessel)	NO	YES	NO	YES	NO
Sea water samples for analysis (O18, 13C & CO2 parameters)	YES	YES	NO	YES	NO
Aerosol (photometer)	YES	YES	NO	NO	NO
Drifting vertical temperature profiles (MARISONDE)	NO	YES	NO	NO	NO

*: provided and/or funded by (or in the framework of) AMMA-France (API)
**: provided and/or (maybe partly) funded by (or in the framework of) AMMA-US (NOAA)
***: provided and funded in the framework of German CLIVAR-TACE contributions (IFM-GEOMAR)
****: provided and funded in the framework of German SOLAS contribution (University of Bremen)

NOTE relative to the French API Instruments list:

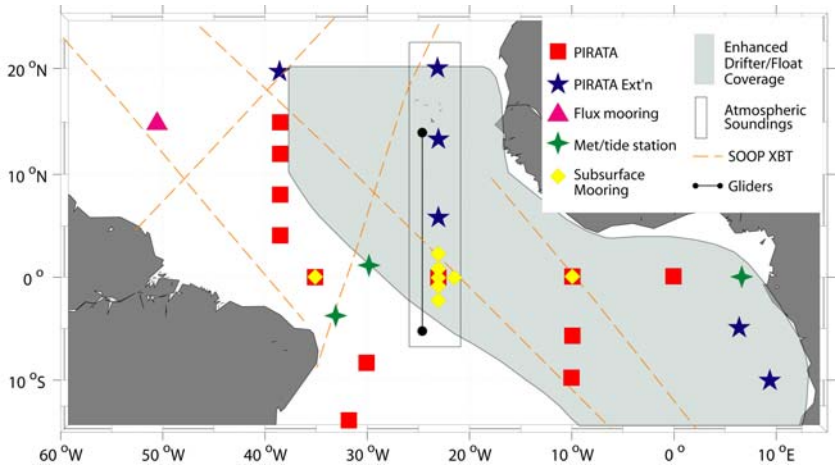
- The measurements referenced as “Hydrology” is referred in the Instruments List “OE_CTD”.
- The measurements referenced as “Currents”, “Continuous SST and SSS”, “Sea water samples for analysis”, “Ocean microstructures”, “Helium (air and ocean)” and “Meteorological measurements “ are related to the Instruments List “OE_Navire”.
- The measurements referenced as “Temperature profiles XBT” and “Salinity profiles XCTD” are referred in the Instruments List “OE_XBT”.
- The measurements referenced as “Surface drifters deployment “ are referred in the Instruments List “OL_Drift”.
- The measurements referenced as “ARGO profilers deployment “ are referred in the Instruments List “OL_Prov”.

- The measurements referenced as “Radiosoundings “ are referred in the Instruments List “OS.RadioSondages”.
- The measurements referenced as “Atmospheric microstructures “ are referred in the Instruments List “OS. MatInstrumente”.
- The measurements referenced as “Drifting vertical temperature profiles “ are referred in the Instruments List “OS. Marisondes”.

2.3 Other LOP/EOP Observations

2.3.1 Observations in the Ocean

PIRATA ATLAS buoys:



In the framework of the PIRATA program 13 buoys are deployed to perform oceanic and atmospheric measurements. 10 buoys have been deployed in 1997, another 3 buoys as southwestern extension in 2005. Their locations are shown by red squares. Four additional buoys will be deployed in 2006 and 2007 by US-NOAA (blue stars) as discussed above. A southeastern extension, that should be endorsed by PIRATA in 2006, is also planed with two buoys (blue stars). One of these buoys could be deployed in 2006 during an EGEE cruise around 6°S-8°E (funded by the regional Benguela Current Large Marine Ecosystem -BCLME- program).

PIRATA surface current mooring:

A PIRATA mooring was deployed at 23°W-Equator from December 2001 to December 2002 then from early 2004, close to an ATLAS buoy. The mooring is equipped with an LADCP measuring the current within the upper 100m. In 2004, IFM-GEOMAR added a downward looking ADCP as part of their CLIVAR program. We can thus expect to have a good current survey for the upper 700 m of the water column. Deep current meters and one acoustic source are also installed on this mooring as components of the French “Equatorial Deep Jets” and German CLIVAR-TACE programs, respectively.

XBT and TSgraph VOS lines:

VOS (Volunteer Observing Ships) provide long time series of subsurface temperature and surface salinity data along regular lines, shown as dashed red lines. These lines have been maintained by NOAA and IRD in the framework of WOCE and CLIVAR. They will continue to be occupied through the EOP and LOP of AMMA.

ARGO Profilers:

From 2000, the ARGO International project (A global array of profiling floats) and its French component CORIOLIS plan to deploy a network of 3000 autonomous floats that provide temperature and salinity vertical profiles to depths between 1000 m and 2000 m. Each profiler provides data every 10 days

and the data are available in real-time through the Global Telecommunications System. The 3000 float array will provide coverage on an average 3° of latitude by 3° of longitude grid. The design life-time of the floats is 4 years. Profilers will be deployed in the tropical Atlantic during AMMA cruises. During the 2005 EGEE cruises, 20 PROVOR (French ARGO profilers) will be launched in the Gulf of Guinea, and at least 10 per year in 2006 and 2007. US and German cruises will also deploy a large number of these profilers in 2006.

Current meter mooring array at 23°W-Equator:

Additionally to the present PIRATA mooring at 23°W at the equator, IFM-GEOMAR will install in June 2006 a current meter mooring array in the framework of a German CLIVAR-TACE contribution. The mooring array will consist of 4 current meter/hydrographic moorings around this location including ADCPs for the near surface flow (including the PIRATA ADCP), as well as deep current meters and CTD sensors at different depths down to a depth of about 1000m. The mooring array would require cruises for recovery/redeployment that could be used for repetitions of the 23°W section from Cape Verde to the equator.

Glider:

A Glider section along 23°W from Cape Verde toward the equator is proposed within the German CLIVAR-TACE program. The Glider will measure temperature, salinity and oxygen in the upper 800m of the water column. However the mission depends on availability and technical ability of a Glider-system.

2.3.2 Coastal Observations

Meteorological station:

During October 2003, a meteorological station was installed at São Tomé Island (6°E-0°N) as a component of the French EGEE/AMMA program. This station failed in December 2003 and was repaired in August 2004. The ATLAS suites of atmospheric observations are collected at this station thus extending the PIRATA measurements eastward along the equator. Data are transmitted daily by ARGOS.

In the framework of the Senegalese oceanographic project, if endorsed by Senegal and funded, a meteorological station could be installed at the westernmost point in Dakar (Pointe des Amadies) in 2006.

Tide gauges:

A tide gauge has been maintained by IRD at São Tomé for many years. This tide gauge was positioned by GPS in 2002. Data are transmitted daily by ARGOS, and accessible through internet at the PIRATA web site. Unfortunately, no other gauges are operational along the GG coast. A few tide gauge stations should be installed in Senegal and the GG in 2005 and 2006 in the framework of ODINAFRICA and GOOS Africa projects (personal communication by Angora AMAN, LAPA-Abidjan/RCI). It should be noted that a few older tide gauges maybe available at NOAA that could also be deployed at to be determined locations.

Coastal stations:

A few coastal stations are maintained in some West Africa countries. In the framework of EGEE/AMMA, an evaluation of these stations began and some efforts will be carried out in order to qualify and standardize the SST measurements using “ONSET” temperature sensors. Contacts have already been done in Ivory Coast, Benin and Togo for these deployments. CRO/ISRA may maintain 7 coastal stations in Senegal. It has to be noticed that three autonomous “ONSET” temperature sensors were already installed in Ivory Coast in December 2002 and January 2003 (at 10m, 20 and 40m depth off Abidjan), but due to internal

problems and political events in this country, measurements have been interrupted in mid-2004 (one sensor has been lost). Onset sensors have been bought and are planed to be installed in Benin, Togo, Nigeria and Ghana, and reinstalled in Ivory Coast when possible.

2.4 Satellite observations

Remote sensing of SST, sea surface height anomalies, surface wind and ocean color are needed to provide increased spatial and temporal resolution of the eastern tropical Atlantic. Products already exist that combine these data to obtain an integrated look at oceanic surface conditions and these products should be furthered tailored to characterize SOP, LOP and EOP conditions.

2.5 Link with modelling studies

2.5.1 Process studies

The cruise data will be used for many numerical experiments that will be conducted by the countries involved (e.g., US, France, Germany) as well as other AMMA investigators. Data will be used for model validation (in France: MERCATOR, ROMS), model improvements (e.g. mixing parameters) and/or assimilation schemes validation. Data will also be used for satellite data validation (SST, SLP, sea surface color, SSS) or satellite sensor calibration (SSS).

2.5.2 Operational use

During the EGEE cruises, most of the temperature and salinity profiles (XBT & CDT) will be transmitted in quasi-real time by satellite (ARGOS) to the CORIOLIS Data Center in France for assimilation processes (MERCATOR). All the drifter, Argo and VOS XBT meteorological and oceanic data are transmitted in real-time without cost through the GTS for use by weather and climate forecast centers.

2.5.3 Data synthesis by models

To obtain a truly four-dimensional view of the oceanic component of the WAM, assimilative models will be used to combine the in situ and remote observations.

On weather time-scales, numerical weather prediction models run at operational centers will combine the ocean and land observations to generate weather forecasts.

On climate time-scales, operational forecast centers will use the oceanic data to generate SST forecasts that are needed for longer time-scale predictions (e.g., seasonal to interannual).

3 Deployment:

3.1 Planning

- during EOP&SOP AMMA cruises :

	2005												2006												2007											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
CTD																																				
XBT (and a few XCTD)																																				
Currents																																				
Surface drifters																																				
ARGO profilers																																				
Sea water samplings																																				
Ocean turbulence																																				
Air Sea fluxes																																				
Radiosoundings																																				
Drifting T(z)																																				
Helium																																				
Tracers analysis																																				

- Additional measurements:

Most of these measurements are obtained thanks to international networks maintained in the framework of CLIVAR, GOOS, etc (eg VOS networks, PIRATA…), and the meteorological station at São Tomé has been installed in October 2003 in the framework of EGEE/AMMA.

x: additional measurements and/or deployments during cruises.

	2004	2005												2006												2007							
	1-12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8
São Tomé meteorological station																																	
XBT VOS network							x			x							x	x	x			x									x		
SSS VOS network							x			x							x	x	x			x									x		
ARGO profilers	Only a few						x			x								x	x			x									x		
São Tomé tide gauge																																	
PIRATA ATLAS buoys	-> 5 in GG						x	h	o	p	e	f	u	l	l	y		x		h	o	p	e	f	u	l	l	y		h	o	p	e
Coastal stations (SST)																																	

3.2 Required enhancements to the LOP/EOP network

Surface drifters equipped with thermister chains and meteorological sensors:

The PIRATA array is limited spatially. Satellite tracked surface drifters can be equipped with thermister chains and meteorological sensors (e.g., sea level pressure and wind). The existing 5° by 5° global drifter array and 3° by 3° Argo array in the eastern tropical Atlantic should be enhanced to include these types of drifters. Specific objectives include increased resolution to determine the adequacy of satellite SST observations in this area of atmospheric aerosol occurrences; characterize the temporal development of the monsoon over the eastern tropical Atlantic; determine the oceanic processes that control the evolution of the SST field in the region; and characterize the temporal evolution of the cooling in the equatorial and coastal upwelling regions with respect to the ITCZ and WAM.

Improved meteorological packages on VOS:

The VOS lines described above collect rudimentary meteorological observations. Placing IMET packages on these vessels would greatly improve the quantity and quality of surface meteorological data, which can be used for both weather forecasts and long-term climate studies.

Improved meteorological packages on research vessels:

The vessels that service the Atlantic ATLAS moorings should be equipped with radiosounding systems to obtain characterizations of the atmospheric boundary layer.

The instruments and associated parameters obtained during the field campaigns are summarized in the following table:

Instrument	**Oceanic Parameters**							**Atmospheric parameters**			
	Surface			**Profiles**							
	Tempe rature	Sali nity	Curren	Tempe rature	Salinity	tracers	Current	Wind	T	P	Fluxes
PIRATA ATLAS r	Yes	Yes		Yes	Yes			Yes	Yes	Yes	Yes
PIRATA current m			Yes				Yes				
CTD	Yes	Yes		Yes	Yes						
XBT	Yes			Yes							
XCTD	Yes	Yes		Yes	Yes						
Surface drifters SS	Yes		Yes								
Surface drifters wi pressure	Yes		Yes					Yes		Yes	
VM-ADCP			Yes				Yes				
L-ADCP			Yes				Yes				
Tsgraph	Yes	Yes									
ARGO profilers				Yes	Yes						
MARISONDE	Yes			Yes				Yes		Yes	
ST Meteo Station								Yes	Yes	Yes	Yes
Coastal stations	Yes	Yes						Yes		Yes	
Atmospheric micro air sea fluxes	Yes							Yes	Yes	Yes	Yes

3.3 Logistical considerations

The cruises and deployment of instruments impose a few constraints that are generally common to every oceanographic cruise and which Task Team members have experience. Most of the problems concern the transportation of equipment to ports used by the research vessels and the need for custom clearances. Efforts to resolve any potential problems should begin now.

One constraint for the EGEE cruises will be storing instruments at Cotonou (Benin) between the two June and September 2005 cruises. This issue can be resolved (for 2005) through communications between TT5 (C.Peugeot/IRD) participants, the Cotonou CRHOB (coll. R.Djiman), and local shipping agents, which have begun.

During the SOP 1 EGEE 3 cruise, the communication between the ATALANTE and the aircraft that will simultaneous survey the Benin section will not be a problem.

The logistics for the German glider using in the Gulf of Guinea and along 23°W, as planed in the framework of TACE by IFM-GEOMAR (see below), have to be established in collaboration with French cruises.

3.4 Priorities and potential problems

3.4.1 Priorities

Most of the basic networks are funded (e.g., Argo, surface drifters, two ATLAS moorings, VOS XBT lines, etc.) and are of equal importance for the planned process studies, calibration/validation of satellite measurements and numerical model validations. A general priority however is to enhance these networks for improving spatial and temporal resolution of both the atmospheric and oceanic boundary layers. Ensuring the maintenance of the ATLAS buoys (and potential extensions) during all three observing periods specifically for air-sea fluxes studies should also be considered as a priority task. We can also consider that during the SOP 1 French EGGE 3 cruise, ocean and atmosphere boundary layers measurements, turbulence (microstructure) measurements in the upwelling areas and the simultaneous survey from aircraft of the Benin section are of top priority.

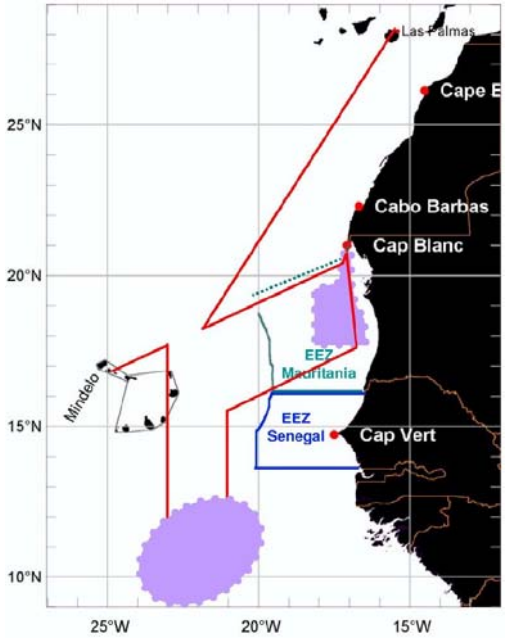
3.4.2 Potential problems

1) - Vessel time: Several EOP cruises are presently not supported (e.g., EGEE 4, SOP 3 late period during boreal fall 2006 and both EGEE cruises planned in 2007).
2) - Senegal cruises: The Senegalese (CRODT/ISRA) contribution is also presently not funded.
3) - ATLAS buoys: ATLAS buoy have failed due to vandalism typically associated with fishing activities in the GG (e.g., 2004). The PIRATA project will continue through 2006. An evaluation of the utility of the buoys for operational agencies and research studies will be conducted in 2005 to determine the form of the post-2006 array. For instance, the equatorial buoys at 10°W and 0°E could be displaced farther south or in the center of the tropical Atlantic basin to reduce potential vandalism problems.
4) - Countries clearance: Cruises trajectories are subject to authorization by countries which control the EEZ in which measurements are planned. Thus, the EGEE cruises track lines may be modified if one of several of the following countries do not provide the requested authorization: Liberia, Ivory Coast, Ghana, Togo, Benin, Equatorial Guinea, Congo, Gabon, São Tomé and Principe, Nigeria, Senegal.
5) - Observers: Due to the large number of clearance countries for EGEE cruises and the fact that these countries may impose one (or even two) observers onboard, the number of scientists could be reduced.

4 Partnership

4.1 Field observations

1) German (IFM-GEOMAR) biogeochemical program: This R/V METEOR cruise is planed in July 2006 in the Guinea Dome and Mauritania upwelling region. Contacts for collaboration are in progress. Twice-daily radio-soundings, as well as ocean microstructure (turbulence) measurements are planned. It would be a potential opportunity for profiler and surface drifter deployments.



2) French PIRATA cruises: These cruises are dedicated to the maintenance of the PIRATA ATLAS buoys network at 23°W-Equator. The four buoys located in the Gulf of Guinea will be maintained during the EGEE cruises from 2005 to 2007. IFM or NOAA could also maintain the 23° W-Eq moorings. These cruises can be opportunities to provide temperature profiles (XBT) and to deploy drifting buoys and ARGO profilers

3) CLIVAR-Atlantic TACE program: The CLIVAR Atlantic TACE program includes the global observing networks described previously. Other TACE activities represent potential opportunities to deploy additional measurement systems (e.g., gliders along 23°W and in the GG by IFM-GEOMAR.

4.2 Training program

- French PIRATA and EGEE cruises will provide opportunities to embark African students or scientists. For example:
- A student from LPA/UCAD-Dakar (Sénégal) would embark during the next PIRATA cruise in May 2005. He will obtain experience in sea water sampling, CTD acquisition, profiler deployments and XBT launches that will be necessary during the potential SOP Senegalese ITAF-DEME cruises.
- - EGEE/AMMA collaborators of LAPA (Univ./Cocody/RCI) are supposed to contribute to the cruises and to send onboard some students (one per cruise).
- Scientists in Togo and Bénin involved with EGEE/AMMA could also participate on cruises.
- Scientists of the solicited EEZ countries will participate as observers but can also be trained in data acquisition and initial processing.
- ARGO data Center: In the framework of ARGO, two data centers exist: one in US (NOAA/AOML-Miami) for the South Atlantic (20°N south) and one in France (IFREMER-Brest) for the North Atlantic (20°S north). Training courses will be organized during which African scientists will be trained in oceanographic data treatment. A meeting was held in Cape Town during May, 2005 about this issue and information is available on the AOMLl website www.aoml.noaa.gov (search for SAARDAC).
- Theses carried out in the framework of AMMA are already in progress in France (1 from LPA/UCAD-Dakar; 2 from University of Cocody/Abidjan).
- Project: In France, African partners will be trained to use MERCATOR results. Simulations stored on CD/DVD can be provided to countries without web connections.

5 Organisation of the TT.

5.1 Leaders and core group, membership:

	Name	Surname	Organism	Function	Email adress
Task Team lead					
International coord.	BOURLES	Bernard	IRD/LEGOS	French cruises	bernard.bourles@ird.fr
	MOLINARI	Robert	NOAA/AOML	US cruises	molinari@aoml.noaa.gov
	BRANDT	Peter	IFM-GEOMAR	German cruises	pbrandt@ifm-geomar.de
Core Group					
In France	CANIAUX	Guy	Météo-France	Air-Sea fluxes in the G during French SOP 1 c	guy.caniaux@meteo.fr
	GOURIOU	Yves	IRD/US025	French cruises material currents	yves.gouriou@ird.fr
	MARIN	Frédéric	IRD/LEGOS	Hydrology, currents	frederic.marin@ird.fr
	ELDIN	Gérard	IRD/LEGOS	Currents	gerard.eldin@ird.fr
	DUPENHOAT	Yves	IRD/LEGOS	Hydrology, currents	
	GIORDANI	Hervé	Météo-France	Air-Sea fluxes	herve.giordani@meteo.fr
In USA	GARZOLI	Silvia	NOAA/AOML	ATLAS buoys	garzoli@aoml.noaa.gov
	LUMPKIN	Rick	NOAA/AOML	Drifters	rick.lumpkin@noaa.gov
	SCHMID	Claudia	NOAA/AOML	Hydrology, currents	Claudia.Schmid@noaa.gov
In Germany	DENGLER	Marcus	IFM-GEOMAR	Microstructures	mdengler@ifm-geomar.de
	RHEIN	Monika	Univ. Bremen	Helium	mrhein@physik.uni-bremen.d

5.2 External diffusion of the information and reporting:

All information concerning this Task Team have to be shared and let available to all national groups, the national AMMA SCs & international AMMA SCs (EU & ISSC), in particular all other international Task Teams. Cruise and data reports will be accessible through AMMA data Center and AMMA web sites.

6 Coordination with other TTs.

Coordination with other related task teams, i.e. mainly TT7, TT8 and TT9 will, occur during field operations through email, phone and fax. Coordination not related to fieldwork will occur through meetings and workshops.

7 Status of the field program (April 2006)

7.1 About the coordination between the cruises

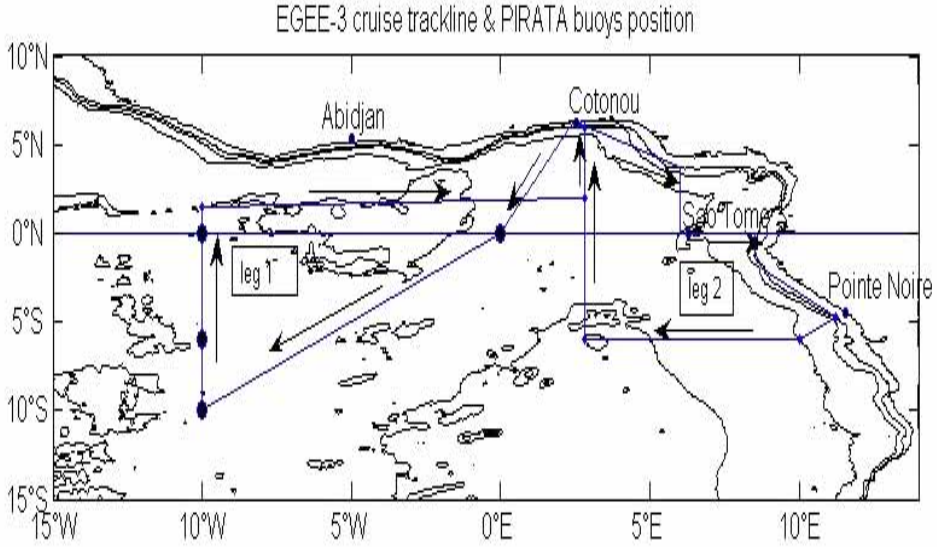
Many points have been clarified from August, mostly during the PIRATA, TACE and CLIVAR Atlantic Panel meetings (Toulouse, 12-14, Venice, 17-19 and 20-21, 2005). During the 2006 SOP, three oceanic cruises will be carried between May and July 2006 as a common and quasi-simultaneous effort from US, Germany and France. Additional short cruises were also planed from Senegal, in order to assess the oceanic upper layer during the different phases of the WAM and to deploy ARGO profilers between Senegal and Cape Verde. These cruises are proposed in the Senegal national AMMA program and elaborated in close collaboration with EGEE, and would be mostly funded by AMMA-France (EGEE). Unfortunately, for many different reasons, these cruises will not be feasible before late 2006 or 2007, and thus no data will be carried out in this area during the SOP. However, and thanks to a close collaboration between the partners and an efficient communication, the ARGO profilers, provided by NOAA/AOML, planed to be deployed during the first Senegalese cruise, initially scheduled in May 2006, will be deployed between Cape Verde and Mauritania in July during an IFM-GEOMAR cruise (Meteor 68/3) especially dedicated to geochemical measurements (resp. A.Körtzinger).

It has to be noticed that during these three French, German and US quasi-simultaneous cruises, radio-soundings, XBT and reduced CTD profiles data will be transmitted in quasi-real time from the three research vessels for Coriolis/Argo and Mercator/Godae projects.

Tracklines of the cruises and measurements that will be carried out during these cruises are explained in detail in the following.

1) The EGEE 3 cruise: From Cotonou to Cotonou (Benin), May 24 to July 6, 2006 onboard the R/V L'ATALANTE, by IRD, Meteo-France & CNRS (France).

Interactions between TT6 and TT8 led to discuss the coordination of Ocean soundings and aircraft flights. The cruise trackline (direction; see map below) and schedule have been adapted in order to ensure the simultaneousness with equipped airplane flights scheduled along the Cotonou line (2°50'E) in mid-June and July (see details below), and also in order to ensure the replacement of the PIRATA ATLAS buoys (black dots on the map above) at the very beginning of the SOP measurements.



During this cruise, many experiments and measurements will be carried out that will be done by teams from the three countries involved in the AMMA TT6 (France, Germany & US).One of the main priorities during the cruise is air-sea fluxes measurements. Different operations are the followings:

a) Flux measurements:

Turbulent fluxes will be estimated by different methods: inertial dissipation, correlation and bulk. Complementary measurements will include radiation, solar and infrared, specific measurements concerning precipitation and precipitation temperature. Collaboration with RSMAS/USA will provide skin sea surface temperature measurements along with solar radiation and aerosol measurements. Turbulent fluxes will be measured during 6 long duration stations (24h to 48h) located close to the PIRATA ATLAS buoys and south of the Sao Tome Island, a few miles off the meteorological station.

Radio-soundings will be performed twice a day, and other at the passage of satellite in the area (*i.e.* a total amount of about 150 atmospheric profiles), with real-time data transmission by GTS.

Ocean mixed layer will be thoroughly documented thanks to thermistance drifting chains (12 "Marisonde" drifters) and a few Surface Velocity Profilers equipped with thermistance chains down to 70m depth.

b) Hydrology and currents:

About 100 profiles (from the surface down to 1000m, maybe 2000m within the equatorial band) will be done during hydrological stations (every ½° along the 10°W, 2°50'E, 6°E and 6°S sections). During these stations, temperature, salinity and dissolved oxygen profiles are acquired continuously along with both horizontal components of the current velocity, and sea water samplings are done for different parameters analysis (salinity, dissolved oxygen, nutrients, Helium, and for a few stations at depths CO2, O18, C13 and CFCs, along with for biogeochemical analysis). Ocean microstructure measurements (vertical mixing) will be done after most of the CTD profiles (coll. IFM-GEOMAR/Germany).

All along the cruise trackline, meteorological parameters, upper layer currents, sea surface temperature and salinity will be continuously measured, and surface sea water samplings will be done for salinity, CO2 parameters and nutrients analysis.

Ten Surface Velocity Profilers (SVP) will be deployed, that measure sea surface temperature (SST) and transmit daily their position and SST measurements. ARGO profilers will also be deployed. These profilers provide every 10 days temperature and salinity profiles from the surface down to 2000m depth. 22 profilers have already been deployed in 2005 during the two first EGEE cruises. About 120 temperature profiles will be carried out (every ¼°) with expendable probes (XBT).

c) Simultaneous airplane measurements:

Two aircrafts will survey twice the 2°50'E meridional section ("Benin" section) from the African coast to 2°N, at low and high atmosphere levels, in order to measure representative parameters of the atmospheric boundary layer conditions (see also TT8 document). During the EGEE 3 cruise, the research vessel will be at the same date at some location of this section, and the same parameters at the air-sea interface, along with parameters within the oceanic boundary layer, will be measured. The two surveys are scheduled on June 15 and July 4, *i.e.* hopefully before and after the WAM monsoon latitudinal drop.

d) Other operations:

The four ATLAS meteo-oceanic buoys of the PIRATA array located in the Gulf of Guinea will be replaced at 10°W-10°S, 10°W-6°S, 10°W-0°N, and 0°E-0N. Actually, two of them disappeared from their last servicing probably due to vandalism (10°W-6°S and 10°W-0°N, respectively in September 2005 and February 2006). But a commitment of the PIRATA committees ensures to maintain the actual network configuration at least until early 2008. Furthermore, an additional buoy will be deployed during the cruise at 6°S-8°E in the framework of the PIRATA-Southeast extension funded by BCLME and proposed by South-Africa.

The meteorological station implemented in Sao Tome in October 2003 will be serviced, before a long duration station (24-48h) that will be done just offshore in order to check if its measurements are representative of the surrounding oceanic conditions.

Furthermore, as IFM-GEOMAR will take care about the PIRATA currentmeter mooring at 23°W-Equator (see below), the deployment of an additional currentmeters mooring at 10°W-Equator, funded by IRD in the framework of PIRATA-France and EGEE, could be feasible during their cruise (see below) in order to assess the surface equatorial currents during the whole SOP period at this particular longitude.

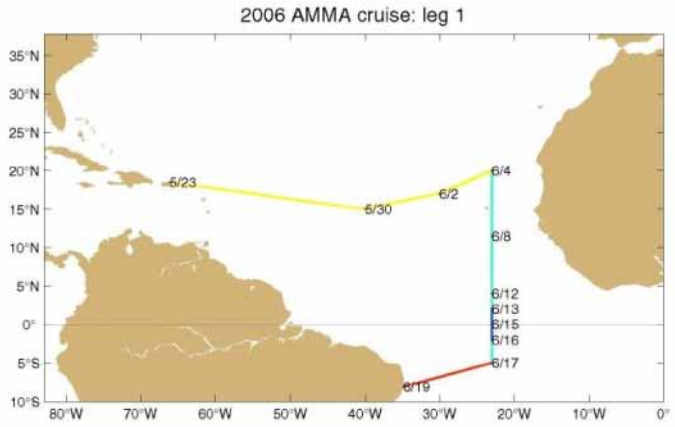
Finally, two radio sounding moorings of IFM-GEOMAR, installed in the framework of CLIVAR in January 2004 during the French PIRATA-FR12 cruise, will be recovered at 10°W-6°S and 10°W-1°N.

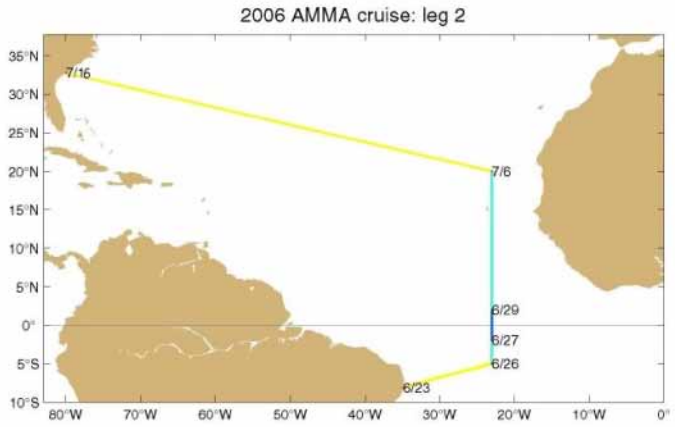
To summarize, coordinated actions by US and German teams during the EGEE 3 cruise include:

- Ocean microstructure measurements (vertical mixing), with IFM-GEOMAR, Kiel (Germany)
- Skin sea surface temperature measurements & aerosols with RSMAS (USA).
- Surface Velocity and temperature profilers (SVP) with AOML/NOAA (USA)
- Helium sampling (vertical upwelling rate) with the University of Bremen (Germany)
- Biogeochemical, radiance, particulate and dissolved absorption with LAMONT (USA)
- Two radio soundings mooring recovering, for IFM-GEOMAR, Kiel (Germany)

Finally, colleagues from several African laboratories (Nigeria, Benin, Togo, maybe Ghana, Ivory Coast, Congo and Senegal) will participate to the EGEE 3 cruise, in order to contribute to the data acquisition and for training and also as observers for the concerned Exclusive Economic Zone (EEZ) of their country.

2) The R/V RON-BROWN cruise: From San Juan (Porto Rico) to Recife (Brazil), and from Recife to Charleston (USA), May 23-July 16, 2006 by AOML/NOAA (USA)





This cruise will be carried out in the Tropical Eastern Atlantic Ocean, principally along the 23°W longitude (meridional section carried out twice at the few weeks interval, see maps for the two legs of the cruise).

During this cruise, many kinds of measurements will also been carried out, in the framework of AMMA and also PIRATA, as two additional ATLAS mooring along 23°W will be deployed in the framework of the PIRATA-North-Eastern extension, proposed and supported by NOAA (USA). These buoys will allow getting atmospheric measurements off Africa during the whole AMMA SOP period.

Different operations are the followings:

a) Flux measurements:

Atmospheric data will be collected to characterize the vertical structure of the Saharan air layer (SAAL), including mineral dust aerosol over the Atlantic Ocean. Skin sea surface temperature, solar radiation and aerosol measurements will be carried out all along the cruise. Atmospheric data will also be collected to investigate the linkages between the vertical distributions of tropospheric ozone with Saharan dust outbreaks. In addition, a suite of trace gas and aerosol ambient measurements, ozonesondes and aerosol sampling will be taken to quantify the microphysical and chemical evolution of the Saharan dust, to analyze the biological and chemical content of size –fractionated aerosol samples and to characterize the density and mass concentrations of aerosols within the SAL.

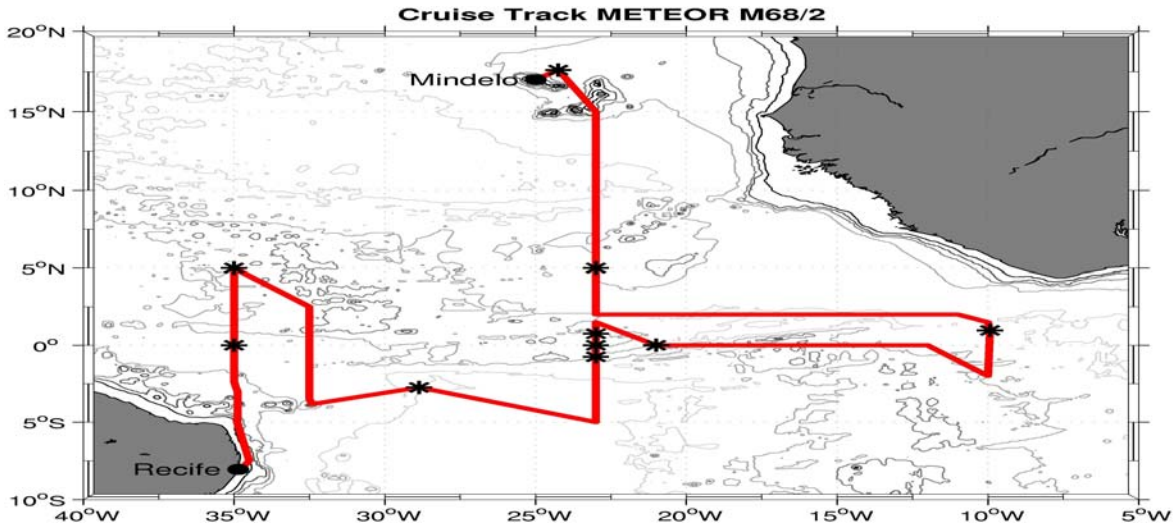
Radio-soundings (86) and ozonesondes (20-30) will also be launched twice a day during this cruise, with real-time data transmission by GTS.

b) Hydrology and currents: Shipboard current measurements and sea surface temperature and salinity will be continuously measured, as well as on-station CTD and current profiling from the surface down to 1500m depth will be carried out along 23°W (about 60 CTD profiles during each leg). Sea water samplings will be done for salinity and oxygen analysis. About 100 temperature profiles will be carried out with expendable probes (XBT).

c) Other operations:

Two ATLAS moorings will be deployed along 23°W (at 4°N and 11.5°N) in the framework of the PIRATA-Northeastern extension, to provide time series of the surface atmospheric parameters, upper ocean temperature, salinity and current structure.

3) The R/V METEOR 68/2 cruise: From Recife (Brazil) to Mindelo (Cape Verde), June 6–July 7, 2006 by IFM-GEOMAR (Germany)



This cruise will allow getting measurements about the ocean circulation in the west (35°W) and center (23°W) of the basin almost simultaneously to the two other cruises and also along the 10°W section near the Equator at a few days interval after EGEE 3.

a) Atmospheric measurements: Radio-soundings will be launched twice a day during this cruise with real-time data transmission by GTS.

b) Hydrology and currents: Shipboard current measurements and sea surface temperature and salinity will be continuously measured, as well as on-station CTDO2 and current profiling (L-ADCP) will be carried out. Sea water samplings will be done for different parameters analysis (salinity, oxygen, nutrients, Helium, and CFCs). Ocean microstructure measurements (vertical mixing) will be done, mostly along the equator, along with Helium sampling. ARGO profilers deployment will be done notably along the equator between 23°W and 10°W.

c) Other operations:

At 23°W between 0.75°N and 0.75°S as well as at 21.5°W-0°N, currentmeters moorings will be deployed and the PIRATA ADCP mooring deployed in May 2004 will be replaced at 23°W-0°N (also equipped with other deep currentmeters in the framework of the German-CLIVAR program). Additional CTD/O2 moorings at 23°W, 5°N and near Cape Verde will be deployed.

If the PIRATA ADCP apparatus correctly works at 23°W-0°N, an additional ADCP mooring will be deployed at 10°W-0°N for the French EGEE/AMMA and PIRATA programs. Equipped with an ADCP around 100m depth, this mooring will allow us to assess the surface equatorial currents during the whole SOP period at this particular longitude.

Finally, AGO profilers provided by USA will be deployed between the Cape Verde Islands and the Mauritanian coasts during a following cruise (the Meteor 68/3 cruise) in July 2006 dedicated to geochemical measurements.

4) ITAF-DEME cruises: From Dakar to Cap-Verde, July to September, 2006 onboard the R/V ITAF-DEME, by Senegal.

In spite of the proposition made by API-AMMA (France) to partly fund these cruises, no clear answer were given by AMMA-Senegal about the organization of these cruises, mostly due to a lack of interest/involvement from the CRODT-Dakar. That point has been discussed in December 2005 during the AMMA conference in Dakar with the coordinator of AMMA-Senegal (Amadou Gaye) and the PI of the ocean project in Senegal (Bamol Ali Sow), who provided an answer regarding the possible participation of R/V ITAF-DEME rather in March 2005 only. In spite of some material preparation at the CRODT, the possibility to send in Dakar XBTs and other material from France and ARGO profilers from US, and the participation of an experimented engineer from IRD, such a late answer and the absence of a clear estimate of the vessel time cost are the main reasons why the first Senegalese cruise initially planed in May 2006 had to be delayed. Anyway, works continue to be done in order to organize cruises from Senegal with the R/V ITAF-DEME in late 2006 or 2007.

7.2 About the R/V ANTEA of IRD and next EGEE cruises.

The next EGEE cruises (*i.e.* EGEE 4 planed in fall 2006 and EGEE 5 & 6 planed in spring and fall 2007) will be carried out from the R/V ANTEA of IRD. There is clear commitment by IRD to repair the R/V ANTEA by spring-summer 2006, in order to be able to do EGEE 4 cruise in fall 2006. This cruise will be a 'test' for the vessel. At now, we know that motors will be changed soon (by June 2006), and scientific material partly replaced and renewed during 2006. Anyway, to provide precise schedules for the EGEE 4 cruise is still impossible at now.

7.3 About the ongoing GOOS observations in the eastern Atlantic

The eastern Atlantic is somewhat arbitrarily defined here as the area between 20°S and 20°N and east of 30°W.

a) Argo floats: As of the middle of October 2005, approximately 75 Argo floats were located in the eastern Atlantic. Additional information is available at http://w3.jcommops.org/website/ArgoMapp

b) Surface drifters: As of the beginning of December there were approximately 35 surface drifters located in the eastern Atlantic. Additional information is available at http://www.aoml.noaa.gov/phod.

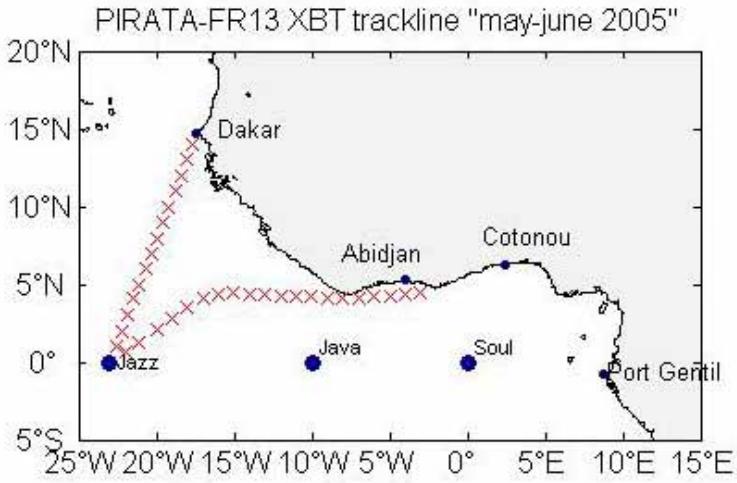
c) High density XBT line AX8: AX8 which runs from Capetown to New York was occupied 3 times during 2005 with another occupation planned before the end of the year. Additional information is available at http://www.aoml.noaa.gov/phod.

d) About the XBT and thermosalinograph VOS lines AX11, AX15 and AX20 under IRD responsibility : AX11 run operationally with high frequency profiles (XBT and XCTD) during two transects carried out in the framework of the ARAMIS project (resp. S.Arnault, IRD/LOCEAN); XBT along AX15 were interrupted during one year from November 2004 to November 2005, and thermosalinograph from February 2005 to November 2005; three transects were achieved along the AX20 line.

7.4 Actions Carried Out In 2005

7.4.1 PIRATA FR 13 cruise:

This cruise has been scheduled in order to replace the ATLAS buoy and currentmeter mooring of PIRATA at 23°W-Equator, in charge of France. It has been possible thanks to the chartering of the R/V LE SUROIT by IRD, which paid 70k€ for that! (cost of the 7 additional days to go to 23°W-Equator from Dakar and to do the field works, the vessel being normally in transit to go directly from France to the Gulf of Guinea for the EGEE 1 cruise).



Two scientists of the IFM-GEOMAR (Kiel) have participated to the cruise in order to do some works in the framework of their German-CLIVAR program and in close collaboration with AMMA-EGEE and PIRATA programs.

During this cruise, the following works (list limited to AMMA-EGEE, PIRATA & ARGO activities) have been carried out:

- Replacing of the ATLAS PIRATA buoy at 23°W-Equator
- Replacing of the currentmeter (surface ADCP) mooring of PIRATA at 23°W-Equator
- 37 XBT launches (see map). Data sent in quasi-real time in the framework of CORIOLIS.
- ARGO profilers have been deployed (1 French PROVOR, 6 German RAFOS -4 deep and 2 shallow-, 6 German APEX and 2 German NEMO)
- 6 Surface Velocity Profilers (SVP, surface drifters) has been deployed (provided by NOAA/AOML)
- 1 CTD-O2 profile has been done at 23°W-Equator
- Sea surface water samplings have been done for salinity and nutrients analysis (every degree).

7.4.2 EGEE 1 and EGEE 2 cruises:

These cruises have been carried out with the R/V Le SUROIT from Cotonou (Benin) from June 7 to July 5, 2005 and from September 3 to September 29, 2005 respectively (see maps below).

These cruises allowed carrying out:

- About 60 hydrological profiles (CTD-O2) and current profiles (L-ADCP) per cruise, along with 11 sea water samplings along the water column (surface to 500m or 1000m) for salinity, dissolved oxygen and nutrients analysis;
- More than 110 temperature profiles per cruise (XBT);
- Change of the 4 ATLAS buoys of the PIRATA program located in the Gulf of Guinea (black dots on the EGEE 1 map above);
- The deployment of 24 ARGO profilers (18 French PROVOR and 6 US SOLO that provide temperature and salinity profiles from the surface down to 2000m depth every 10 days) ;

- About 30 sea surface samplings per cruise for salinity, nutrients, CO2 parameters, C13 and O18 analysis;

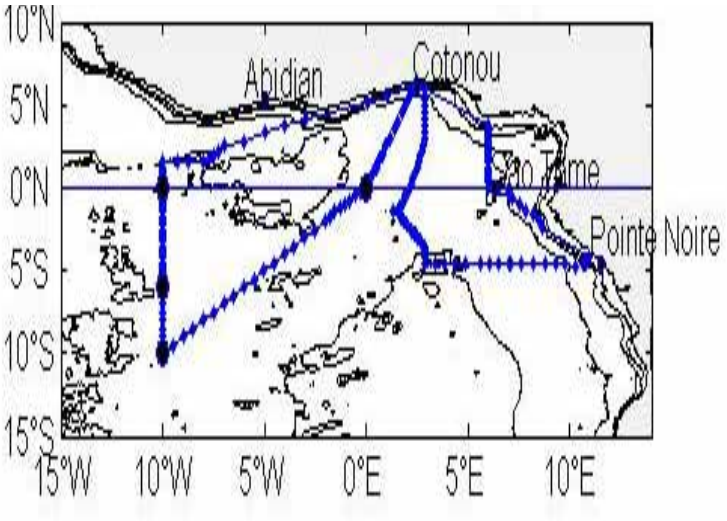
- The deployment of 16 surface drifters (SVP) that provide daily sea surface temperature and surface current drift measurements (coll. NOAA/AOML -Miami-USA).

- Upper layer current measurements all along the trackline (surface to 200m depth), along with meteorological measurements, sea surface temperature and salinity (thermosalinograph);

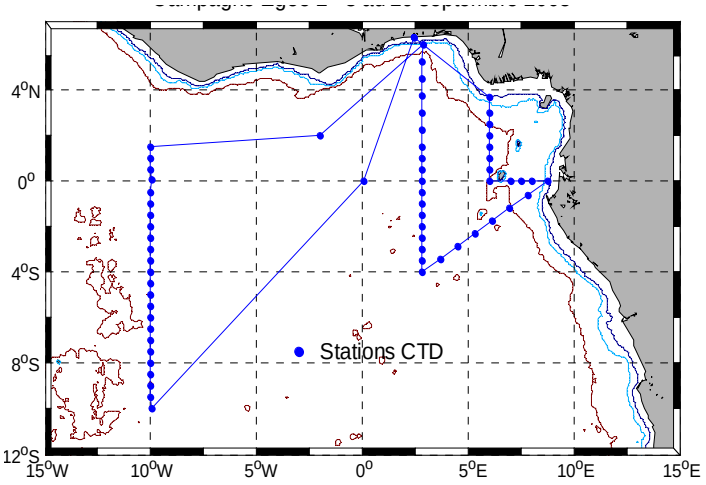
- 12 microstructure profiles along 10°W during EGEE 2 (that allow an estimate of vertical mixing; coll. IFM-GEOMAR / Kiel, Germany)

- About 60 sea water sampling along the vertical during hydrological profiles along 10°W and 3°E during EGEE 2 for Helium (that allow an estimate of vertical upwelling rate; coll. University of Bremen, Germany).

Trackline of the EGEE 1 cruise
(dots correspond to temperature profiles)



Trackline of the EGEE 2 cruise
(dots correspond to temperature/salinity profiles)



Due tot the reduced vessel speed, the planed tracklines have been modified in the eastern part and about 80% of the initial objectives have been achieved during these two cruises. However, the adapted trackline during EGEE 2 east of São Tome allowed us to have fitted measurements in order to study the Equatorial UnderCurrent termination.

7.4.3 Coastal stations:

In the framework of EGEE/AMMA, an autonomous "ONSET" temperature sensor has been installed in the port of Cotonou (Benin) in July 2005. The data will be compared with the usual coastal measurements carried out in a traditional way (twice or three times per week).

7.4.4 Training:

- A total of 8 scientists from African countries have participated to the three French cruises carried out in 2005. Details are given in the following. Actually, it is systematically asked to the competent authorities of the solicited countries for working clearances in their Economic Exclusive Zones (EEZ) to favour the participation of scientists in place of official observer when possible.
- One Senegalese young scientist, Mr Malik Wade, from the Laboratoire de Physique de l'Atmosphère (LPA, University of Dakar) has been invited to participate to the PIRATA FR 13 cruise. This

scientist is actually doing a Master in physical oceanography in France (Université de Bretagne Occidentale / Brest) from Oct. 2005.

- Three scientists of Benin, Dr.Roger Djiman (chief of the Centre de Recherche Hydrologique et Océanographique du Benin: CRHOB), Georges Degbé & Zacharie Sohou, both working to CRHOB, have been invited to both EGEE 1 and EGEE 2 cruises (one people per leg).
- One scientist of Ivory Coast, Dr.Yves Kouadio, working to the Laboratoire de Physique de l'Atmosphère (LAPA; University of Cocody) has been invited to participate to the EGEE 1 cruise (1st leg; no scientist had time availability to participate to EGEE 2, for which one scientist of LAPA were also invited).
- One scientist of Nigeria, Mr Lekan Adekanmbi working with Mme Regina FOLORUNSHO to the Nigerian Institute for Oceanography and Marine Research (NIOMR), has been invited to participate to the EGEE 2 cruise (2nd leg), in place of an usual official observer from the Nigerian Navy (as done during EGEE 1).
- One scientist of Togo, Mr Damien Gatogo working with Pr A.B. BLIVI to University of Lomé (Dept of Geomorphology), has been invited to participate to the EGEE 2 cruise (1st leg).
- One scientist of Congo, Mr Auguste Locko, working to the IRD Center of Pointe Noire, has been invited to both EGEE 1 and EGEE 2 cruises (2nd legs)

African Monsoon Multidisciplinary Analyses
Afrikaanse Moesson Multidisciplinaire Analyse
Afrikanske Monsun : Multidisiplinaere Analyser
Analisi Multidisciplinare per il Monsone Africano
Analisis Multidiciplinar de los Monzones Africanos
Afrikanischer Monsun : Multidisziplinäre Analysen
Analyses Multidisciplinaires de la Mousson Africaine

The International Implementation Plan

Version 3.0
May 2006

Coordinated by The International Coordination and Implementation Group (ICIG)

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AMMA International Project Office
Edited by Elisabeth van den Akker
Paris, 31 May 2006

African Monsoon Multidisciplinary Analyses
Afrikaanse Moesson Multidisciplinaire Analyse
Afrikanske Monsun : Multidisiplinaere Analyser
Analisi Multidisciplinare per il Monsone Africano
Analisis Multidiciplinar de los Monzones Africanos
Afrikanischer Monsun : Multidisziplinäre Analysen
Analyses Multidisciplinaires de la Mousson Africaine

The International Implementation Plan

Version 3.0
May 2006

AMMA International Implementation Plan (IIP)

The IIP is composed out of an Introduction chapter and 10 TT-documents written within different time periods due to project development.
This document is dated May 2006 and will still undergo necessary changes following the development of AMMA.

The following versions of the whole document or of TT-documents were subsequently published:

Version 1.0	September 2005
Version 1.1	December 2005
Version 2.0	March 2006
Version 3.0	May 2006

Note: The version indicated at the footnote of each TT-document indicates the version incorporating the latest changes.