

THE EGEE 1&2 CRUISES IN THE GULF OF GUINEA

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Scientific context

The main objectives of the EGEE (Etude de la circulation océanique et de sa variabilité dans le Golfe de Guinée / Study of the oceanic circulation and its variability in the Gulf of Guinea) project are to study in the framework of AMMA the oceanic circulation and its variability in the upper layers of the eastern Tropical Atlantic, more precisely in the Gulf of Guinea (GG), through the joint utilization of in situ and satellite measurements along with numerical models results.

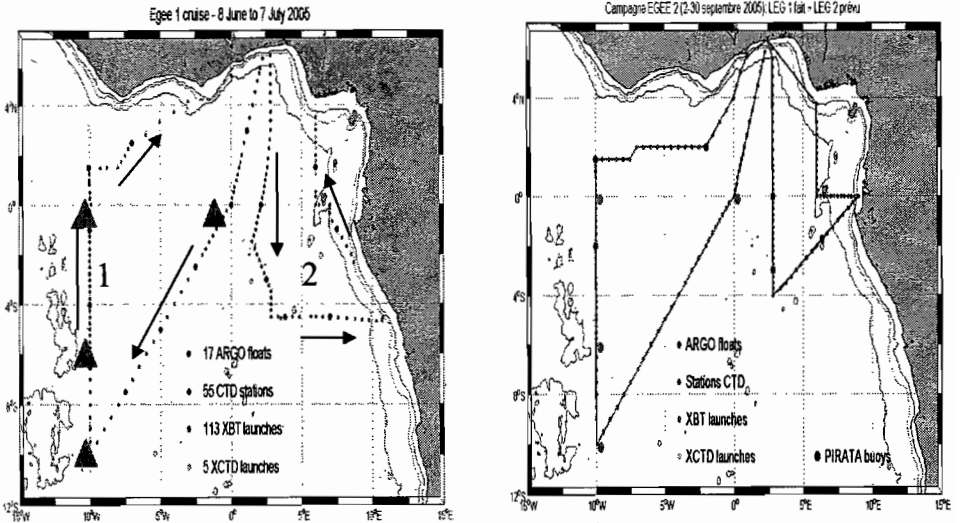
The EGEE project includes different kinds of complementary works, including studies based on in situ and satellite measurements, products validation, numerical experiments, air-sea exchanges and fluxes analysis... (refer to associated posters: Bourlès et al., poster 0.01; Kouadio et al., poster 0.03; Dagorne et al., poster 0.05; Bourlès et al., 0.43; Ayina et al., 3.31; Bentamy et al., 3.32; Bourras & Caniaux, 3.33; Dagorne et al., 3.34; Giordani et al., 3.35, Peter et al., 3.36...)

Most of the works carried out in the framework of EGEE principally aim to better understand the oceanic processes responsible for the SST and mixed layer variability, their impacts on air-sea exchanges, and finally to improve numerical simulations through a better estimate of mixing parameterization. Such studies obviously need dedicated in situ measurements, carried out along same sections during two monsoon phases (late boreal spring and early fall), and during three years, in order to assess both seasonal and interannual variability.

The EGEE 1 & EGEE 2 cruises

a) general presentation:

Thus, two oceanographic cruises per year will be carried out in the framework of EGEE, during the three years of the AMMA Extended Observation Period (EOP; 2005-2007), and the first two ones have been carried out in June-July 2005 (EGEE 1) and September 2005 (EGEE 2) onboard the R/V LE SUROIT from COTONOU (Benin; see figures 1). The EOP EGEE cruises are mostly dedicated to the study of the variability of the hydrological parameters and currents in the ocean upper layers (see posters 0.01 and 0.43 for details on the SOP dedicated cruises).



Figures 1 : Maps of EGEE 1 (left) and EGEE 2 (right) and summarize of works (CTD: blue dots; XBT & XCTD: red and green dots; ARGO profilers: black dots) Red triangles = PIRATA buoys)

These cruises allowed to carry out many kinds of works and measurements :

- 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;
- the deployment of 24 ARGO profilers (18 french PROVOR and 6 US SOLO –coll. S.Garzoli, NOAA/AOML –Miami-USA- 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, C13 and O18;
- the deployment of 16 surface drifters (SVP) that provide daily SST and surface current drift measurements (coll. R.Lumpkin, NOAA/AOML-Miami-USA).
- upper layer current measurements all along the trackline (surface to 200m depth), along with meteorological measurements, SST and salinity (thermosalinograph);
- 12 microstructure profiles along 10°W during EGEE 2 (that allow an estimate of vertical mixing; coll.M.Dengler, IFM-GEOMAR / Kiel, Germany)
- about 60 sea water samplings during hydrological profiles along 10°W and 3°E during EGEE 2 for Helium analysis (that allow an estimate of vertical upwelling rate; coll. M. Rhein, University of Bremen, Germany).

b) Very first observations:

It has first to be noticed that the 2005 seemed to be particular climatic year in the Tropical Atlantic: during the 2005 boreal summer, the SST were very warm in the northern tropical Atlantic (and the north of the GG in May-June), and the SST were very cold along the equator, the south of the GG (cold tongue) and within the eastern coastal upwelling (off Gabon). We observed that the SST decreased from about 5°C around 5°W-Equator in three weeks... According to the Reynolds & Smith climatologic index, 2005 was the coldest equatorial upwelling observed in June since 1981 (-1.5°C in June 2005 within the 5°W-1°5W longitude band and 3°S-Equator latitude band; not shown). SST lower than 19°C has been measured off Gabon on July 2, 2005. In September, the SST consequently increased along the equator and the coastal upwelling from Ivory Coast to Benin can be observed.

The surface measured currents allow observing different patterns:

- The Guinea Current (eastward current located north of the equator) is relatively weak in June (note that the first section between Benin and 0-0, where the GC may appear weak or even reversed, was done at the very beginning of the cruise), and well developed in September, when it appears with meanders at 2°N ;
- the eastward flows measured at the equator along 10°W in June and September and at 3°E in September seem to be a signature of the surfacing of the Equatorial UnderCurrent, that is linked to the equatorial upwelling (upward movement of the thermocline and of subsurface / cold waters);

c) Conclusions:

The EGEE cruises have been detailed in quasi-real time by internet, and a description can be found at: http://www.brest.ird.fr/actualites/actu_sept_05.htm. A very important number of measurements have been carried out during the EGEE1 and EGEE 2 cruises, and different studies will be initiated thanks to these data. For example the SST distribution in the GG during the monsoon onset will be studied in relation with the relatively strong observed winds during EGEE 1 cruise (along with precipitation anomalies in the west Africa), the mixed layer depth and the measured currents. The data treatment and validation steps are still in progress, and a first data set should be available in mid-2006. A data report will be provided (that should be also available through the AMMA/EGEE web page :

http://www.brest.ird.fr/activites/act_LEGOS_Brest.htm.



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Convective wind system with aerosols, named "haboob", Hombori in Mali, West Africa.