

Report of Tropical Atlantic Climate Experiment (TACE) Observations Working Group

The Tropical Atlantic Climate Experiment (TACE) is an observational and modeling effort to advance predictability of climate variability in the tropical Atlantic and surrounding regions. TACE was envisioned as a program spanning a period of approximately 6 years (2006-2011). The results of TACE are expected to contribute to the final design of a sustained observing system for the tropical Atlantic. The main focus of TACE is on improving the predictability of the eastern tropical Atlantic climate and the representation in models of key dynamical processes underlying its behavior.

During the last years the establishment of the TACE observing system made substantial progress. While the PIRATA program represents the backbone of the observational network, several observational programs - partly initiated with the help of TACE – are currently active in the central and eastern tropical Atlantic (Fig. 1).

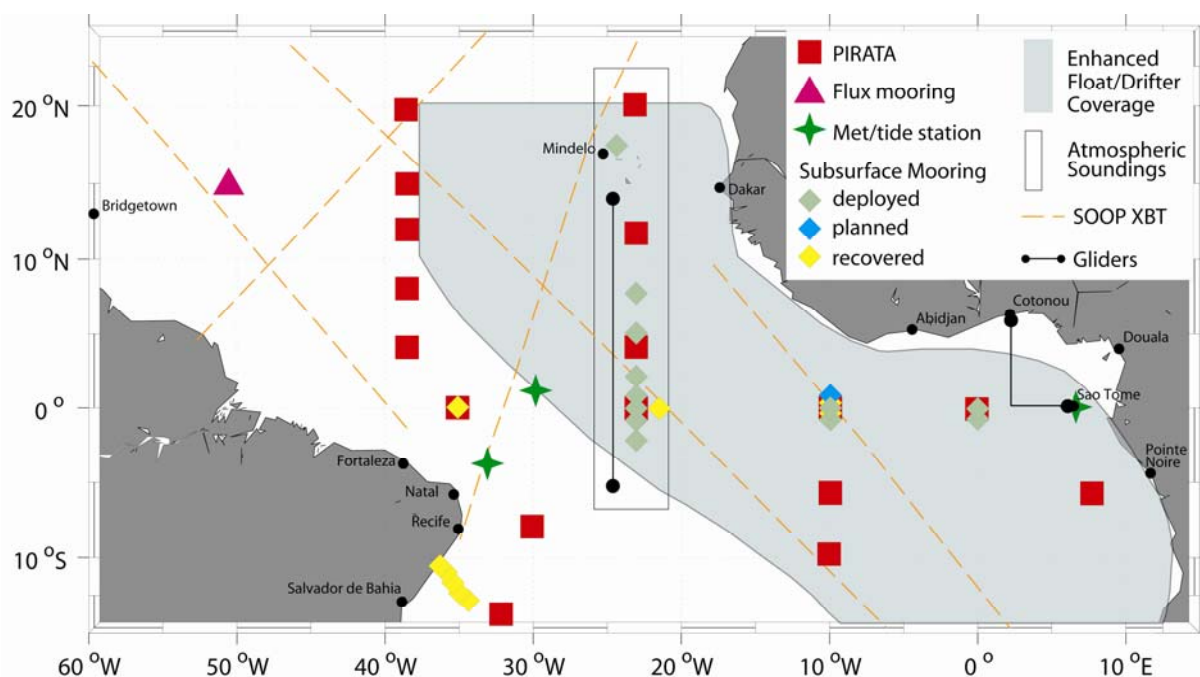


Fig. 1: Observational network in the tropical Atlantic (<http://tace.ifm-geomar.de/>).

Particularly in the eastern tropical Atlantic, which was during recent years characterized by exceptional low data coverage, a large amount of data became available. With the last (out of six) research cruises of the French EGEE program (as part of the AMMA program, in cooperation with PIRATA & TACE) into the Gulf of Guinea in June and September 2007, a major effort ended during which measurements of radiative fluxes, atmospheric parameters for the calculation of turbulent fluxes were systematically performed so as profiles of temperature, salinity and currents in the mixed layer. In combination with an extensive upper ocean microstructure program (M. Dengler, IFM-GEOMAR), the acquired data set represents a unique data base for the analysis of the evolution of the oceanic heat budget during the onset and mature phase of the equatorial cold tongue.

Subsurface Current Meter Moorings:

Additional observations of the upper ocean current system have been carried out in the frame of PIRATA as well as US and German research programs. While the US EUC program is aimed to observe the EUC in the eastern Atlantic through new moored current meter (ADCP)

observations at 10°W and 0°E, for a three-year period from September 2007 to September 2010, the German EUC program includes a mooring array along the 23°W meridian consisting of 5 moorings between 2°N and 2°S that will be maintained until boreal summer 2011. The next cruises to service the moorings are scheduled within the US EUC program in spring 2009 (with an additional R/V Antea cruise in September 2008) within the German EUC program in November 2009.

The objectives of both projects are to provide a thorough description of the mean state and variability of the EUC in the central and eastern Atlantic including its seasonal intensity and eastward penetration of into the Gulf of Guinea. Particularly equatorial wave dynamics are in the focus of these programs, studying among others the effect of Tropical Instability Waves (TIWs) and Kelvin waves on sea surface temperature (SST) variability in the eastern tropical Atlantic and associated climate variability in the tropical Atlantic region.

As part of the French PIRATA observation system, and as contribution to TACE & AMMA, a subsurface ADCP mooring has been deployed at 10°W-Eq; this mooring will be replaced in September 2008 during the French PIRATA FR18 cruise.

Drifter and Float observations:

NOAA's Global Drifter Program is working to maintain a global array of 1250 drifters at 5x5 degree resolution, including the Tropical Atlantic. Many deployments are conducted from AX8, a Volunteer Observation Ship line between Cape Town, South Africa and the US east coast. In the central and southern Tropical Atlantic, drifters move west from that line, strongly affecting the subsequent data distribution. Other opportunities, such as the US Navy's African Partnership Station, are used to deploy drifters east of AX8. A number of international partners also deploy drifters throughout the region.

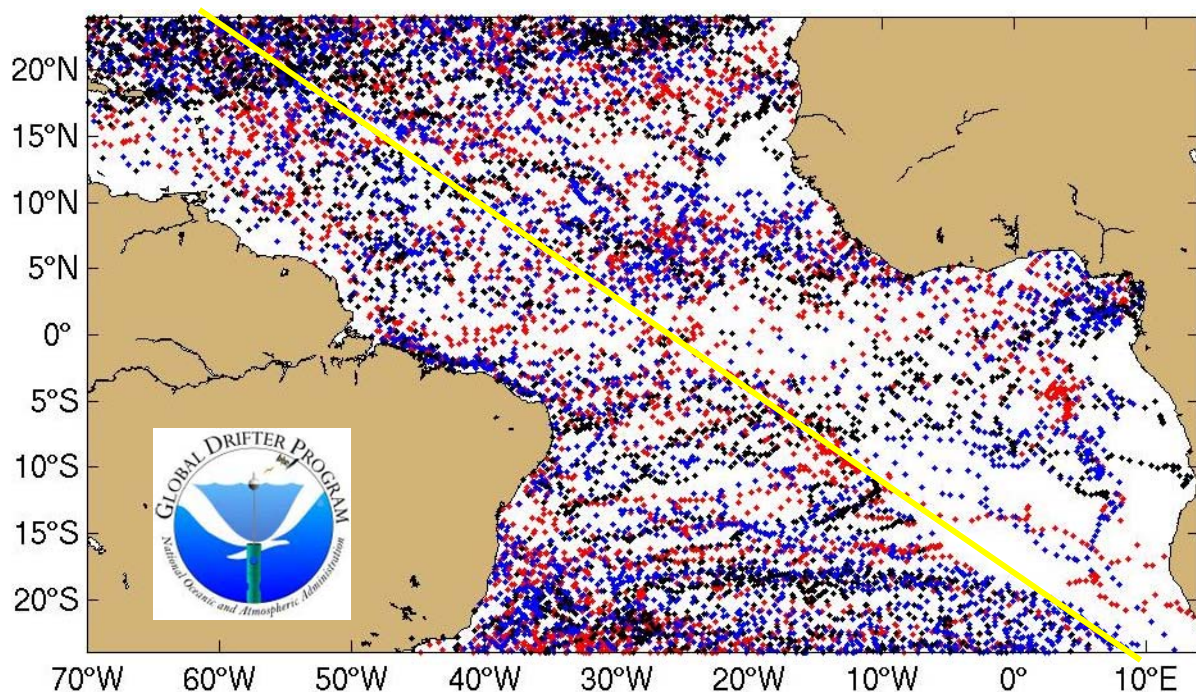


Fig. 2 Weekly drifter positions from drifters in 2006 (red), 2007 (blue) and 2008 (black, through July 21) as well as the Volunteer Observation Ship line AX8 (yellow line).

ARGO floats in the central and eastern Tropical Atlantic were deployed mainly in the frame of US, French and German ARGO programs. While the data coverage in the equatorial

Atlantic is largely improved compared to previous years, in the Tropical Southeast Atlantic there are still large gaps (Fig. 3).

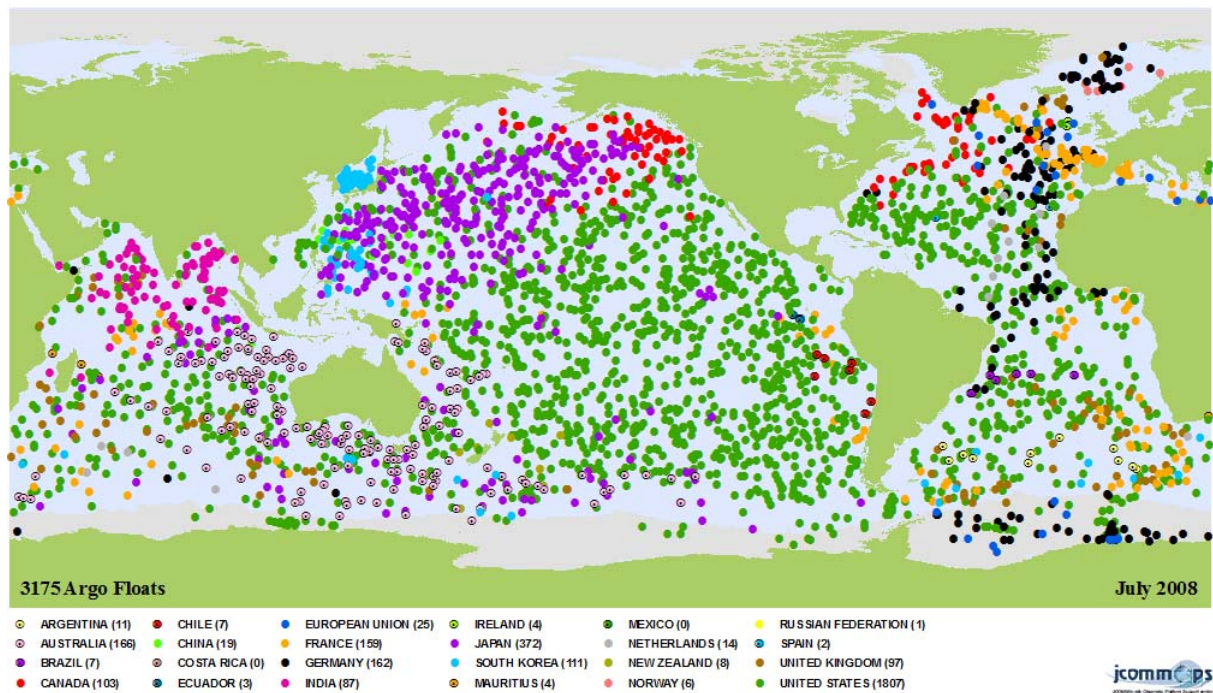


Fig. 3. Active ARGO floats by country.

Climate-Biogeochemistry Interactions

A major German research program (SFB 754) focuses on the climate-biogeochemistry interactions in the tropical ocean with particular emphasis on the oxygen minimum zone in the Tropical North Atlantic. This program includes observations from subsurface hydrographic (oxygen) and current meter moorings at 5N and 8N along the 23W meridian, a tracer release experiment at 300 m depth (tracer injection was in April 2008), a glider repeat section along 23W and extensive biogeochemical and physical shipboard observations. The first 4 year phase of the program started in 2008. This program will strongly enhance the physical and biogeochemical database in the tropical North Atlantic between the equator and Cape Verde Islands.

PIRATA NEE: ATLAS moorings at 4N, 11.5N and 20.5N, 23W and at 20N, 38W

All measure shortwave, currents at 10m, air temperature, sea temperature and salinity at multiple depths, wind speed and direction, rain, and humidity. The full-flux site at 11.5N, 23W also includes longwave and barometric pressure. These moorings are serviced approximately once per year, with complementary hydrographic observations, a dense hydrographic line along 23W to 1500dbar, and opportunistic oceanic (drifter, floats, XBTs, thermosalinograph, ADCP) and atmospheric (sondes, ozonesondes and direct turbulent fluxes) measurements.