The SPURS-MIDAS cruise

The Spanish in-situ contribution to the international SPURS (Salinity Processes in the Upper ocean Regional Study) experiment is taking place on board the R/V Sarmiento de Gamboa from March 16, 2013. A team of scientists from SMOS-BEC, plus other researchers and technicians from ICM and UTM-CSIC Barcelona, NUI Galway, LOCEAN Paris, LDEO-U. Columbia New York and U. Vigo are performing a wide range of mesoscale and submesoscale measurements to contribute understanding the mechanisms of formation and permanence of the largest ocean salinity maximum in the centre of the North Atlantic subtropical gyre. Several standard and prototype instruments are used in measuring sea surface salinity and other ocean variables.

Underway near-surface salinity along Sarmiento de Gamboa track from the Canary Islands to the SPURS site (figure: O. Hernandez, LOCEAN)

Velocity field at 24 m below the surface measured along the Sarmiento track during the mesoscale survey (figure: M. Emelianov, SMOS-BEC)

A survey of the central SPURS area by a towed CTD probe, undulating in the top 250 m, plus an acoustic current profiler, has allowed a mesoscale description of the oceanographic conditions and selection of specific sites for higher resolution measurements. While the Sarmiento performed this survey the US R/V Endeavor serviced several moorings and autonomous vehicles that were deployed in the 2012 SPURS cruises.

Both vessels are performing microstructure and other high resolution measurements close to the surface, as for example with the Air-Sea Interaction Profiler (ASIP) designed and

manufactured by the National University of Ireland that repeatedly samples the top 100 m in 20 minutes cycles to record a bunch of physical parameters including turbulence. Surface drifter prototypes for salinity, temperature and wave observations, built by the SMOS-BEC and LOCEAN teams, are also being tested during the cruise.

Several researchers from both vessels examining the ASIP sensors during a visit of the Endeavor team to the Sarmiento on March 27

Other data and water samples, collected underway, in fixed stations, or by towed plankton nets, are to be used for studies on air-sea fluxes, bio-optical properties of the ocean surface, accumulation of plastic particles inside the gyre, ichtyoplankton species distribution, and testing a new method to detect artificial uranium isotopes in sea water.

And how does SMOS fit with these in situ measurements? SPURS also intends to test the usefulness of remotely sensed SSS (from SMOS and Aquarius) in upper ocean dynamics studies. While we are at sea, other colleagues are processing the satellite data and running numerical models where the different kinds of information, including our measurements in near-real time, are assimilated and continuously compared to the in situ description.

The Sarmiento de Gamboa navigation to the SPURS area drawn over an optimally interpolated SMOS CP34-BEC level 3 map corresponding to the 10 days previous to the cruise (figure: J. Martínez & M. Umbert, SMOS-BEC)

During our transit we crossed the relatively fresh waters of the Canary current region with salinity of about 36.8, and entered into the salty center of the gyre, where we soon reached values of 37.45, significantly above climatology. It seems that we are now in a period of warmer and saltier ocean

surface, with no heavy rains in the area as low pressure systems and fronts are crossing the Atlantic further north and we lay in a relatively calm band that brings us good sea conditions for open ocean work.

Salinity along the Sarmiento the Gamboa track as recorded by the vessel on 16-29 March (blue), extracted from a SMOS level 3 map for 16-25 March (red), and from the World Ocean Atlas (black) March climatology (figure: M. Umbert, SMOS-BEC)

A comparison of the SSS along the cruise track as recorded by the on-board thermosalinograph (quite noisy signal due to ship motion) and from a SMOS L3 OI product indicates that the satellite captures most of the variability with respect to climatology. However, the figure is in fact a mixture of a spatial distribution (SMOS, 10 days average) with the temporal+spatial variability as observed by the ship during the 13 days since we left Las Palmas. Besides this temporal misfit, the SMOS SSS data in the left hand side of the section is affected by contamination from L-band land emission due to the vicinity of the Canary Islands. On the right, in situ measurements were taken beyond the time window covered by SMOS.