High resolution glider missions to monitor and understand the variability of the circulation & ecosystem response from basin to mesoscale

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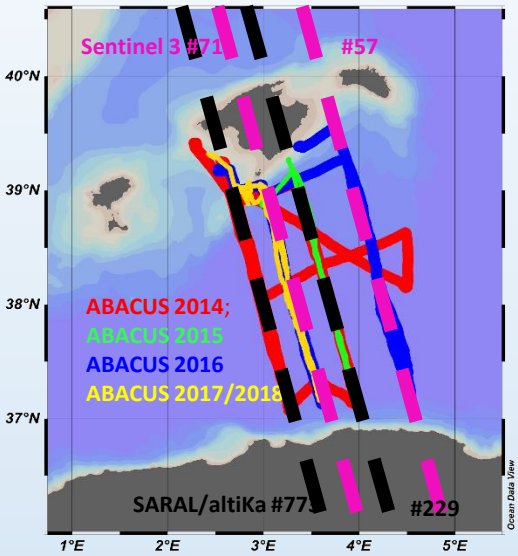
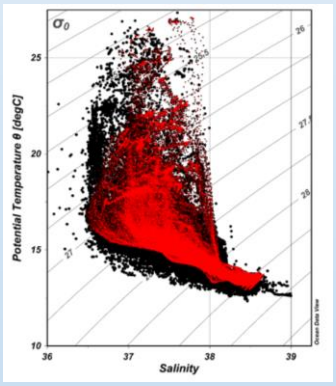
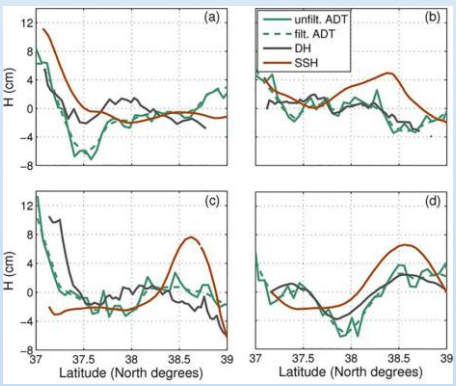
Since 2014 four deep glider missions were conducted in the Western Mediterranean Sea between the Balearic Islands and the Algerian coast in the framework of the "Algerian BAsin Circulation Unmanned Survey -ABACUS". These missions were carried out through the SOCIB external access program, supported by JERICO and JERICONEXT TNA EU funded framework. The main objective of ABACUS was to establish and understand the high-resolution variability of the circulation collecting physical and biological data of the surface and intermediate water masses across one of the key Mediterranean Sea chokepoints. More specifically ABACUS allowed the realization of several repeated and also the investigation of the dynamics of mesoscale eddies, given the joint use of real time satellite data and the adaptive sampling capabilities of gliders. Missions were mainly realized along the groundtrack of SARAL/altiKa and SENTINEL 3 satellites.



Glider physical and biological data have been also compared with historical dataset, remotely sensed data and numerical model output. The high-resolution glider data reveal good correlation with both the altimetry along track data from satellite missions and outputs of several models (Aulicino et al., JMS, 2018). Surface layer data show large amplitudes and gradients, emphasizing the intense dynamic activity in the study area while the variability observed at intermediate depths can contribute in describing any trend in both temperature and salinity of the Mediterranean water masses.

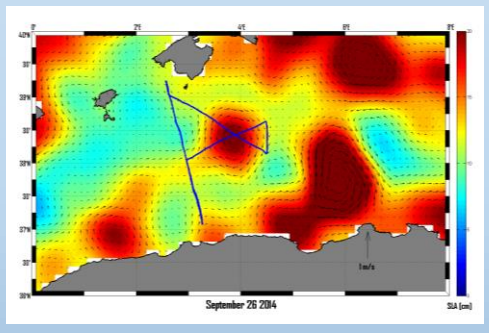


Theta/s diagram including ABACUS (red) and the historical data (black) available over the AB from Medar Medatlas II project, Coriolis CORA-3.4, and WOHP.

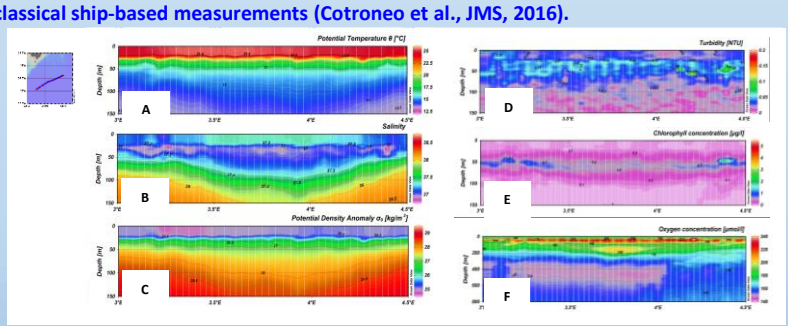


Filtered (dashed green line) and unfiltered (solid green line) ADT from altimetry; dynamic height (gray line) along SARAL/AltiKa groundtracks 773 (upper panels) and 229 (lower panels) associated with the passage of the satellite south of the Balearic islands of (a) 17 September 2014; (b) 26 November 2014; (c) 12 December 2014 and (d) 23 October 2015 computed from the glider data; and SSH (brown line) along the four tracks obtained from the MFS numerical model.

Results from ABACUS showed that in situ glider data can provide useful information on the internal structure, properties and dynamics of mesoscale features like eddies and filaments that can be barely observed by classical ship-based measurements (Cotroneo et al., JMS, 2016).



Sea level anomaly map (color scale) and associated geostrophic velocity anomalies (black arrows) from AVISO data on 26 September 2014. Blue line shows the glider track from15 September to 20 October 2014.



Sections from surface to 150 m depth of potential temperature (a), salinity (b), potential density anomaly (c), turbidity (d), chlorophyll concentration (e) along the SW/NE axis of the eddy. Oxygen concentration (f) is shown for the 0–800 m layer show a clear signature of the eddy structure

CONCLUSION

Basin and mesoscale of the AB can be effectively monitored through high resolution glider missions. A larger number of glider sections across this basin, extending over the four seasons, are needed to understand the intense spatial and temporal variability of the circulation in this region and its impact on the circulation and ecosystem response in the western Mediterranean; the continuation of the Mallorca-Algeria endurance line through the ABACUS 5 missions planned in 2018/2019 will certainly contribute to this aim.

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