PL24B-2668

THE SANTANDER ATLANTIC TIME-SERIES A deep water observatory representative of the Eastern North Atlantic.

***A. Lavín**, R. Somavilla, C. González-Pola, C. Rodríguez, M. Ruiz-Villareal, E. Tel, A. Viloria, D. Cano, E. Marcos, R. Graña, I. Reguera, and L. Ibañez.*

alicia.lavin@ieo.es *(Instituto Español de Oceanografía. Spain).*

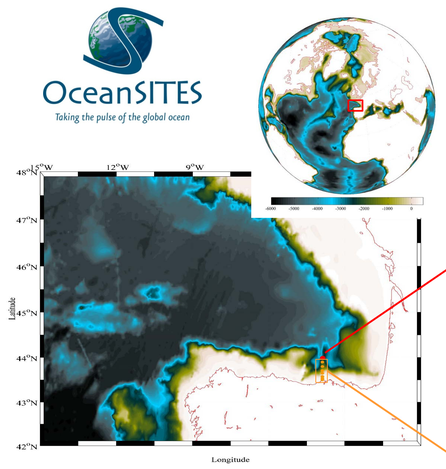
The Santander-Atlantic-Time-Series (SATS)

The SATS including the AGL buoy data and its oceanographic station have provided -for more than 12 years now- repeated high-frequency observations of interlinked meteorological, oceanographic and biogeochemical variables that enable to obtain a comprehensive description of ocean processes from the seafloor to the atmosphere at a site representative of the mid-latitudes of the Eastern North Atlantic.

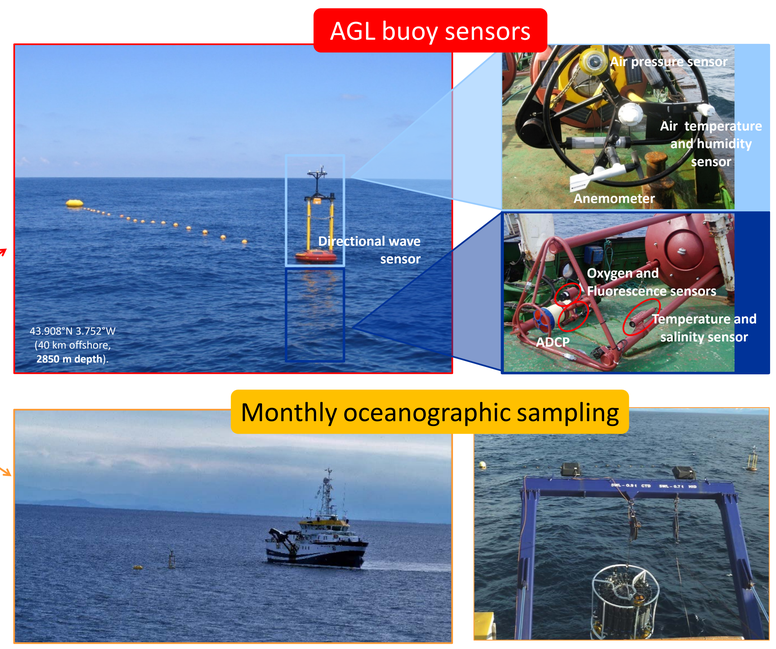
The **Santander standard section** has been running from early 90's as a monthly hydrographical series in six fixed stations covering from coastal to oceanic waters. Near the outer station, 2800m depth, the Augusto Gonzalez de Linares (AGL) ocean-meteorological buoy was deployed in June 2007. For the monthly cruises, the research vessel equipped with a rosette and 911plus SBE CTD takes water samples to analyze various parameters including plankton biomass and dissolved nutrients, allowing check and calibration of buoy sensors.

The **AGL buoy** is equipped with meteorological sensors set up at 3m above sea surface, directional wave sensor in the deck and oceanographic sensors placed at a depth of 3m. Data are transmitted hourly via IRIDIUM to the reception station located at the IEO Santander Center.

The **use of data and collaboration are encouraged** and are **accessible** at **IEO website (www.boya-agl.st.ieo.es)** or on regional alliances as **IBIROOS (www.ibi-roos.eu)**, or international ones as **SeaDatanet** (seadatanet.org), **JCOMMOPS (www.jcommops.org)** or OceanSITES **(www.oceansites.org)**.



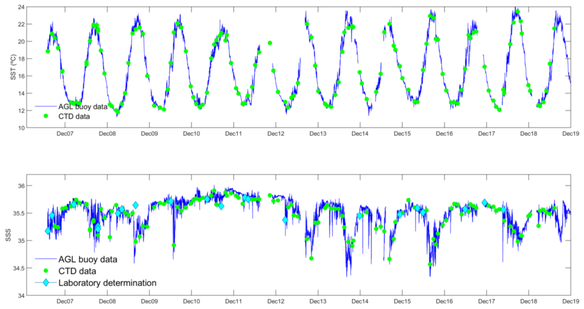
SATS location
representative of the mid-latitudes of the Eastern North Atlantic



High frequency at the air-sea interface

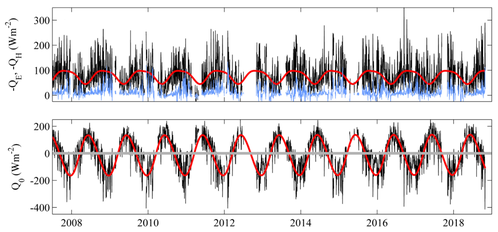
Data in real time are available at the AGL buoy web page. **The monthly visit to SATS oceanographic station enables quality control.**
As products at http://www.boya-agl.st.ieo.es/boya_agl/index.php are available among others:

QC oceanographic and meteorological time-series



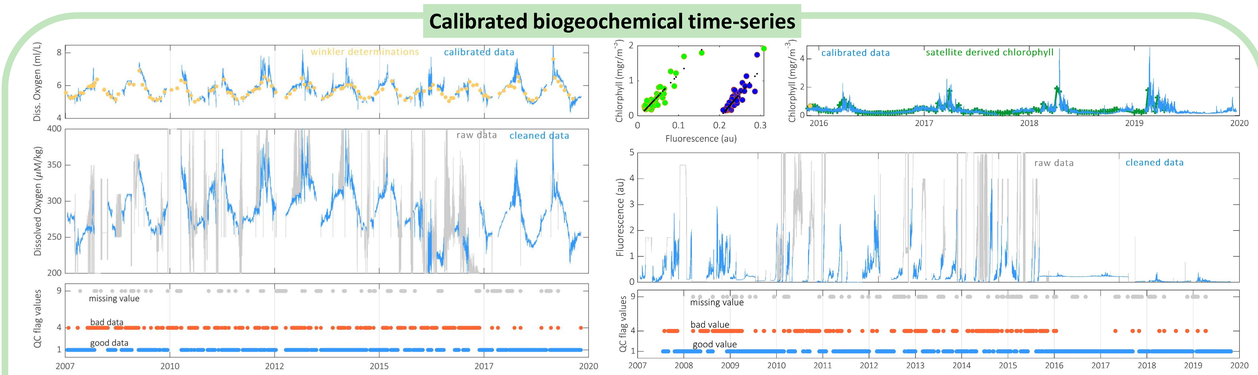
Meteorological and oceanographic sensors show very good performance.

Air-sea heat fluxes



Latent and sensible heat fluxes are calculated using meteorological and oceanographic measurements at the air-sea interface using Fairall algorithm. The installation of short and long wave radiation sensors is planned for the next year.

Calibrated biogeochemical time-series

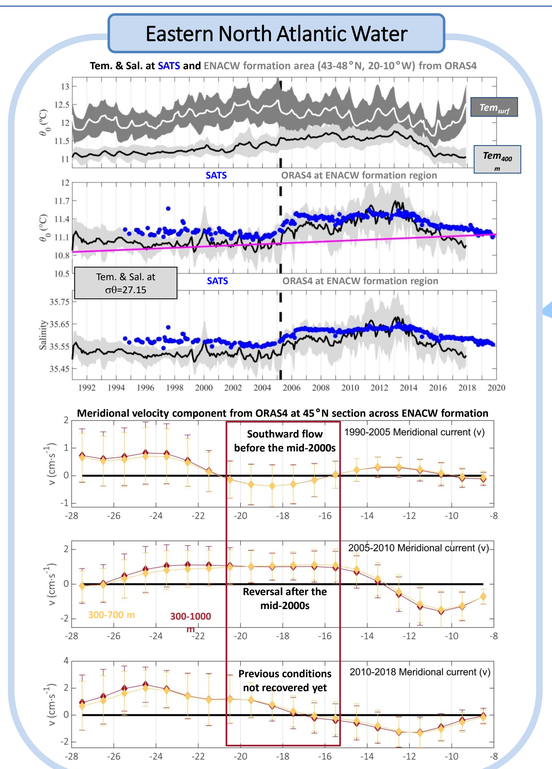


Oxygen and chlorophyll sensors require a careful calibration due to their performance is strongly affected by biofouling. First, time-series must be 'cleaned' and then calibrated against laboratoty determinations. Since 2016 a new chlorophyll sensor with biowiper has been installed and a antifouling cooper tape has been added to the oxygen sensor and their performance have remarkably improved.

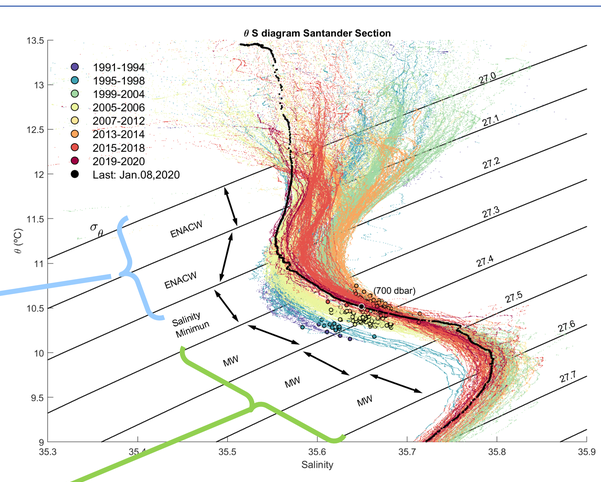
Long-term variability

In the mid-2000s, extraordinary convective mixing events transformed ENA modal waters into a much saltier, warmer, and denser variety, transferring upper ocean heat and salt gained slowly over time to deeper layers. Increasing densities altered the ocean circulation patterns reversing the southward regional flow and enhancing the access of saltier southern waters to higher latitudes. Since the mid-2010s, saltening trends reversed. Annually averaged, the freshening is accompanied by above average temperatures, but persistent cold outbreaks at the end of the winter are enabling to develop very deep winter mixed layers in this new regime too. New ENA modal waters are remarkably fresher. According to ORAS4 meridional velocity data, the previous conditions of southward regional flow of ENACW have not been recovered yet.

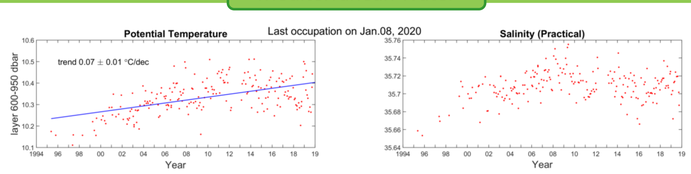
Eastern North Atlantic Water



Updates of Fig. 2 and Fig S3 from Somavilla et al. GRL 2016

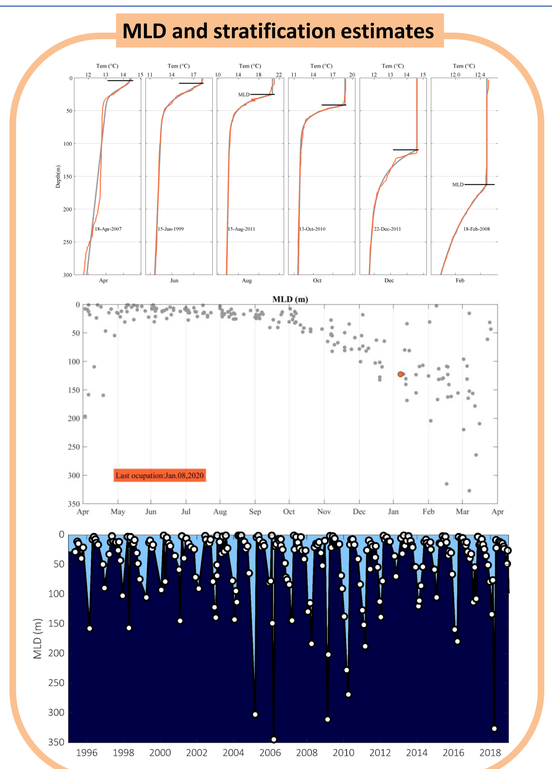


Mediterranean Water



Ocean heat and salt content estimates are also provided as SATS products with a monthly basis

MLD and stratification estimates



Update of Fig. 9 from Somavilla et al. JRG 2017

References

Somavilla, R.; González-Pola, C.; Schauer, U.; Budéus, G. Mid-2000s North Atlantic shift. Heat budget and circulation changes. Geophys. Res. Lett. 2016, 43, 2059–2068.
Somavilla, R.; González-Pola, C.; Fernández-Diaz, J. The warmer the ocean surface, the shallower the mixed layer. How much of this is true? J. Geophys. Res. Oceans 2017, 122, 7698–7716.
Somavilla, R.; Rodriguez, C.; Lavín, A.; Viloria, A.; Marcos, E.; Cano, D. Atmospheric Control of Deep Chlorophyll Maximum Development. *Geosciences* 2019, *9*, 178.
Somavilla, R.; Lavín, A.; Rodriguez, C.; Cano, D. AGL buoy. A high frequency view of processes at the air-sea interface. In Proceedings of the IEEE Oceans 2011-Europe, Santander, Spain, 6–9 June 2011.
Fairall, C.; Bradley, E.; Rogers, D.; Edson, J.; Young, G. Bulk parameterization of air-sea fluxes for tropical ocean global atmosphere coupled ocean atmosphere response experiment. J. Geophys. Res. 1996, 101, 3747–3764.
Balmaseda, M. A., K. Mogensen, and A. T. Weaver (2013), Evaluation of the ECMWF Ocean Reanalysis ORAS4, Q. J. R. Meteorol. Soc.,doi:10.1002/qj.2063.

Acknowledgements

This work has been partly funded by European Union's Interreg Atlantic Area projects MyCoast (EAPA 285/2016, http://mycoast-project.org) and iFADO (EAPA165/2016, http://www.ifado.eu), and by the '*Centro de Investigación del Medio Ambiente*' (CIMA) of the Cantabrian Government.