

New developments on Biscay-AGL Observatory. From derived products to sensor networks.

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Introduction

The Santander standard section has been running from early 90's as a series of monthly hydrographical series under the broader IEO program RADIALES. This program was devised to provide hydrographical and biogeochemical series in marine waters around Spain. The sampling scheme was designed to perform the sampling typically in 1-day journeys assisted by small ships, therefore the main focus was in the continental shelf. However, due to the proximity of the shelf-break in front of the city of Santander (SE Bay of Biscay) it was possible to gather a monthly series of intermediate waters since early 90's in the outer stations. The sampling was limited to 1000 m until late 2007, then it was extended to 1500 and since 2014, after the construction of a larger regional ship, RV Ramón Margalef, that is in charge of the sampling, it covers the full-depth 2400 m.

The Augusto Gonzalez de Linares ocean-meteorological buoy (named after the Santander Oceanographic Center founder in 1886) was set close to Station 7, the first deep water station of the Santander Standard Section. The section covers shelf, slope and deep waters. Both systems form part of the Spanish Institute of Oceanography Observing System (IEOOS) which provides quality controlled data and information about Spanish surrounding waters and comprehends several subsystems.



The combination of the monthly regular sampling and the AGL buoy provides us with a continuous status of the oceanic waters in the region, providing a basis for basic science [1,2]. Moreover, the existence of water samples nearby the buoy allows a monthly check and calibration of the sensors, this is of major importance for the less stable optical sensors as O₂ and chlorophyll-fluorescence. Starting on September 1st, 2014 a number of products from the observatory will be delivered operationally as part of the EU-FP7 FixO³ project.

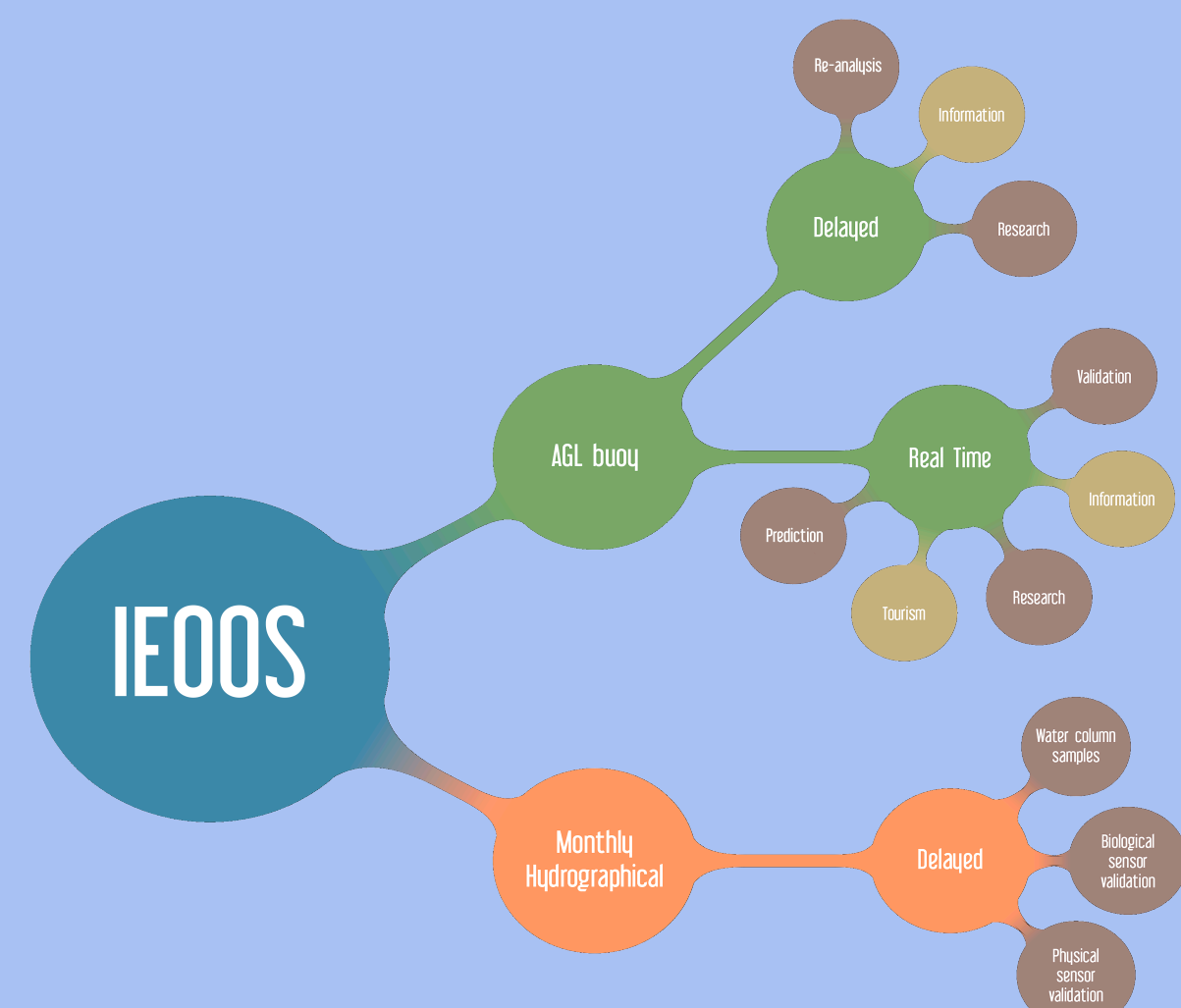
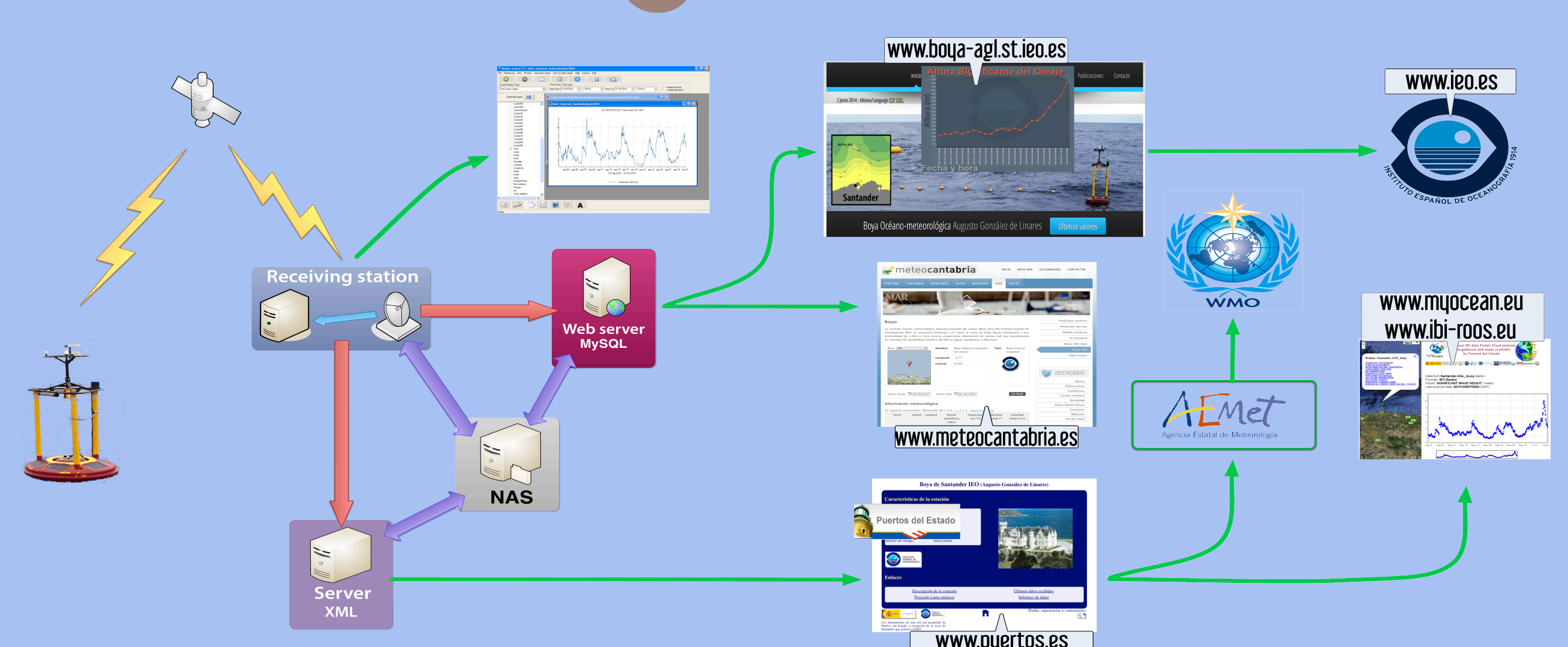
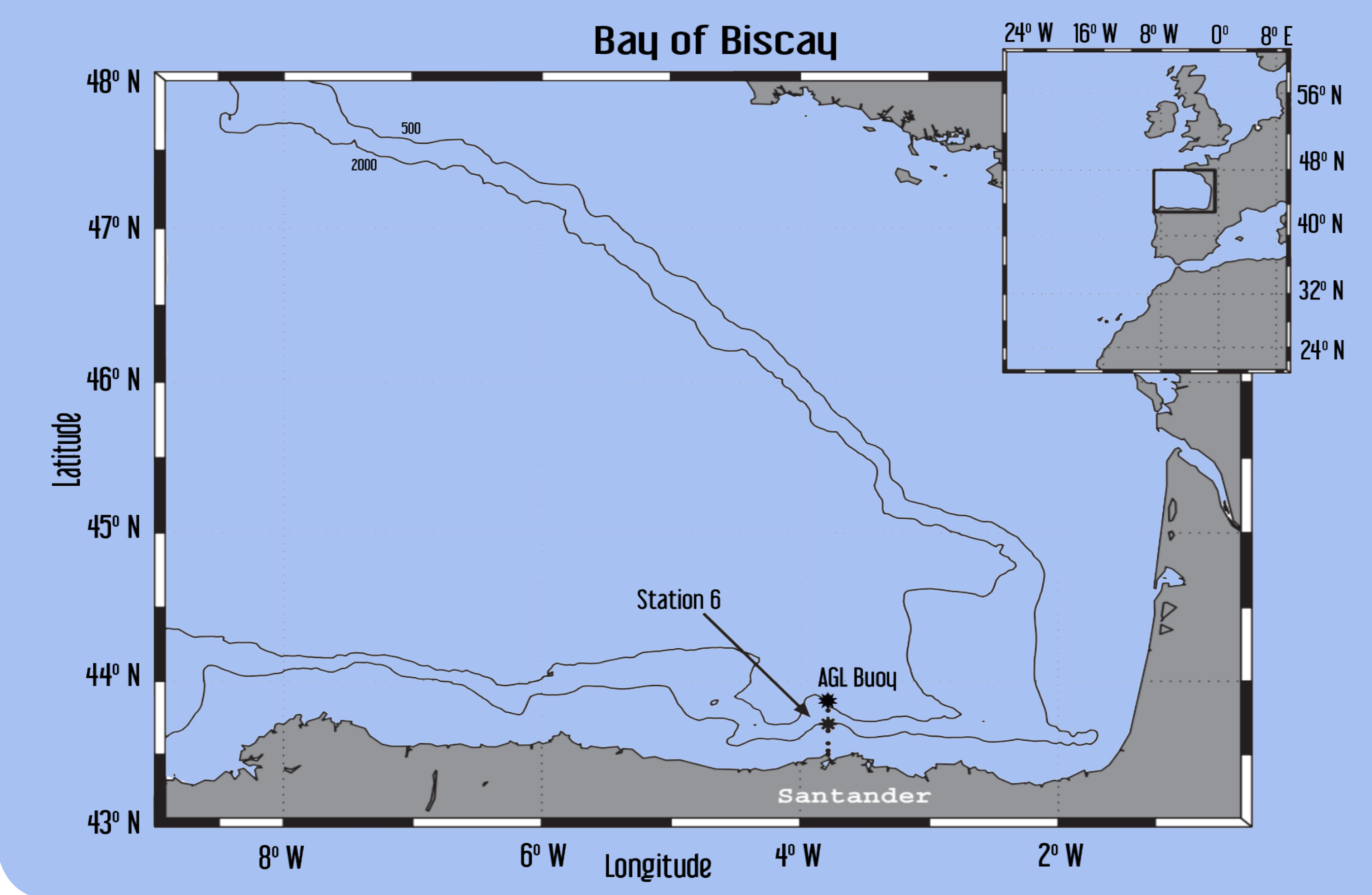


Figure on the left shows different type of data managed by IEO. Data provided by AGL buoy and Santander monthly cruises, both specifying the type of date (real time or delayed) and their most common use.

Figure below, shows the automated process that data from AGL buoy follows, from reception to public display in several web portals of selected institutions

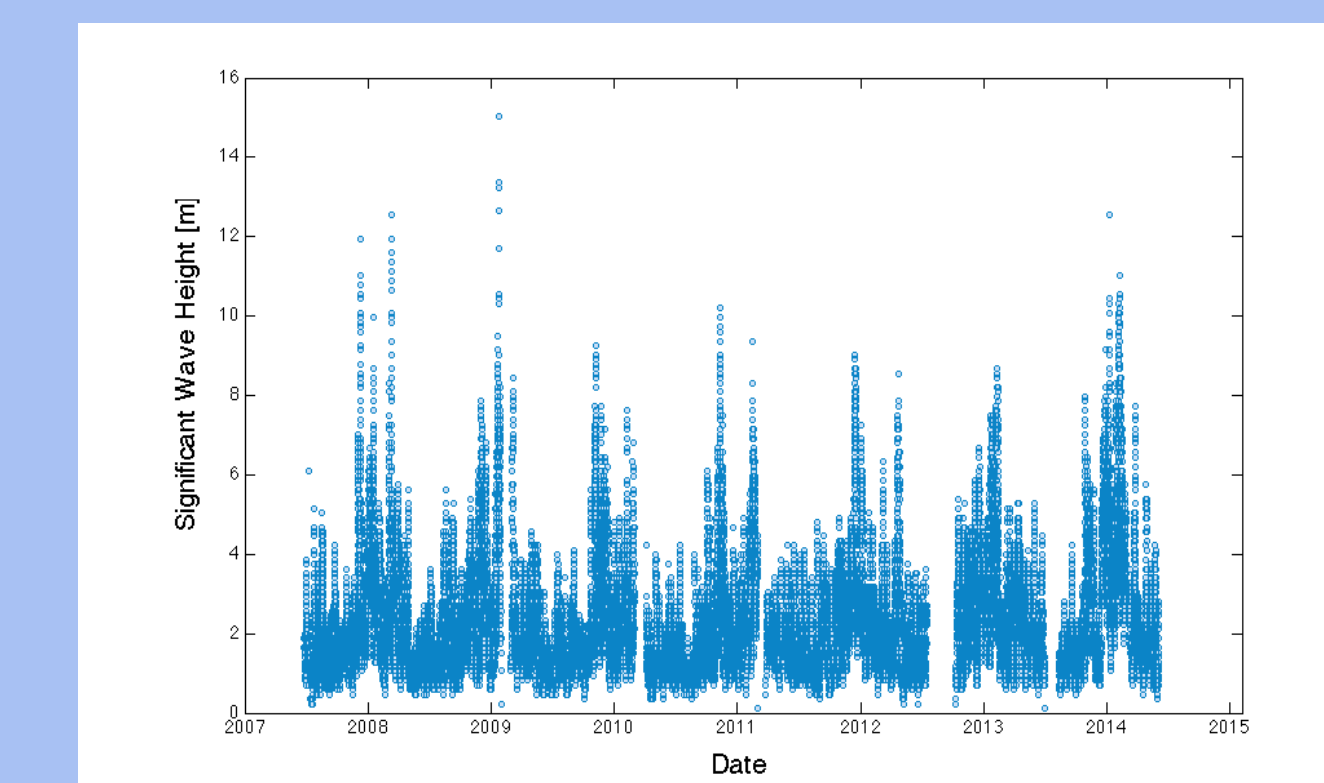


Location

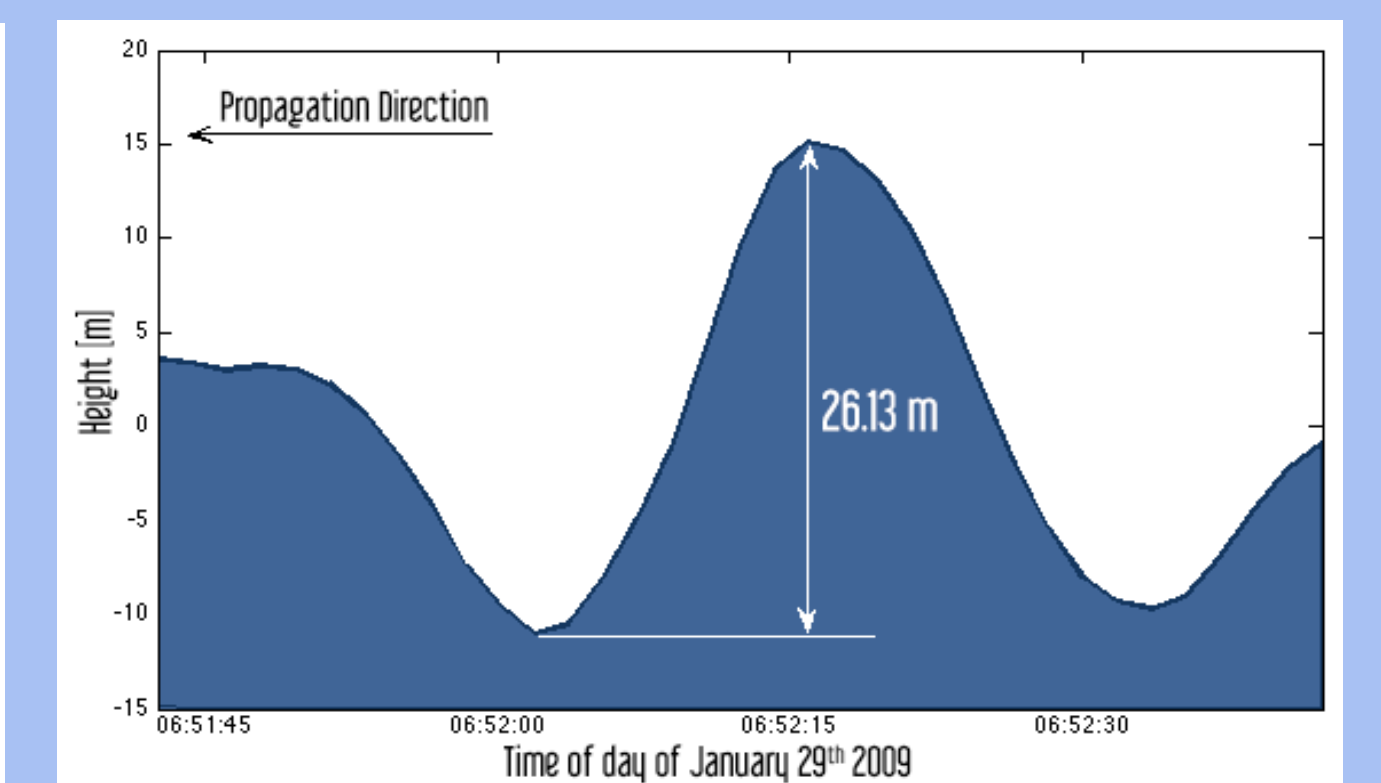


Biscay AGL Buoy Data Series

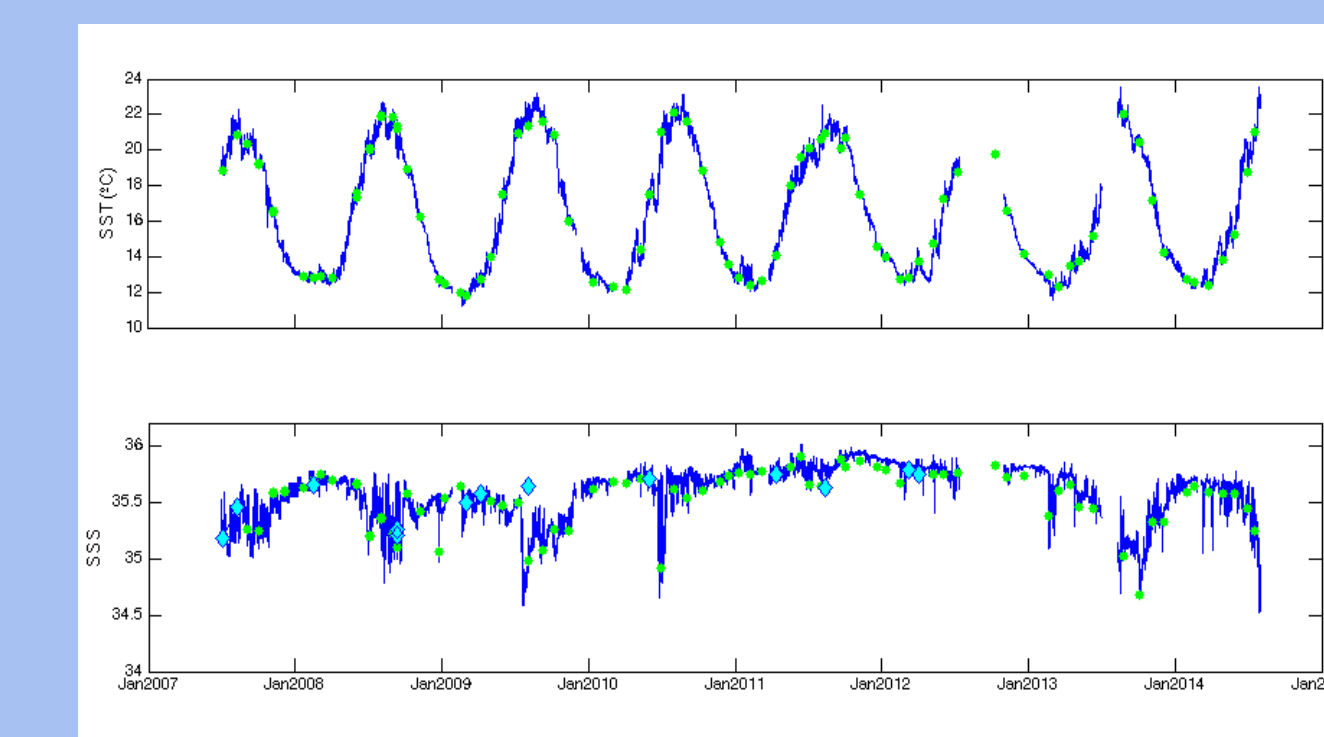
The following figures show some samples of data series obtained from the AGL Buoy [3,4].



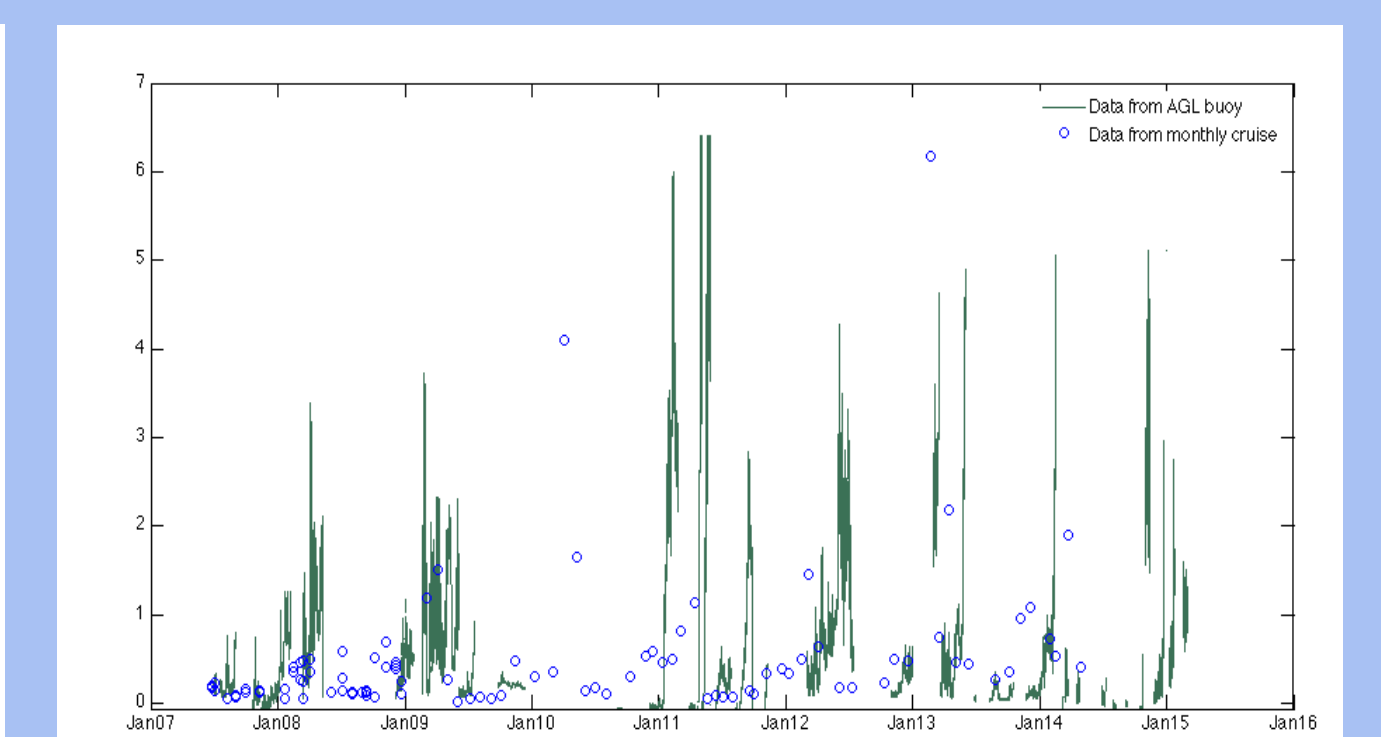
Significant wave height series from mooring to summer 2014



Highest measured wave by AGL buoy on January 29th 2009. It reached 26.13m height.



Sea surface temperature and salinity from mooring to autumn 2014. Dots show crosscheck from monthly cruises.

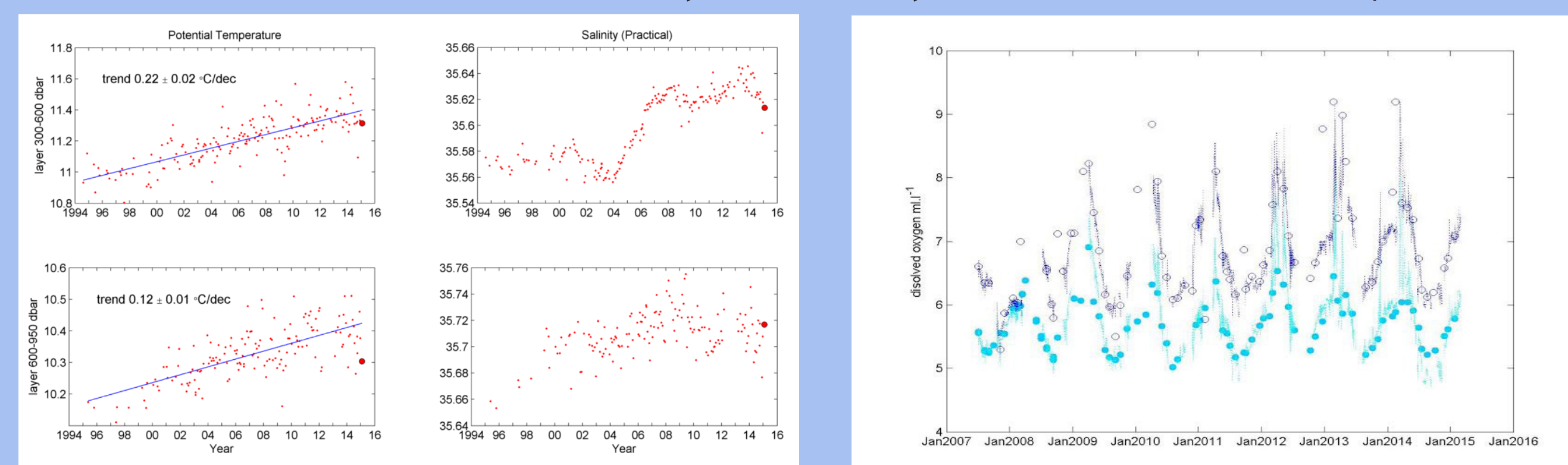


Chlorophyll-a series since 2007. Green line series shows AGL buoy data and blue dots shows data from monthly cruises.

Besides the samples shown here there are also time series for air temperature, humidity, wind speed and direction, currents speed and direction up to 90 m deep, wave mean and peak period, chlorophyll and oxygen.

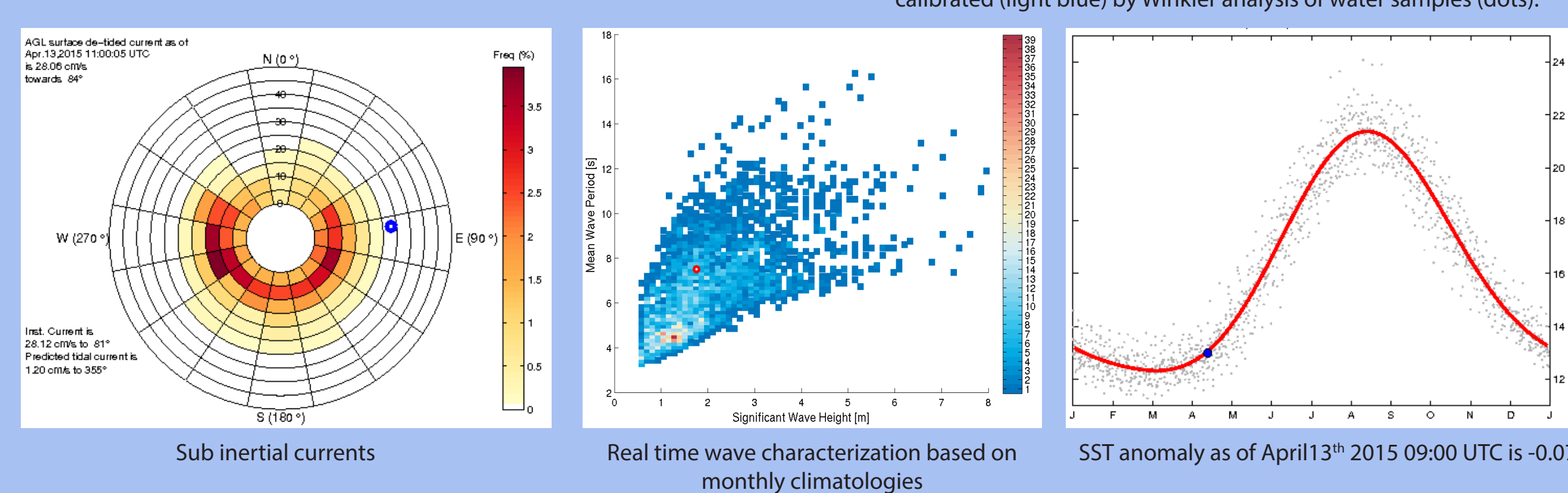
Derived Products

Products are elaborated from data both of the Buoy and the monthly cruise. Below there are some samples



Central waters trends, temperature and salinity. Last sampling March 27th 2015

Dissolved oxygen series from the buoy, both uncalibrated (dark blue) and calibrated (light blue) by Winkler analysis of water samples (dots).



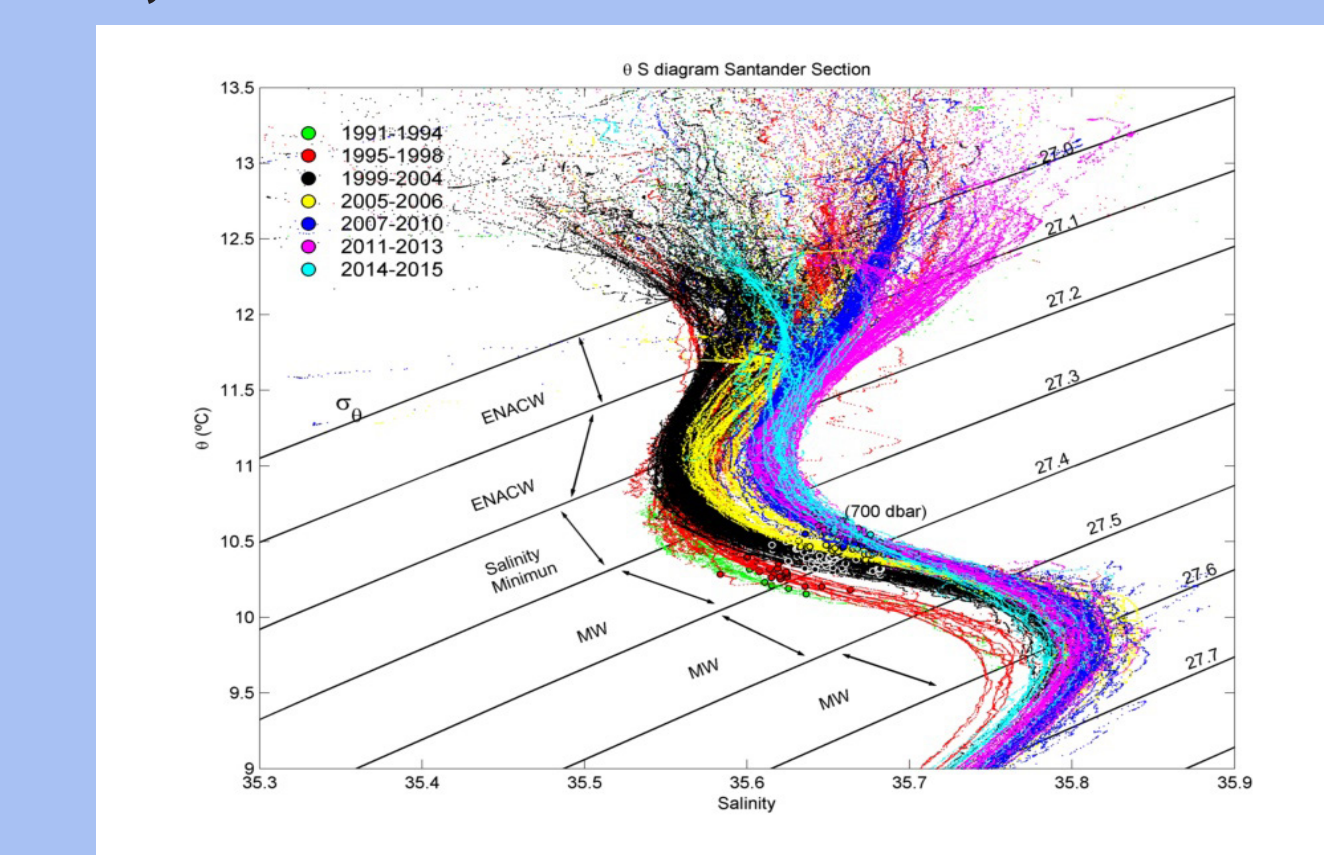
Sub inertial currents

Real time wave characterization based on monthly climatologies

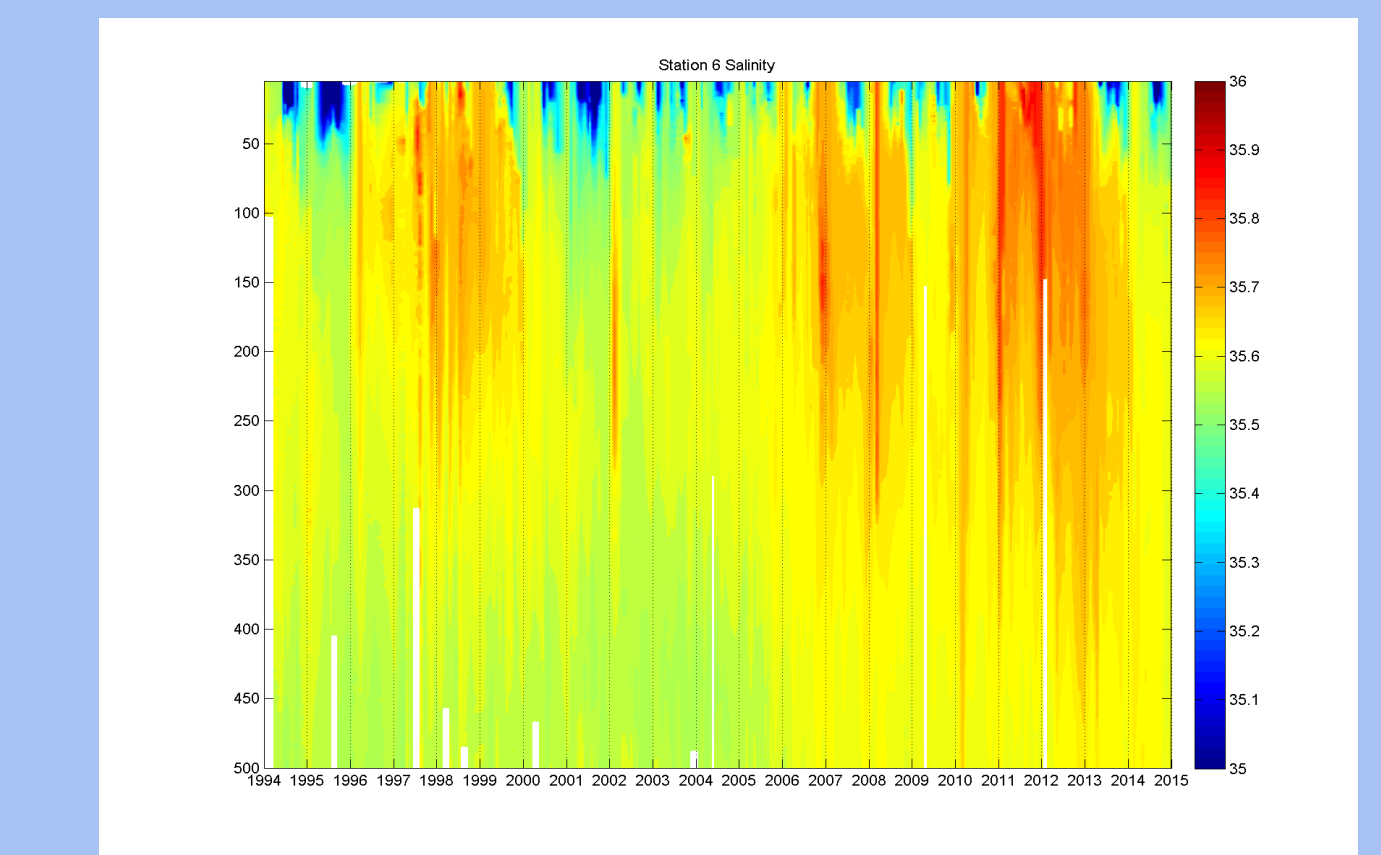
SST anomaly as of April 13th 2015 09:00 UTC is -0.07

Santander Standard Section. Station 6

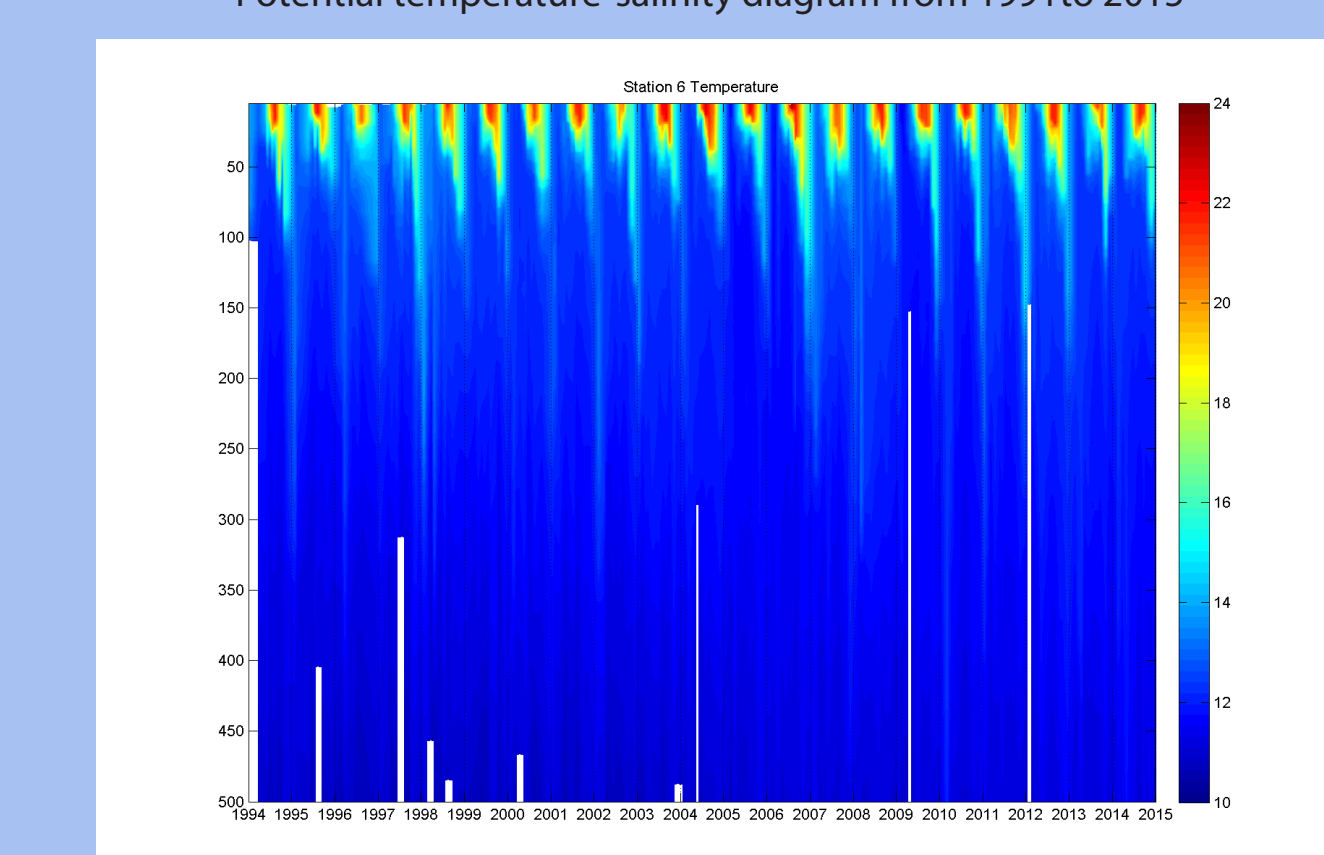
Station 6 is located at 43° 42.5' N, 003 47' W at a depth of 850m, very close to the shelf break and have been monthly sampled since May 1992. It can be considered representative of continental slope conditions in the southern Bay of Biscay



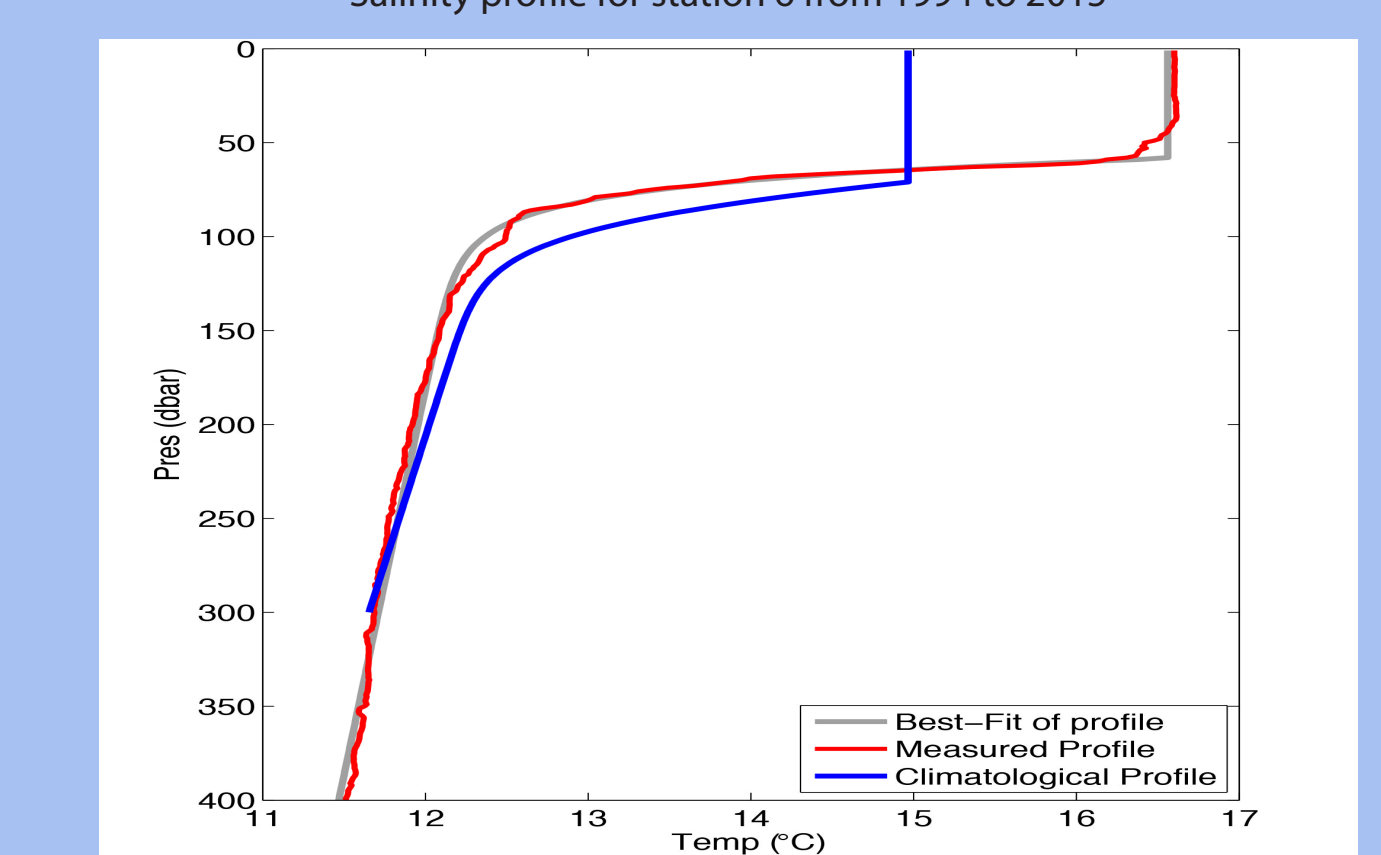
Potential temperature-salinity diagram from 1991 to 2015



Salinity profile for station 6 from 1994 to 2015



Temperature profile for station 6 from 1994 to 2015



Analysis of temperature profile [5] of Nov 27, 2014. Respect to the climatological average profile, Mixed Layer temperature is 1.5°C warmer, Mixed Layer Depth is nearly 15 meters shallower and stratification strength of the seasonal thermocline is more than double (0.11 °C m⁻¹ vs 0.05°C m⁻¹).

Acknowledgements The Biscay AGL buoy and the Santander Standard Section form part of the IEOOS, and are funded by the Spanish Institute of Oceanography and the EU Infrastructure Project FixO3 (Fixed Point Open Ocean Observatories) and the VACLAN/COVACLAN Projects of the Spanish Funding Agency. We want to thank the staff of the Santander, Gijón, A Coruña, IE O Centers and the crew of the IEO Oceanographic vessel Ramón Margalef.

References [1] Somavilla, R., González-Pola, C., Rodríguez, C., Josey, S.A., Sánchez, R.F. and Lavín, A. 2009. Large changes in the hydrographic structure of the Bay of Biscay alter the extreme mixing of winter 2005. *J. Geophys. Res.*, 114, C01001, doi:10.1029/2008JC004974. [2] Somavilla, R., González-Pola, C., Lavín, A. and Rodríguez, C. 2012. Temperature and salinity variability in the south-eastern corner of the Bay of Biscay (NE Atlantic). *Journal of Marine Systems*, doi: 10.1016/j.jmarsys.2012.02.010 [3] Oceanic-meteorological conditions observed during severe storms in the southern Bay of Biscay. Cano, D.; Artech, J.L.; Lavín, A.; Rodríguez, C.; Somavilla, R.; García, M.J., doi: 10.1109/Oceans-Spain.2011.6003466 [4] The Spanish Institute of Oceanography (IEO) Coastal Observing System at the southern Bay of Biscay, new real-time development: The ocean-meteorological AGL Buoy. Lavín, A.; Somavilla, R.; Artech, J.L.; Rodríguez, C.; Cano, D.; Ruiz-Villareal, M. [5] Gonzalez-Pola, C., Fernandez-Diaz, J. M., Lavín, A., 2007. Vertical structure of the upper ocean from profiles fitted to physically consistent functional forms. *Deep-Sea Res.* 154 (11), 1985-2004. doi:10.1016/j.dsr.2007.08.007



IMDIS 2016
Gdansk 11-13 October

