

Studying physical processes in the Southwestern Atlantic to understand BIOlogical productivity & regional ecosystems (SABIO)

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Objectives & Motivation

The main objective of the **SABIO** project is to improve our understanding of the physical processes in the Southwestern Atlantic that impact the biological productivity and the regional ecosystems by using satellite altimetry, in-situ and model output data.

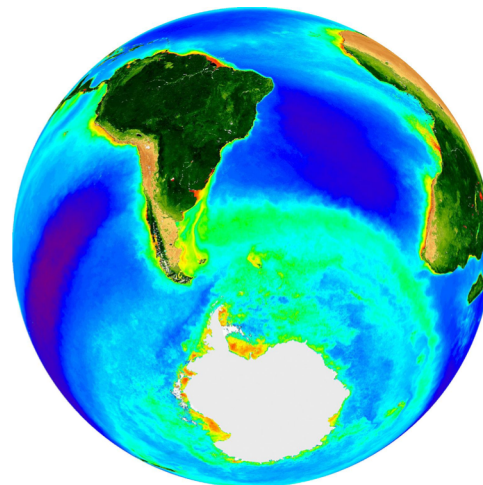
The objective is motivated by the following questions:

- (Q1) What are the main physical drivers of the large biological activity observed over the Patagonian shelf and slope?
 (Q2) Does the Malvinas Current (MC) acts more as a blender or as a barrier between open ocean and shelf waters?
 (Q3) How are structured the different trophic levels (phytoplankton, intermediate trophic levels, elephant seal prey) within the water column according to the oceanographic conditions associated with the foraging habitat (Patagonian shelf, Patagonian upper slope, and oceanic water beyond the MC) targeted by southern elephant seals?

The data necessary to answer these questions are obtained through two on-going field experiments (see below).

Taking advantage of the in-situ dataset that are being collected, the project also proposes to answer the following two questions that are complementary to the main objective indicated above:

- (Q4) What is the contribution of the steric height effect to sea level variability in the Southwestern Atlantic at intra-seasonal scales?
 (Q5) What are the state-space topologies of the dynamical systems that characterize the Southwestern Atlantic?



Project Execution: 2021 field activities

The first experiment collects in-situ physical data (temperature, pressure, salinity, currents) thanks to four fixed moorings that have been deployed in the Patagonian shelf in September 2021.

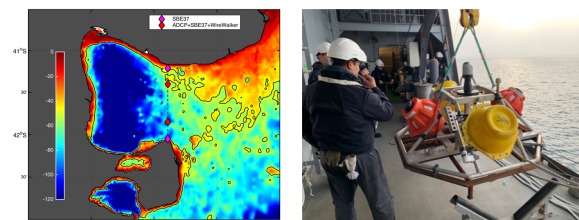


Figure 1: left: positions where instruments have been planned to be deployed. So far, the three northernmost moorings have been deployed. Right: Mooring M2 ready to be deployed.

The second experiment is measuring physical variables (temperature, pressure, salinity, wind) and biological variables (light and acceleration that are used as a proxy of phytoplankton and prey catch attempt rates) at the same time through eleven elephant seals that have been instrumented in Peninsula Valdez (Argentina) in October 2021 and are sampling the Southwestern Atlantic.



Figure 2: Left: Female equipped in October 2021 with a CTD-Oxygen oceanographic tag designed by the Sea Mammal Research Unit as part of the H2020 Nautilus project. Right: Elephant seal male equipped in October 2021 by a CTD-GPS Oceanographic tag.

Results

Contribution of steric effect to sea level anomaly Ruiz Etcheverry et al, FORUM Session Science III, Mesoscale and sub-mesoscale oceanography

One of the specific objectives of SABIO project is to analyze the contribution of the density change, known as steric effect, in the sea level anomaly using in situ data collected from elephant seals. This peculiar dataset allows us to study short spatial scales

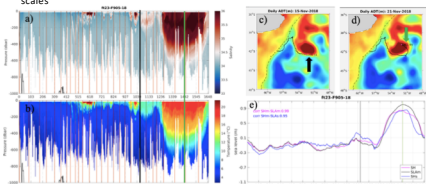
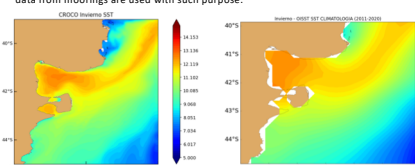


Fig. 5: Vertical sections of a) salinity and b) temperature along the trajectory of the ES F905. The dark-orange vertical line indicates the beginning of the day. c) and d) are two stages of satellite SLA superimposed with the portion of the trajectory used by the ES F905. The black and green arrows match with the black and green lines in panels a) and b). e) model SRI (orange line), satellite SLA and model SLA along the ES F905 trajectory. X axis represents the distance of the trajectory of the ES from the isobath 200 meters.

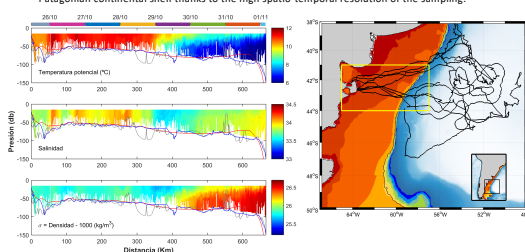
Heat and salt exchange at the San Matías gulf, Aubone et al, TALK 2 of Nov 14:15 @ Sala grande

One of the specific objectives of SABIO project is to analyze the contribution of the heat and salt fluxes across the mouth of the San Matías gulf. A numerical model and data from moorings are used with such purpose.



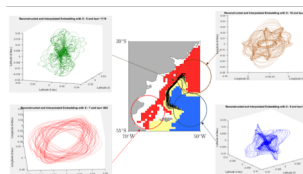
Analysis of hydrographic data collected by Southern Elephant Seals in the Argentine Continental Shelf, Martinez et al, POSTER COA2022_015, 3 of Nov 14:00 to 14:45 @ Mezzanine

In situ data obtained from CTD sensors installed in 6 elephant seals (Mirounga Leonina) that crossed the Argentine Continental Shelf between October 17 and 31, 2019 are analyzed. Overall, the dataset collected by the elephant seals allows a unique characterization of the highly dynamic and complex Patagonian continental shelf thanks to the high spatio-temporal resolution of the sampling.

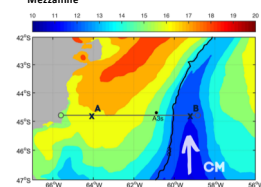


Topological analysis of oceanographic time series, Sciamarella et al, POSTER SC32022_024, 1 of Nov 14:00 to 15:45 @ Mezzanine

Three-dimensional embeddings obtained for drifters with a path in the different Lagrangian provinces. The next steps in this research line include (1) working with the velocity time series of the same dataset, (2) using the eigenvalue pairs of the SSA analysis to construct multivariable embeddings, (3) working with virtual particles to construct a topological grid, (4) computing topological paths coinciding with those of the elephant seals, to throw light on the ocean dynamics of the region they are visiting.



Variability of Continental Shelf Currents in Southern Patagonia from In-situ, Satellite and Reanalysis Timeseries, Lago et al, POSTER COA2022_008, 3 of Nov 14:00 to 14:45 @ Mezzanine



The seasonal cycle is modulated by the presence of the Malvinas Current through the thermoclinic effect. In summer, the water of the continental shelf is warmer, and a zonal SST gradient develops between the relative warm continental shelf water and the relative cold Malvinas Current, entraining a geostrophic response in the meridional circulation of the outer shelf.

The intra-seasonal SLA signal is characterized by fast-propagating waves that originate in the Chile continental shelf, enter the southern tip of the Patagonia continental shelf and propagate northward in less than 4 days. Current satellite altimetry products are not able to detect these fast waves observed in the SLA fields. MEKATON DORIS reanalysis can reproduce them better with limitations for periods of less than 5 days.

Acknowledgements

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