Southwestern Atlantic currents from in-situ and satellite altimetry data

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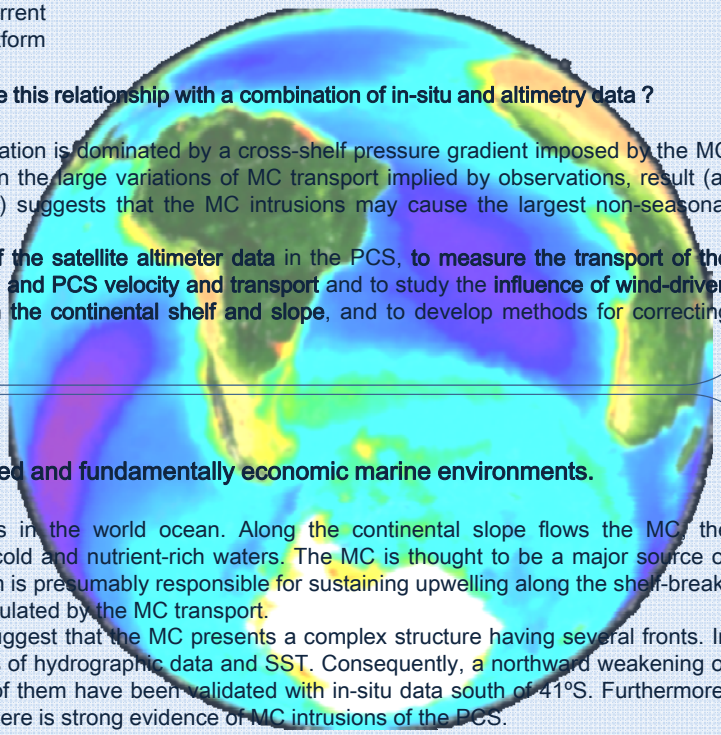
Three main objectives to improve our understanding about :

- the circulation on the Patagonian continental shelf (PCS) using satellite altimetry data combined with in-situ data
- the dynamics of the Malvinas Current (MC), a mayor western boundary current
- the interactions between the MC and the circulation on the continental platform



Is the Malvinas Current the main driver of shelf transport and can we evaluate this relationship with a combination of in-situ and altimetry data ?

Objectives are motivated by recent studies that indicated that (a) shelf circulation is dominated by a cross-shelf pressure gradient imposed by the MC and (b) evidences of intrusions of the MC into the PCS around 41ºS. Given the large variations of MC transport implied by observations, result (a) suggests that similarly large variations may occur over the shelf, while (b) suggests that the MC intrusions may cause the largest non-seasonal temperature and chlorophyll-a variability observed over the shelf.

As anticipated results, the general objectives are : to assess the **validity of the satellite altimeter data** in the PCS, **to measure the transport of the Malvinas Current** at different latitudes, to explore the **co-variability of the MC and PCS velocity and transport** and to study the **influence of wind-driven currents and coastal trapped waves** on sea level and **current variability on the continental shelf and slope**, and to develop methods for correcting satellite altimetry data for their effects.

Motivation and challenges

Patagonia Continental Shelf and Malvinas Current: two climate-related and fundamentally economic marine environments.

The Southwestern Atlantic continental shelf is one of the richest areas in the world ocean. Along the continental slope flows the MC, the northernmost extension of the Antarctic Circumpolar Current that carries cold and nutrient-rich waters. The MC is thought to be a major source of nutrients to the SW South Atlantic and its interaction with the sloping bottom is presumably responsible for sustaining upwelling along the shelf-break. Numerical and analytical models indicate that the upwelling intensity is modulated by the MC transport.

Little is known about the MC further upstream and several observations suggest that the MC presents a complex structure having several fronts. In addition, a recirculation of the MC has been hypothetized from the analysis of hydrographic data and SST. Consequently, a northward weakening of the MC is predicted. Despite the importance of these observations, none of them have been validated with in-situ data south of 41ºS. Furthermore, recent studies addressed that the MC modulates the shelf circulation and there is strong evidence of MC intrusions of the PCS.

In this context, this project aims to provide **new data to allow accurate CAL/VAL exercises for the variety of altimetry data**. Furthermore, data analysis will improve understanding on the **dynamics of both regions**. It is expected that analysis will have an important socio-economical impact considering PCS and adjacent shelf-break as one of the most productive areas of the World Ocean.

Methodology

To accomplish the objectives listed above a substantial array of instruments to measure conductivity, temperature, pressure and currents will be deployed for one year along **Jason track #26** in 2014. Instruments will be recovered, re-calibrated on-board and re-deployed along a **zonal section at 44.7°S** (Fig. 1). Jason track #26 has been chosen to deploy instruments because it is approximately **perpendicular to the MC flow** and thus a direct comparison between velocities estimated from in-situ and satellite data can be achieved. We selected the 44.7°S latitude to investigate the MC flow away from the **influence of the Confluence region**. This region has been sampled previously with hydrographic sections and will be reoccupied in the future. Thus, the section proposed will contribute to a multi-disciplinary analysis and to quantify interannual variability.

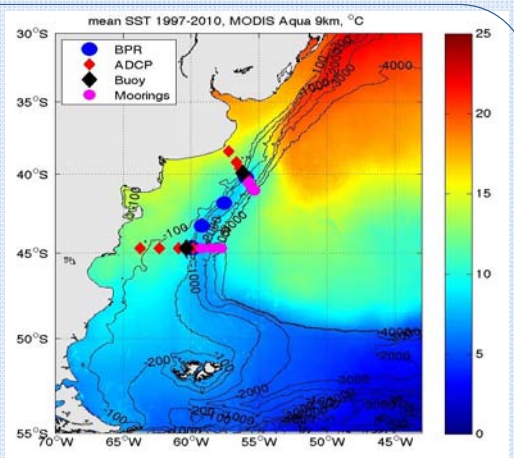


Fig. 1 : Jason track #26 and zonal section at 44.7°S

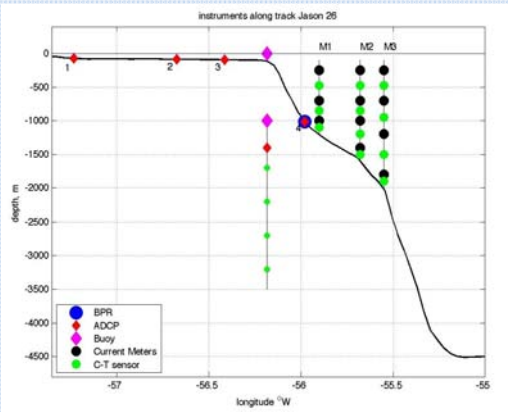


Fig. 2 : Intruments along Jason track #26

We propose to deploy (Fig. 2) 3 shallow water ADCPs, 1 oceanographic buoy fully equipped (wind speed and direction, relativehumidity, sea level pressure, air temperature sensor), 1 long-range ADCP over the shelf-break and three tall moorings with current meters over the shelf-break.

The long-range ADCP and the three moorings with **current meters** will monitor the MC. Each mooring will also be equipped with **C-T sensors** in-between the current 12 moorings and at the bottom to monitor heat and salinity across the MC. The C-T sensors will also be used to compute baroclinic shear and relative geostrophic variations between moorings. Also, 4 **Bottom Pressure Recorder** (BPR) will be deployed to try to explain the association between the sustained primary production and the Patagonian continental considering the hypothesis : an along-shore pressure gradient or a coastal trapped waves.

Perspectives

Our long-term goal is to test the following hypothesis :

- The magnitude of the along-shelf transport of the middle and outer continental shelf circulation is mainly driven by the strength of the MC transport
- It is possible to monitor the transport of the PCS and MC by combining in-situ and satellite altimetry data

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