Conference Title:

Fronts and retroflections in the Atlantic Ocean

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Abstract:

The intensity of the returning limb of the global overturning circulation (GOC) is critically set by the dynamics of a limited number of regions in the Atlantic Ocean. These are the input of surface freshwater to the Labrador Sea and salty Mediterranean water, as well as four major current diversions in western boundary currents: the retroflection of the Aghulas Current, the Brazil-Malvinas Confluence, the equatorial zonal retroflections, and the splitting of the Gulf Stream into the Azores and North Atlantic Currents.

In this conference we will focus on the retroflections of the western boundary currents in the South and Atlantic Ocean: the Brazil-Malvinas Confluence and the system of equatorial zonal jets. A retroflection is a sudden diversion of a boundary current at some critical latitude, either caused by a change in the force balance, the encountering of different water masses, or some continental geomorphological feature.

The Brazil-Malvinas Confluence represents the encountering of two very distinct water masses: the cold, fresh and nutrient-rich waters of Antarctic origin collide with the warm, salty and nutrient-poor subtropical waters, both with speeds in excess of 1 m s^{-1}. The outcome of the collision is local exchange in the form of lateral intrusions and detached eddies, leading to high primary production, and the creation of a major region of water recirculation and air-sea heat exchange to the east of the confluence region.

The system of equatorial zonal jets includes two very different retroflections: those occurring within 2-3º of latitude from the Equator, caused by a local vanishing of the Coriolis force, and a seasonal retroflection taking place at a latitude of 7-8ºN, induced by the wind field in the tropical ocean. The former are the Equatorial Undercurrent and its northern and southern branches, the later is the North Equatorial Counter Current (Rosell-Fieschi et al., 2015). These jets are interconnected by meridional recirculations, creating a relatively homogenous tropical water mass, with its origin being the South Atlantic subtropical gyre (Castellanos et al., 2015). The northern limit of this region is the Cape

Simple mass conservation arguments indicate that the intensity of the returning limb of the GOC is connected to the rate of formation of deep waters, implying fundamental large-scale teleconnections in the state of the Earth system. A possible corollary of this conference is that the only possible way for an improved understanding of the Earth system is via the study of these local processes but keeping in mind their global implications, searching for the predominant teleconnections that make possible their ensemble response.

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Verde frontal system, separating these relatively nutrient-rich waters from nutrient-poor waters formed in the central region of the Norh Atlantic subtropical gyre (Peña-Izquierdo et al., 2015).