PROPOSAL ABSTRACT:

Name of Principal Investigator:	**Maria Andrea Piñones Valenzuela**
Proposal Title:	Exploring the spatial and temporal extension of modified Circumpolar Deep Water Intrusions into a coastal Antarctic embayment: a combination of ocean modeling and observations

Describe the main issues to be addressed: goals, methodology and expected results. **The maximum length for this section is 1 page** (Must use letter size, Verdana size 10 or similar).

This proposal aims to study the extension, variability and influence of modified Circumpolar Deep Water (mCDW) into a coastal embayment of Antarctica. The study proposes the use of a high-resolution coupled ocean-sea ice-glacier model to determine the main local mechanisms that force the intrusions to the innershelf of Fildes Bay. The results obtained within this project will help to understand the bottom up controls of the local distribution of nutrients and primary producers with implications for the distribution of the upper trophic predators.

The dominant circulation feature around the Southern Ocean is the eastward flowing Antarctic Circumpolar Current (ACC) that transports Circumpolar Deep Water (CDW) a relatively warm, dense, nutrient rich water mass that is believed to participate and contribute to the heat and nutrient budgets of the Antarctic continental shelf. When ACC impinges the continental shelfbreak and interacts with the bathymetry, CDW intrusions bring oceanic water onto the shelf. The advection of CDW not only brings nutrients and heat to the continental shelf but also transports krill larvae from upstream regions, advection and the subsequent retention along the shelf facilitates the growth of the local populations of Antarctic krill and therefore the maintenance of highly productive biological hot spots areas. There is a strong coupling between biological and physical processes participating in the formation of the hot spots, however the dominant drivers seem to be correlated to local physical forcings in coastal embayments and the innershelf regions (Bernard et al., 2017). Accordingly, the main objective of this research is to determine the main circulation drivers responsible for the extension and frequency of intrusions of modified Circumpolar Deep Water into Fildes Bay. To that end, the project will include three inherently related specific goals: 1. To determine the frequency and extension of intrusions from Bransfield Strait into Fildes Bay; 2. To determine residence times and flux of tracers in Fildes Bay; 3. To measure currents and to determine local physical forcings of the circulation in Fildes bay entrance. In order to understand the main circulation mechanisms in Fildes Bay (i.e. main objective) this study proposes to develop a high-resolution coupled ocean circulation-sea ice-glacier model, an implementation of the Regional Ocean Modeling System (ROMS) for Fildes Bay.

To accomplish specific goals 1 and 2 a set of tasks and simulations will be done, that include the analysis of simulations already obtained with a high-resolution (1.5 km) regional circulation model that shows advection of a passive tracer along the ACC pathway in the study region. These simulations will identify the spatial extension of mCDW intrusions in the Bransfield Strait near Fildes Bay entrance, which will be used as a starting point to set up simulations with the high-resolution model implemented for Fildes Bay. In order to determine the extension and frequency of intrusions into the bay, simulations using a passive tracer will be done. The tracer will be released in the regions previously described. To accomplish objective 2 a set of Lagrangian particle experiments will be performed to determine residence and flushing times of the bay under different physical (wind, tides and freshwater inputs) forcings. Time series of a dye flux (dye units Sv^{-1}) will be compared to simulated heat flux and wind stress in order to determine the input of heat to the bay by the mCDW intrusions and the role of local wind forcing. A comparison and analysis of model outputs and underway current observations will be done to accomplish objective 3. Identifying the main physical mechanisms that control the extension and frequency of intrusions of mCDW proposed in this study is crucial to understand bottom up controls of the Antarctic marine food web.