Report - On the pathway and modification of the northwestern Weddell Sea shelf water on its way to the Bransfield Strait

The waters filling the deep basin of the Bransfield Strait can be used as a proxy for understanding changes in the Weddell Sea dense shelf waters, a precursor of the Antarctic Bottom Water. There are, however, still many uncertainties on the pathway, variability and modification of the shelf waters from the Weddell Sea to the deep Bransfield Strait. Water mass properties on the Antarctic continental shelf and slope are poorly observed because ocean sampling can be logistically challenging in these areas. I intended to characterize the circulation and biological signature of the shelf waters at the northwestern Weddell Sea as they enter the Bransfield Strait. To achieve such extensive sampling, we intend to use an ocean glider, which allow data acquisition under rough conditions and with higher spatial resolution than traditional methods (Schofield et al. 2013). We deployed the glider from the Brazilian navy ship Almirante Maximiano during the oceanographic cruise OPERANTAR XXXVII, in January 2019. We intended to deploy the glider at the start of the cruise and sample continuously along a ~75 km transect at the shelf break of Bransfield's Strait deep basins, at the vicinity of Joinville Island (Fig.1), for a month.

The Brazilian navy ship Almirante Maximiano left the Punta Arenas port on the 3rd of January, returning to the same port on the 12th of February after spending 5 weeks in the Bransfield Strait. We first deployed the glider on the 7th of January at WP1 (Figs. 1 and 2), and we intended to collect data for the longest period possible, while the ship would be simultaneously doing CTD sections and collecting biological and chemical samples to complement the glider measurements. Unfortunately, however, the equipment revealed a communication problem just after deployment, likely associated with a malfunctioning antenna connector (Fig. 3). The equipment was brought back onboard and maintenance procedures were performed in the attempt to put the equipment back into working conditions. After the maintenance, the glider was deployed again at the same waypoint WP1 (15th of January). As the equipment worked properly in the initial hours, the ship left the deployment area and started the CTD stations along the glider transect. The glider sampled the water column for roughly 24h, after which it started to present the same communication problems. After two deployment attempts the mission had to be cancelled and the equipment recovered as it would be lost otherwise.

The 24h hours of collected data allowed sampling of 16 profiles (8 dives, Fig. 4) of physical and biological properties of the water column (the raw data can be seen in the following link of Bransfield mission: http://www.ueaglider.uea.ac.uk/DIVES/index.php). The amount of data collected is, unfortunately, not enough to achieve the goals set in the proposal. Despite such a short deployment, the data collected reveals itself as being incredibly interesting and encouraging for future deployments. As the glider moved eastward along the Bransfield Strait northern shelf break, the thermocline deepens (Fig. 5), and the fluorescence maximum increases. The fluorescence maximum (~140), which was a subsurface feature (~20 m) at the beginning of the deployment, develops into a surface maximum, with values above 160 at the surface and values around 100 as

deep as 180 m. This increase in fluorescence could be associated with the eastward drift of the glider and spatial changes in water masses. However, hydrographic stations that were simultaneously being sampled by the ship at the centre of the Brasifield Strait showed similar increase in fluorescence and a change in phytoplankton community. This spatial consistency suggests that the glider was actually sampling the evolution of a phytoplankton bloom. A longer glider deployment, in which the glider would cross the Strait as planned, would have provided the spatial and temperoal data coverage to evaluate the evolution of the physical environmental associated with the phytoplankton bloom.

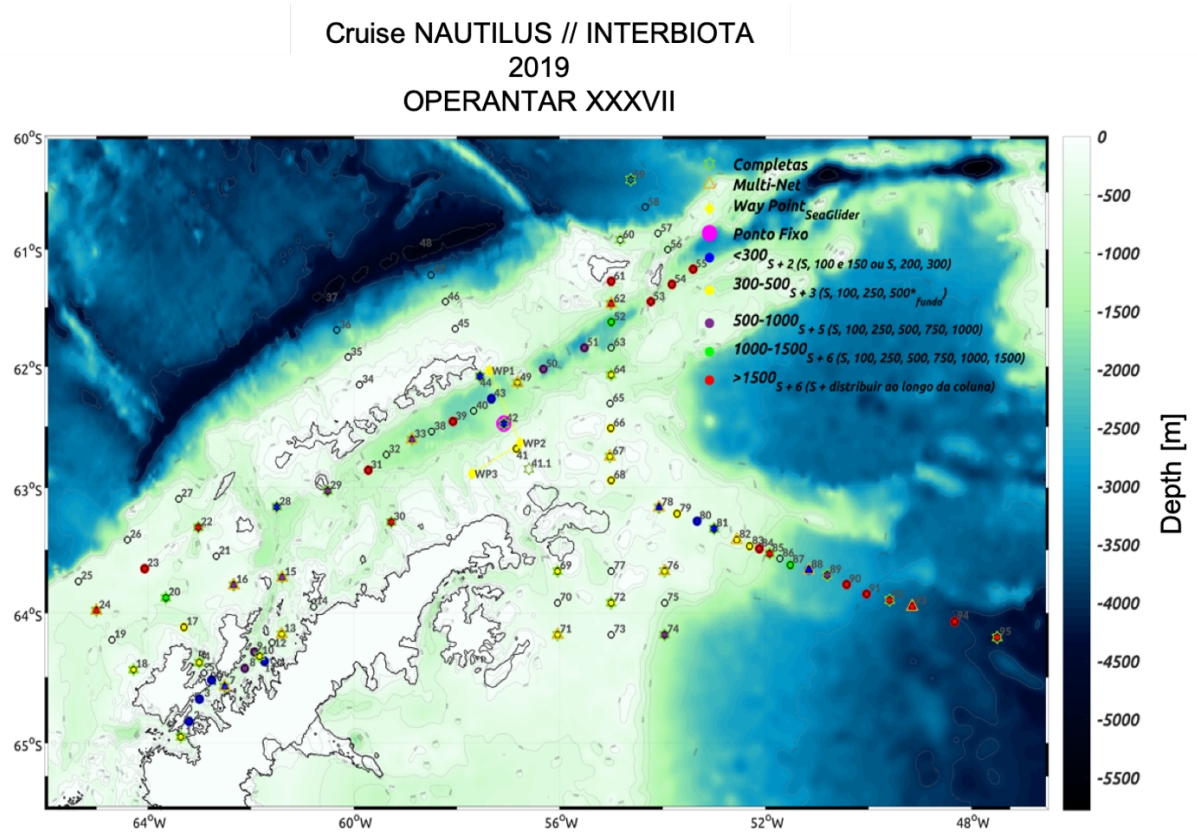

Figure 1: Map with the data sampling planned to be takeng during the cruise. WP1, WP2 and WP3 indicate the section that would be sampled by the glider.

Figure 2: Glider being deployed from the small support boat.

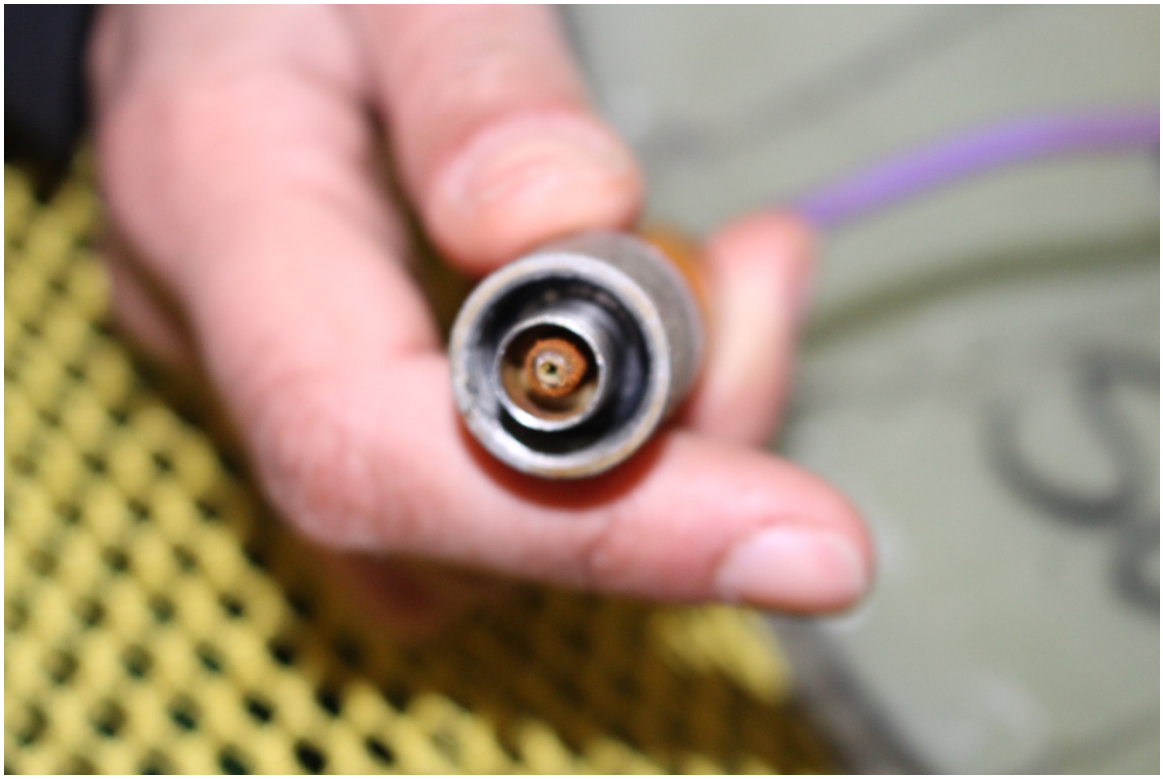

Figure 3: Antenna connector showing signs of corrosion.

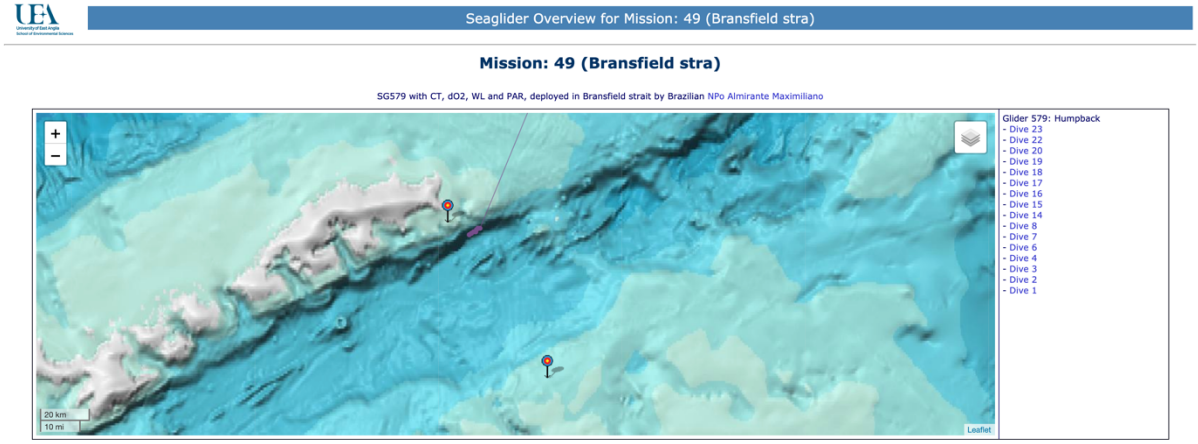

Figure 4: Map showing the position of the dives performed by the glider during the deployment (15/01 to 16/01). Data can be found on http://www.ueaglider.uea.ac.uk/DIVES/index.ph.

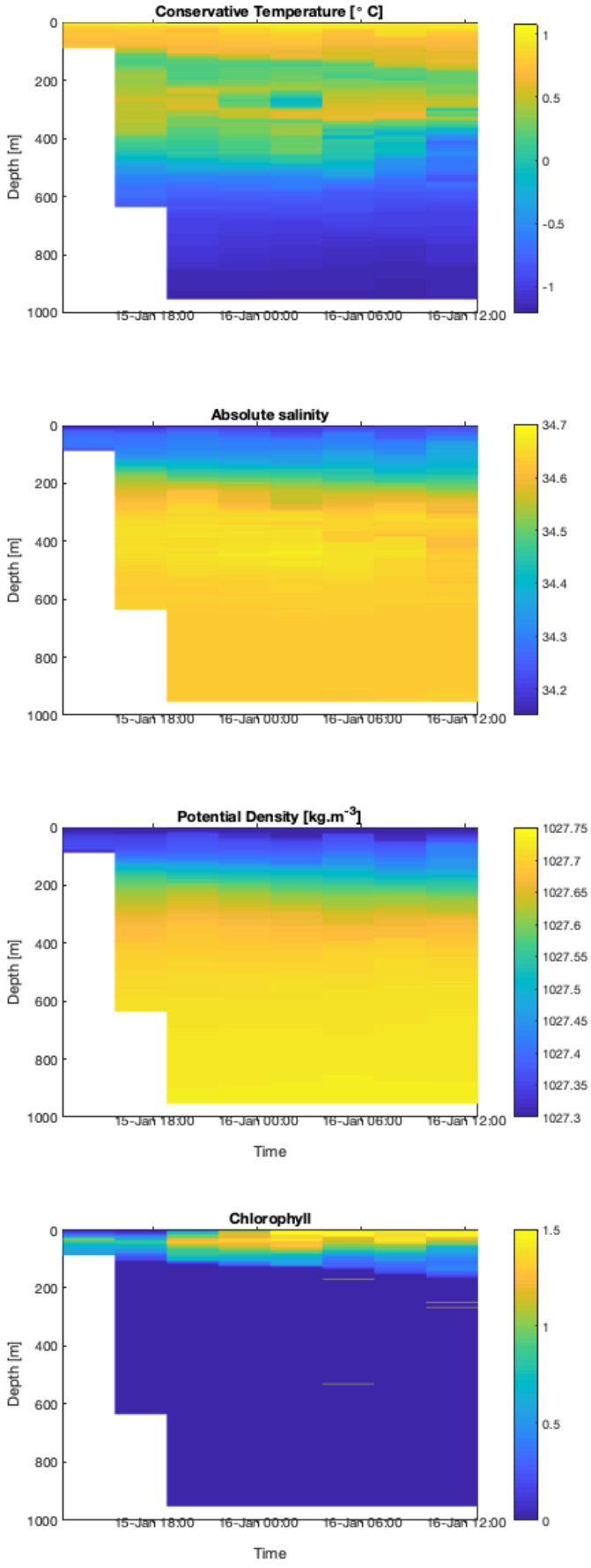

Figure 5: Conservative temperature, Salinity, Potential Density (kg.m^{-3}) and Chlorophyll measured by the glider during the deployment.