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Satellite Sea Surface Salinity assessment close to the ice edge in the Southern Ocean (SSSS)

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ABSTRACT

The main objective of this research project is to analyze the salinity distribution close to the ice edge using the available measurement capacities aboard the ""Le Commandant Charcot"" Ship. The gathered in-situ measurements along vertical profiles in the firsts 15 meters depth and along the vessel trajectory, will be used to assess the capacity of satellite Sea Surface Salinity (SSS) maps to reproduce the surface salinity variability close to the ice edge. We will study the salinity profiles, in the first upper layer of the ocean (CTD casts), and the salinity surface distribution (thermosalinograph transects). The ocean salinity is an important factor for understanding the ocean-ice-atmosphere interactions in the Southern Ocean. The SSS distribution is linked to sea ice production and water evaporation (positive SSS anomalies) and to melting and precipitation (negative SSS anomalies). Therefore, the analysis of SSS allows for monitoring changes in sea ice distribution and concentration. Because of the distance and adverse weather conditions, acquiring in-situ salinity measurements in the Antarctic zone is extremely difficult. Taking advantage of the participation in the ARICE-PONANT campaign, we will be able to have in-situ salinity measurements in the first meters of the water column using the RBR-maestro3 CDT profiler aboard. Moreover, we will carry out surface measurements along the itinerary by the thermosalinograph SBE45, and ocean currents measurements using the Ocean Observer III 38kHz ADCP to further understand the dynamics of the freshwater from melting to the ocean. Being flexible with the vessel possibilities and agreeing with the Science Coordinator from Le Commandant Charcot, we would like to perform a transect going from the ice edge to the open ocean perpendicular to the ice edge and to take regular measurements in the water column from 15 meters depth and up to the surface, while continuous measurements from the ADCP and thermosalinograph over the entire itinerary will be taken. Since 2009, a new generation of satellites (SMOS from ESA and, later, Aquarius and SMAP from NASA) have provided radiometric measurements in L-band, allowing us to retrieve SSS from space. Our research group (BEC-ICM) is an expert in producing SSS maps from SMOS for more than one decade. In the Southern Ocean, there are several aspects that hamper the SSS retrieval from L-band measurements. The reduction of the sensitivity of brightness temperatures to SSS in cold seas degrades the accuracy of the SSS retrieval in polar regions. Moreover, L-band measurements are seriously affected by land–sea, and ice–sea

contamination effects and also by the large wind–current–wave interactions. Therefore, even though the in-situ measurements in remote regions are very scarce, having them as ground truth is crucial for validating and enhancing the quality of new satellite products. Recently, some of these difficulties have been partly addressed thanks to different research projects in our group and by mid-2023, a new specially-tailored product for the Southern Ocean will be released. The in-situ measurements acquired in this project will be critical to better understand the distribution of salinity close to the ice edge and to validate new SSS satellite products in this climate change hotspot.