Structure of the subpolar gyre in the Australian-Antarctic Basin derived from Argo

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Revealing a physics of the Antarctic subpolar gyre is substantial to understand the exchange processes of heat and materials in the Antarctic continental margin. Here we show autonomous profiling float (Argo) data over the past decade revealed the structure of the circulation in the seasonal ice zone off East Antarctica. A new method is introduced to utilize Argo under ice whose position is not well-determined. We devised automated position interpolation algorithm so as to follow isobaths, which is consistent with the contour of ambient potential vorticity. Estimation error by this interpolation was evaluated using the data whose coordinate are well-determined. The new scheme recovered as much as 40% of profiles in the seasonal ice zone. Their trajectories at 1000dbar clarified the horizontal velocity field of the continental margin(see Figure 1). The subpolar gyres off Wilkes Land and possibly off Mac Robertson Land (Prydz Bay Gyre) seem to be bounded by the westward ASF to the south and the eastward velocity maximum along 62-64S to the north in the Australian-Antarctic Basin. The eastward velocity maximum along 60-62S very likely corresponds to the southern ACC front (Kim and Orsi, 2014). The velocity maximum along 62-64S probably corresponds to the climatological position of Southern Boundary of ACC (or SB, based on Orsi et al. 1995; red curve in Figure 1), although the latitude is found systematically to the north of SB. Additionally, CTD data provided by Argo inferred a characteristic structure of isopycnals. The result provides a detailed structure of subpolar gyres broadly consistent with Wakatsuchi et al., 1994, indicating a strong control of coastal bathymetry.

Keywords: Southern Ocean, Argo float, physical oceanography

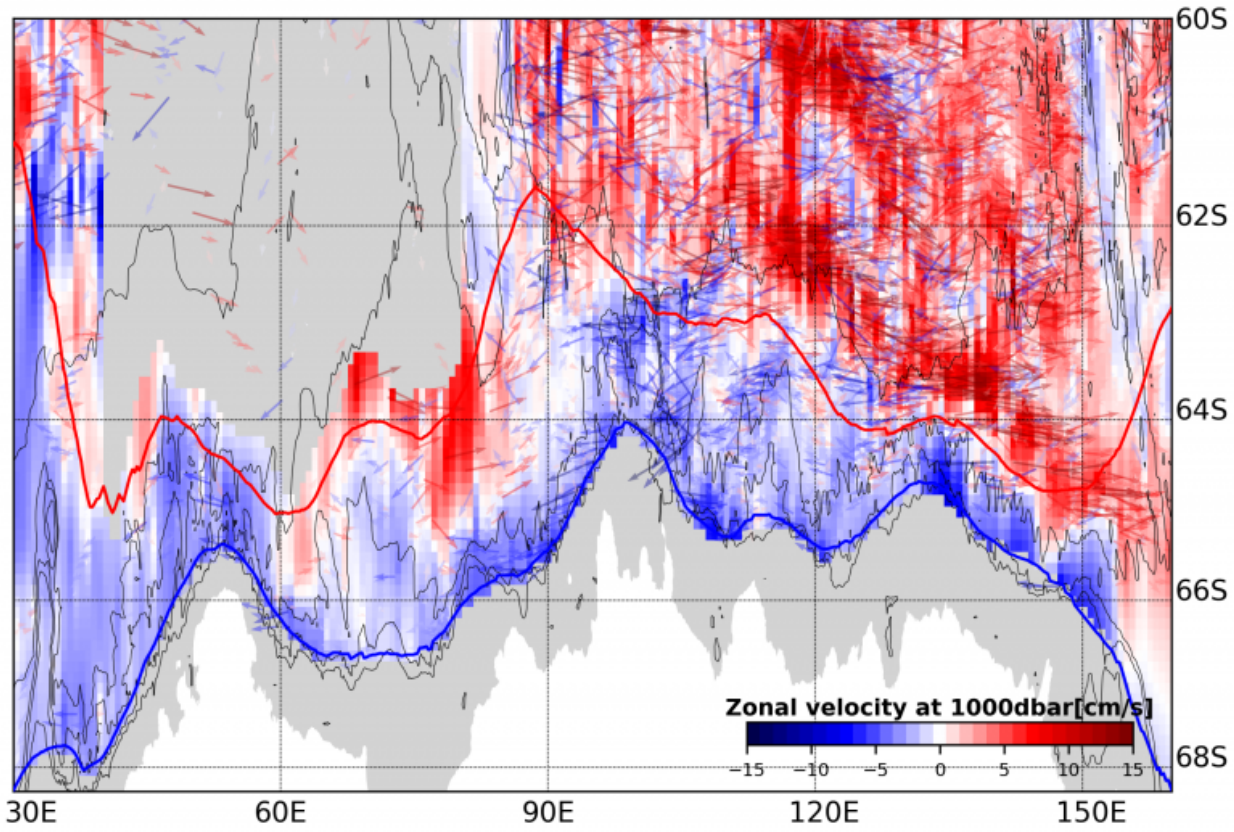

Figure 1. Zonal velocity field at 1000 dbar derived from Argo trajectories. All data points which are used for spacial interpolation are plottted by arrows with the same coloring as the shade (colorbar). Positions of SB and ASF are estimated from climatology of Shimada et al., 2017 and shown by red and blue curve, respectively.

