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Revisiting the Malvinas Current upper circulation and water masses using a HR ocean reanalysis

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We use 25 years of ocean reanalysis to revisit the Malvinas Current, a major route of Antarctic Intermediate Waters, from the South (Drake Passage) to the North (Brazil-Malvinas Confluence) from the synoptic to interannual time scales. The MC mean surface velocity structure evolves as the geometry of the continental slope changes. Over the Malvinas Plateau, the slope is gentle, the MC is rather wide and is organized in two jets. As the slope steepens further north, the jets narrow, intensify and merge at 45°S. The MC appears as stable current over the 25 years connecting two of the major regions with high eddy kinetic energy (Drake Passage and the Brazil Malvinas Confluence). The MC plays a minor role in the velocity variations observed at the confluence at seasonal and interannual scales. Velocity variations at the confluence are related with changes in the intensity of the Brazil Current (BC), in particular, the summer intensification (+15 cm/s at the surface) of the BC (34°-36°S over the slope) advects into a winter intensification and southward displacement of the BC overshoot (40/44°S-54°W).

The Malvinas Plateau is a key region for eddy activity dissipation and for water mass properties modification. Winter deep mixed layers occasionally reach 600 m south of 50°S on the Malvinas Plateau, and show large interannual variations. We compute the volume transport in the layer associated with the Subantarctic Surface Waters (SASW), Subantarctic Mode Waters (SAMW) and Antarctic Intermediate waters (AAIW) over sections spanning the 55 -41°S latitudinal range. The transport time series along the Patagonian slope have a mean of 27.1+- 0.1 Sv and a standard deviation decreasing from south (51°S) to north (45°S) from 4.6 and 3.4 Sv. Variations of SASW/SAMW/AAIW transport are small at the seasonal scale; in contrast, the transport times series vary over a range of 5 Sv at the interannual scale. In general the transport time series covary and show an absolute minimum in 2004 of the order of 23+-2 Sv. This minimum was associated with a unique southward displacement of the BC overshoot leading to a blocking event at 48°S disconnecting the MC from its source in March, followed by a feeding event in May supplying polar waters reducing the SASW/SAMW/AAIW layer volume. Over the 25 years there is a significant freshening trend and no trend in volume transport.