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The Salinity Signal of the Shelf/Deep-Ocean Exchanges in the Southwestern Atlantic

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Large continental discharges inject buoyancy, nutrients and carbon into the coastal ocean, which significantly impact the coastal marine ecosystems and the oceanic circulation. The offshore detrainment of these low-salinity plumes are a critical component of the global biogeochemical cycle, in particular the carbon cycle, but these processes are difficult to observe and quantify. The south West Atlantic subtropical region is characterized by the confluence of the Malvinas and the Brazil currents as well as the export of diluted waters from the Rio de la Plata and the neighboring shelf. The large salinity contrast allows the use of the new generation of satellites, as SMOS and Aquarius, capable of remotely sense surface salinity, with large scale coverage and frequent enough time sampling to document the surface expression of the interaction between the shelf and the deep-ocean. We combined regionally tailored satellite derived surface salinity data from Aquarius and SMOS, satellite altimetry (and SST) data, in-situ observations and the results of numerical simulations to characterize the detrainment of the low salinity plume from the Rio de la Plata and continental shelf into the Brazil/Malvinas Confluence as well as the fate of the entrained waters within the complex mesoscale eddy system observed offshore. Our results reveal the development of large outflow events, which cause extensive low salinity regions. A concurrent analysis of in-situ observations indicate that while some of these events have spatial scales of only a few tens of kms wide, and are therefore undetected by Aquarius or SMOS, others have spatial scales that are large enough to be detected by the satellite salinity sensors. The analysis also reveals that although the along-shore winds are the dominant influence on the low salinity plume in the inner and middle shelf, the contribution of local winds to the offshore export of these waters remains to be determined. Some export events appear to be triggered by mesoscale deep-ocean eddies that develop along the western edge of the Brazil Current. These results draw confidence in the use of satellite derived sea surface salinity at scales lower and closer to shore than previously expected.