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Surface oxygen balance in the Subantarctic Mode Water Formation region.

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In the Subantarctic Zone (SAZ) of the southeast Pacific, the densest, coolest, and freshest Subantarctic Mode Water (SAMW) is formed. There, water masses reset their physicochemical characteristics interchanging properties with the atmosphere, and play a critical role in global climate through their impact on the overturning circulation and oceanic heat and carbon uptake. We estimate the magnitude, variability and uncertainty of the air-sea flux of oxygen from five years of hourly observations around the Observatories Initiative (OOI) Southern Ocean mooring.

The magnitude of oxygen fluxes depends greatly on the parameterization used, particularly for high wind events. Hence, there is a need for validation of the high wind speed regime at high latitudes. Surface waters remain undersaturated from autumn to mid-spring, when most of the annual oxygen uptake occurs. We calculate a total annual flux into the ocean of -12.6 ± 3.4 mol m^{-2} yr^{-1}, with a thermal component of -10.3 ± 2.6 mol m^{-2} yr^{-1} and a non-thermal component of -1.0 ± 0.3 mol m^{-2} yr^{-1}. These results provide the first estimate of oxygen fluxes for the region from high-frequency observations, surpassing previous estimates for the entire SAZ by one order of magnitude.