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# Antarctic Intermediate Water Formation in a High-Resolution OGCM

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The importance of the Antarctic Circumpolar Current (ACC), and the Southern Ocean, in the Climate System, has become apparent in the last decades. Water masses formed at these high latitudes are linked to the shallow and deep branches of the meridional overturning circulation. The Antarctic Intermediate Water (AAIW), as the main water mass ventilating the base of the worlds ocean thermocline, plays a central role not only in the climate system dynamics, but also in the global cycles of carbon dioxide and other bio-geochemical tracers. The mechanisms AAIW formation, as well as, the relationship among the rate of formation of the AAIW, the ACC frontal locations and mesoscale activity at the fronts are investigated in this study. Thus, in this research the output of the Estimating the Circulation and Climate of the Ocean, Phase II (ECCO2) project is used. It is a global high-resolution data synthesis in space and time, that is obtained through an orthogonal projection of the Massachusetts Institute of Technology general circulation model (MITgcm) onto available satellite and in-situ data.

During winter, deep mixed layers (ML) of up to 600 m are formed as a result of deep convection. In turn, the deep ML are the nursery grounds for the Subantarctic Mode Water (SAMW), the lighter precursor of the AAIW.

Diapycnal transformation of AAIW, due to internal mixing and air-sea interactions, is found to occur mainly in the South Pacific Ocean, which is known to be one of the most important regions for AAIW transformation. However, significant AAIW transformation is also observed in the South Indian Ocean. In ECCO2, AAIW is represented for by the water masses within the 27-27.8 kg m-3 neutral density range. While the heaviest AAIW (27.4-27.8 kg.m-3) is formed in the South Indian Ocean, reaching a peak production of about 40Sv during late July, the lighter version of the AAIW (27-27.4 kg.m-3) is mainly produced in the South Pacific Ocean.

We found that eddy fluxes efficiently transfer heat and buoyancy between the subtropical and the subpolar regions, mainly in the regions where these two gyres are in close proximity (e.g., near the Brazil-Malvinas Confluence and south of Africa, in the Agulhas Retroflection region). These buoyancy fluxes are important on setting up the final density footprint that is characteristic of the AAIW in the different ocean basins.