EGU21-2821, updated on 24 Oct 2021
https://doi.org/10.5194/egusphere-egu21-2821
EGU General Assembly 2021

Assessing "Drake Passage Leakage" in an eddy resolving ocean model

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The upper limb of the Atlantic Meridional Overturning Circulation (AMOC) is supplied in the South Atlantic from Drake Passage (DP) and Agulhas Leakage (AL). The relative contributions from DP and AL influence the stratification as well as the properties of the upper limb return flow and potentially impact the formation of deep water in the North Atlantic.
While early studies suggested a clear dominance of the AL contribution, recent studies indicate that the DP contribution is not negligible. Here, we use a set of Lagrangian experiments in the eddy-resolving (1/20 degree) ocean model INALT20 to analyze the inflow from DP into the South Atlantic in more detail. We find that the majority of water, that enters the subtropical South Atlantic across 30° S from DP, originates from the upper 2000 m of the northern branch of the ACC that follows the Sub Antarctic Front (SAF). Before entering the South Atlantic, the majority of theses particles turn northward east of DP and follow the SAF through the Brazil Malvinas Confluence, where the SAF meets the Sub Tropical Front. In or parallel to the South Atlantic Current, particles cross the basin and become part of the subtropical gyre to follow the Benguela Current northward. We further compare pathways, volume transports, transit times and thermohaline properties of particles entering through DP and leaking into the South Atlantic to those from particles not leaking into the South Atlantic. These analyses help exploring potential recipes for building a timeseries of “Drake Passage leakage”, complementary to the already established Agulhas Leakage timeseries.