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Characteristics and robustness of Agulhas Leakage estimates: an inter-comparison study of Lagrangian methods

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The exchange of water between the Indian Ocean and South Atlantic with their different thermohaline properties via Agulhas Leakage is important for the meridional overturning circulation. Agulhas Leakage as well as the output of ocean general circulation models in general can be analysed using a Lagrangian approach with a variety of different tools available. Here, Agulhas Leakage is estimated with both the newly developed tool Parcels and the well established tool Ariane, and different designs of the Lagrangian experiment are analysed. In a hindcast simulation with the eddy-rich ocean sea-ice model INALT20 (1/20° horizontal resolution) under the new JRA55-do forcing, Agulhas Leakage increases from the early 1960s to mid 1980s, but there is no clear trend afterwards, which is in contrast to earlier studies using hindcast simulations under the CORE forcing. During the transit from the Agulhas Current at 32°S to the Cape Basin, a cooling and freshening of Agulhas Leakage waters occurs especially in the western part of the Retroflection, resulting in a density increase as the thermal effect dominates. The average transport, its variability, trend and the transit time from the Agulhas Current to the Cape Basin of Agulhas Leakage is simulated equally with the Lagrangian tools Ariane and Parcels, emphasising the robustness of our method.