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A new estimation of Agulhas Leakage using observations and simulations of Lagrangian drifters and floats

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We use observations of surface drifters and profiling floats that have passed through the Agulhas system since 1997 to make a new estimate of Agulhas leakage transport. Agulhas Leakage is water that leaks from the Indian Ocean subtropical gyre into the Atlantic Ocean and is thought to be a critical component of the larger climate system, with evidence that an increase in leakage can lead to a strengthening in the Atlantic Meridional Overturning Circulation. The number of float and drifter observations in the Agulhas system has quadrupled since the seminal study of Richardson (2007), who estimated a leakage of 15 Sv. Using these observations, we provide an updated Lagrangian leakage estimate where, for the first time, we correct for sampling biases associated with drifter and float behavior. Sampling biases are estimated by simulating isobaric and profiling particles and comparing their leakage to the leakage of true Lagrangian particles. These simulations are run using an off-line particle-tracking tool and Community Climate System Model (CCSM), a coupled climate model, velocity outputs from the 20th century climate change runs in 2002-2007. We find that drifters tend to leak northward into the Benguela system at the surface, while floats follow the northwestward Agulhas leakage corridor identified through satellite altimetry. The isobaric behavior of floats leads to 7% less leakage, while their profiling behavior leads to 2% more. We find that the isobaric behavior of drifters tends to have a minimal effect on leakage. Using the observed transport of the Agulhas Current at 34°S, combined with the corrected Lagrangian observations, we estimate a new leakage transport of 22 Sv.