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Coherent Water Transport Across the South Atlantic
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The role of mesoscale eddies in coherently transporting Agulhas leakage across the South Atlantic Ocean is investigated using a recent technique from nonlinear dynamical systems theory applied on geostrophic currents inferred from the over two-decade-long satellite altimetry record. Independent of the reference frame chosen, this technique seeks Lagrangian eddy boundaries as material loops embedded in coherent material belts of fluid that defy the incoherence of the ambient turbulent flow. As such, they cannot stretch into, or break away from, the enclosed fluid region. Long-lived eddies are found to acquire material coherence away from the Agulhas retroflection, near the Walvis Ridge in the South Atlantic. Yearly, 1 to 4 coherent material eddies are detected with diameters ranging from 40 to 280 km. A total of 23 eddy cores of about 50 km in diameter and with at least 30% of their contents traceable into the Indian Ocean were found to travel across the subtropical gyre with minor filamentation. No more than 5% of such cores pour their contents on the North Brazil Current. While ability of eddies to carry Agulhas leakage northwestward across the South Atlantic is supported by our analysis, this is more restricted than suggested by earlier ring transport assessments.