Argo floats, cyclonic eddies and the great Agulhas Current

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Argo floats, with altered profiling missions, have been used in a number of experiments to investigate Madagascar Cyclonic Eddies as source waters of the Agulhas Current, along with the Agulhas Current itself. The experiments were undertaken over a number of years and use floats on daily and five-daily profiling frequencies, with park depths ranging from 300 to 1000 m, and profiling from 1000 m to the surface.

Key results of the first 3D Lagrangian evolution of Madagascar cyclonic eddies across the southern Mozambique Channel highlight a volume transport of 17.3 ± 7.9 Sv (1 Sv = 1 x 10^6 m^3), with heat and freshwater fluxes of -0.1 ± 0.08 PW (1 PW = 10^{15} W) and 0.07 ± 0.05 Sv respectively, per eddy. This experiment highlights the potential of cyclonic eddies to thus supply substantial quantities of cold fresh water to the Agulhas Current, but also a technique on how to obtain valuable insights in to the evolution of subsurface mesoscale dynamics.

A study of the evolution of the Agulhas Current from Port Edward (north) to Port Alfred (south) highlights the fast-flowing yet stable nature of the current devoid of oceanic mesoscale eddy influence. Initial results show positive subsurface heat and salt anomalies, synonymous with the intensified Agulhas Current. Additionally, the very inshore float, which propagates south almost exclusive of the current, displayed similar positive anomalies. These are likely due to shelf edge Ekman Veering dynamics.

These studies highlight the value of using profiling Argo floats to investigate subsurface dynamics of mesoscale eddies and Western Boundary Currents. These observing platforms should be considered in conjunction with traditional Conductivity, Temperature and Depth (CTD) surveys, newly developed glider technologies, state-of-the-art ocean models and remotely sensed data to obtain a full picture of the Greater Agulhas Current System.