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Horizontal and vertical patterns of isopycnal diffusivities in the Antarctic Circumpolar Current: Lessons from subsurface floats deployed in an eddying model.

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Mixing generated by mesoscale eddies is believed to play an important role in the transfer of water masses and tracers across the Antarctic Circumpolar Current (ACC). While eddy activity is strong in regions with strong currents, such as the ACC, strong currents can also act as mixing barriers, leading to small effective eddy diffusivities. Here, we discuss the horizontal and vertical distributions of isopycnal eddy diffusivities (κ) estimated from the dispersion of numerical floats released in the core regions of the ACC in the Parallel Ocean Program (POP), and we test the relationship between these diffusivities, eddy kinetic energy (EKE) and mean flow.

Estimated Lagrangian κ are horizontally highly variable and can be high in the core of the ACC and to the north of the ACC in regions where eddy kinetic energy is high. Elevated values are found near topographic features and close to the Brazil-Malvinas Confluence Zone and Agulhas Retroflection. At each depth interval, κ is correlated with the eddy velocity, and there is little evidence for any correlation with the strength of the mean flow. Vertically, cross-stream eddy length scales increase with depth, suggesting that eddy mixing may be enhanced at depth where PV gradients are weaker. This effect is masked by the strong decrease with depth of eddy velocities, leading to depth invariant cross-stream κ averaging 1300 ± 150 m^2 s^{-1} around the Polar Frontal Zone.

The results imply that in the core of the ACC, subsurface values of κ cannot simply be mapped from surface eddy kinetic energy in the core of the ACC and that the meridional variations of κ change with longitude.