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Isopycnal Diffusivities in the Antarctic Circumpolar Current Inferred from Lagrangian Floats in an Eddying Model

Alexa Griesel (1), Sarah T Gille (1), Janet Sprintall (1), Julie L McClean (1), Joseph H LaCasce (2), and Mathew E Maltrud (3)

(1) Scripps Institution of Oceanography, La Jolla, USA (agriesel@ucsd.edu), (2) University of Oslo, Department of Geosciences, Oslo, Norway, (3) Los Alamos National Laboratory, Los Alamos, USA

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). Whether the commonly used eddy diffusivity model used to parameterize Southern Ocean eddy mixing processes is appropriate remains unclear. Furthermore, different methods have predicted different magnitudes and spatial distributions of the eddy mixing coefficients.

Here, we analyze the dispersion of numerical floats released in the core regions of the ACC in the 1/10 degree Parallel Ocean Program (POP). We test the applicability of the eddy diffusion model and the relationship between the resulting Lagrangian diffusivities, eddy kinetic energy, and mean flow.

The results imply that parameterizations that (only) use eddy kinetic energy to parameterize the diffusivities are incomplete. We suggest that dominant correlations of Lagrangian eddy diffusivities with eddy kinetic energy found in previous studies could occur as a result of inferring the diffusivity by integrating the velocity autocovariance over too short a time lag.
We find evidence that strong mean flow inhibits cross-stream mixing within the ACC, but there are also areas where cross-stream diffusivities are large in spite of strong mean flows, for example in regions close to topographic obstacles such as the Kerguelen Plateau.

We will discuss the skill of these Lagrangian diffusivities in parameterizing zonally integrated as well as local eddy tracer transport across the ACC.