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How well do Lagrangian diffusivities parameterize the effects of eddies in the Southern Ocean of an eddying model ?

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Eddy diffusion coefficients used in eddy parameterization schemes have been diagnosed with various methods in the Southern Ocean. These studies have produced conflicting results, although they are consistent with different hypotheses for eddy diffusivity distributions. Even though eddy mixing can be diagnosed with different methods, the fundamental issue remains whether these eddy diffusion coefficients actually have sufficient skill to parameterize eddy transports in a downgradient parameterization. Lagrangian floats provide a way to test the applicability of the eddy diffusion model.

Here, we will assess how well Lagrangian diffusivities, deduced from numerical float trajectories in the Southern Ocean of the 1/10 degree Parallel Ocean Program, parameterize zonally integrated as well as local eddy transports. With the 50,000 numerical floats we achieve stable Lagrangian statistics and unprecedented horizontal and vertical resolution of Lagrangian diffusivities. We then calculate Eulerian eddy diffusivities from the ratio of the raw eddy fluxes and mean tracer gradients, and from the divergence of the eddy fluxes and parameterization.

Eddy transport is overestimated using the Lagrangian diffusivities particularly in the upper ocean, and reasons for the discrepancy are explored. Topography plays a role in the correlation of Eulerian and Lagrangian diffusivities.

We will discuss implications for the analysis of observational data from the Southern Ocean and the relation to eddy diffusivity estimates from other methods.