Estimating eddy diffusivities in the ocean

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Away from the surface and bottom boundaries, the interior of the oceans is stably stratified in general, and mixing occurs there due to turbulence generated by shear instability and under appropriate conditions, double-diffusive convection. The resulting eddy diffusivities of momentum and scalar properties are determined by the gradient Richardson number Ri in the case of shear instability and the density ratio R_{rho} in the case of double diffusive convection. However, in oceanic regions susceptible to double-diffusive convection, velocity shear may not be negligible, in which case, both Ri and R_{rho} play a role in determining the intensity of mixing and hence the prevailing diffusivities. Which mode of mixing dominates, depends on the precise values of these parameters. For low Richardson numbers, shear driven instability prevails and for high Richardson numbers, double diffusion can dominate. As such, when measuring eddy diffusivities in the ocean interior, it is essential to deploy a microstructure profiler along with an ADCP so that the precise location of the oceanic region in the Ri - R_{rho} parameter space can be determined. In this talk, we provide an overview of theoretical, observational and numerical model studies of eddy diffusivities in the ocean, with particular emphasis on double diffusive convection, and present some results from recent observational campaigns.

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