

Abstract Submitted
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Quantifying eddy diffusivities EMILY SHUCKBURGH, University of Cambridge, JOHN MARSHALL, MIT — The advection-diffusion equation for the concentration of a tracer may be transformed into a pure diffusion equation by using the area or volume inside concentration contours as a coordinate. The corresponding effective diffusivity depends on the geometry of the tracer field, which is determined by the underlying flow. Here we show that this effective diffusivity may be used as a quantitative diagnostic of eddy transport and mixing. We use a family of simple analytic flows as a test-bench and compare the calculated effective diffusivity with other diagnostics. As an example of the usefulness of the effective diffusivity diagnostic, an attempt to arrive at a more definitive estimate of ocean near-surface eddy diffusivities will be described. Arguably the key uncertainty in the coarse-resolution ocean models used in climate research is lack of knowledge of the magnitude of the diffusivities and their variation in space and time. The results of effective diffusivity calculations for the Southern Ocean show high spatial variations in eddy diffusivity and this has important implications for the understanding of the residual circulation.

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