# Components of the 3-d Lagrangian Diffusivity Tensor in a Periodic Channel Featuring Zonal Jets

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Components of the 3-d Lagrangian Diffusivity Tensor are estimated in a periodic channel ocean model featuring eddy-driven zonal jets. Eddy-driven jets play an important role in the interior ocean ventilation with tracer gases. The presentation of diagonal components focuses on lateral mixing; Lagrangian and Eulerian estimates for meridional mixing agree on vertical variation of diffusivity, i.e. increase with depth due to barrier effects of the zonal jets. Early maxima in the Lagrangian spreading rates should not be used to estimate asymptotic spreading rates since they are caused by meandering zonal jets and represent nonlinear dispersion. We remove the zonal mean flow to obtain Lagrangian estimates for zonal mixing, and show that this procedure yields misleading results for meridional diffusivity. Our findings are in line with previous studies highlighting the importance of shear dispersion by the mean flow for the suppression of meridional mixing by zonal jets.

The off-diagonal components determine the antisymmetric part of the diffusivity tensor. Drawing on the concepts of form drag and Reynolds stresses, we demonstrate how well this quantity describes the difference between the Eulerian mean velocity and the Lagrangian transport velocity.