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Lateral Diffusivity from Tracer Release Experiments in the Tropical North Atlantic Thermocline

Donata Banyte, Martin Visbeck, Toste Tanhua, Tim Fischer, Gerd Krahmann, and Johannes Karstensen
GEOMAR, Helmholtz Centre for Ocean Research, Kiel, Germany, Germany (dbanyte@geomar.de)

Lateral diffusivity is computed from a tracer release experiment in the northeastern tropical Atlantic thermocline. The uncertainties of the estimates are inferred from a synthetic particle release using a high resolution ocean circulation model. The main method employed to compute zonal and meridional components of lateral diffusivity is the growth of the second moment of a cloud of tracer. The application of an areal comparison method for tracer-based 'effective diffusivity' in the field experiments is also discussed. The best estimate of meridional eddy diffusivity in the Guinea Upwelling region at about 300 m depth is estimated to be $K_y \sim 500$ m^2 s^{-1} $(300 - 700)$. The zonal component of lateral diffusivity is estimated to be $K_x = 1200$ m^2 s^{-1} $(600 - 1800)$. In comparison to K_y, K_x is almost twice larger, resulting from the tracer patch stretching by zonal jets. Employed conceptual jet model indicates that zonal jet velocities of about 0.01 m s^{-1} $(0.005 - 0.02)$ are required to explain the enhancement of the zonal eddy diffusivity component. Overall, the effective eddy diffusivity is estimated to be $K_e = 700$ m^2 s^{-1} $(500 - 900)$. Finally, different sampling strategies are tested on synthetic tracer release experiments. They indicate that the best sampling strategy is a sparse regular sampling grid covering most of the tracer patch.