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Depth dependent mixing in the eastern North Atlantic: An application of the tracer-contour inverse method

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The tracer-contour inverse method is used to infer mixing and circulation in the eastern North Atlantic. Solutions for the vertical mixing coefficient D, the along-isopycnal mixing coefficient, K, and a geostrophic streamfunction, Ψ, are all direct outputs of the method. The method predicts a vertical mixing coefficient of order 10^{-5} m^2 s^{-1} in the upper 1000 m of the water column consistent with in situ observations. The method predicts a depth dependent along-isopycnal mixing coefficient which reduces from order 1000 m^2 s^{-1} close to the mixed layer to order 100 m^2 s^{-1} in the interior, consistent also with observations and previous hypotheses. The robustness of the results are tested with a rigorous sensitivity analysis including the use of two independently constructed data sets.

This study confirms the utility of the tracer-contour inverse method. The results presented support the hypothesis that vertical mixing is small in the thermocline of the subtropical Atlantic Ocean. A strong depth dependence of the along-isopycnal mixing coefficient is also demonstrated, supporting recent parameterisations for coarse resolution ocean models.