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Structure and Mixing of a Turbulent Meandering Plume Part 2: Turbulent Mixing and Eddy-Diffusivity D.R. WEBSTER, D.L. YOUNG, Georgia Tech, A.I. LARSSON, University of Gothenburg — Turbulent mixing in a meandering non-buoyant chemical plume is far less understood than in a straight plume – partially due to the difficulty separating the plume meander fluctuations from the turbulent fluctuations. In this study we present high resolution measurements of the covariance of the turbulent fluctuations of velocity and concentration in a phase-locked meandering plume, acquired by combining simultaneous PTV velocity and LIF concentration measurements. The effectiveness of the eddy-diffusivity model for predicting the turbulent flux is assessed. Analysis of the data reveals that the spatial distribution of the turbulent flux is governed by the large-scale alternating-sign vortices that induce the plume meander. Further, regions of high turbulent flux are co-located with areas of large phase-averaged concentration gradients. As a result, the eddy-diffusivity framework models the turbulent flux effectively. As expected from turbulent mixing theory, the eddy-diffusivity coefficient plateaus at a constant value once the plume width reaches the size of the largest eddies (i.e., the scale of the water depth in this open channel flow). However, when the plume width is less than the water depth the eddy-diffusivity coefficient scales with the plume width to the 3/4 power. This differs from the theoretical 4/3 scaling that results from the assumption of an inertial subrange. The extent of the inertial subrange is extremely limited in the current moderate-*Re* open channel flow.

D.R. Webster
Georgia Tech

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