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Turbulent generation of scalar covariance between two initially distant scalars: implications for enhanced mixing and reaction MICHAEL SOLTYS, FARROKH SHOAEI, JOHN CRIMALDI, University of Colorado — Mixing and reaction between two scalars initially separated by scalar-free ambient fluid is important in problems ranging from ecology to engineering, but is relatively unstudied compared to the more common topology where the two scalars initially share a material interface. We use a two-channel PLIF system in a laboratory flume to quantify the instantaneous spatial structure of two independent scalars released from laterally separate locations in homogeneous grid turbulence. Local reaction rates in the low-Damkohler limit can then be computed. We demonstrate that the two passive scalars selectively aggregate in attracting regions of the turbulent flow, as quantified by streamwise development of positive scalar covariance. A decomposition of the total reaction into mean and instantaneous contributions reveals that the relative contributions depend strongly on streamwise location. Our results demonstrate that over 80% of the downstream reaction is associated with the scalar covariance produced by instantaneous flow processes, such that the total reaction greatly exceeds that predicted my mean processes alone.

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