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Correlating Lagrangian structures with forcing in two-dimensional flow NICHOLAS OUELLETTE, CHARLIE HOGG, Stanford University, YANG LIAO, Yale University — Lagrangian coherent structures (LCSs) are the dominant transport barriers in unsteady, aperiodic flows, and their role in organizing mixing and transport has been well documented. However, nearly all that is known about LCSs has been gleaned from passive observations: they are computed in a post-processing step after a flow has been observed, and used to understand why the mixing and transport proceeded as it did. Here, we instead take a first step toward controlling the presence or locations of LCSs by studying the relationship between LCSs and external forcing in an experimental quasi-two-dimensional weakly turbulent flow. We find that the likelihood of finding a repelling LCS at a given location is positively correlated with the mean strain rate injected at that point and negatively correlated with the mean speed, and that it is not correlated with the vorticity. We also find that mean time between successive LCSs appearing at a fixed location is related to the structure of the forcing field. Finally, we demonstrate a surprising difference in our results between LCSs computed forward and backwards in time, with forward-time (repelling) LCSs showing much more correlation with the forcing than backwards-time (attracting) LCSs.

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