Stirring inertia in time-dependent low Reynolds number flows\textsuperscript{1}
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of a kinematic flow and its transport using Lagrangian coherent structures (LCS)
based on finite-time Lyapunov exponents (FTLE) neglects dynamical effects, such
as pressure, as well as dynamically important constraints, such as potential vorticity
conservation. Chaotic advection, on the other hand, often neglects inertial effects,
which are prominent in LCS. We present results for very low Reynolds number lab-
oratory flows, including a Stokes double gyre, vertically sheared strain and a four
roll mill. Images of tracer (dye) and FTLE fields computed from particle image
velocimetry (PIV) reveal complementary sets of flow structures, giving a more com-
plete picture of transport in these flows. We confirm by computing FTLE of an
exact time-dependent Stokes flow solution and present implications of these findings
for inertial object transport in flows.

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