Abstract Submitted
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Fast computation of Lagrangian coherent structures: algorithms and error analysis STEVEN BRUNTON, CLARENCE ROWLEY, Princeton University — This work investigates a number of efficient methods for computing finite time Lyapunov exponent (FTLE) fields in unsteady flows by approximating the particle flow map and eliminating redundant particle integrations in neighboring flow maps. Ridges of the FTLE fields are Lagrangian coherent structures (LCS) and provide an unsteady analogue of invariant manifolds from dynamical systems theory. The fast methods fall into two categories, unidirectional and bidirectional, depending on whether flow maps in one or both time directions are composed to form an approximate flow map. An error analysis is presented which shows that the unidirectional methods are accurate while the bidirectional methods have significant error which is aligned with the opposite time coherent structures. This relies on the fact that material from the positive time LCS attracts onto the negative time LCS near time-dependent saddle points.

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