Abstract Submitted
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Complexity of coherent structures computed from braids of passive particles[1] MARKO BUDISIC, JEAN-LUC THIFFEAULT, Univ of Wisconsin, Madison — Transport in fluids can be characterized by tracking passive particles advected by the fluid flow. When particles are distributed densely, as can be achieved in laboratory, the fluid velocity field can be reconstructed through Particle Tracking Velocimetry, enabling computation of Lyapunov exponents or other numerical analyses. When particles are sparse, as in drifter measurements of oceans, the velocity field cannot be reliably reconstructed. Nevertheless, the amount of entanglement of particle paths over time can be used to estimate the dynamical complexity of the flow by computing the Finite-Time Braiding Exponent (FTBE). The technique is based on braid dynamics and measures the rate at which particle motion stretches topological loops, i.e., the "rubber bands" enclosing subsets of particles. Allshouse and Thiffeault showed that minimally-stretching loops correspond to the structures coherent under material transport in flows. We extend their work and couple it to the FTBE calculations in order to characterize the spatial distribution of flow complexity. Analysis is demonstrated on the Hackborn rotor-oscillator model, which exhibits regions of chaotic and regular dynamics, and can be realized both numerically and experimentally.

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