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2D FTLE in 3D Flows: The accuracy of using two-dimensional data for Lagrangian analysis in a three-dimensional turbulent channel simulation MATTHEW ROCKWOOD, MELISSA GREEN, Syracuse University — In experimental, three-dimensional vortex-dominated flows, common particle image velocimetry (PIV) data is often collected in only the plane of interest due to equipment constraints. For flows with significant out of plane velocities or velocity gradients, this can create large discrepancies in Lagrangian analyses that require accurate particle trajectories. A Finite Time Lyapunov Exponent (FTLE) analysis is one such example, and has been shown to be very powerful at examining vortex dynamics and interactions in a variety of aperiodic flows. In this work, FTLE analysis of a turbulent channel simulation was conducted using both full three-dimensional velocity data and modified planar data extracted from the same computational domain. When the out of plane velocity component is neglected the difference in FTLE fields is non-trivial. A quantitative comparison and computation of error is presented for several planes across the width of the channel to determine the efficacy of using 2D analyses on the inherently 3D flows.

Melissa Green
Syracuse University

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