Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Sensitivity of LCS identification to flow field resolution and random errors ALI B. OLCAY, UWP, TAIT S. POTTEBAUM, USC, PAUL S. KRUEGER, SMU — Ridges in the finite-time Lyapunov exponent (FTLE) fields obtained from fluid flows provide separatrices that are transport barriers. These ridges, called Lagrangian coherent structures (LCSs), can be used to identify vortex boundaries and study mixing processes in complex, time-dependent flows. The accuracy of LCS identification is inherently dependent on the accuracy of the underlying velocity field used to compute the FTLE field. To quantify the effect of velocity field errors, this study considers the two canonical flows: a steady 2D vortex pair and an axisymmetric vortex ring generated by a starting jet. The velocity field for the vortex pair was determined analytically while the vortex ring flow was obtained from CFD for jet $Re = 1000$. Velocity field errors were introduced by smoothing and sub-sampling the data (mimicking DPIV interrogation window size effects) and adding random noise. The results show that the LCS location can be shifted as much as $0.2D$ when sub-sampling the velocity field from a resolution of $0.01D$ to $0.125D$ (D is the vortex diameter) and the effect of noise on the mean LCS location is small compared to the resolution effect.

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Date submitted: 11 Aug 2009 Electronic form version 1.4