Lagrangian Transport Barriers in 3D Unsteady Flows

Daniel Blazevski (1) and George Haller (2)

(1) Institute for Mechanical Systems, ETH Zurich, Switzerland (blazevski@imes.mavt.ethz.ch), (2) Institute for Mechanical Systems, ETH Zurich, Switzerland (georgehaller@ethz.ch)

Transport barriers in 3D flows form the cores of coherent tracer patterns, acting as locally most repelling or most shearing material surfaces. Here we present an extension of the 2D variational theory of Lagrangian Coherent Structures (LCS) to detect such extremum surfaces in 3D temporally aperiodic velocity fields. Shear LCSs obtained in this fashion provide material boundaries for 3D Lagrangian vortices. We illustrate the theory on model velocity fields.