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Short- and Long- Time Transport Structures in a Three Dimensional Time Dependent Flow[1] RODOLPHE CHABREYRIE, STEFAN LLEWELLYN SMITH, University of California, San Diego Mechanical and Aerospace Engineering — Lagrangian transport structures for three-dimensional and time-dependent fluid flows are of great interest in numerous applications, particularly for geophysical or oceanic flows. In such flows, chaotic transport and mixing can play important environmental and ecological roles, for examples in pollution spills or plankton migration. In such flows, where simulations or observations are typically available only over a short time, understanding the difference between short-time and long-time transport structures is critical. In this talk, we use a set of classical (i.e. Poincaré section, Lyapunov exponent) and alternative (i.e. finite time Lyapunov exponent, Lagrangian coherent structures) tools from dynamical systems theory that analyze chaotic transport both qualitatively and quantitatively. With this set of tools we are able to reveal, identify and highlight differences between short- and long-time transport structures inside a flow composed of a primary horizontal contra-rotating vortex chain, small lateral oscillations and a weak Ekman pumping. The difference is mainly the existence of regular or extremely slowly developing chaotic regions that are only present at short time.

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Rodolphe Chabreyrie
University of California, San Diego Mechanical and Aerospace Engineering

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