Lagrangian transport patterns in the Ria de Vigo, NW Spain

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We study the submesoscale surface transport in the Ria de Vigo, NW Spain, an estuary with tidal and wind-driven circulation. We analyze the output of the coastal model MOHID with Lagrangian methods and compare the results to drifter experiments. Lagrangian Coherent Structures (LCS) are extracted from the model flow as ridges in fields of the Finite-Time Lyapunov Exponent (FTLE) that can be identified with transport barriers. The LCS reveal the fundamental structure of the modelled circulation in the estaury that is a superposition of the tidal inflow and outflow, the wind-driven currents and the long-term drift on the shelf. LCS are attached to prominent coastal boundaries, as islands or capes, indicating that the geometry of the flow patterns is dominated by bathymetry. Although the vertical flow can be important at the coast and is not considered here, the found transport patterns can be seen as the surface footprint of the 3D circulation in the estaury. Comparing the trajectories of real surface drifters to the computed transport barriers in different typical meteorological sitiations, we find that the drifter trajectories are in agreement with the different coherent water masses predicted by the model. The knowledge of the global transport patterns of water masses in this highly populated coastal region is indispensable for estimating the leeway of contaminations, and for ecological studies that deal with the drift of eggs and larvae or investigate plankton blooms.

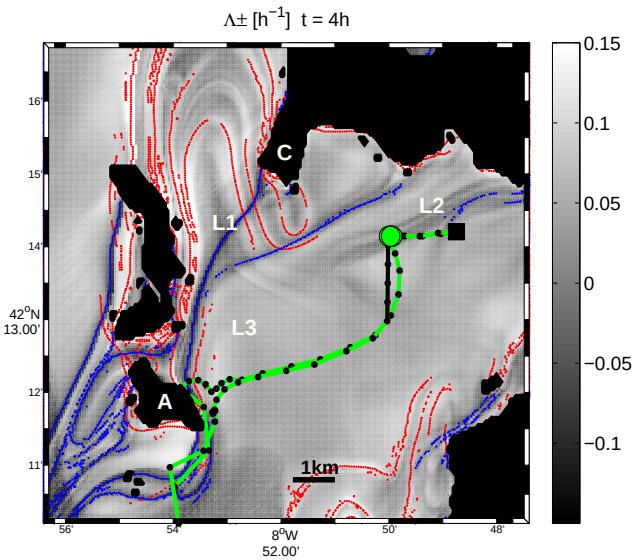

FIG. 1: Typical attracting (blue) and repelling (red) LCS in the Ria de Vigo, estimates of transport barriers. Drifter trajectories (green) agree with the predicted transport patterns.

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