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Lagrangian Coherent Structures and drifter experiments in a tidal driven flow in the Ria de Arousa (Galicia, Spain)

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We study the two-dimensional time dependent surface currents at the western coast of Galicia, Spain, including estuarines (Rias Baixas) and off-shore regions (Costa da Morte). Turbulence in ocean currents plays an important role for the mixing of water volumes with different scalar properties. The spatial structures of the current indicate, where turbulence-induced mixing can be expected. The mixing spreads available nutrients and has therefore a strong influence on the biological production. The currents also drive the temporal evolution of oil spills and other contaminations on the surface. Lagrangian Coherent Structures (LCS) of the flow are detected by the analysis of Finite Time Lyapunov Exponents (FTLE) of the velocity field. This approach is based on the theory that the distance of two particle trajectories grows exponentially in time for turbulent flows and reveals the flow structures that are relevant for mixing. The analyzed velocity data is obtained from a operational 3-dim ocean model (MOHID), which was run for different typical meteorological situations at the coast of Galicia.
Concerning aquaculture, the region Rias Baixas is one of the most productive areas in the world. The presence of harmful algae blooms (HAB) is a severe problem for this industry. Therefore the knowledge of areas of retention of primary production and HABs inside the Rias is very important.
In order to monitor the structure of the flow and possible retention zones, several drifter experiments are performed in the framework of the DRIFTER (AMPERA) project in an estuarine (Ria de Arousa), where the flow is mainly forced by the tides and the wind. The predicted mixing properties and LCSs from the model are compared to data from these experiments.