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Lagrangian Structure on the Oil Spill

The understanding of the circulation of ocean currents, the exchange of CO2 between atmosphere and oceans, and the influence of the oceans on the distribution of heat and momentum on a global scale is key to our ability to predict and assess the future evolution of climate [1, 2]. Global climate change is affecting sea breathing through mechanisms not yet understood [3]. The ocean is important in the regulation of heat and moisture fluxes, and oceanic physical and bio-geochemical processes are major regulators of natural greenhouse gases. Understanding how oceans mix their waters is key to provide sound forecasts on the climate [1]. Global change also affects marine biodiversity and threatens the survival of ecosystems and exploitable resources. To predict not only the effects of global change on the oceans, but also the response time of climate feedback requires to improve detection systems and to open new lines of research. We use a novel Lagrangian descriptor (function M, defined in the [4]). It is based on the measure of the arclength of trajectories of particles in the surface of the ocean in a given time. This methodology to build global Lagrangian descriptors for arbitrary time dependent flows based on the intrinsic geometrical and physical properties of trajectories. This technique has been proved in [5, 6, 7] to characterize the Kuroshio current. We employ this tool on the data of velocity fields obtained from HYCOM project, to identify the underlying structures in the oceanic currents that predict their influence in the movement of the particles in the ocean. And detect invariant manifolds, hyperbolic and non-hyperbolic flow regions in the oil spill in the Gulf of Mexico. We acknowledge to CESGA for support with the supercomputer FINIS TERRAE. Thanks for support by grants: CSIC-OCEANTECH, I-Math C3- 0104, MICINN-MTM2008-03754 and MTM2008-03840-E, and C. Madrid- SIMUMAT.

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