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Kinematic properties and error analysis at an intense front: preliminary results from a cluster of surface and subsurface drifters

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Tracing the three-dimensional pathways of water parcels and particles in the upper ocean is of importance from many perspectives. It provides insight into where, and by what path, surface properties, gases, contaminants and trace substances entering the surface ocean will end up. Observation, understanding and prediction of the three-dimensional pathways by which water from the surface ocean makes its way into the deeper ocean is the goal of this research.

During May of 2018 a pilot cruise in the framework of the CALYPSO ONR Departmental Research Initiative took place on the Alboran Sea in the Western Mediterranean Sea. This region is characterized by a strong semi-permanent front between the fresher Atlantic water that enters the Western Mediterranean at Gibraltar, and the more saline Mediterranean waters. It is populated by organized, time evolving features (jets, fronts, and gyres) that provide an ideal test bed for a dynamical systems-based Lagrangian analysis. During this cruise nearly a hundred drifters were deployed together with 2 ship surveys equipped with ADCP, 3 glider, uCTD, ecoCTD and biochemical sampling.

In this work we use the method proposed by Molinari and Kirwan (1975) to calculate the differential kinematic properties of flow, divergence, vorticity, shearing rate and stretching rate from a set of drifters. These values are obtained through the study of the evolution in time of a patch formed by a set of drifters. Results from drifters at different depths, surface and 15m, show different dynamics in these layers. To check the value of these results, an error analysis is performed using a numerical model where the kinematic properties are known.