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The dynamical evolution of long lived eddies and the characterization of their 3D structure in the Mediterranean Sea (2000-2017).

Alexandre Stegner (1), Briac Le Vu (1), Cori Pegliasco (2), Alexis Chaigneau (2), Artemis Ioannou (1), Franck Dumas (3), Yannis Faugere (4), and Xavier Carton (5)

(1) CNRS-Ecole Polytechnique, France (stegner@lmd.ens.fr), (2) LEGOS, CNRS-INSU, Toulouse, France,, (3) SHOM, Brest, France, (4) CLS, Toulouse, France, (5) LOPS, UBO, Brest, France.

We build an unique database (DYNED-Atlas) of surface intensified eddies for a 17 year period (2000-2017) in the Mediterranean Sea. This database contain the physical and the dynamical characteristics of mesoscale eddies detected from the cross analysis of DUACS gridded altimetric products (formerly distributed in AVISO, now in CMEMS) and Argo profiles. Among other characteristics the typical size, the intensity and the trajectory of each detected eddy were calculated. An iterative method was used on the AVISO surface geostrophic velocities in order to compute the cyclostrophic velocity components. The addition of these ageostrophic terms leads to a significant velocity increase for some mesoscale anticyclones. Then, the estimations of the three-dimensional eddy structures were deduced from the co-localization of surfacing Argo temperature/salinity data into altimeter-detected eddy areas.

We were then able to quantify the typical temperature, salinity and density anomalies associated to the recurrent mesoscale anticyclones which control the regional circulation of the Mediterranean Sea. We observed, during this 17 years period, that the long-lived anticyclones of the eastern basin have a much deeper extend that the Algerian Eddies. Moreover, we were able to reconstruct, with a high accuracy, the three-dimensional structure of few eddies that were surveyed by more than fifty Argo profiles. The comparison with other remote sensing images (SST and CHL) was also used to quantify the errors on the eddy detection, from DUACS altimetric maps, when the density of tracks is reduced. This study showed that the combination of DUACS products and the in-situ Argo data sets could provide a regional characterization of the three-dimensional structure of individual eddies, far beyond the classical composite eddy analysis.