BASIN AND SUB-BASIN SCALE VARIABILITY IN THE LEVANTINE BASIN

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Abstract
In the last six years the surface layer of the Levantine Basin was extensively studied in the framework of some international projects (ALTIFLOAT, CINEL, MELMAS, PERLE). A considerable amount of in situ data were collected in this region, giving the opportunity to produce an updated version of the surface current paths. Drifter, altimetry and Sea Surface Temperature data, collected during the period 2013-2018, were analysed and compared to the historical drifter dataset acquired between 1993 and 2010. The results show an increasing of the sea level in the southern Levantine in the period 2013-2018 with the strengthening of anti-cyclonic basin-scale structures. In the northern Levantine, the western branch of the Rhodes Gyre is strengthened and a north-westward shift of the Ierapetra Eddy core is observed.

Keywords: Surface waters, Levantine Basin, Currents

The surface circulation in the Levantine Basin derives from the complex interaction among multi-scale flow patterns (basin scale, sub-basin scale and mesoscale), producing a high spatio-temporal variability of the current field (Menna et al., 2012). This region is the most sensible to the climatic changes of the Mediterranean Sea, showing large increase in temperature and decrease in precipitation in recent years (Kum and Celik, 2014). These phenomena will increase in the coming years, as described by model simulations (Lelieveld et al., 2012). From an oceanographic point of view, future scenarios based on model results describe a progressive enhancement of an Eastern Mediterranean Transient – like events in the Eastern Mediterranean (Adloff et al., 2018). In this context, the present study aims to define the differences in the basin and sub-basin scale circulation of the Levantine Basin in recent years with respect to the historical data results (described in Menna et al., 2012) and eventually connect these differences with the increasing climatic variability of the region. The low-pass filtered and interpolated (6 hours) drifter tracks are used to estimate the pseudo-Eulerian mean velocity fields during the periods 1993-2010 (Figure 1) and 2013-2018 (Figure 2) in bins of 0.25°x0.25°.

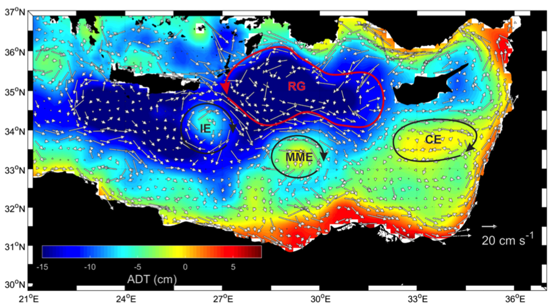

Fig. 1. Mean drifter currents in spatial bins of 0.25°x0.25° (arrows) superimposed on mean maps of ADT (gray shades) during the period 1993-2010.

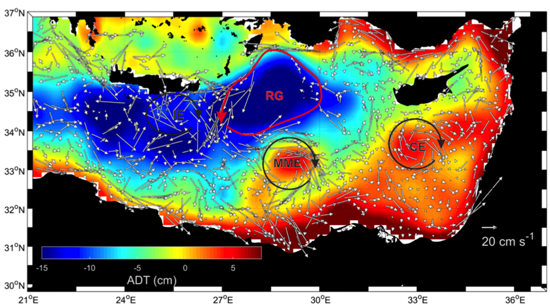

Fig. 2. Same as Figure 1 but for the period 2013-2018.

The mean maps of daily Absolute Dynamic Topography (ADT; 1/8º Mercator projection grid) derived from altimeter and the satellite Sea Surface Temperature (SST; 0.04°x0.04°) distributed by CMEMS, are used in the same periods of drifter data (Figures 1 and 2).
The surface currents in the period 2013-2018 (Figure 2) show larger intensities and a higher mean sea level in the main basin-scale structures of the southern Levantine - the Mersa-Matruh Eddy (MME) and the Cyprus Eddy (CE) – compared to the historical data (Figure 1). The mean location and shape of the MME are steady over time, whereas the CE is mainly elongated zonally according to historical data and more circular (similar extension in latitude and longitude) in recent years. In the western Levantine, the mean location of Ierapetra Eddy (IE) is centred at about 34.5°N and 27° E in the historical data (Figure 1), whereas in the recent years it moved north-westward, allowing the western branch of the Rhodes Gyre (RG) to brush the eastern coasts of the Crete island (Figure 2). The longitudinal extension of the RG is reduced and its western branch is more intense during the period 2013-2018. The increment/reduction of anticyclonic/cyclonic activity in the Levantine Basin in recent years can be related to: 1) a larger inflow of Atlantic Water from the west due to the predominant cyclonic activity in the Ionian Sea during the period considered (Menna et al., 2019) and a consequent sea level rise; 2) an increase of the SST during the period 2013-2018 (not shown) with respect to the historical data.

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