# INTERMEDIATE AND DEEP CIRCULATIONS IN THE EASTERN BASIN OF THE MEDITERRANEAN: FOCUS ON ITS CENTRAL PART FROM THE EGYPT OBSERVATIONS (2005-2007)

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## Abstract
The Eddies and GYres Paths Tracking (EGYPT, 2005-2007) program was an unprecedented effort to acquire observations in the Eastern Basin, both in situ and remotely sensed. The intermediate and deep circulations between Crete, Libya and Egypt are studied here using mainly the time series of a one-year array of 7 moorings equipped with 30 currentmeters and 10 hydrological probes, and the dense network of 125 CTD casts (10-20km-spaced) realised during the EGYPT-1 campaign (April 2006).
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The similarity of the surface circulation patterns between the Western and Eastern Basins prompted original ideas [1]: following our previous work in the Algerian subbasin, in order to improve our knowledge and understanding of the circulation in the Eastern Basin, we conducted the program EGYPT, with the major aim to monitor the path of the Atlantic Water (AW) -with a focus on the Libyo-Egyptian Current (LEC)-, and the Mediterranean Waters (MWs) [2, 3, 4]. We collected current time series with a network of 7 moorings, ~70km spaced, equipped with 5 to 6 currentmeters and hydrological probes from surface (~60m) to the bottom. We initially planned to deploy the moorings off Egypt, since there is no shelf and we could have easily sampled most of the AW flow when alongslope, but we were finally not allowed to do so. The moorings had to be moved off Libya, with two main drawbacks: they were further offshore due to the shelf (over which the AW flows for a great part), and the bathymetry is complex. And finally the upper part of 4 out of 7 moorings went adrift after fish bites, which prompted their anticipated recovery after one year (April 2006 - March 2007), instead of the planned 2-year duration. But the dense CTD network of 125 casts (one out of two down to the bottom) realized during the EGYPT-1 cruise (April 2006) allowed a dense sampling (10-20 km spaced) at subbasin-scale, including the southern shelf and south of Crete. The other observations acquired, among which satellite thermal images, drifters and ARGO profilers, have been listed in [5].

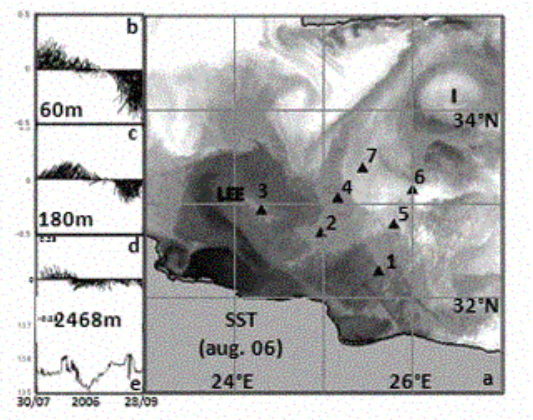


Fig. 1. The passage of a LEE (from east to west) over the mooring 3 during summer 2006, showing the associated anticyclonic currents down to the bottom. a) SST image from mid-August 2006 showing the LEE and Ierapetra (I), EGYPT moorings network (triangles), b-e) records at mooring 3 of current in b) surface, c) intermediate (scale +/- 0.5m/s) and d) bottom layer (scale +/- 0.25m/s), and of e) potential temperature in the bottom layer (scale 13.5-13.7° C).

As expected [2], between Libya, Egypt and Crete the intermediate and deep MWs circulate anticlockwise and alongslope, when not disturbed by mesoscale eddies generated by either the LEC (the Libyo-Egyptian Eddies: LEEs) or the wind (as Ierapetra). We specify the main pathways of the MWs known to form in the Adriatic, the Aegean and the Levantine subbasins, and evidence unreported intermediate water from the Adriatic. As expected from our understanding of the Western Basin functioning, waters at depths 500-1500m are relatively old, so that they are more homogeneous and their circulation is generally weaker than below. At depth (> 3000m), the circulation is markedly influenced by the complex bathymetry, as well as possibly by eddies such as Ierapetra and LEEs, which we show can extend that deep (figure 1). The deeper currents display a high variability in both direction and velocity, with peaks up to 40cm/s a few metres above the bottom. The deepest T and S display variations over ranges of 0.05°C and 0.01, up to ~0.10°C and 0.02 during few-day episodes (figure 1e). Such a high variability is obviously due to the heterogeneity of the deep waters formed far to the north. It is thus clear that deep waters encounter little mixing while spreading and circulating from their formation areas.

A consequence is that the climatological data bases, necessarily based on (historical) sparse data in both time and space, are to be used with extreme caution when it comes to deducing water pathways (cf the LIW path problem when applying unattended statistics on Algerian subbasin data sets [6]), or any climatological signal [7]. In this context, the EGYPT data set can be regarded as a snapshot of reference for 2006-2007. Correlatively, given the natural variability of AW [8] or MWs [9] in the whole Mediterranean Sea, all riparian countries should foster the regular monitoring at basin scale, using not only moorings and thermosalinometers on merchant lines (e.g.Hydrochanges and Transmed CIESM programs, resp.), but also yearly CTD cross-basin transects, an effort sustained for few years now by Italian colleagues in the Western Basin [10].

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