THE SURFACE CIRCULATION IN THE EASTERN BASIN OF THE MEDITERRANEAN AND THE IMPACT OF THE MESOSCALE EDDIES.

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Abstract

The EGYPT (Eddies and GYres Paths Tracking) - EGITTO program data sets provide an unprecedented insight into the Eastern Basin surface circulation. They confirmed the Atlantic Water (AW) path be an anticlockwise circuit along the basin slopes, and its frequent offshore dispatching related to the paddle-wheel effect of the mesoscale eddies generated by the southern part of the circuit, the Libyo-Egyptian Current. However, in opposition with earlier observations, several eddies have been tracked drifting westward for several months, up to one year. The study of the circulation in the Eastern Basin remains a challenge yet.

Keywords: Eastern Mediterranean, Circulation

Our knowledge and understanding of the circulation in the Eastern basin have yet to be improved. The EGYPT/EGITTO program (2005-2007) was a main effort to acquire in situ observations in the Eastern Basin, with a focus on its southern part that has been little sampled up to now. Platforms included a 1-year 7-mooring array, a network of 125 CTD casts, ~ 200 XBTs, ~100 surface drifters, ~15 Argo profilers, and the continuous coverage with thermal satellite images to allow for targeted sampling [1]. In the south the circulation of the Atlantic Water (AW) has been clearly shown anticlockwise and alongslope [2, 3], in agreement with numerical simulations [4]. However the corresponding distribution of the lower salinities most often appear complex, that is highly variable in space and time. Indeed the Libyo-Egyptian Current (LEC) is unstable, and generates mesoscale (anticyclonic) Libyo-Egyptian Eddies (LEEs) [5]. The numerous interactions between the LEC and one or more LEEs induce a paddle-wheel effect, that dispatch AW first offshore and then around the LEEs [6]. That was shown during the EGYPT-1 campaign: on the CTD transect from the Libyan shelf to the Greek slope (figure 1), the minimum of salinity was found on the northern edge of the eddy LE. Another LEE, downstream LE and south of the wind-induced Ierapetra eddy (I-2005, figure 1), also concurred to dispatch AW on the eastern edge of I-2005 (see the corresponding drifters trajectories on fig.5k of [3]). The figure 2 illustrates this paddle-wheel effect: AW is indeed transported offshore eastward, but on the successive edges of LEEs: there is no such permanent path as the so-called "Mid-Mediterranean Jet" (MMJ). Now, because LEEs can remain motionless, drift, and/or interact with neighbouring ones for several months, they have a significant weight in statistics that can lead to artefacts. This is the case for instance of the Lagrangian statistics on the drifters trajectories, of which the mean displays a strong jet offshore Libya. When this evokes a MMJ, it is actually the northern edge of a LEE [7].

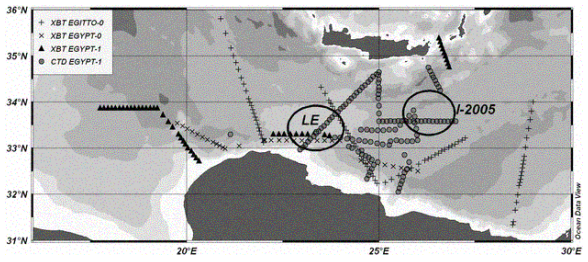

Fig. 1. Sampling during the EGYPT-EGITTO program, with the main eddies indicated for Spring 2006.

These LEEs, and Ierapetra as well, can actually perturb the circulation down to the bottom (~3000m), as shown by the deeper currentmeters [8]. Now, contrary to the general eastward drift observed during 4 years on the period 1996-2000 (over 1000 IR images analysed [9]), in 2006 3 LEEs drifted westward alongslope for months, one for more than 1 year [8]. One hypothesis put forward is the abrupt change of the steepness of the slope [10]. But such a change occurs only for in eddy (LEE1) off Libya at 24°E. Additional analyses are thus required. The study of the Eastern Basin circulation might be more difficult than that of the Western Basin: while the weight of the mesoscale dynamics and the variability it induces imply to acquire additional such high resolution synoptic surveys, rising problems to gain authorizations for sampling are most likely to keep their number low. The Eastern Basin is likely to remain a challenge for some time.

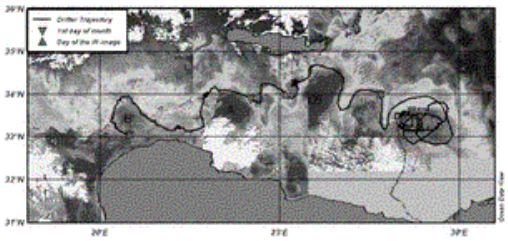

Fig. 2. Trajectory of a surface drifter from February to May 2006.

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