GLIDER TRANSECTS IN THE LEVANTINE SEA: A STUDY OF THE WARM CORE CYPRUS EDDY

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Abstract

In March 2009, two gliders began occupying a hydrographic endurance line for measurements of temperature, salinity, dissolved oxygen, optical backscatter, and fluorescence in the Levantine Sea south of Cyprus in a butterfly pattern over the Eratosthenes Seamount. The line will extend in space and time an historical one. Comparison with past hydrographic cruise data shows similarities. In particular, a large anticyclonic eddy, the Cyprus Eddy, over the Eratosthenes Seamount dominates, with traces of Atlantic Water around the periphery. This eddy was investigated intensively by a fleet of gliders from November 2009 to January 2010.

Keywords: Hydrography, Levantine Basin

In March 2009, two gliders began occupying an endurance line for measurements of temperature, salinity, dissolved oxygen, optical backscatter, and fluorescence in the Levantine Sea south of Cyprus. The transects follow a butterfly pattern over the Eratosthenes Seamount, extending to a maximum depth of 1000 m. The operational transects represent the first in a planned time series for the next several years to be carried out by the Oceanography Center of the University of Cyprus (OC-UCY). Following the 4th EGO Meeting and Glider School in Larnaca in November 2009, a joint project, "EYE of the Levantine," was carried out in which 6 gliders were deployed to investigate the Cyprus warm core eddy observed earlier in the year by both glider and shipboard CTD. In December 2009, the *TARA Oceans* vessel was involved as well with CTD and water samples and the deployment of 4 surface drifters and 2 profiling floats in and around the eddy. Near the end of the experiment, the eddy was sampled again with shipboard CTD grid carried out by the *Maria S. Merian* in mid-January 2010. At this time, only one of the original gliders continued to collect data while beginning the second round of its endurance line, which should also pass through the eddy. About 2000 profiles down to 1000 m and 1000 profiles down to 200 m have been collected by the fleet of gliders including measurements of not only temperature and salinity, but also fluorescence (Chl a, CDOM) and backscatters (at 470, 532, 660, 700, and 880 nm).

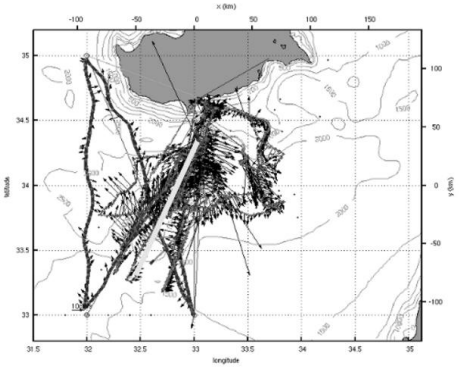

Fig. 1. Map of glider tracks with bathymetry and depth-averaged velocity centered over each dive from 23 November 2009 to 18 January 2010. One of the transects to be shown later is highlighted by a thick grey line.

Since the POEM cruises of the 1980s [1], the general vertical and horizontal distributions of the water masses of the region have been known: the Levantine Surface and Intermediate Water (LSW and LIW) masses sandwiching the Atlantic Water (AW), with the Eastern Mediterranean Deep Water (EMDW) at the deepest observed levels. The variability of the AW pathway, the eddy structures, and absolute transport are all to be addressed by the operational "section series," but in this paper, we present the results of the even more intensive sampling of an eddy using a fleet of gliders which provide a larger-scale synoptic view not possible with a single platform of any kind. The dominant feature of the data set is the anticyclonic (warm, salty core) eddy known as the Cyprus Eddy [2] near the Eratosthenes Seamount (Fig. 1). During the experiment the eddy had a radius of about 40 km and consisted of a core of LIW extending down to 500 m. Currents averaged over the 1000 m dives peaked at the edge with magnitudes of 0.30 m s^{-1}. During the experiment, the eddy shifted about 10 km to the east. The slightly fresher AW is found just below the thermocline, most often around the periphery of the Cyprus Eddy (Fig. 2). Dissolved oxygen, optical scattering, and chlorophyll fluorescence typically show maximum values also in the layer just below the thermocline.

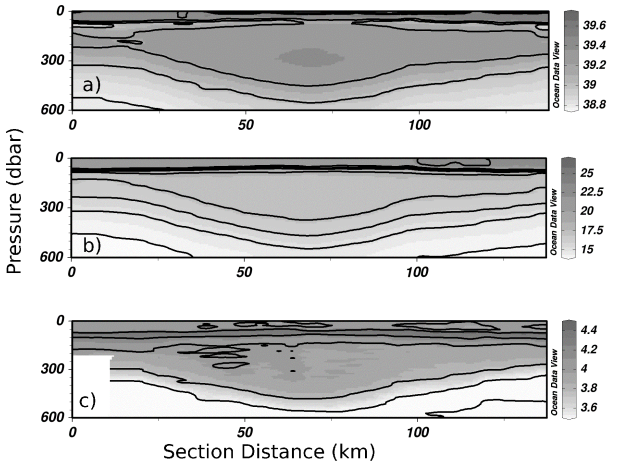

Fig. 2. Vertical section from North to South of a) salinity, b) potential temperature (deg C), and c) dissolved oxygen along transect highlighted in Fig. 1, from 24 November 2009 to 02 December, 2009.

Remotely-observed sea level anomaly (AVISO) products showed similar surface signals, at coarser resolution, as did drifter tracks. Operational forecasts were not as successful in predicting the eddy presence: OC-UCY forecasted a similar eddy, but in a slightly different location and time. Future work includes the assimilation of glider profiles into the operational forecasts at OC-UCY, and further comparison with satellite altimetry, remotely-sensed sea surface temperature and ocean color.

References

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