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Glider and satellite high resolution monitoring of a mesoscale eddy in the Algerian basin: effects on the mixed layer depth and biochemistry

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Despite of the extensive bibliography about the circulation of the Mediterranean Sea and its sub-basins, the debate on mesoscale dynamics and its impacts on biochemical processes is still open because of their intrinsic time scales and of the difficulties in sampling. In order to clarify some of these processes, the "Algerian BAsin Circulation Unmanned Survey - ABACUS" project was proposed and realized through access to JERICO Trans National Access (TNA) infrastructures between September and December 2014. In this framework, a deep glider cruise was carried out in the area between Balearic Islands and Algerian coasts to establish an endurance line for monitoring the basin circulation. During the mission, a mesoscale eddy, identified on satellite altimetry maps, was sampled at high-spatial horizontal resolution (4 km) along its main axes and from surface to 1000 m depth. Data were collected by a Slocum glider equipped with a pumped CTD and biochemical sensors that collected about 100 complete casts inside the eddy. In order to describe the structure of the eddy, in situ data were merged with new generation remotely sensed data as daily synoptic sea surface temperature (SST) and chlorophyll concentration (Chl-a) images from MODIS satellites as well as sea surface height and geostrophic velocities from AVISO. From its origin along the Algerian coast in the eastern part of the basin, the eddy propagated to north-west at a mean speed of about 4 km/day with a mean diameter of 112/130 km, a mean elevation of 15.7 cm and clearly distinguished by the surrounding waters thanks to its higher SST and Chl-a values. Temperature and salinity values along the water column confirm the origin of the eddy from the AC showing the presence of recent Atlantic water in the surface layer and Levantine Intermediate Water (LIW) in the deeper layer. Eddy footprint is clearly evident in the multiparametric vertical sections conducted along its main axes.

Deepening of temperature, salinity and density isolines at the center of the eddy is associated with variations in the Chl-a, oxygen concentration and turbidity pattern. In particular at 50 m depth, along the eddy borders, Chl-a values are higher (1.1-5.2 μg/l) than in correspondence of the eddy center (0.5-0.7 μg/l) with maxima values registered in the southeastern sector of the eddy.

Calculation of geostrophic velocities along transects and vertical quasi geostrophic velocities (QG-w) over a regular 5 km grid from glider data, helped in describing the mechanism and functioning of the eddy.

QG-w presents an asymmetric pattern, with associated relatively strong downwelling in the western part of the eddy and upwelling in the southeastern part of it. This asymmetry in the vertical velocity pattern, bringing LIW in the euphotic layer, as well as eventual advection from the northeastern sector of the eddy may justify the observed increase in Chl-a values.