GEOSTROPHIC CURRENTS IN THE MEDITERRANEAN AND BLACK SEAS DERIVED FROM ARGO FLOAT PROFILES

Pierre-Marie Poulain [1]*, Milena Menna [1] and Ziqing Zu [2]
[1] Ist. Naz. di Oceanografia e Geofisica Sperimentale - ppoulain@inogs.it
[2] University of Chinese Academy of Sciences

Abstract
Data from profiling floats and CTD sections are used to reconstruct the mean geostrophic currents in the Mediterranean and Black Seas at different pressure levels. The main features of the basin and sub-basin scale circulation and their vertical extension are analysed and described.

Keywords: Circulation, Mediterranean Sea, Black Sea

Temperature and salinity profiles derived from Argo floats are used in conjunction with MEDAR/MEDATLAS and altimetry data in order to describe the main characteristics of the geostrophic circulation during the period 2001-2014 in the Mediterranean Sea and 2005-2014 in the Black Sea. Hydrographical data were linearly interpolated on standard pressure levels (i.e., [10 20 50 100 200 400 600 800 1000 1200 1400 1600 1800] dbar), then the CTD profiles were organised in pairs according to spatial and temporal criterions. Surface altimetry currents were interpolated at the mean location and time of each pair of profiles and the geostrophic velocities relative to the surface currents were estimated using the thermal wind equation. These velocities were then divided in bins of 0.5°x 0.5° and the best evaluation of the mean geostrophic velocity in each bin is estimated using the least-square method.

In the Black Sea, the basin-scale cyclonic boundary current (Rim Current-RC) is coherently reconstructed at 10 dbar depth (Fig. 1), showing typical velocities of ~50 cm/s, in agreement with [1] and [2]; in the interior of the basin the geostrophic currents define two cyclonic sub-basin gyres. On the 400 dbar depth (Fig. 2), the eastern sub-basin gyre flows anti-cyclonically, showing a reversal of the intermediate currents with respect to the surface. The anticyclonic gyre persists between 400 and 1000 dbar depths.

In the Western Mediterranean the Northern Current (NC) as well as the cyclonic circulation of the Liguro-Provencal basin extend vertically between the surface and the bottom layer (see Figs. 1 & 2). The Algerian Current (AC) show intense velocities of 20-25 cm/s between 10 and 100 dbar depths (Fig. 1), whereas it disappears below 100 dbar. In the Tyrrhenian Sea currents flow cyclonically above the 400 dbar depth (Figs. 1 and 2) and the Northern Tyrrhenian Eddy (NTE) is recognizable east of the Corsica and Sardinia Island.

In the Eastern Mediterranean the cyclonic signature of the South Adriatic Gyre (SAG) dominates the circulation of the southern Adriatic in the whole water column (Figs. 1 & 2). The Northern Ionian Gyre (NIG) shows an anticyclonic pattern in the surface layer and a cyclonic one in the intermediate layer. The Atlantic-Ionian Stream (AIS) shows intensities of 15 cm/s between the surface and the 800 dbar depth. In the Levantine basin the Mid Mediterranean Jet (MMJ), the Mersa-Matruh Eddy (MME) and the Rhodes Gyre (RG) are clearly recognizable above the 400 dbar depth (Figs. 1 & 2); the Ierapetra Eddy (IE) shows a deeper signature between the surface and 800 dbar depth.

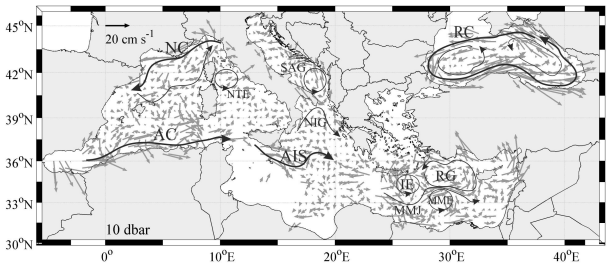

Fig. 1. Mean geostrophic currents in the Mediterranean and Black Seas at 10 dbar depth (grey arrows); the main currents and circulation features are emphasized with black arrows; the acronyms are defined in the text.

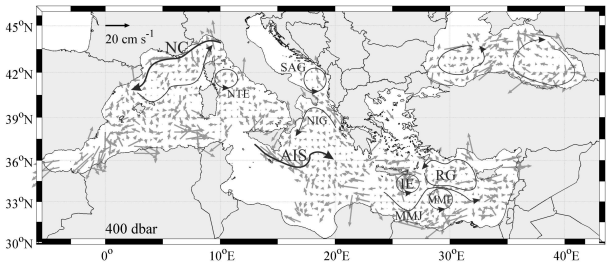

Fig. 2. Same as Fig. 1 but for 400 dbar.

References

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