

MEDARGO: MEASUREMENTS OF WATER MASS PROPERTIES AND SUBSURFACE CURRENTS IN THE MEDITERRANEAN AND BLACK SEAS WITH ARGO FLOATS

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Abstract

Argo floats have been deployed in the Mediterranean and Black Seas (MBS) since 2000 to measure profiles of temperature, salinity and biogeochemical/optical properties, and estimate sub-surface currents. In 2015, the Argo network reached a maximum of about 100 active floats, covering most sub-basins. The operation of floats in the MBS is coordinated by the Argo regional Center (MedArgo), which is a component of the Euro-Argo European research infrastructure. The MedArgo data, for instance, have been used to study dense water formation processes in the Adriatic, the temporal evolution and spatial distribution of the Atlantic Water (AW) and the Levantine Intermediate Water (LIW), and the Mediterranean subsurface circulation.

Keywords: Monitoring, Mediterranean Sea, Black Sea

As part of the international Argo program, profiling floats have been deployed in the World Oceans and some marginal seas since 1999 to collect temperature-conductivity-depth (CTD) profiles. In recent years, some floats have also been equipped with additional sensors to measure biogeochemical and optical seawater properties. Argo is a major component of the Global Ocean Observing System (GOOS) and its main goals are to: 1) provide near-real time (NRT) in-situ data for operational oceanography applications, and 2) collect worldwide observations on a long term basis to support climate change studies. The Argo data are readily and freely available in both NRT and, after quality control and validation, in delayed mode (DM), through dedicated Global Data Assembly Centers.

Argo floats are autonomous freely-drifting profilers which reduce their buoyancy to dive to a prescribed parking depth (typically 1000 m in the World Ocean but for the Mediterranean typically 350 m and the Black Sea 200 m), drift for a little less than 10 (World Ocean) or 5 (MBS) days, dive down to a maximum of 2000 m and rise to surface (by increasing their volume) while measuring seawater properties. At the surface floats are localized by Argos or GPS, and transmit their data to satellites (Argos or Iridium) before they repeat their diving cycle.

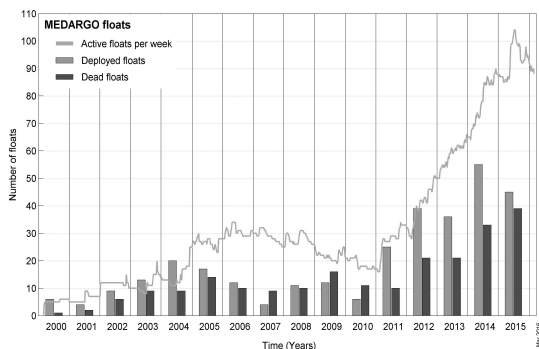


Fig. 1. Temporal evolution of the number of active Argo floats in the MBS with weekly resolution. Number of float deployments and losses per year.

In the MBS, Argo floats have been operated starting in late 2000. The number of float deployments per year in the Mediterranean reached a maximum of 20 in 2014 with the EC FP5 MFSTEP project [1], then it reduced to less than 5 in 2007 before increasing substantially and reaching about 50 in 2004. For the Black Sea, the number of deployments varied between 0 and 6 per year with a maximum in 2013-2014. The temporal evolution of the number of active floats in the MBS is shown in Fig. 1, along with the number of deployments/losses per year. The recent increase in the number of active Argo floats is mostly due to contributions of several countries participating in the Euro-Argo European Research Infrastructure Consortium. This number tends to stabilize around 80 and 10 floats for the Mediterranean and Black Sea, respectively, in late 2015. At the end of 2015, a total of 314 floats had been deployed and more than 31400 CTD profiles had been acquired. In May 2015, the Argo fleet reached a

maximum of 104 active floats, providing about 750 CTD profiles per month.

Floats equipped with additional biogeochemical sensors have been deployed since 2008. In total, 18 floats were equipped with dissolved oxygen (DO) sensors, while 40 included more biogeochemical sensors to measure chlorophyll and colored dissolved organic matter and other optical properties. A limited number of floats had also a sensor to measure nitrate concentration and, in the Black Sea, hydrogen sulphide. Fig. 2 shows the geographical distribution of the Argo floats in the MBS at the end of 2015.

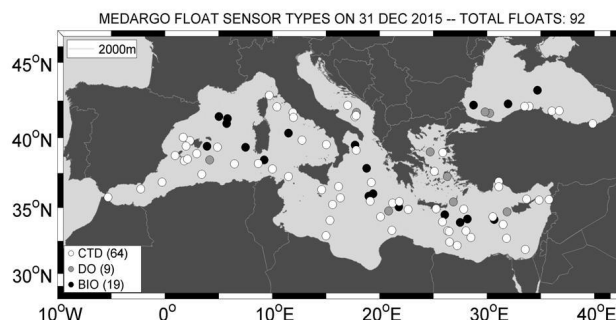


Fig. 2. Geographical distribution of the Argo floats in the MBS at the end of 2015 (CTD, DO and biogeochemical - BIO)

MedArgo NRT CTD data are routinely being assimilated into numerical forecasting models as part of the Copernicus Marine Environment Monitoring Service. In addition, the DM quality controlled MedArgo data have been used to investigate several aspects of the MBS oceanography. We hereby mention only a few studies: 1) The subsurface displacements of the floats have been analyzed to estimate the currents near 350 m in the entire Mediterranean Sea [2]; 2) MedArgo data have been used to describe the formation, pathways and temporal evolution of exceptionally dense water formed in the Adriatic in winter 2012 [3]; 3) The temporal variations and spatial structure of the two most important water masses in the Mediterranean, the AW (minimum salinity) and LIW (maximum salinity), have been described using the entire MedArgo dataset.

References

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