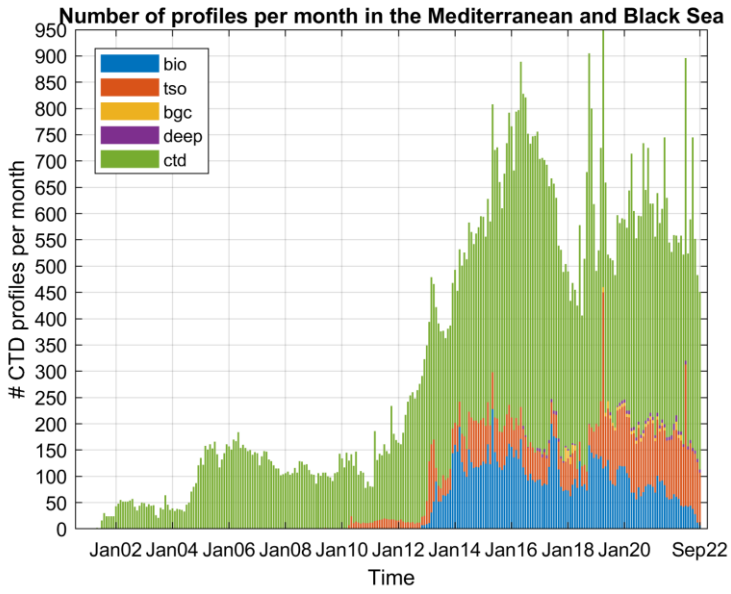
## 1. Real Time Status

- Data acquired from floats

More than 86400 Argo profiles were acquired in the Mediterranean and in Black Seas between 2000 and October 2022. The temporal and spatial distribution of these profiles is depicted in Figure 1, sorted by the different float types used (Core-Argo, Core-Argo with DO, Bio-Argo, Deep-Argo and BGC-Argo [equipped with sensors to measure the 6 EOVs]); the monthly and yearly distribution is shown in Figure 2. More than 70 floats per month have been operated simultaneously in the basins in 2022 and more than 5500 profiles have been acquired (up to October 2022) by different float models (Figure 3).



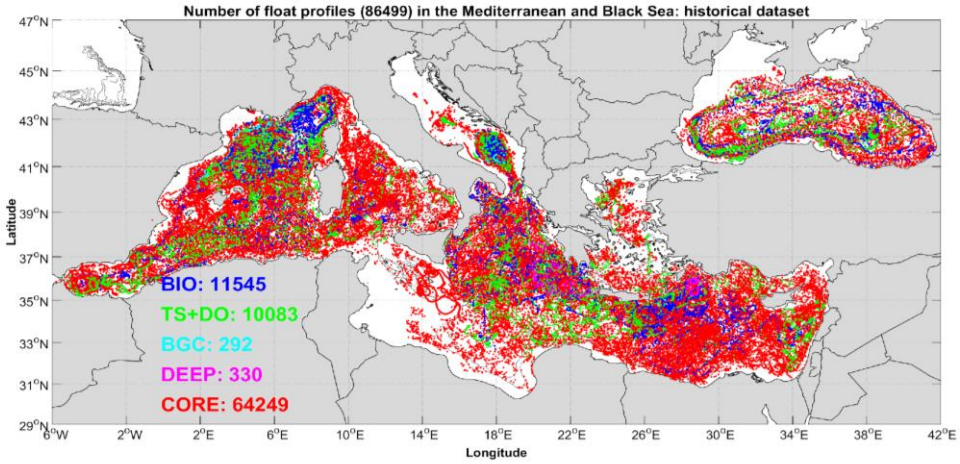



Figure 1. Temporal (upper panel) and spatial (bottom panel) distribution of float profiles in the Mediterranean and Black Sea between 2000 and October 2022.

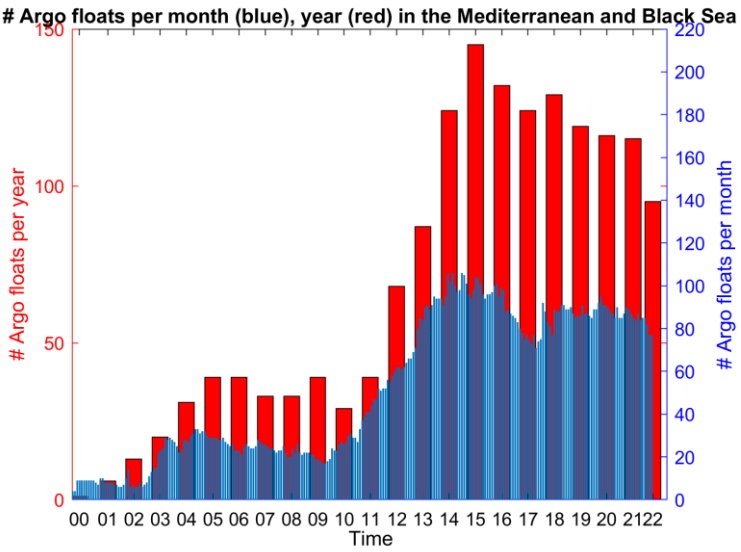



Figure 2. Monthly (blue bars) and yearly (red bars) distribution of Argo floats in the Mediterranean and Black Sea between 2000 and October 2022.

The number of profiles acquired by Argo-extension floats in 2022 is about 1600 whilst the ones collected by the core-Argo floats are about 4000 (Figure 3). EU, Spain, Greece, France, Bulgaria and Italy contributed to maintain/increase the Argo population in 2022: a total of 14 new floats have been deployed both in the Mediterranean and in the Black Seas; 10 out of 14 platforms are core-Argo, 4 are core-Argo with DO. In addition, Greece plans to deploy 3 TS and Italy 6 floats (3

core, 2 Bio, 1 Deep) in the Mediterranean Sea at the end of 2022. The deployment strategy was chosen according to the project's targets and to replace dead floats or under-sampled areas.

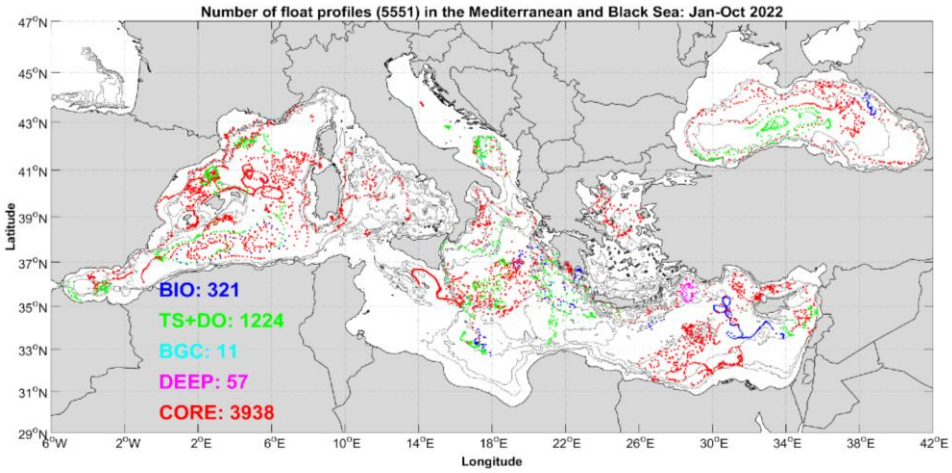



Figure 3. Spatial distribution of profiles collected by Argo floats in 2022 (January-October) in the Mediterranean and Black Sea: locations are color-coded per float type.

Statistics have been computed to assess the fleet performance. The survival rate diagrams produced are separated by transmission mode (figure 4). The maximum operating life is more than 500 cycles, whilst the mean half-life is about 150 cycles (figure 4a). In this computation, active floats with life lower than the mean half-life and recovered floats were excluded (about 20). The vertical distance (upward profiles) traveled by floats is computed and used as an indicator of the profiler performance (figure 4b). The maximal distance observed is about 550 km, whilst the mean distance traveled is about 125 km. The balance of the population is in figure 5a and the annual death rate in figure 5b.

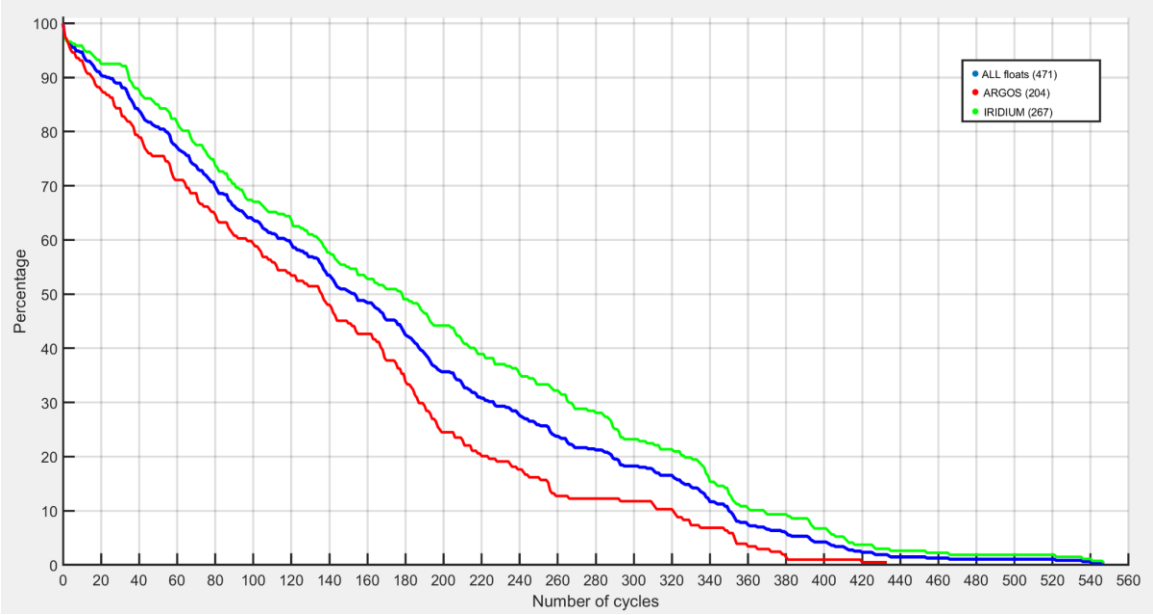



Figure 4a. Survival rate diagrams separated by telemetry system.

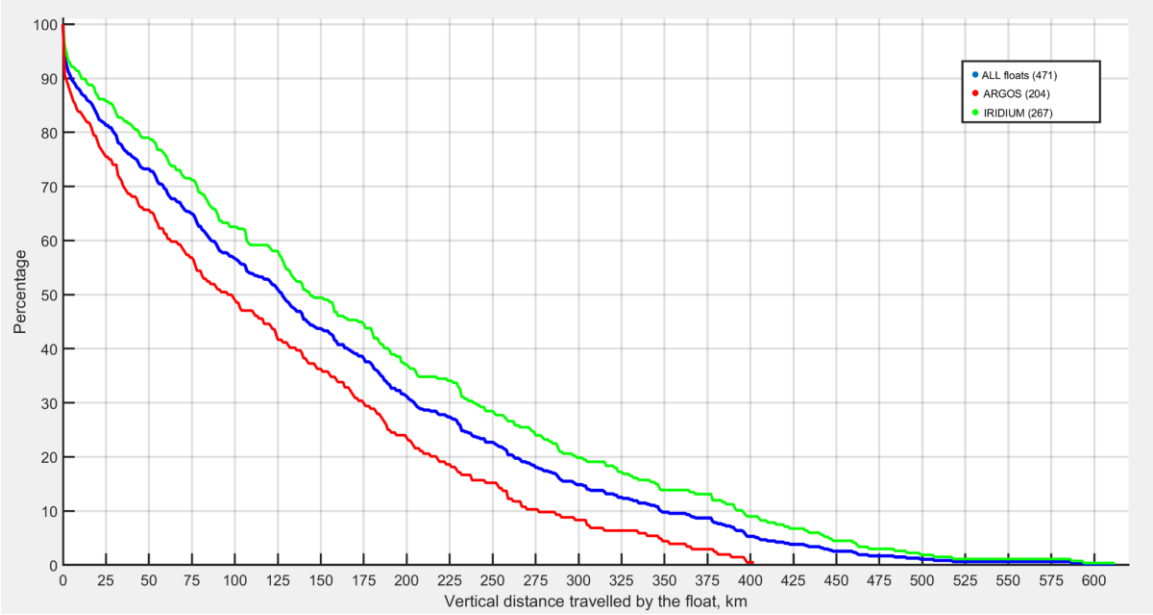



Figure 4b. Diagram of the vertical distance traveled floats, separated by telemetry system.

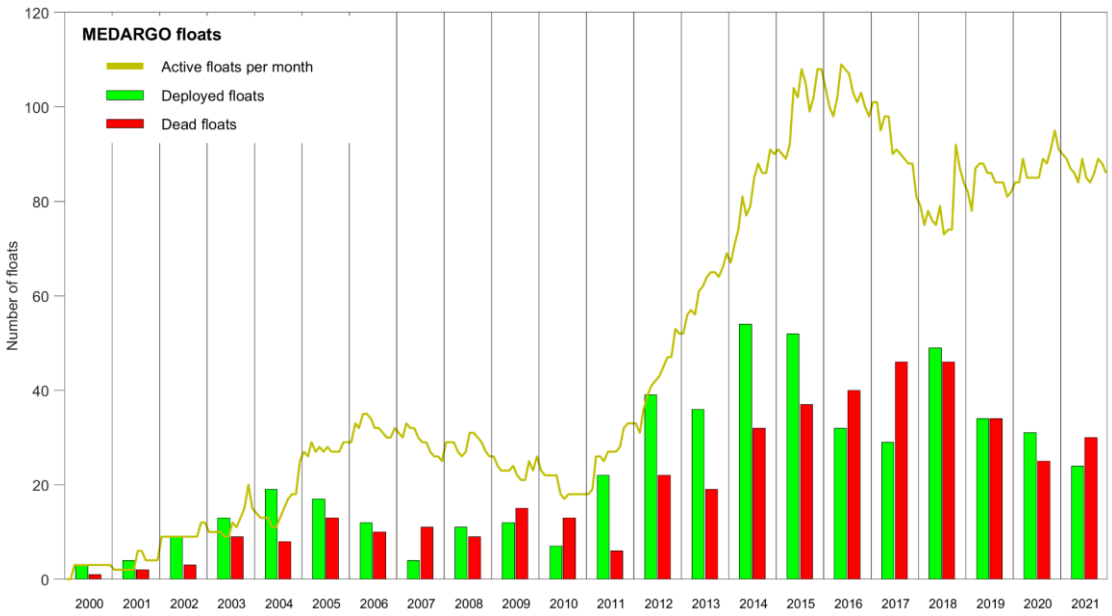



Figure 5a. Balance of the population (rate of population change related to the number of yearly deployments and dead floats).

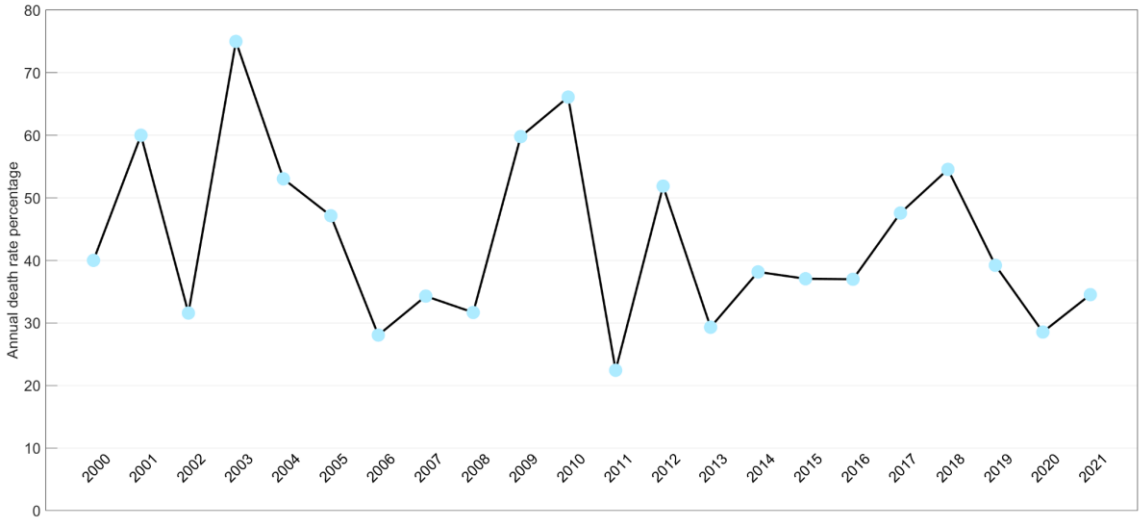



Figure 5b. Annual death rate (ration between yearly failure and yearly average population).

- Delayed mode data sent to GDACs

Most of the eligible floats were quality controlled in delayed-mode for salinity, temperature and surface pressure and the respective D-files were gradually sent to GDAC. The DMQC method was applied to approximately 76% of eligible floats deployed between 2003 and 2021 in the Mediterranean and Black Seas (figures 6 and 7). 10% out of this percentage were quality controlled but the D-files were not sent to GDAC yet. This percentage includes analysis that has to be repeated due to problems related to the reference dataset or in the data itself, shallow floats. The DMQC report/info of each float can be downloaded by the MedArgo web page (http://argo.ogs.it/medargo/table_out.php).

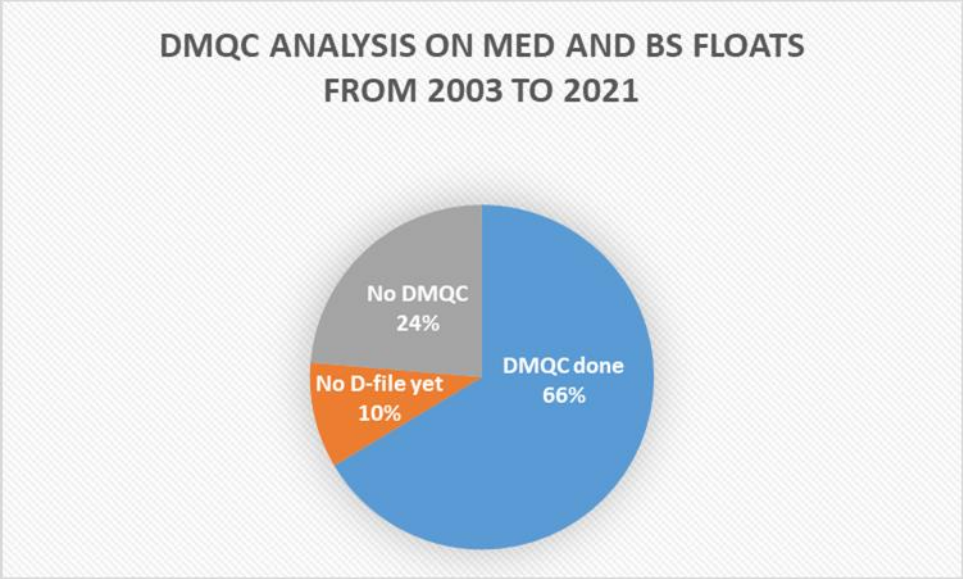



Figure 6. DMQC status.

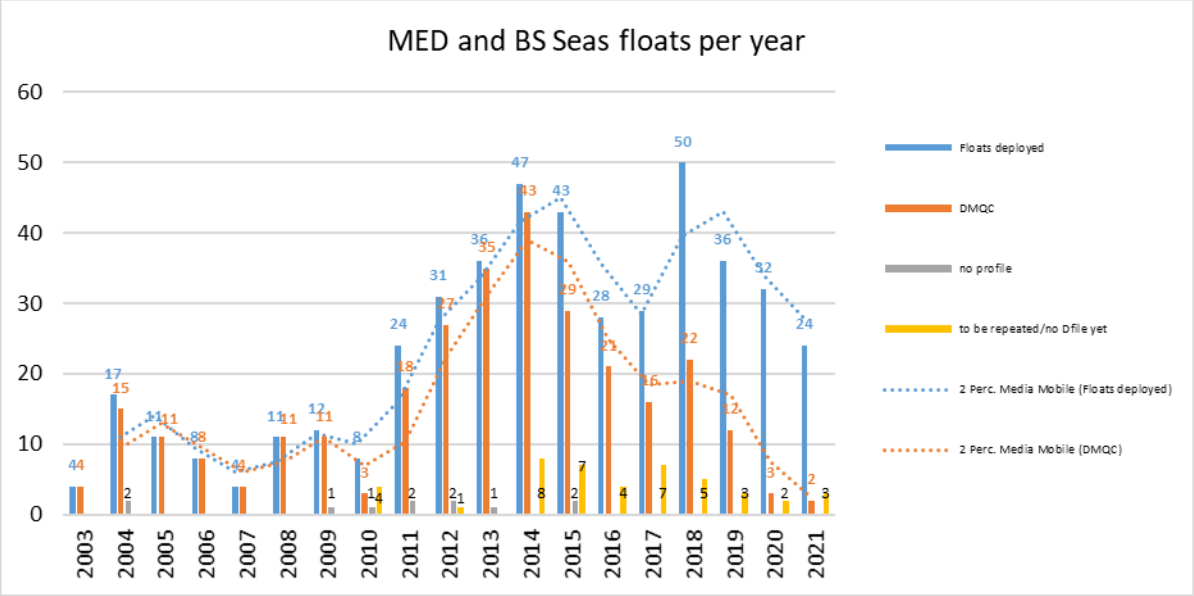



Figure 7. DMQC status per year.

## 2. Delayed Mode QC status

OGS performed the DMQC activity for the Argo data in the Mediterranean and Black Seas. The OW method in conjunction with other procedures is adopted to conduct the quality control analysis for the salinity data.

- To solve the problem that occurs when different vertical sampling is used, the procedure that creates OWC source has been improved. The modified procedure has been published on github: https://github.com/euroargodev/dm_floats/tree/master/src.
- A new OWC plot is under construction: it is a map in which the float trajectory and all possible climatological data inside the fixed spatial and temporal scales are shown (figure 8). The OWC method can lead to misleading results in the Med and BS when the reference dataset is very old. This new plot wants to give an idea of the age of the climatological dataset when compared to the float profiles and see if the time difference between the two datasets is within the temporal scale set for OWC.

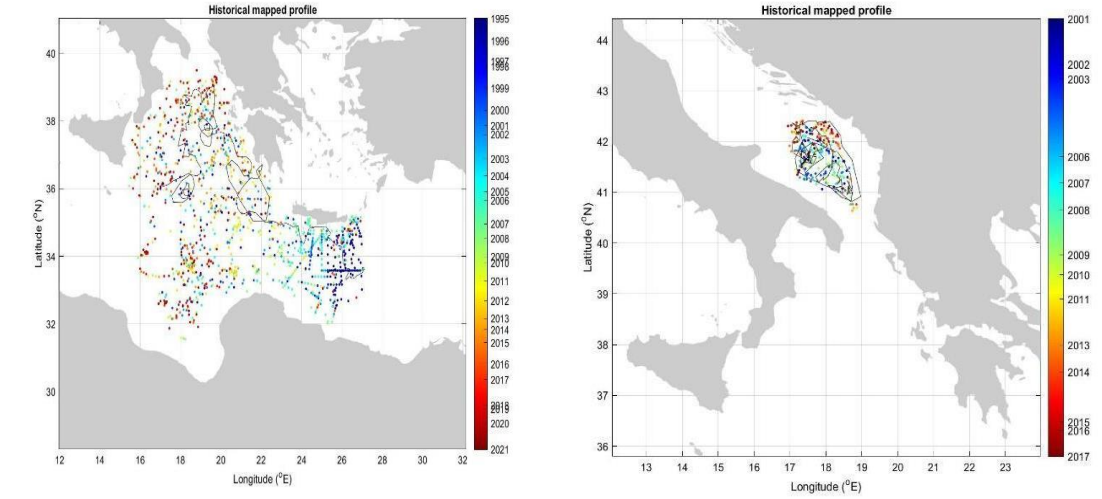



Figure 8. Two examples of a new OWC plot. On the left WMO 6903765 float deployed on 25/10/2019, on the right WMO 6903799 float deployed on 25/04/2021.

- The DMQC analysis has been conducted also on the deep floats deployed in the Mediterranean Sea. CPcor corrections have been applied and compared. The optimal CPcor value obtained has been reported in a shared spreadsheet (https://docs.google.com/spreadsheets/d/1ai1I0gzyHHRv_n6t2M3BMWVBp1F9XO4L2XB1YhBni9U/edit?usp=sharing). OWC and additional qualitative analysis were applied to evaluate any potential sensor drift. An example of DMQC analysis of deep floats was published on github: (https://github.com/euroargodev/dmqc_deep_examples/tree/main/MediterraneanSea). OGS will continue to implement delayed mode procedures for adjusting salinity data from Deep-Argo floats with the SBE CTDs in MED Sea, selecting the CPcor correction that provides the best result.

- The high-quality ship-based CTD reference data from the near-surface to depths more than 2000 m, for QC purposes of Core and Deep-Argo float data in the Mediterranean and Black seas, was reviewed and improved (figures 9 and 10). Data was collected from several research institutes at regional level and the main European Marine Services. Data was converted in mat format to be used in OWC procedure. A quality control was applied such as an additional visual check to avoid spike or duplication. Data was merged and divided in subsets of WMO boxes

according to the climatological areas of the Mediterranean Sea. The updated reference dataset consists of about 66800 CTD profiles. Due to a more detailed quality control and the exclusion of profiles in the first 80 dbar (especially in the Adriatic sub basin), there are less CTD profiles compared to the previous one. This resulted in a good spatial distribution with more recent/contemporaneous data. In order to obtain an even more accurate reference dataset, the procedure developed at BSH is being adapted to marginal seas to find errors, suspicious data, large time gaps, etc.

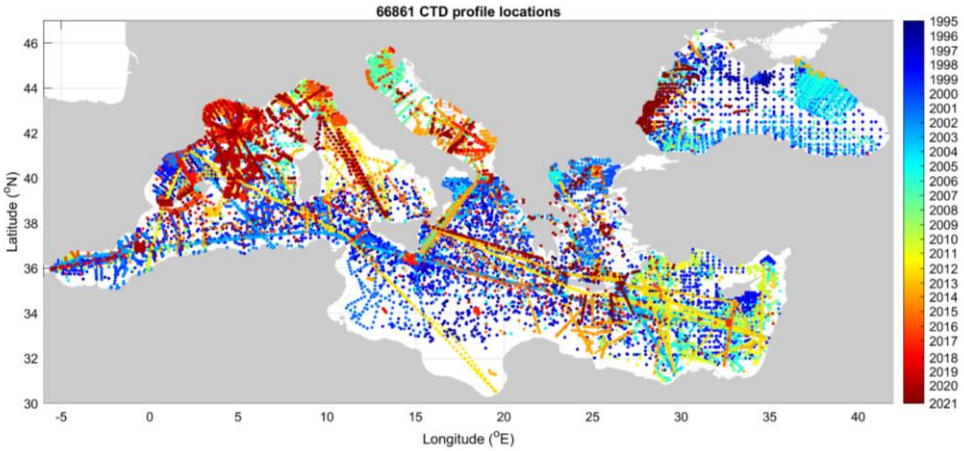



Figure 9. Spatial distribution, color-coded for time, of the CTD profiles in the final version of the CTD reference dataset of the Mediterranean and Black Seas.

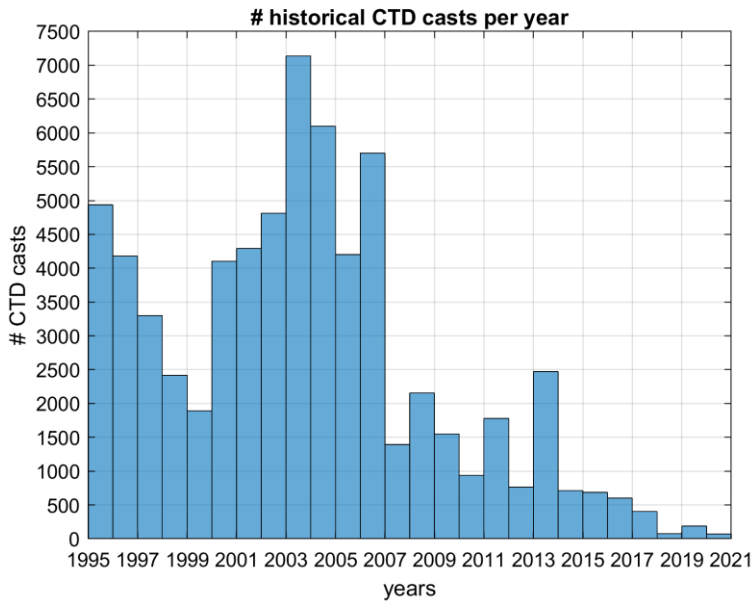



Figure 10. Temporal distribution of the CTD profiles in the final version of the CTD reference dataset of the Mediterranean and Black Seas.

## 3. Value Added items

- List of current national Argo web pages, especially data specific ones

The MedArgo web page new address is http://argo.ogs.it/medargo/). Tables and graphics are updated in near real time. The floats deployed during 2022 have been added to the web page as soon as the technical information is available. The float positions are plotted daily (Figure 11); the monthly and the whole trajectories are also provided. Links with the Euro-Argo data selection tools and GDAC center (Coriolis) are also available for downloading both the real-time and delayed-mode float profiles.

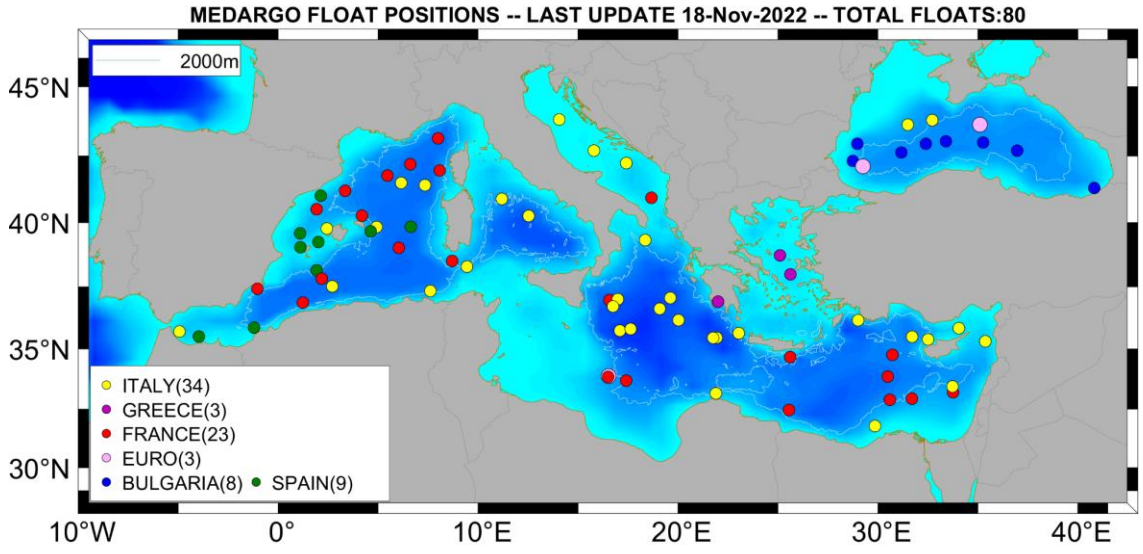



Figure 11. MedArgo float positions as of 18 November 2022 (updated daily).

- Products generated from Argo data that can be shared

a. Daily maps of float positions (Figure 11)

b. Monthly maps of float positions and track

c. Physical and Biogeochemical Argo float data are assimilated in numerical forecasting models by CMCC and OGS; 3D daily maps of Mediterranean ocean forecasting systems are produced and available on CMEMS (Figure 12).

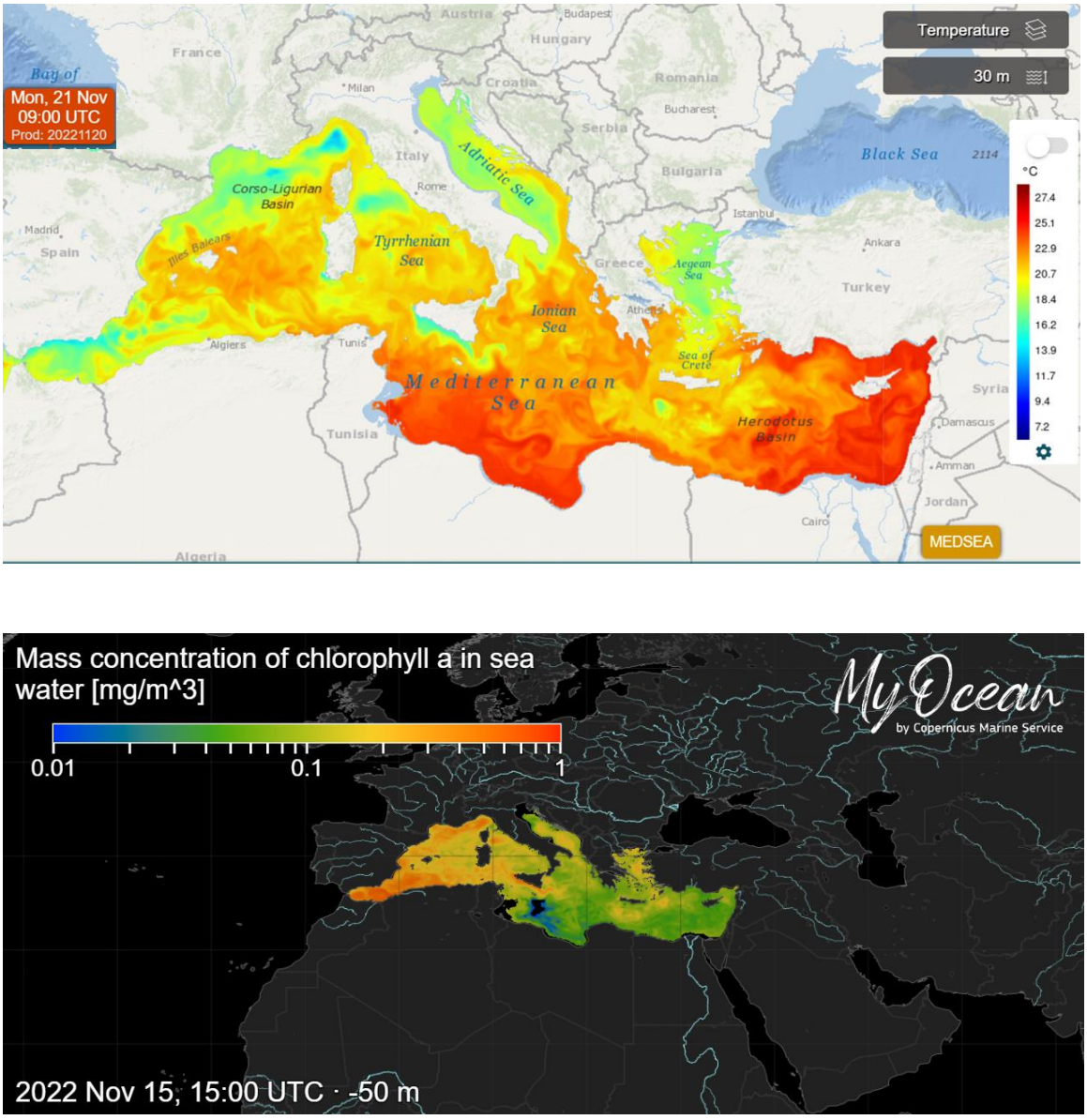



Figure 12. Forecasting models' products available on CMEMS. Physical (top) and biogeochemical (bottom) products.

d. An operational validation system has been developed by SOCIB to systematically assess the model outputs at daily, monthly and seasonal time scales. Multi-platform observations including in-situ measurements (Argo floats included) are used for this systematic validation (figure 13).

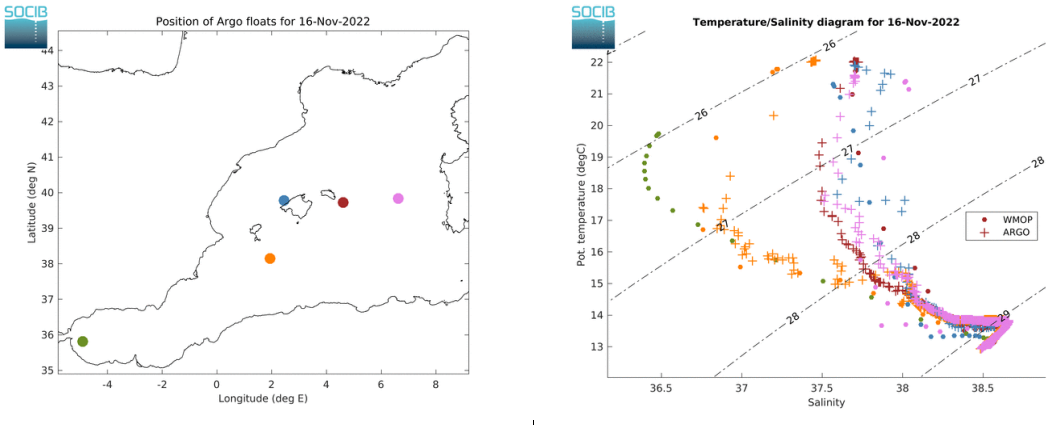



Figure 13. The WMOP temperature and salinity vertical profiles are compared to the last available vertical profiles from Argo floats.

## 4. Regional Centre Functions

✓ MedArgo is the Argo Regional Centre for the Mediterranean and the Black Sea. OGS, who coordinates the MedArgo activities, established several collaborations with European and non-European countries in order to set the planning and the deployment coordination of floats. Hence, a good coverage is maintained throughout the years. As part of these cooperations, the float data are transferred in near real time to MedArgo and 14 new floats have been deployed in the Mediterranean and Black Sea during 2022, through a coordinated activity of deployment opportunities and thanks to scientific projects. More floats (3 core, 3 TS+DO, 2 Bio, 1 Deep) will be deployed before the end of 2022.

✓ There are 68 active Argo floats in the Mediterranean Sea and 12 in the Black Sea as of 18 November 2022.

✓ The main MedArgo partners (Italy, Greece, Spain, France and Bulgaria) strengthened collaborations with the riparian countries through the H2020 Euro-Argo RISE project, to improve the Argo activities (deployment plans and opportunities, sharing reference datasets for QC, sharing expertise, joint activities). Furthermore, in the framework of this project, extension of Argo operations in shallow/coastal waters is ongoing.

✓ The high-quality CTD reference dataset for DMQC has been improved and updated.

✓ The D-files of 66% of the eligible profiles (core variables) have been submitted to the GDAC.

Future plans:

- Maintain > 60 active floats, with ~25% BGC and Bio
- Maintain 2 deep floats in deep Ionian & Rhodes Gyre area
- Maintain > 10 active floats, with ~20% Bio & TS DO

## 6. Other Issues

- Bio/BGC profiles are decreasing
- In the Black Sea deployments are delayed due to the war in the area