European contribution to the OneArgo array

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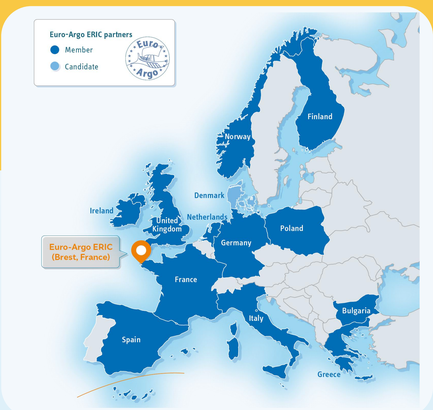

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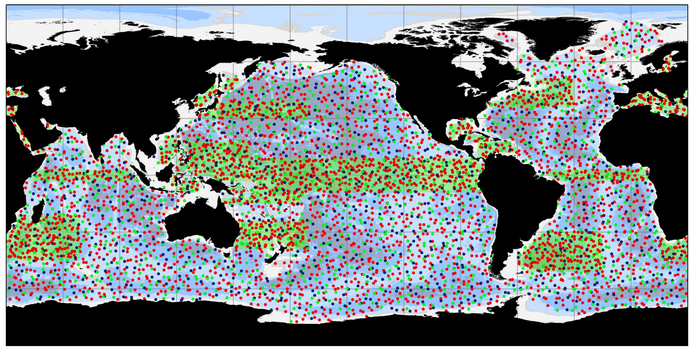
OneArgo

The Argo international programme is a major component of the Global Ocean Observing System. Originally designed to provide temperature and salinity profiles in the upper 2 km of the ice-free ocean, the Argo array has been expanded into seasonal ice zones, marginal seas, deeper waters (Deep-Argo) and biogeochemical parameters (BGC-Argo), forming the new "*global, full-depth and multidisciplinary*" OneArgo programme, which implementation has started after the OceanObs'19 Conference (Roemmich *et al.* 2019).

Euro-Argo aims at maintaining ¼ of the new OneArgo array. This poster presents the strategy for the OneArgo network implementation in Europe and the associated challenges.



OneArgo variables
Pressure
Temperature
Salinity
Oxygen concentration
Chlorophyll-a concentration
Suspended particules
Nitrate concentration
pH
Downwelling irradiance

OneArgo design. The aim at international level is to achieve the global coverage by 2030

The Euro-Argo ERIC

The Euro-Argo programme, coordinated by the Euro-Argo ERIC (European Research Infrastructure Consortium), represents **the European contribution to the Argo international programme**, as the sum of European national contributions plus occasional project-based contributions from the European Commission. The ERIC is composed of **12 members** with financial commitments at national level and is coordinated by a central office based in Brest, France.

What drives Euro-Argo

The European contribution to Argo is driven by scientific interests, while considering the needs of both the operational and satellite-based communities, and ensuring a global implementation of the OneArgo design in collaboration with international partners.

Euro-Argo has been a key player in driving the evolution of Argo and its new missions. A new type of float able to carry additional BGC sensors, while enabling the float to fulfil its BGC-Argo mission (10 days cycles, for 4 years) has recently been developed in Europe. A number of these jumbo floats have been deployed with two additional types of sensors: (i) particle size imagers and (ii) hyperspectral radiometers, showing encouraging results, and high potential for Ocean Colour satellite data validation (Fig. 1) .

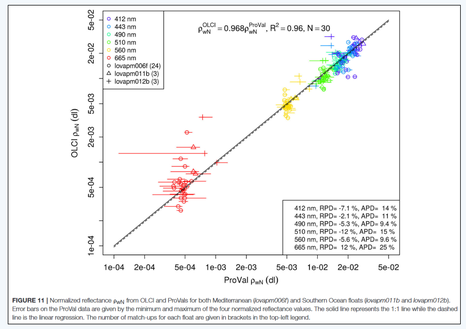


FIGURE 11 | Normalized reflectance ρ_{wN} from OLCI and ProVals for both Mediterranean (iovapm006f) and Southern Ocean floats (iovapm011b and iovapm012b). Error bars on the ProVal data are given by the minimum and maximum of the four normalized reflectance values. The solid line represents the 1:1 line while the dashed line is the linear regression. The number of match-ups for each float are given in brackets in the top-left legend.

Figure 1. Leymarie et al., *Frontiers*, 2018

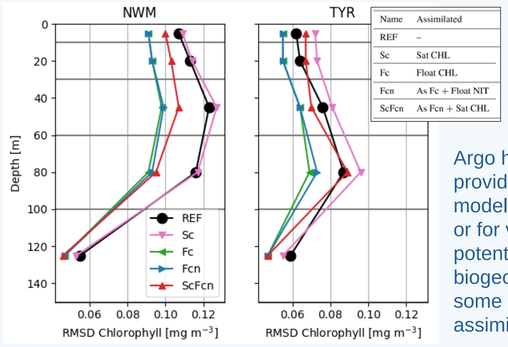


Figure 2. Difference between model and Argo – Terruzzi et al., *Biogeosciences*, 2021

Argo has always been key for providing *in situ* measurements to modelers, either for data assimilation or for validation. With OneArgo, the potential is expanding towards biogeochemical (BGC) modelling, and some groups in Europe are already assimilating BGC parameters (Fig. 2).

Jumbo BGC float © T. Jessin

The global coverage of the core-Argo array, achieved in the early 2000's, is an unprecedented asset to monitor the global Ocean Heat Content of the upper 2000m of the ocean (Fig. 3). The deployment and maintenance of a global Deep-Argo component will also enable to observe trends in the deeper waters, which contribution has been shown to be significant (von Schuckman *et al.* 2023).

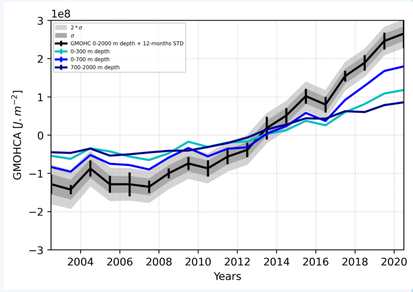


Figure 3. Kolodziejczyk et al., *JGR*, 2019

Euro-Argo network implementation

Euro-Argo's long-term objective to contribute to ¼ of the international OneArgo array corresponds to maintaining about **1200 European active floats**, including **300 Deep** and **250 BGC floats**. This ambitious target should be achieved by 2030, subject to appropriate funding.

The monitoring of **European marginal Seas**, namely the **Baltic**, the **Black** and the **Mediterranean Seas**, is one of Euro-Argo priorities for Euro-Argo. Maintaining a network of BGC-Argo floats in these regions will contribute to the monitoring and assessment of the marine environment status and functioning in relation to climate change as part of the European Union Green Deal. Efforts will also be made to maintain an appropriate number of Deep active floats in the Mediterranean Sea.

	# of active BGC floats	# of active Deep floats
Mediterranean Sea	7	6
Black Sea	3	0
Baltic Sea	2	0
Arctic (>60°N)	-	3
Rest of the world ocean	238	271
TOTAL	250	300

Euro-Argo long term regional targets for the Deep & BGC missions

In complement, Euro-Argo aims to contribute to the implementation of OneArgo at **global scale**, in coordination with international programmes, with a specific interest in maintaining an appropriate **BGC floats array in the Nordic Seas, Arctic Ocean and the South West Indian Ocean**. For the Deep-Argo mission, Euro-Argo is currently following international recommendations to **maintain the current pilot experiments**, while pursuing efforts towards **technological refinements** (e.g. long-term stability). Because of their predominant roles in the ventilation and long-term sequestration of climatic signals into the deep (via convective mixing and downslope cascading), **the North Atlantic, the Nordic Seas** and the **Southern Ocean** stand out as the most natural targets and will be European scientific priorities for Deep Argo. Discussions have started with key data users to decide whether the priorities should be to start a global Deep-Argo implementation with sparse floats or to focus on specific regions.

The distribution of dissolved oxygen (DO) concentration at global scale is driven by physical, biogeochemical and biological processes and DO data is in a key position of many biogeochemical processes. The optode DO sensor is of proven maturity and can provide very accurate measurements, after appropriate corrections have been applied. It is currently carried by a large proportion of Euro-Argo floats, including most of European Deep-Argo floats. In the long-term, Euro-Argo plans to equip at least **3/4 of its fleet (all missions) with a DO sensor**.

Next steps & Challenges

The implementation of the new OneArgo design, and more specifically the BGC and the Deep-Argo missions, come with new challenges for Euro-Argo, including the cost, but also the need for growing capacity both at manufacturer level and in the teams involved with operations, data management, data quality and sensor accuracy assessment and monitoring. As one piece of a multiplatform ocean observing system, Argo and Euro-Argo will also have to improve synergies with other ocean observing networks in the future, to efficiently progress in ocean knowledge and management.

Euro-Argo is currently involved in activities aiming at scaling-up the Argo international data system (e.g. serve Argo data through cloud services, mutualisation of efforts for Argo data decoding in the context of diversification of floats and sensor types) and improving the European Ocean Observing System operations in synergy with other European Marine RIs (GEORGE and AMRIT Horizon Europe project).

GEORGE

AMRIT

Discussions are currently being held and will be pursued with teams using Argo data in the context of the Copernicus Marine service, ESA and Eumetsat, to work out how Euro-Argo could better answer their requirements and to progress collaboratively in highlighting the value of OneArgo to funding agencies in order to achieve the full OneArgo implementation in the next 5 years.

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