**Euro-Argo ERIC** - European Research Infrastructure

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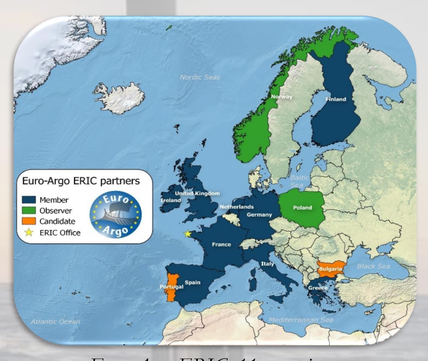
# Strategy for Argo in Europe for the next decade

## INTRODUCTION

Started as a FP7 EU project in 2008, Euro-Argo became a European Research Infrastructure Consortium (ERIC) in 2014.



*Euro-Argo ERIC: 11 countries*

The objectives of the Research Infrastructure are to coordinate and sustain the European contribution to the global Argo network, with around 250 European Argo floats deployed per year (1/4 of the network), through both national and European funds (*MOCCA project, see poster 71. in session 3*).

The main challenges for Euro-Argo for the coming years are to sustain the core-Argo programme and to implement the new phase of Argo with an extension towards biogeochemistry, the polar oceans, the marginal seas and the deep ocean. In 2016, Euro-Argo has revised the strategy for the evolution of Argo in Europe, in a new version of the document (*Euro-Argo ERIC (2016)*[1]). This reference document will be revised regularly taking into account both technological developments and the international Argo strategy. It provides recommendations on Argo floats deployments, including insights on the European contribution to the core-Argo programme, and sections dedicated to the Argo extensions.

## BIOGEOCHEMICAL ARGO

The progressive addition of new bio-optical (oxygen, Chla fluorescence, backscattering, radiometry) and other chemical sensors (nitrate, pH) to the system starts to let Biogeochemical-Argo (BGC-Argo) become a reality (Johnson and Claustre, 2016).

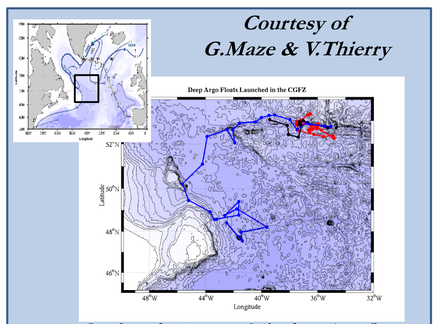
A target size of 1000 fully equipped BGC-Argo floats with uniform regional distribution is anticipated for the global array, which corresponds to **25 % of all Argo floats**. Euro-Argo aims at contributing to ¼ of the global effort, with an additional effort put **on equipping half of the whole European fleet with oxygen** sensors. Regional refinement is proposed depending on the interest of the research community for biogeochemical monitoring in specific seas or regions and it is expected that the European contribution will boost the BGC-Argo global network development.

## DEEP ARGO

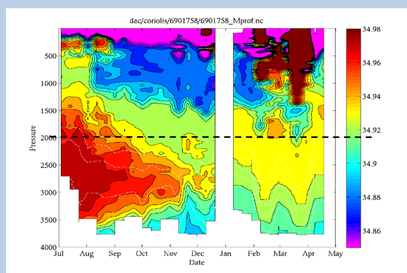
Many recent studies have highlighted the crucial contribution of the intermediate, deep and abyssal oceanic layers to the global energy and sea level budgets. Pilot experiments have demonstrated the capability of floats to make **interesting measurements up to 4000m and 6000m depth**. Sensor development is continuing as well as evaluation of the design of the Deep-Argo array proposed by Johnson et al. (2015).

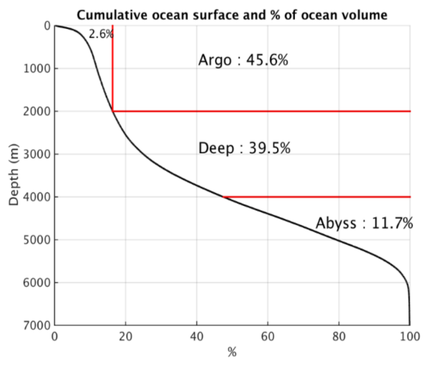
On the long term, the target for the European contribution to the Deep-Argo array is about 20% of the international target, which, based on the Johnson et al. (2015)'s straw-plan would correspond to about **240 active floats**. The strategy for Deep Argo is to first focus **on areas where large deep signals are located**, that is where deep-water masses are formed, namely the **North-Atlantic Ocean** and the **Southern Ocean**.

*Courtesy of G.Maze & V.Thierry*



*Southward trajectory of the deep Argo float 6901758 (blue) between deployment (July 2015) and May 2016*


*One year time series [2015-2016] of salinity measured by the deep Argo float 6901758*



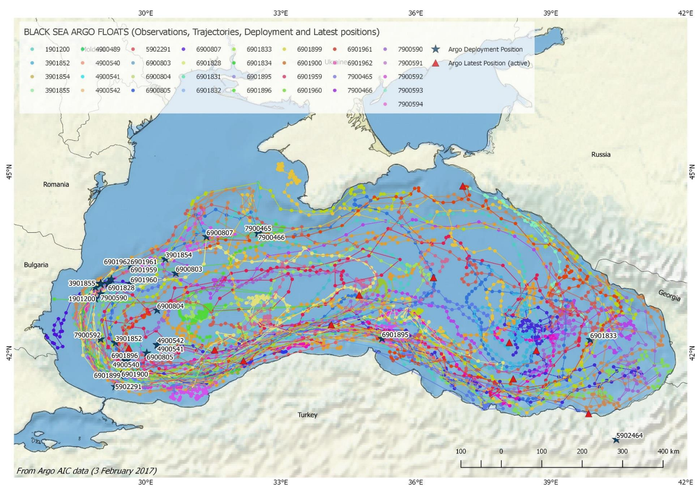
*Le Reste et al. (2016)*

The core (2000m) and deep (4000m) Argo boxes together cover almost 90% of the ocean volume (Le Reste et al. 2016). While 4000m Deep–Argo floats are sufficient to sample the entire water column in the North-Atlantic ocean, 6000m Deep-Argo floats should be preferred where the ocean is the deepest and especially in the Southern Ocean where warming of the abyssal layers is the largest.

## CORE ARGO & MARGINAL SEAS

Euro-Argo will ensure that the European deployments fulfil both the **international Argo programme requirements** in terms of global geographical repartition and the European scientific and operational oceanography community's needs. The **Atlantic Ocean** is a region of great interest for the European research community, and float deployments will be continued in this ocean, with a specific attention on keeping the appropriate sampling in equatorial and **boundaries regions (twice the classical sampling)**.

The **Mediterranean and Black Seas** are strongly affected by human activities and climate change, and defined by variability scales much smaller than the global ocean. The aim is to double the Argo sampling in these southern Europe Seas, with, **60 active floats** at all time in the **Mediterranean Sea** and at least **10 active floats** in the **Black Sea** with cycles of 5 to 10 days and parking depths adapted to the region.



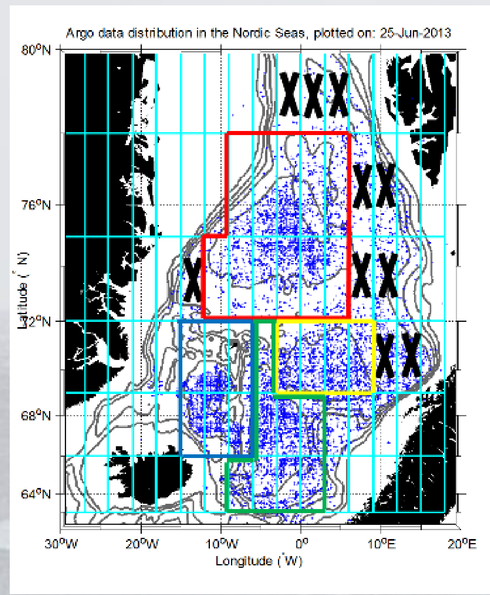
*Argo Float observations in the Black Sea since first deployments in 2002*

Continuous assessments of the chosen float parameters are necessary and will be performed.

Argo activity in the **Baltic Sea** started in 2011 by Finland.. The recommendation for the Baltic Sea is to keep **7 active floats at all time**, with a precise repartition within the several basins. Recovering the floats on an annual basis is planned, with redeployment after laboratory calibration. The Baltic Sea with its seasonal sea ice cover could also serve as a test bed for the development of Argo floats operating in sea ice environments. The gained expertise could then be exploited in the development of floats for the Arctic Ocean.

## HIGH LATITUDES EXTENSION

At present, the use of floats in the polar oceans is seriously impeded by the presence of sea ice. Nevertheless, the high latitudes are key regions of the global climate system and thus need to be monitored.



*3°x3° boxes for deployments: 10 floats in boundary currents, 29 in deep basins. Greenland Sea - Icelandic Plateau - Lofoten Basin - Norwegian Basin.*

Ice-avoidance algorithms for Southern Ocean, first developed by AWI for NEMO floats, have been successful in reducing damage to floats deployed in the seasonally ice-covered Southern Ocean. Euro-Argo aims at maintaining **50 active floats in the Weddell Gyre** based on the nominal design density. In the northern hemisphere, other direct methods of ice-sensing, especially based on optical measurements, are being tested for the ice-covered high latitudes in the Baffin Bay (NAOS project).

Using the core-Argo target, the Euro-Argo recommendations include that a total of **39 Argo floats should be active in the Nordic Seas**, among which 1/4 within the boundary currents, with a parking depth of 500m.

With the ongoing technological development, a further extension of the global Argo array in to the ice-covered areas of the Northern high latitudes - including Arctic - is envisioned (at about 5 years).

## References


- **Euro-Argo ERIC (2016): Strategy for evolution of Argo in Europe, v3.2.** DOI: 10.13155/48526
- Johnson, K. S., and H. Claustre (2016): Bringing biogeochemistry into the Argo age, *Eos, 97,* https://doi.org/10.1029/2016EO062427.
- Johnson, G. C., J. M. Lyman and S. G. Purkey (2015): Informing Deep Argo Array Design Using Argo and Full-Depth Hydrographic Section Data, JAOT 32, DOI: 10.1175/JTECH-D-15-0139.1
- Le Reste, S., V. Dutreuil, X. André, V. Thierry, C. Renaut, P. Y. Le Traon and G. Maze (2016): "Deep-Arvor": A New Profiling Float to Extend the Argo Observations Down to 4000-m Depth, JAOT 33, DOI: 10.1175/JTECH-D-15-0214.1.