

# GERMAN ARGO PROGRAMME

## PRESENT STATUS AND FUTURE PLANS

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### 1. Background and organization of German Argo activities

The German Argo programme has been initialised as a partnership between three oceanographic institutions (AWI, BSH, IfM-Geomar) in Germany. German Argo began in 2004 and was funded by the Ministry of Research until the end of 2007. German Argo is an operational programme since the beginning of 2008 and the Ministry of Transportation is providing long-term funding for German Argo. BSH will manage the German contribution to the international programme. An expert group consisting of the BSH and partners from the oceanographic institutes has been established to coordinate the German deployment plans.

Deployment of profiling floats started as early as 1998 within several research projects. All pre-Argo floats were declared Argo-equivalent floats and the respective data sets have been submitted to the GDACs through Coriolis. Floats deployed by IfM-Hamburg in the context of the Mersea and WEN projects have also been made available for the Argo programme.

The BSH and KDM (a consortium of German research institutes) are participants in the Euro-Argo project. Euro-Argo will aim at promoting an European contribution to Argo and establish an European structure from the various national programmes (to be defined in the Euro-Argo PP) after 2011.

#### 1.1 Deployed floats

Since 1998, more than 380 floats have been deployed by Germany in a number of different geographic areas and programmes (ARGO\_AWI, ARGO\_Greenland, BSH, Clivar Marine German Programme, IFM2, IFM\_GEOMAR, SFB460, TROPAT, WECCON, WEN). Deployments have focused on meeting specific German research requirements, but contributed also to the global array. The German contribution is comparable to that from other developed countries and has provided a significant contribution to the growing Argo array.

The main interest of Germany will remain in the Atlantic, but to maintain the global array floats could also be deployed in the other oceans if necessary. Recent deployments reflect the specific research interests and range from the Nordic Seas, the subpolar North Atlantic, the tropical Atlantic to the Atlantic sector of the southern Ocean.

Overall Germany plans to contribute to the Argo global array at the level of about 60-70 floats per year with funding from BSH/BMVBS (about 50 floats/year) and individual science programs (BMBF, DFG and national budgets at about 20 floats/year). The majority of the Argo-equivalent floats will be used for regional enhancements in the polar areas. In 2010 the agreed funding will amount (44/6) floats funded by BMVBS and (2/20) floats funded by science programmes. The numbers in parenthesis indicate core Argo/additional deployments.

Year	Deployed floats
2000	27
2001	21
2002	14
2003	27
2004	45
2005	65
2006	36
2007	39
2008	72
2009	35
2010	49 +??
2011 plans	50 + rest of 21 from 2010 + 20 science floats

Tab. 1: Floats deployed by Germany as a contribution to Argo since 2000

## **1.2 Float Development**

Most of the floats deployed by Germany in the past are APEX floats purchased from Webb Research, but a smaller amount of floats are manufactured by the German company Optimare. Optimare has been working in close collaboration with the AWI and has developed a float type suitable for partially ice covered seas. These floats are equipped with an ice sensing algorithm which prevents the float from ascending to the surface under ice conditions and prevents it from being crushed. Float profiles are stored internally until they can be transmitted during ice free conditions. The ice sensing algorithm has been successfully tested in the Antarctic, in 2009 initial tests have been performed in the Arctic which will be continued in 2010. Most of the German floats are equipped with the standard Seabird CTD but occasionally additional sensors as Aanderaa optodes and Rafos acoustic receivers are installed.

Deployments in 2010 lag behind the original plans due to time delays in float procurement. But the remaining 21 floats will be deployed early 2011. Since the price of floats increased due to the dollar exchange rate a slightly smaller amount of floats could be purchased. The float deployment from the science community is also lagging behind the original plans for 2010. The deployment in the Southern Ocean is going to take place mainly in 2011. Until the end of the year the deployments will have reached 49 floats in the Northern and Southern Atlantic.

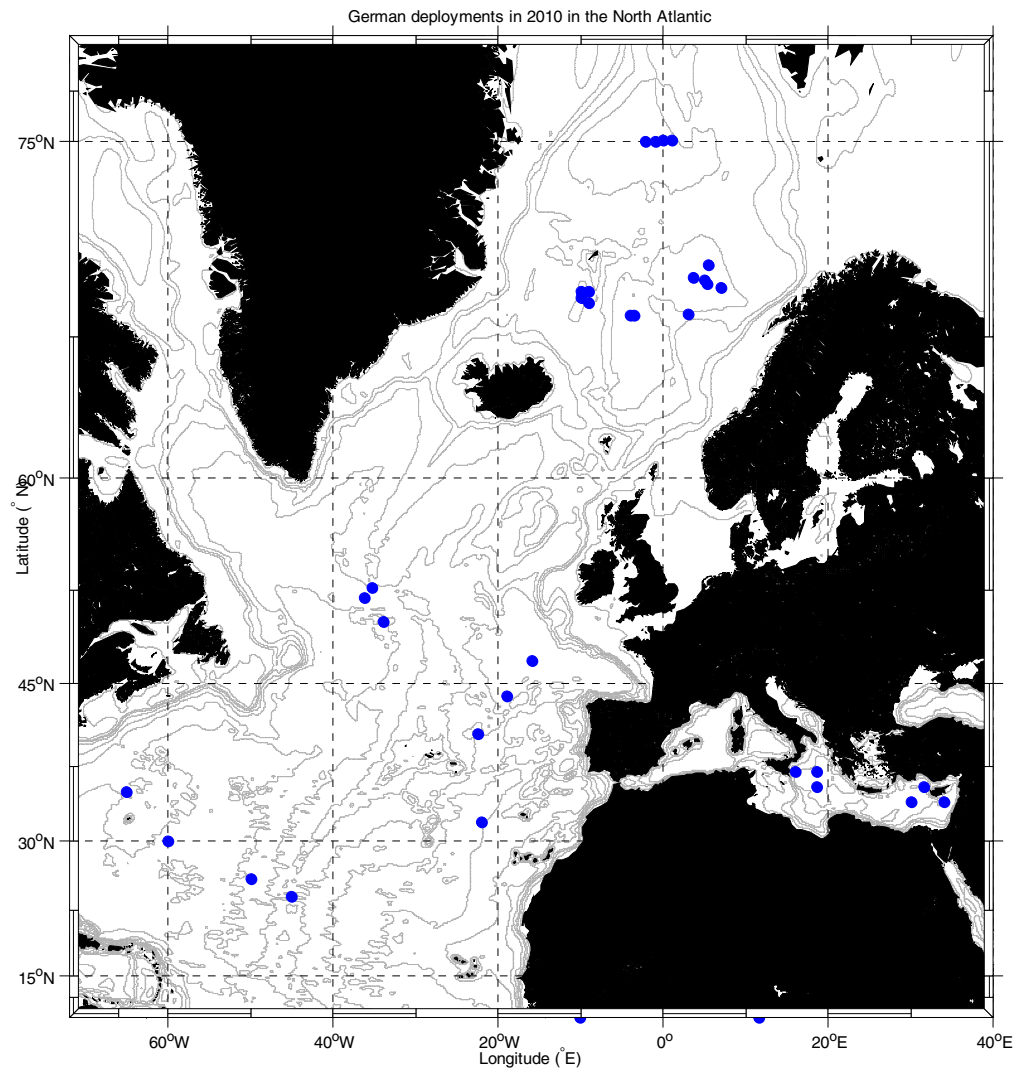


Fig. 1a: Float deployment in 2010 in the Northern Atlantic.

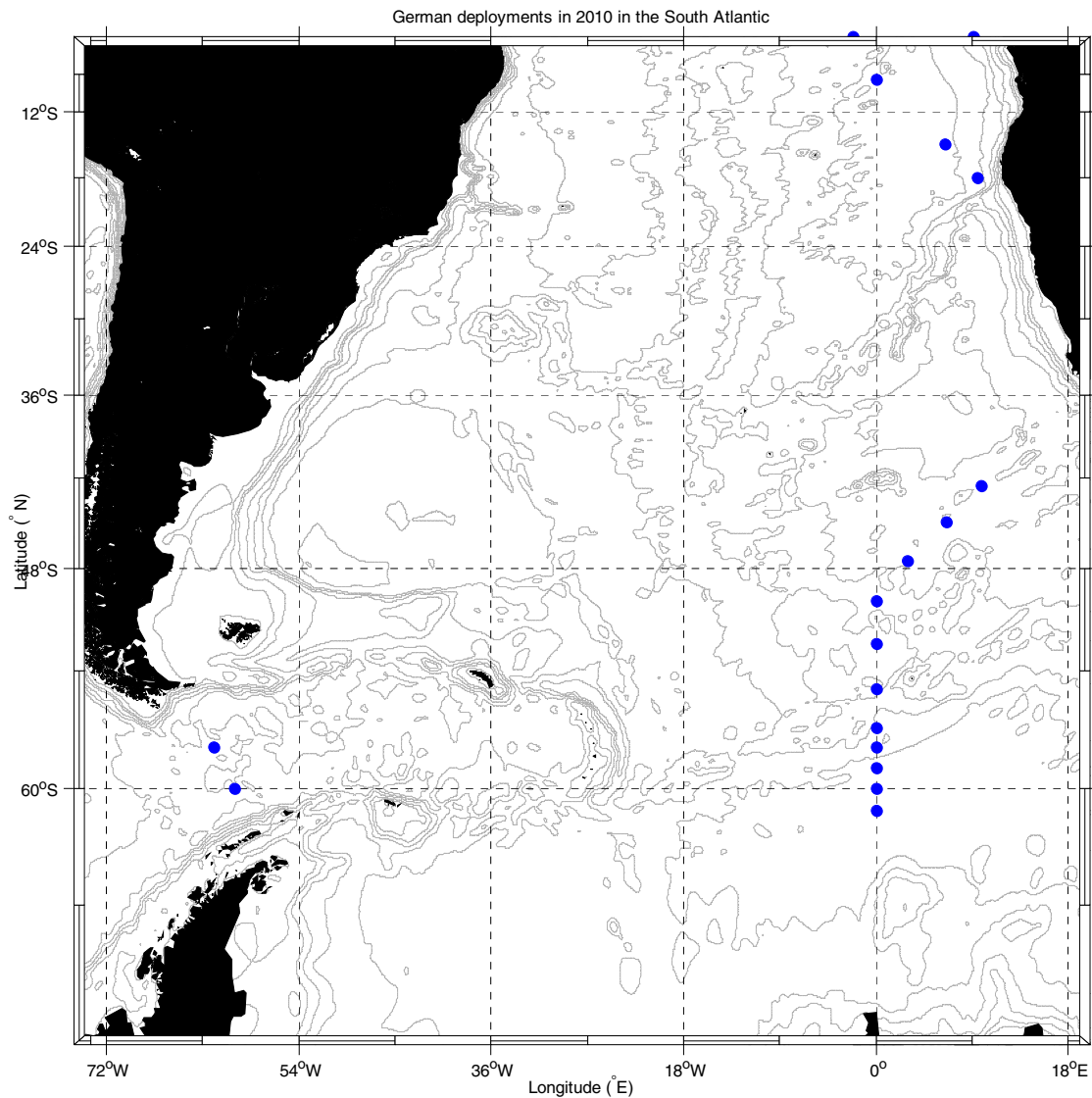


Fig. 1b: Float deployments in 2010 in the South Atlantic

### **1.3 Data management**

Real-time data processing. The real-time data processing for all German floats is performed at the Coriolis Center in France. Data processing follows the procedures set up by the Argo Data Management Team.

Delayed-mode data processing. The delayed mode processing is distributed between the various German institutions contributing to Argo, depending on their area of expertise. AWI is responsible for the southern Ocean, IfM-Hamburg together with BSH is processing the German floats in the Nordic Sea, and BSH is covering the tropical, subtropical Atlantic and subpolar Atlantic. The sharing of delayed-mode data processing will be continued in the coming years, but BSH will cover all the German floats which have not been assigned a PI.

BSH also has adopted some European floats which did not have a DMQC operator assigned to them. All German institutions have been working in close collaboration with Coriolis and delayed mode data have been provided on a 6 monthly basis. Delays in delayed-mode data processing have occurred occasionally due to changes in personal and delay in data transmission in the Southern Ocean due to ice coverage. Delayed-mode data processing follows the rules set up by the Data Management Team.

North Atlantic Argo Regional Centre (NA-ARC). Germany has contributed to the activities of the NA-ARC. Work has concentrated on acquiring recent CTD data to improve the reference data set for the North Atlantic Ocean needed for scientific QC of the float data and coordinates the delayed mode processing in the different institutes in Germany. Germany has adopted floats from different smaller Argo programmes as Norway, Netherlands, Finland, Poland and Denmark.

#### **1.4. Operational and scientific use of Argo data**

A key aspect of the German Argo programme is to develop a data base for climate analysis from Argo data, to provide operational products (time series, climate indices) for interpretation of local changes and to provide data for research applications. German Argo is planning to host an annual user workshop where research applications can be presented and requests for operational products can be specified.

Ocean science: Argo data are being used by many researchers in Germany to improve the understanding of ocean variability (e.g. circulation, heat storage and budget, and convection), climate monitoring and application in ocean models (assimilations, boundary conditions,...).

## **2. Funding**

### **2.1 Existing funding for German Argo**

As noted above the German Argo Project has been funded by the Ministry of Research from 2004-2007 and will be funded by the Ministry of Transportation from 2008 onwards. Funding in 2007 was meant to ensure a smooth transition into the operational phase and covered only personnel costs. Overall the level of support is indicated in the table below. Approximately 50 floats per year will be contributed to the global array by Germany. Funding from the Ministry of Transportation covers only costs related to float procurement and transmission costs, personnel will be provided by BSH. This will consist of 1 scientist and 1 technician.

Year	Float related costs	Manmonth/Year
2007	0k€	36
2008	550k€	24
2009	600k€	24
2010	600k€	24
2011	600k€	24
2012	600k€	24
2013	650k€	24

*Table 2. Previous and future funding for German Argo.*

## **2.2 On the future funding and organization for German Argo – links with Euro Argo PP**

Germany will contribute to the Argo global array at the level of about 50 floats per year. Requests for financial contribution have been included in the national budgets for 2009-2013, but final budget negotiations will be carried out on an annual basis. As part of the Euro-Argo preparatory phase, BSH will work with its funding ministry to agree on a long-term European structure. The research community has also secured funding for floats in the order of 20 floats per year for the next 3 years which will mostly be used for regional enhancements in the polar areas.

## **3. Future plans for 2011**

Float deployment in 2011 will be performed in co-operation with the German research institutes. Germany owns deployment capabilities for all oceans including the ice covered areas but foreign research cruises will be used as well to cover all intended deployment areas.

The main goal is to support the global array in the Atlantic ocean. The intended deployment areas cover particularly data sparse regions in the Atlantic, the Nordic Seas and the Mediterranean. Additional floats will be deployed in the Weddell Sea. Floats from the science community will be deployed in the Southern Ocean and the Pacific.