

Argo Germany National Report 2014

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1. The status of implementation (major achievements and problems in 2014)

Data acquired from floats:

Most of the floats deployed by Germany are operated by BSH but additional funding has been acquired by various research institutes. BSH deployed 58 floats in 2014, 18 floats purchased in 2014 were kept in store to serve deployment cruises early 2015 and 3 additional floats needed repair and will be re-delivered in 2015. Additionally planned deployments for 3 floats in the Mediterranean had to be cancelled because the working permits for the Turkish Waters were denied. The Alfred-Wegener-Institute (AWI) had planned to deploy additional 27 floats in the Atlantic Sector of the Southern Ocean and in the Weddell Sea between December 2014 and January 2015. 15 floats have been deployed but so far haven't sent data. When the ongoing technical analysis is finished the remaining floats could be deployed at the end of 2015. 8 floats have been deployed by GEOMAR in the Pacific. This gives a total of 71 German float deployments until the end of 2014.

Currently (February 2th, 2015) 144 German floats are active (Fig.1) and the total number of German floats deployed within the Argo program increased to 694.

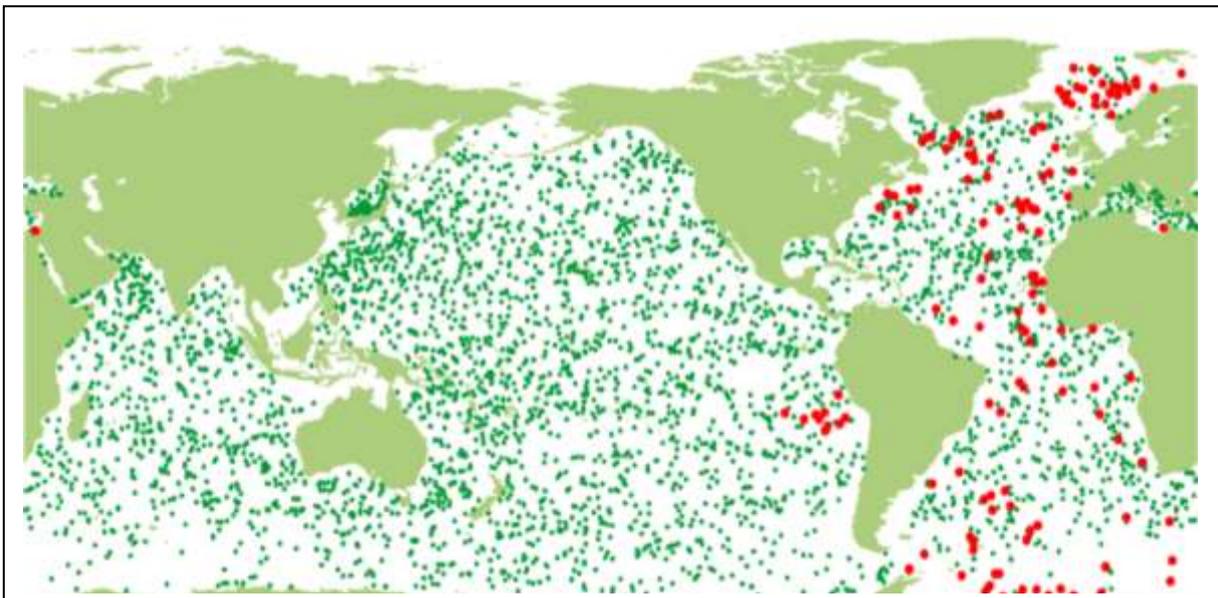


Fig. 1: Locations of active German floats (red) with active international floats (green) (Argo Information Centre, February 2015).

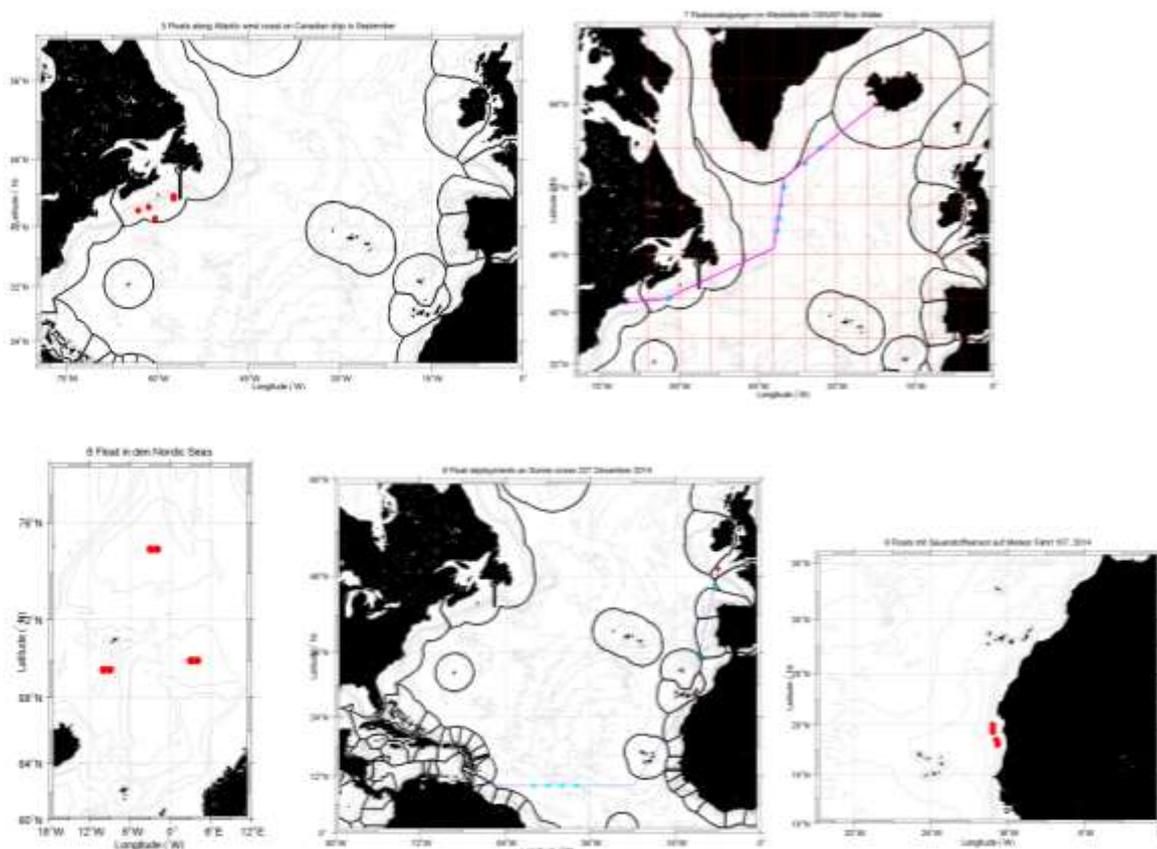
In the past most of the German floats were APEX floats purchased from Webb Research, but a smaller amount of floats were manufactured by the German company OPTIMARE. The company has been working in close collaboration with the AWI and has developed a float type suitable for partially ice covered seas. 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. In the last year three manufacturers supplied the floats

purchased by BSH: ARVOR floats from NKE and NOVA floats from METOCEAN. Additionally 14 APEX floats were supplied by WEBB/TELEDYNE as replacement for floats which had problems with their alkaline batteries.

We had discovered major technical problems with the alkaline batteries in our APEX floats deployed since 2010. Until early 2014 more than 30 floats expired early with life cycles of about 700-800 days. The technical data sent back from the floats indicate a sudden loss of battery voltage to values of around 7 volts during the last profile and increased battery consumption during the previous cycles. We contacted TELEDYNE/WEBB about the problem and it was discovered that the floats were experiencing 'energy flue' because of a design change in the floats. As a possible fix against the premature fail of the entire battery pack due to failure of an individual alkaline battery a diode was installed in the design in 2004, but was removed again in 2009/2010. WEBB/TELEDYNE has offered 14 floats in compensation for the malfunctioning floats in 2014 and we are expecting more replacements in 2015.

Most of the German floats deployed in 2014 are standard TS floats, but 6 floats deployed by BSH and 8 floats deployed by GEOMAR carried additional oxygen sensors. Deployment was carried out mostly on research vessels but also with the help of the German Navy. The research vessels comprised Canadian, German, UK, and US ships.

The deployment locations for 2014 are shown in Fig. 2a-j.



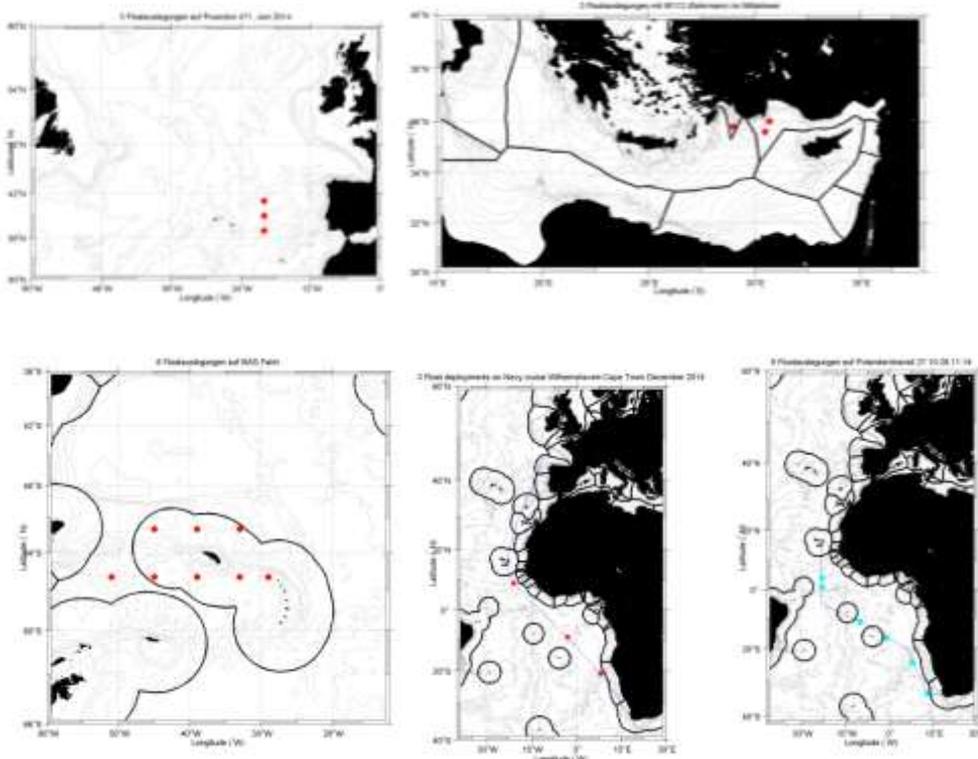


Fig. 2a-j: Deployment cruises and positions for 2014. Please note that the cruise in the Mediterranean has been cancelled.

Germany has joined the new European Research Infrastructure Consortium EURO-ARGO-ERIC which was established in July 2014 in Brussel by 9 founding countries (France, Germany, United Kingdom, Italy, Netherlands, Norway, Greece, Poland and Finland).

2. Deployment plan for 2015

The deployment plans for 2015 will comprise at present about 54 floats from BSH in the Atlantic, the Nordic Seas, Indian Ocean and the Southern Ocean and consists of floats purchased already in 2014, funds from 2015 and returned floats/repairs. The priority of our deployments is grid completion and extension of the core Argo array into the seasonally ice covered oceans in the Nordic Seas and the Southern Ocean. We are expecting additional replacements by WEBB/TELEDYNE for floats with energy flu in 2015, the numbers will be evaluated in March 2015. Contacts with researchers on potential deployment cruises have been established and agreement has been reached on the possibility to deploy floats. We will decide on additional deployment positions during the first half of 2015, depending on the exact numbers of available floats. The German Navy has been contacted about potential deployments in the Indian Ocean during the regular survey operations. 6 Floats for the Indian Ocean have been uploaded on a German Navy ship and will be deployed during their patrol duty. Deployment positions for already the planned cruises are given in Fig. 3, 4 and 5. The AWI has 12 remaining floats from the Polarstern cruise in 2014/2015 which could be ready for deployment at the end of 2015.

Fig. 3: South Atlantic deployments

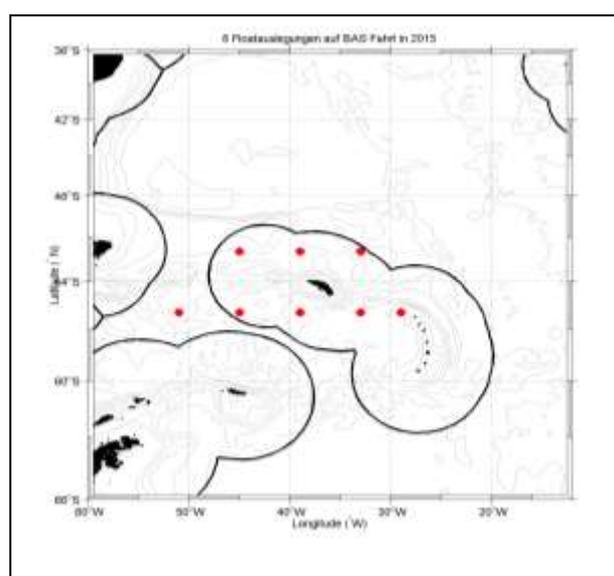
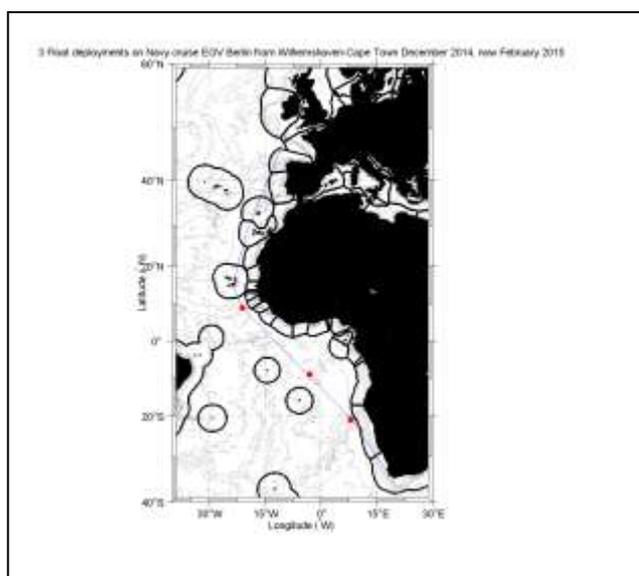
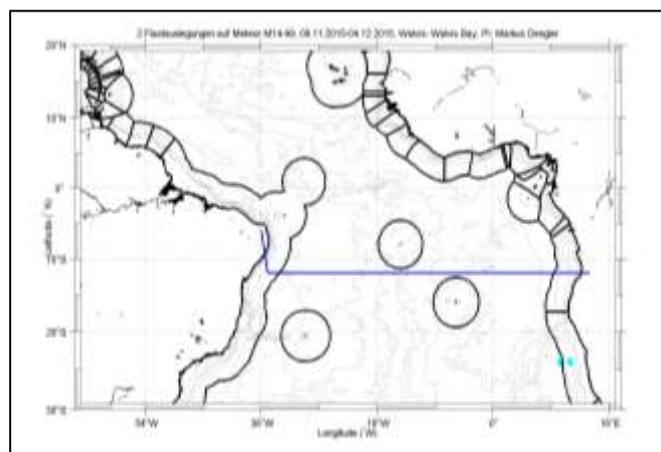
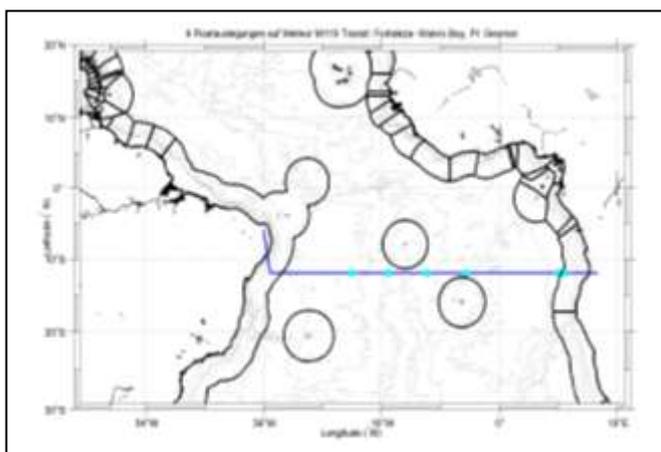
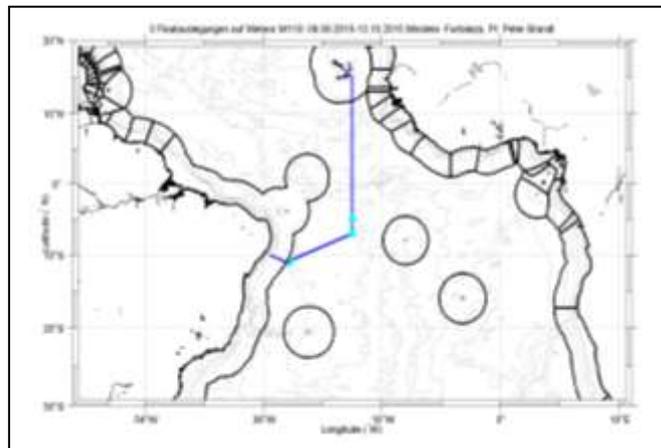
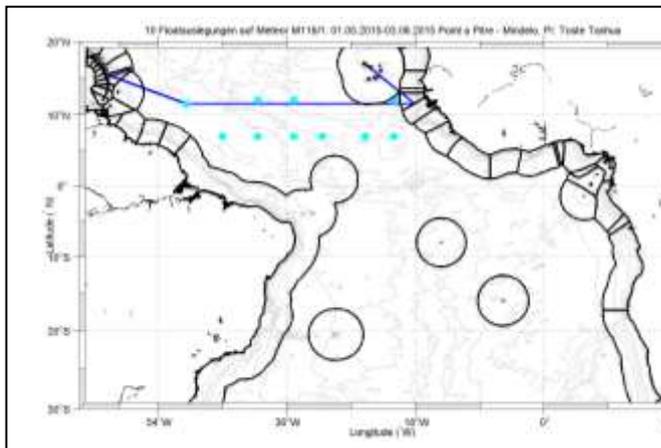


Fig. 4: North Atlantic deployments

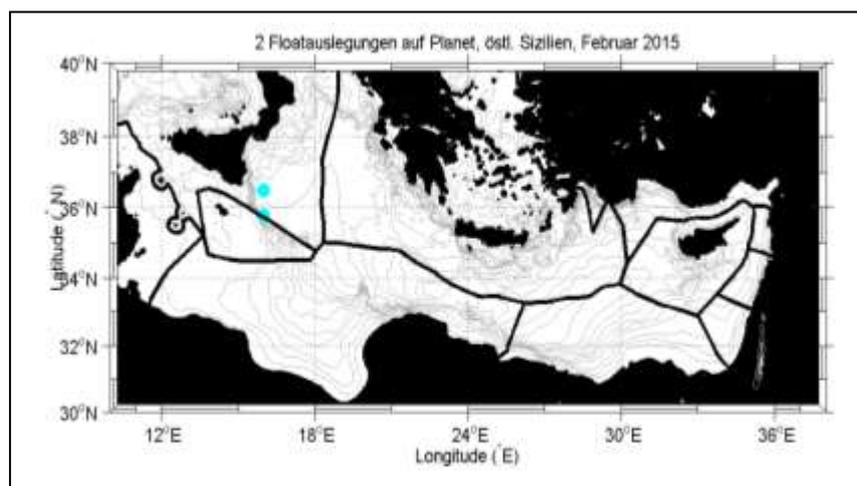
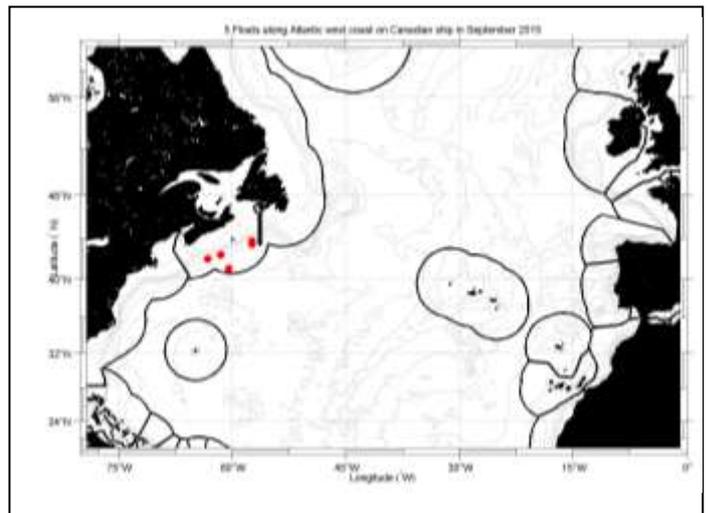
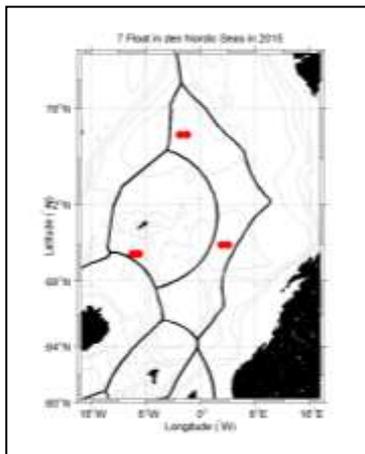
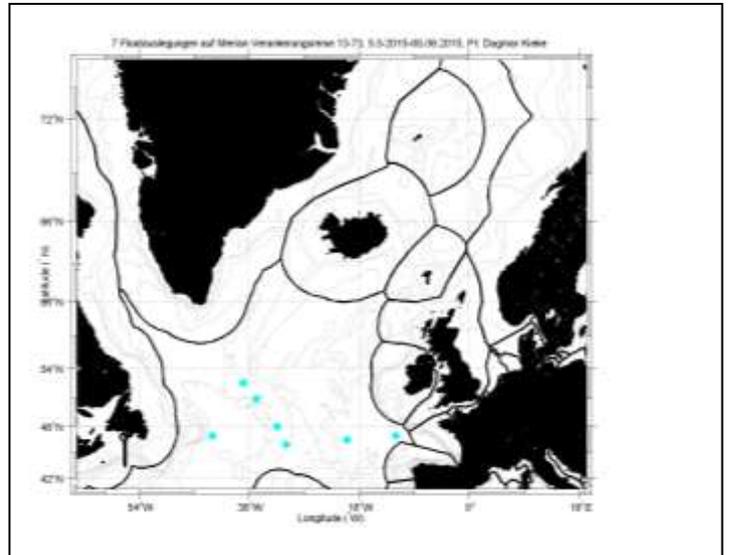
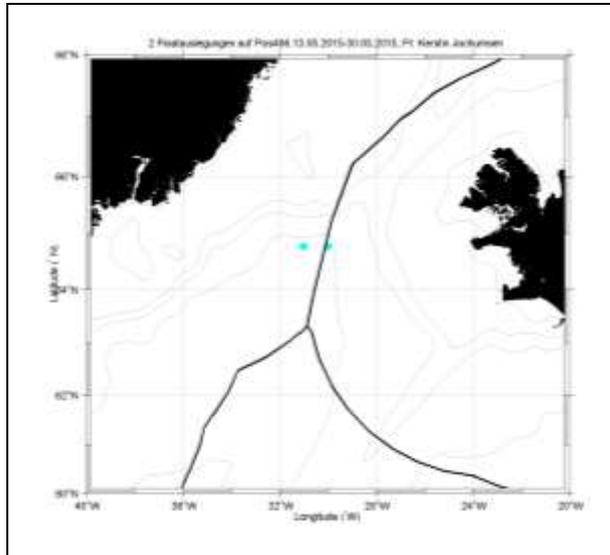
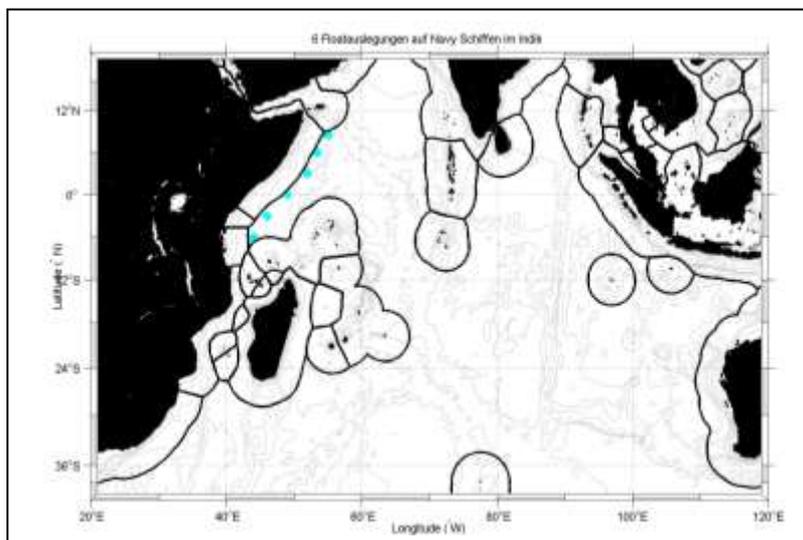


Fig. 5: Indian Ocean deployments



3. Commitments to Argo data management

Data issued to GTS

The profiles for all German floats are processed by Coriolis and are distributed on the GTS by way of Meteo-France.

Data issued to GDACs after real-time QC

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.

Data issued for delayed QC

The delayed mode processing is distributed between the various German institutions contributing to Argo, depending on their area of expertise. The Alfred-Wegener Institute is responsible for the Southern Ocean and GEOMAR is processing the Pacific floats. IfM-Hamburg together with BSH are processing the German floats in the Nordic Sea, while BSH is covering the tropical, subtropical and subpolar Atlantic. German floats in the Mediterranean on the other hand are processed by MEDARGO. The sharing of delayed-mode data processing will be continued in the coming years, but BSH will cover all German floats which have not been assigned to a PI. BSH has also adopted some European floats which did not have a DMQC operator assigned to them, such as national Argo programs from the Netherlands, Denmark, Norway, Finland and Poland. All German institutions have been working in close collaboration with Coriolis and delayed mode data have been provided on a 6 month 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. The DMQC process is well underway and no major delays have been encountered.

Delayed mode data send to GDACs

All delayed mode profiles from BSH have been sent to the Coriolis GDAC node. The total number of available profiles from German floats is 48894 (February 2th, 2015), the number of DM profiles is 43608. The percentage of DM profiles with respect to the total number of profiles is about 85%.

4. Summary of national research and operational uses of Argo data

Web pages

BSH is maintaining the Argo Germany Web site. The URL for the Argo Germany is:

<http://www.german-argo.de/>

It provides information about the international Argo Program, German contribution to Argo, Argo array status, data access and deployment plans. It also provides links to the original sources of information.

Statistics of Argo data usage

Currently no statistics of Argo data usage are available. The German Navy uses Argo data on a regular basis for the operational support of the fleet and uses their liaison officer at BSH to communicate their needs. The SeaDataNet portal uses German Argo data operationally data for the Northwest European Shelf.

Publications based on Argo:

Bittig, Henry C. (2014). Towards a Quantum Leap in Oceanic Oxygen Observation - From Oxygen Optode Characterization to Autonomous Observation of Gas Exchange and Net Community Production, Dissertation, Christian Albrecht University Kiel.

Bittig, H.C., B. Fiedler, R. Scholz, G. Krahnemann, and A. Körtzinger (2014). Time response of oxygen optodes on profiling platforms: Dependence on flow speed and temperature and recommendations for field applications. *Limnol. Oceanogr.: Methods* 12, 617-636, doi: 10.4319/lom.2014.12.617.

Ronja Eisner, Die Entwicklung der Deckschicht im Islandbecken und ihr Beitrag zum Nordatlantischen Tiefenwasser, Bachelor Thesis, 52 pp., University of Hamburg, 2012.

Kieke, D., und I. Yashayaev (2015), Studies of Labrador Sea Water formation and variability in the subpolar North Atlantic in the light of international partnership and collaboration, *Prog. Oceanogr.*, 132, [doi:10.1016/j.pocean.2014.12.010](https://doi.org/10.1016/j.pocean.2014.12.010).

Products generated from Argo data

A key aspect of the German Argo program is to develop a data base for climate analysis from Argo data, to provide operational products for interpretation of local changes and to provide data for research applications.

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.

Germany contributes to the NARC and contributes recent CTD data to the Argo climatology.