

USA Report to AST-17, March 2016. (Submitted by D. Roemmich)

Organization of U.S. Argo:

The U.S. Argo Program is supported with major funding provided by the National Oceanic and Atmospheric Administration (NOAA), and additional participation of the U.S. Navy. It is implemented by a U.S. Float Consortium that includes principal investigators from six institutions: Scripps Institution of Oceanography (SIO), Woods Hole Oceanographic Institution (WHOI), the University of Washington (UW), the Atlantic Oceanographic and Meteorological Laboratory (AOML), the Pacific Marine Environmental Laboratory (PMEL), and the Naval Research Laboratory (NRL/Monterey). Float technology development, production, deployment, array monitoring, and data system functions are distributed among these institutions on a collaborative basis.

In addition to U.S. Argo floats, Argo-equivalent floats have been provided from a number of U.S. float groups, programs, and principal investigators. A notable U.S. Argo-equivalent program is Southern Ocean Carbon and Climate Observations and Modeling (SOCCOM). SOCCOM, with support from the National Science Foundation and in partnership with U.S. Argo, has deployed over 50 floats equipped with biogeochemical sensors in the Southern Ocean, and plans to increase the size of its array to 200 floats in the coming 5 years. The contributions of all Argo-equivalent partners are gratefully acknowledged.

The present 5-year cycle of U.S. Argo implementation began in July 2015, and extends through June 2020.

Objectives:

During the present 5-year cycle, U.S. Argo will sustain its contribution of half of the Core Argo array, while enhancing coverage on a regional basis (high latitudes, western boundary and equatorial regions, marginal seas) as recommended through ocean observing system community activities and endorsed by the AST. These coverage enhancements will only be implemented if sufficient resources are available to maintain the original Argo coverage and the data quality of the Argo array. Further improvements in data quality, timeliness, and resolution are planned, along with ongoing extensions to float lifetimes and cost-effectiveness.

A major enhancement to Argo is the implementation of Deep Argo to extend sampling to the ocean bottom (to pressures as high as 6000 dbar). As a key component of the Deep Ocean Observing Strategy (DOOS), Deep Argo is needed to close regional and global budgets of heat, freshwater, and steric sea level, and for exploration of deep ocean circulation. Deployment of several regional Deep Argo pilot arrays is being undertaken to test floats and sensors, to aid in global array design, and to demonstrate the capability to deploy on a regional basis. U.S. Deep Argo deployments will be integrated with planned contributions of international partners.

Support level:

The support level for U.S. Argo is determined on a year-to-year basis. Support levels for Core U.S. Argo have remained approximately flat since 2004, during which time the number of floats deployed has diminished by about 11 floats per year due to inflation. Through technology improvements leading to increases in the mean lifetime of floats, the number of active U.S. floats remains approximately equal to the high levels of about 1800 floats achieved since 2008. However, the present number of yearly deployments is not sufficient to maintain U.S. Argo (Fig 1). A possible augmentation by about 46 floats in 2016 (Yellow triangle in Fig 1) is under consideration to begin to mitigate this shortfall.

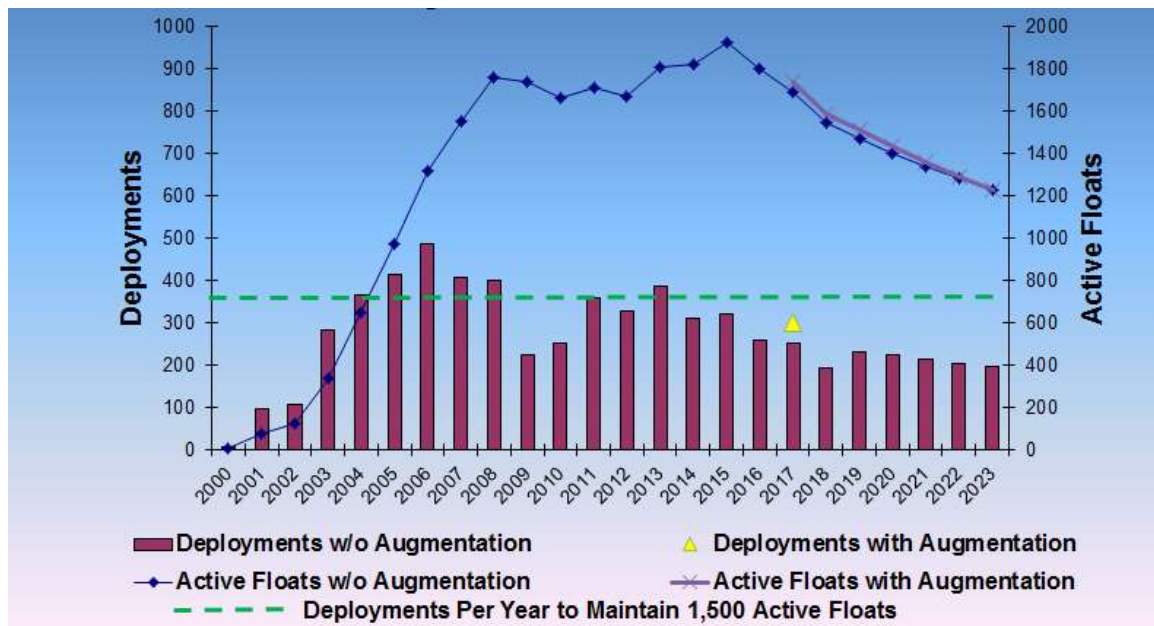


Fig. 1: Yearly deployments by the United States Argo Program through December 2015 with and without a possible one-time, 46-float augmentation in 2016. The figure also includes a projection of the number of active U.S. Argo Program floats, and of deployments based on 3.5% inflation. The number of active U.S. Argo Program floats in the Core array is projected to drop below 1,500 in 2018-19 without the augmentation and 2019-20 with the augmentation. The number of deployments necessary to maintain 1,500 active floats is 357 annually.

Support for U.S. Argo includes float production and deployment, technology improvement, communications, data system development and implementation for real-time and delayed-mode data streams, and participation in international Argo coordination, Regional Centers, and outreach activities.

Since 2011, U.S. Argo has been supported for development and testing of Deep Argo floats. These instruments profile to pressures as great as 6000 dbar, and are capable of more than 100 cycles. Successful prototype float deployments were carried out in 2013 – 2015, including 2 Deep SOLO instruments that were deployed in June 2014 by RV Tangaroa, completing about 110 profiles each, to depths of about 5700 m, before being recovered in September 2015. Deployment of regional pilot arrays began in the SW Pacific Basin in late 2015, and is

continuing in 2016 (Fig. 2). U.S. Argo was a sponsor of the international Deep Argo Implementation Workshop in May 2015.

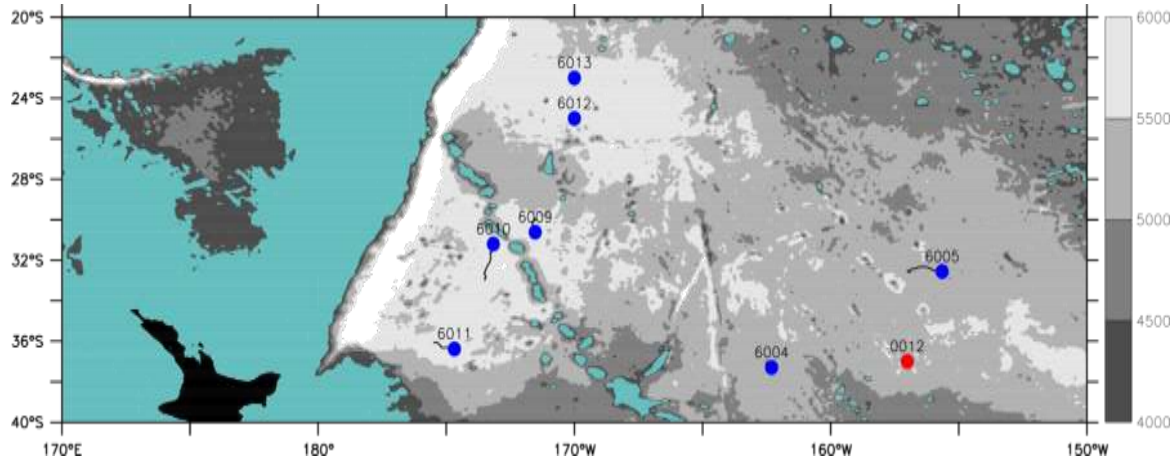


Fig 2 The SW Pacific regional Deep Argo array including Deep SOLO (blue) and Deep APEX (red) floats. Floats 6012 and 6013 will be deployed in May 2016; all others are presently active. Additional Deep Argo floats may be added to this array. See <http://sio-argo.ucsd.edu/deep.html>.

Status:

As of March, 2016, there are 2142 active U.S. Floats (source AIC) and these have completed an average of 152 cycles. Of the active floats (Fig 3), 1921 are provided by the U.S. Argo Program and 221 by partnering Argo-equivalent programs.

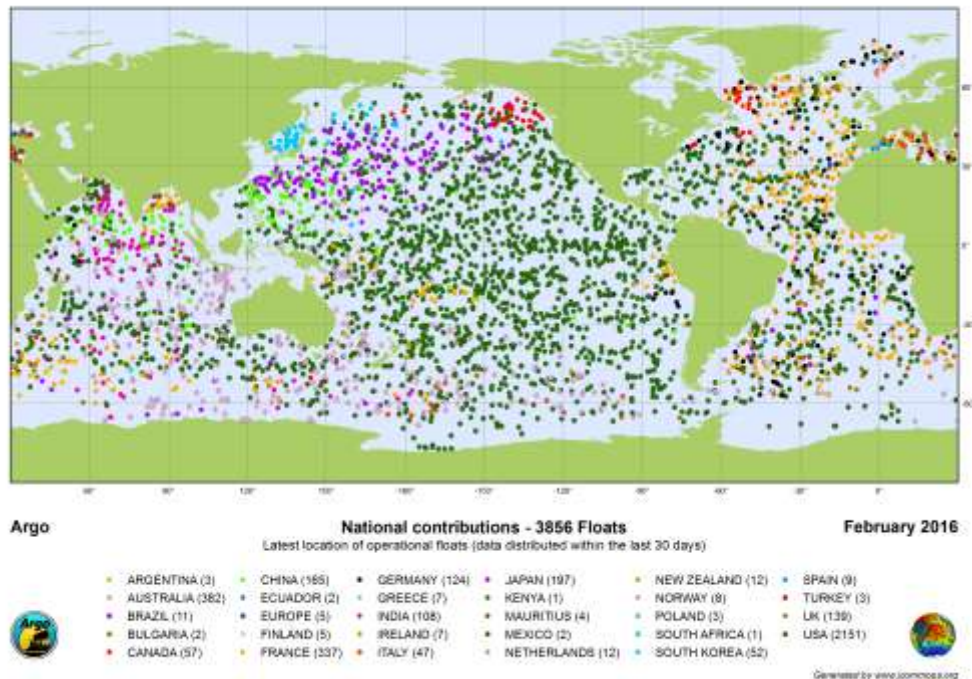


Fig 3 Positions of 2151 active U.S. floats (green dots) as of February 2016.

The highest priority for U.S. Argo is to sustain the Core Argo array. Specific plans for float deployments in 2016, as they evolve, are posted on the AIC deployment planning links. A major U.S./New Zealand deployment cruise from New Zealand to Tahiti and back on RV Kaharoa was carried out in late 2015. This voyage deployed 105 Core Argo floats in the South Pacific Ocean and 9 Deep Argo floats in the SW Pacific Basin. A Kaharoa cruise to the Indian Ocean is planned in October 2016 to deploy Core Argo and Deep Argo floats.

The U.S. Argo Data Assembly Center is based at NOAA/AOML. Real-time data from all U.S. Argo floats are transmitted via the GTS. GTS transmission uses parallel systems developed at AOML and housed at AOML and at Collect Localisation Satellites (CLS), implementing internationally-agreed quality control tests. The AOML data center serves as the national focus for data management and is the conduit for delayed-mode data to pass between the PIs and the GDACs. During 2016, processing of delayed-mode files continued but was slowed somewhat by adoption of new file formats.

In addition to the national DAC, a Global Data Assembly Center (GDAC) is run as part of the GODAE server, located at the Naval Research Laboratory, Monterey. The two GDACs at NRL/Monterey and IFREMER/Brest are mirror images in their assemblies of Argo data from all international partners, and are responsible for dissemination of the data. Several U.S. institutions participate in Argo Regional Center activities, including AOML's role as focus for the South Atlantic ARC.