# USA Report to AST-11, La Jolla California USA, March 2010 (Submitted by Dean Roemmich)

# Organization:

U.S. Argo is supported through the multi-agency National Ocean Partnership Program (NOPP). It is implemented by a U.S. Float Consortium that includes principal investigators from six institutions: Scrips 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 Fleet Numerical Meteorology and Oceanography Center FNMOC). Float production, deployment and data system functions are distributed among these institutions on a collaborative basis. Following two years of pilot activity supported by the Office of Naval Research (ONR) and the National Oceanic and Atmospheric Administration (NOAA) (FY99, FY00), and a 5-year (FY01-05) full implementation phase under NOPP, the Argo project is now in the fourth year of a five-year continuation, supported by NOAA and (for FNMOC participation) the Navy.

In addition to U.S. Argo floats, Argo-equivalent floats have been provided from a number of U.S. Sources, including University of Hawaii, PMEL, AOML, NAVOCEANO, and Florida State University.

The present 5-year cycle of U.S. Argo implementation will end in mid-2011.

## Support level:

The support level for U.S. Argo is aimed at providing half of the global Argo array. The target level is 1500 active floats, based on a deployment rate of about 410 floats per year. There were 316 floats funded in FY02, 344 in FY03, 410 in FY04, 410, in FY05, 390 in FY06, 368 in FY07 and about 360 in FY08. Due to level funding, further incremental reductions in float numbers are likely.

The U.S. Argo effort 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.

#### Status:

As of March, 2010, there are 1770 active U.S. Floats that have provided at least one profile in the past 12 days. Of these, 88 are Argo-equivalent floats provided by partnering programs, and the rest are provided by U.S. Argo. From January 2009 to March 2010, 271 floats were deployed by U.S. Argo (Fig 2), plus 63 Argo-equivalent floats by U.S. partners. The large number of active U.S. Argo floats relative to the target number of 1500 reflects the high deployment rate in 2005-2006, to clear a backlog of instruments funded but not deployed earlier. A concern for the international array is that the number of U.S. floats is likely to decrease in the future below the 1500 float target number.

U.S. float deployments in 2009 were reduced due to the CTD pressure-sensor microleak problem, with deployments restarting in late 2009 following a hiatus of several months. A substantial backlog of 2009 instruments remains to be deployed. The majority of U.S. Argo float deployments during the year were in the Southern Hemisphere. This included a major cruise deploying 99 U.S. floats in the South Indian Ocean, jointly staged with Australian Argo and New Zealand Argo on R/V Kaharoa.

Out of 1886 Argo floats presently active in the Southern Hemisphere, about two-thirds have been provided by the U.S. Priorities for float deployments are established by the U.S. Argo Science and Implementation Panel, comprised of members of the U.S. Float Consortium and representatives of Argo data user groups. The highest priority is deployment of a global Argo array. Specific plans for 2010 float deployments, as they evolve, are posted on the AIC deployment planning links. A major U.S./New Zealand/Australia deployment cruise in the South Pacific Ocean is planned in late 2010 on R/V Kaharoa.



*Fig 1.* Positions of all active Argo floats in black, with positions of active U.S. Argo floats in red, March 2010.



Fig 2. Positions of U.S. Argo deployments during 2009 and early 2010.

A continuing effort in U.S. Argo is aimed at technology improvement: for increased float lifetime and improved performance. Ongoing improvements in reliability have been demonstrated in recent years. Out of 430 U.S. Argo (PMEL, SIO, UW, WHOI) floats deployed in 2004, 114 remain active as of March 2010. The floats deployed in 2004 have, while they were active, completed an average of 155 10-day cycles. The objective of a 4-year mean lifetime (i.e. 146 cycles) has been achieved with these floats. Floats deployed in 2005 and 2006 appear to be doing even better. A goal of U.S. Argo is to extend average float lifetimes beyond 4 years.



*Fig 3.* Survival rate for U.S. floats, including Argo-equivalent, by year of deployment (source: AIC).

The U.S. Argo Data 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) and operating around-the-clock, running software developed at AOML to implement 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 2009, the U.S. backlog in delayed-mode quality control was substantially reduced (Fig 4).

In addition to the national DAC, a Global Data Assembly Center (GDAC) is run as part of the GODAE server, located at FNMOC/Monterey. The two GDACs at FNMOC/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.



Fig 4. Number of profiles held at GDACs for U.S. floats (source: AIC), including those with delayed-mode and real-time levels of quality control. Roughly 65,000 of the RT profiles are less than one year old and not yet eligible for DM processing.

# Uses of Argo data – OceanObs'09

U.S. Argo participated extensively in the OceanObs'09 process and conference (<u>http://www.oceanobs.net</u>) through Argo-related Community White Papers and plenary presentations. OceanObs'09 demonstrated the high societal value and broad uses of Argo data.

With regard to basic research, there are now more than 160 peer-reviewed papers using Argo data and having a U.S.-based lead author (<u>http://www.argo.ucsd.edu/Bibliography.html</u>).

## Issues

The U.S. Argo Science and Implementation Panel held its annual meeting in Dec 2009 at the University of Hawaii. Some issues discussed there included:

- Ongoing impacts on operations and data quality of the pressure-sensor microleak problem.
- Requirements for dedicated ship time for deployment in remote regions.
- Sparse coverage of Argo floats south of 45°S.
- Need for increased effort on identifying and correcting systematic errors in Argo data.
- Continuing improvements in float technology lifetime and capabilities.