The Argo Project: Global Observations for Understanding and Prediction of Climate Variability

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Table of Contents

1. Project Summary....1
2. Scientific and Observing System Accomplishments....4
   2.1 Extending Argo into the Deep Ocean....10
   2.2. Scientific Highlights....11
   2.3. Outreach and Education....15
3. Publications and Reports....17
   3.1. Publications by Principal Investigators....17
   3.2. Other Relevant Publications....18
4. Administration....18

1. Project Summary

The U.S. component of the international Argo Program (http://www.argo.ucsd.edu), a global array of autonomous profiling floats, is implemented through this award. The present report covers portions of Phase 4/Year 5 and Phase 5/Year 1 of U.S. Argo, as described below.

As of November 1, 2007, the international Argo Program, including the US contribution, met its goal of building a global array of 3000 active profiling CTD floats (Roemmich and Owens, 2000, Roemmich et al, 2001, 2002, Gould et al., 2004), and established a data system to meet the needs of both operational and scientific users for data delivery in real time and delayed mode. In order to maintain the Argo array, it is necessary to replace over 25% (800) of the instruments every year. Argo is a major initiative in oceanography, with research and operational objectives, providing a global dataset for climate science and other applications. It is a pilot project of the Global Ocean Observing System (GOOS).

Phase 1 (9/99 – 9/02) and Phase 2 (7/00 – 6/02) of US Argo provided regional arrays of CTD profiling floats to demonstrate technological capabilities for fabrication and for deployment of float arrays in remote ocean locations (Phase 1) and to demonstrate the capability for manufacture and deployment of large float arrays (Phase 2). Development of the U.S. Argo Data System was carried out to make Argo data publicly available within a day of collection, to apply automated quality control procedures consistent with international Argo practices, and to provide research-quality data in delayed-mode.

Phase 3 of US Argo was a 5-year project (8/01 – 6/06) aimed at full implementation of the US component of Argo. Float deployment rates were increased to more than 400 per year beginning in CY 2004 (Fig 1). Objectives were to achieve 1500 active US Argo floats (50% of the global array), to

improve the spatial distribution of floats toward the target of uniform 3° spacing, to increase the mean lifetime of floats to 4 years, to operate the near-real time and delayed-mode data systems consistent with international agreements, and to provide substantial leadership and coordination roles for international Argo.

Phase 4 of US Argo was a follow-on 5-year project (7/06 – 6/11) aimed at improving and sustaining the US component of Argo. Float deployment rates averaged around 360 per year (Fig. 1). Objectives are to sustain the array of 1500 active US Argo floats; to further improve the spatial distribution of floats through targeted deployments; to further increase the mean lifetime of floats beyond 4 years; to continue to improve and operate the near-real time and delayed-mode data systems consistent with international agreements; and to provide substantial leadership and coordination roles for international Argo

Phase 5 of US Argo is a 4-year follow-on project (7/11-6/15) whose objectives, in addition to sustaining the present Argo array and improving its data quality, include expansion of the array into the high latitude oceans having seasonal ice cover, improved spatial resolution in western boundary current regions, and extension of float capabilities into the deep ocean (Deep Argo). All of these extensions were strong recommendations of the OceanObs'09 scientific consensus.

Success in realizing program objectives will depend on year-to-year availability of resources and on mean float lifetimes. The US Argo Program has been able to maintain over 1500 active floats since 2007. There were lower than normal deployment rates in 2009 and 2010 due to the previously reported CTD recall due premature failure of the pressure sensor. Deployments in 2012 are down slightly due to cruise delays from FY 2012 to the first quarter of FY 2013.

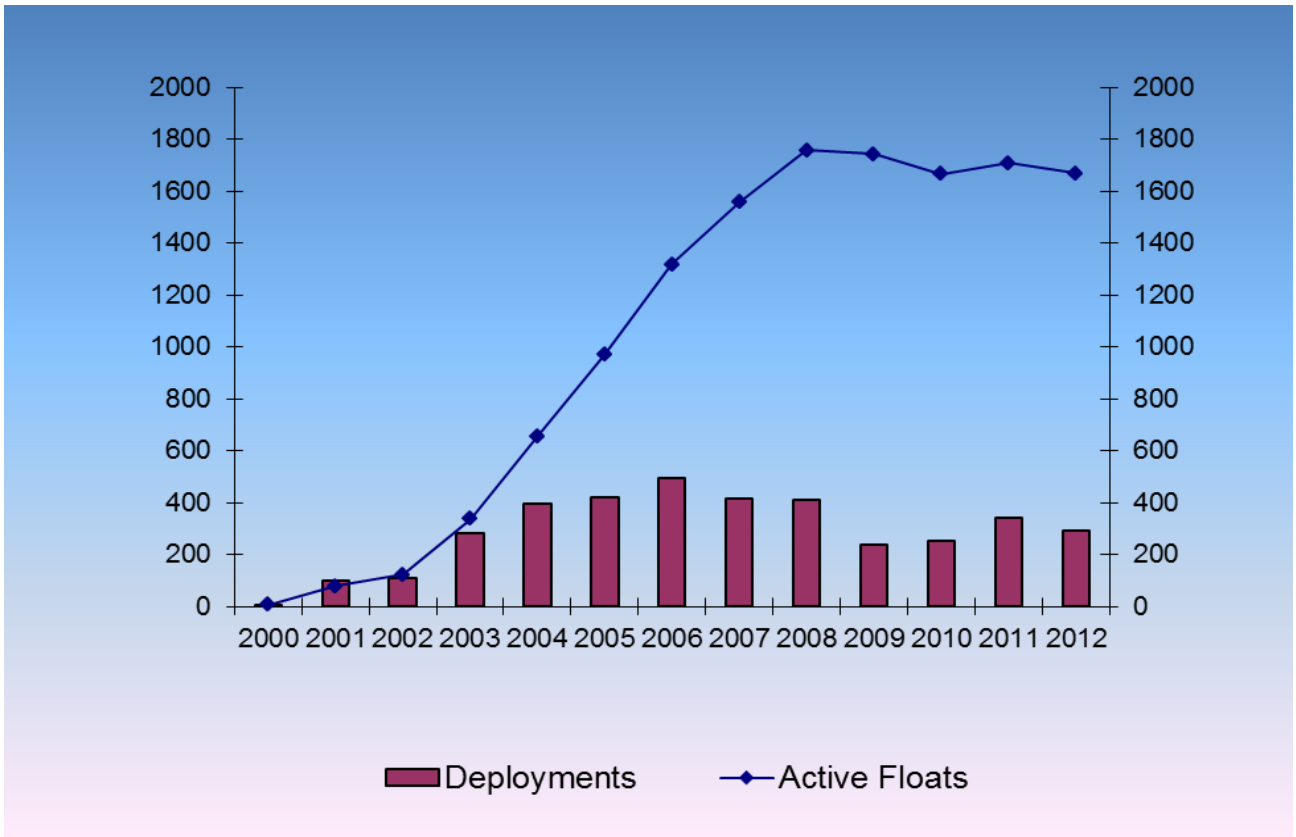


***Figure 1**: Yearly deployments by the United States Argo Program through 30 September 2012 and the number of active U.S. floats.*

Float production and deployment are accomplished by four facilities – SIO (production and deployment), WHOI (production)/AOML (deployment), UW (assembly and deployment), and PMEL (thorough testing and deployment of commercially manufactured floats). This distributed effort has been designed to safeguard the US contribution to the Argo Program from unforeseen problems at any one of the partner institutions. It also makes Argo success independent of the participation of any individual PI and institution or of any single float design. It allows the large amount of effort to be shared. It encourages individual, technical innovation and enhancement. While the initial focus has been on improving float technical performance, attention of the PIs will increasingly focus on demonstrating the scientific value of Argo.

The data system is also distributed. AOML is the US Argo Data Assembly Center (DAC), responsible for acquiring the float data received by satellite communications, for carrying out real-time quality control, and for distribution of data via the GTS and to the Global Argo Data Assembly Centers. The second step in data management is a semi-automated drift-adjustment of the salinity sensor carried out by each float-providing PI, using nearby high quality CTD data for comparison with float temperature/salinity data (Wong et al, 2003, Owens and Wong, 2009). The final step is individual examination of all profiles by the float-providing PIs, in order to provide high-quality data suitable for research applications.

Approximately 95% of Argo data meet the timeliness target, being available within 24 hours of collection via the GTS and/or internet (http://www.usgodae.org/, or HTTP://WWW.IFREMER.FR/CORIOLIS/CDC/ARGO.HTM).

1.1 Compliance with the National Environmental Policy Act (NEPA)

In accordance with NOAA Administrative Order (NAO) 216-6, "Environmental Review Procedures for Implementing the National Environmental Policy Act," a review was conducted for the Argo Program. As a result of that process, NOAA determined that Argo is categorically excluded under NAO 216-6 from requirements to prepare an environmental document.

2. Scientific and Observing System Accomplishments

The goal of 1500 active US Argo floats has been achieved (Fig 2). As of October 2012 there are 1792 active US Argo Program floats, plus 84 US Argo-equivalent instruments that also feed data to the US Argo DAC. Floats are presently being deployed at a rate of ~320 per year. The increase in float

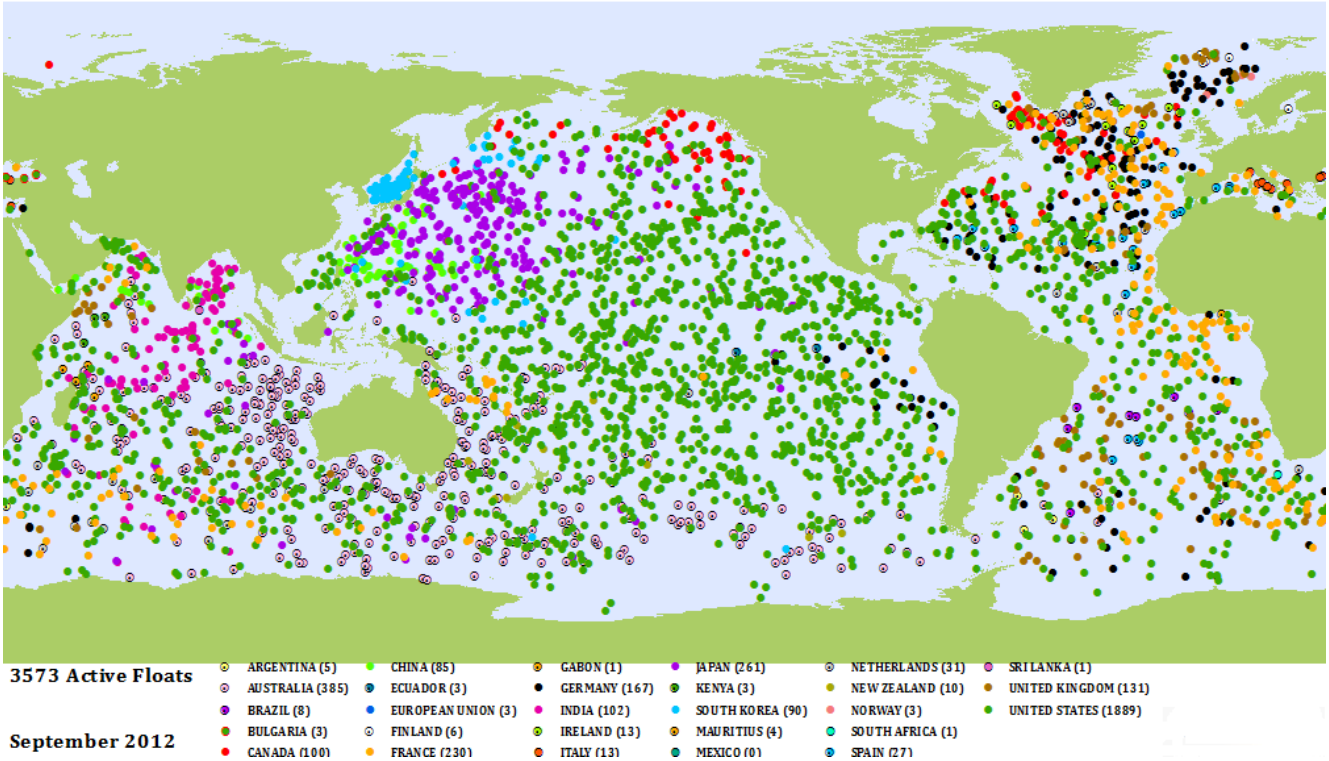


***Figure 2**: The Argo Array as of 30 July 2012. As of 9 October 2012 there were 1905 active US floats , including1789 floats funded under the U.S. Argo Program, and 116 other US (Argo-equivalent) floats whose data are released by the PIs via the U.S. Argo Data Assembly Center.*

deployments that occurred in 2005-2007 was the result of a hiatus in float production in 2001-2003 to address problems leading to high, premature failure rates. Those floats were deployed beginning in

2004. It is not possible to deploy a global array entirely with opportunistic use of research vessels and commercial ships, and so chartered vessels are used to deploy some floats in the South Indian and South Pacific Oceans (description follows). Of the 1764 active US Argo floats, 1142 are in the Southern Hemisphere, reflecting the US commitment to eliminate the northern bias of the international Argo array and achieve uniform global coverage. A notable effort has been the collaboration between US Argo and NIWA (Argo-New Zealand), resulting in more than 980 deployments since 2004 in remote ocean locations by NIWA's R/V Kaharoa.

Good progress has been made in increasing float lifetimes (Fig 3). Figure 3 is based on calendar years. For floats deployed in 2007, about 65% remain active with an average of 154 cycles. Nearly 90% of 2005 deployments remained active for at least 100 cycles. It is likely that the goal of a 4-year mean lifetime has been met for both APEX and SOLO designs. Floats deployed in 2006-2008 exhibited a higher failure rate due to a problem in CTDs manufactured by Sea-Bird Electronics discussed in previous reports. Prototype SOLO-II floats have been deployed, the first float achieving over 300 cycles in an accelerated testing program. Commercial production of the SOLO-II has begun and the first US purchases of the SOLO-II have occurred. The US is the technology leader in profiling floats and about 90% of floats in the international array are made in the US.

The Argo data system continues to operate well, with the AOML DAC providing near-real time data to the GDACs in NetCDF format consistent with international specifications. Improvements in procedures continue to be implemented as required by the International Argo Data Management Team. A backlog in processing of research-quality delayed-mode data has been substantially reduced and will be eliminated in the coming year. The pressure offset error detected in some WHOI floats in 2008 has been corrected (http://www-argo.ucsd.edu/Acpres_offset2.html). Procedures are being considered for more effective detection of systematic data errors.

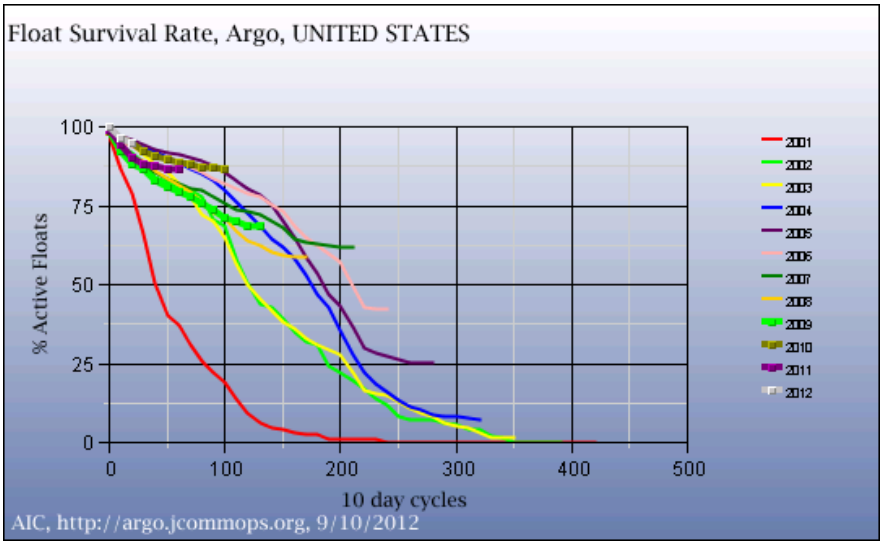
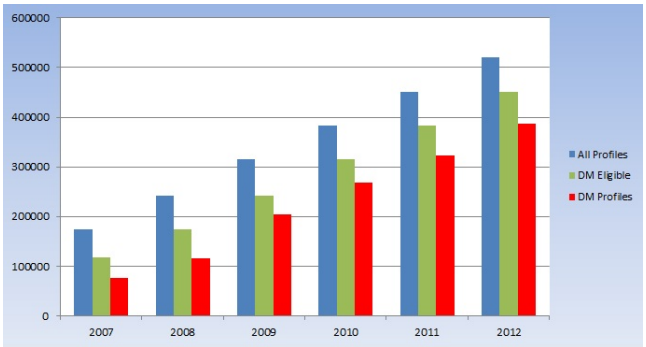


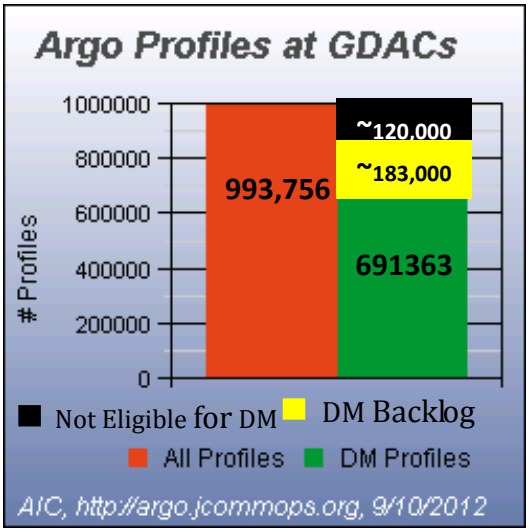
Figure 3: *Float reliability: The average number of cycles for U.S. Argo Program Floats deployed in 2007 (the most recent year where all floats have been deployed for at least 4 years as of 9 October 2012) is 154 with 65% still active.*

The US Argo consortium plays strong leadership roles in the international Argo project. This includes the international Argo Steering Team Co-Chairman (Dean Roemmich, SIO), the international Argo Data Management Team and many international panel memberships. US partners provide international leadership in float technology and data management techniques through workshops and training of international colleagues. Argo was the dominant observing system discussed during the OceanObs'09 Conference in Venice in late September of 2009. US partners provide coordination for deployment planning activities in the Pacific, Atlantic, and Southern Oceans. The US is also a leader in utilization of Argo data, organizing international symposia and through sharing of research results and operational capabilities.

A sparse global Argo array was achieved in 2004, and so there are now 8 years of continuous global coverage. Today Argo is providing over 110,000 high quality profiles of temperature and salinity annually, most to 2,000 meters, homogeneously distributed over the global ocean, without seasonal bias. Beginning in 2007, more than 100,000 profiles a year are being received with 91% being distributed on the GTS within 24 hours of collection (U.S. – 96% within 24 hours), and approximate 96% available within 72 hours via the GTS and Internet. Figure 4(a) shows the growth of U.S. Argo Program profiles available at the GDACs since June 2007 and the status of the Delayed-Mode Quality Control processing as of October 2012.



(a) *U.S. Argo Program profiles at the GDACs as of 30 September each year.*



(b) Status of Global Argo Delayed-Mode Quality Control (DMQC) processing as of 9 October 2012.

Figure 4: *Argo Profiles at the Global Data Assembly Centers (GDACs)*

Because of the need to obtain extended data records to assess instrument drift, profiles are considered "eligible for DMQC when a one-year record has been obtained from the instrument. As of this report, approximately 80% of the total number of profiles eligible for DMQC processing have been processed. The U.S. Argo Program has processed approximately 89% of its eligible profiles. DMQC processing is a labor intensive process. Three generations of software routines have been published and used to process profiles in an semi-automated mode, however, a large fraction (20% or so) have to be manually inspected to determine if a signal represents sensor drift or represents changing water masses. Assessing water mass changes requires inspection of the T-S profiles, an understanding of the dynamics of the region, and often access to other datasets such as high-quality, shipboard CTDs. Figure 4(b) presents the status of DMQC processing for the global Argo Program.

One major impact of Argo has been in the amount of data now being received from the Southern Hemisphere, which constitutes about 60% of the global ocean. A number of factors, many related to the geographic isolation of the Southern Ocean and lack of population in the southern hemisphere contribute to the lack of data from the Southern Hemisphere. Opportunities for the collection of routine observations are limited to a very few, major shipping routes in the tropics and subtropics. Observations in high latitudes are generally limited to research programs occurring at irregular frequencies and Antarctic research and supply vessels which transit specific routes. Very few observations are taken during the Austral winter, with those that are, taken north of 30º S.

Table 1 presents all temperature profile data, including Argo and non-Argo, received by the Coriolis Operational Oceanography Center Data Service in Brest, France which is also one of the Argo GDACs (the other being at the Fleet Numerical Meteorology and Oceanography Center in Monterey, California). The data are from December (Austral summer) and July (Austral winter) 2010, months with an equal number of days. The number of Argo profiles delivered is over 4,700 in both periods, relatively uniformly distributed except south of 60º S, the region subject to seasonal ice cover (Argo floats can operate under ice, storing profiles for later transmission). There are very few non-Argo profiles south of 30º S in the Austral winter. This means that all operational ocean models would lack any *in situ* temperature profile data from a vast portion of the ocean during the Austral winter if not for Argo data. Even in the Austral summer, there would only be around 30 temperatures profiles a day, on average, from the Southern Ocean if not for Argo.

Globally Argo provides approximately three times as many temperature profiles in a year as XBTs plus CTDs received at Coriolis. The major portion of the XBT profiles are to 750 meters while CTD data often goes to 2,000 meters and deeper and includes salinity data. Sometime between mid-November and early-December 2012 the 1,000,000th profile with high quality T&S data below 1,000 meters will up uploaded to the Argo GDACs. The top panel of Figure 5 is a plot of the density distribution on a 1˚ x 1˚ grid of Argo profiles below 1,000 in the Argo database as of 31 July 2012. The lower panel of Figure 5 is a similar plot of all of the non-Argo T&S profiles (i.e., hydrographic casts, CTD profiles, etc.) below 1,000 m in WOD09. In only 8 years of global coverage Argo has not only nearly doubled the number of T&S profiles below 1,000 m from all other sources but it has provided relatively homogeneous coverage throughout the global oceans without temporal bias.

The Argo array is providing unprecedented views of the evolving physical state of the ocean. It reveals the physical processes that balance the large-scale heat and freshwater budgets of the ocean and provides a crucial dataset for initialization of and assimilation in seasonal-to-decadal forecast models. The present 8-year global dataset provides a baseline of the present climate-state of the oceans against which future variability can be observed by a sustained Argo array. With 8 years of global data we have, for the first time, a stable estimate of the mean of the global ocean over a fixed period of time.

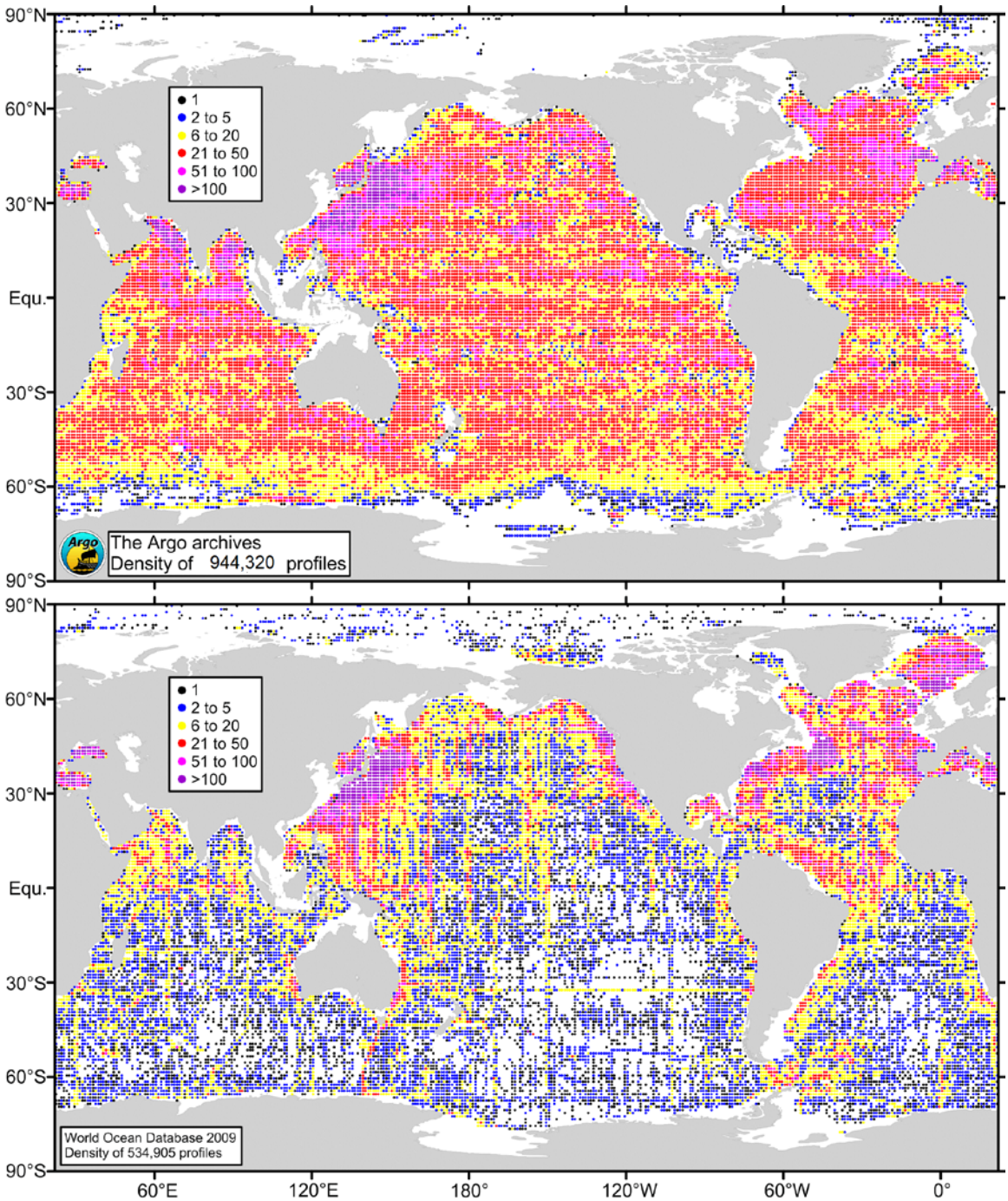


Figure 5: *Density of profiles, 1˚ x 1˚ grid, of T&S below 1,000 m (top) in the Argo database as of 31 July 2012 and non-Argo profiles (bottom) in WOD09.*

2.1 Extending Argo into the Deep Ocean

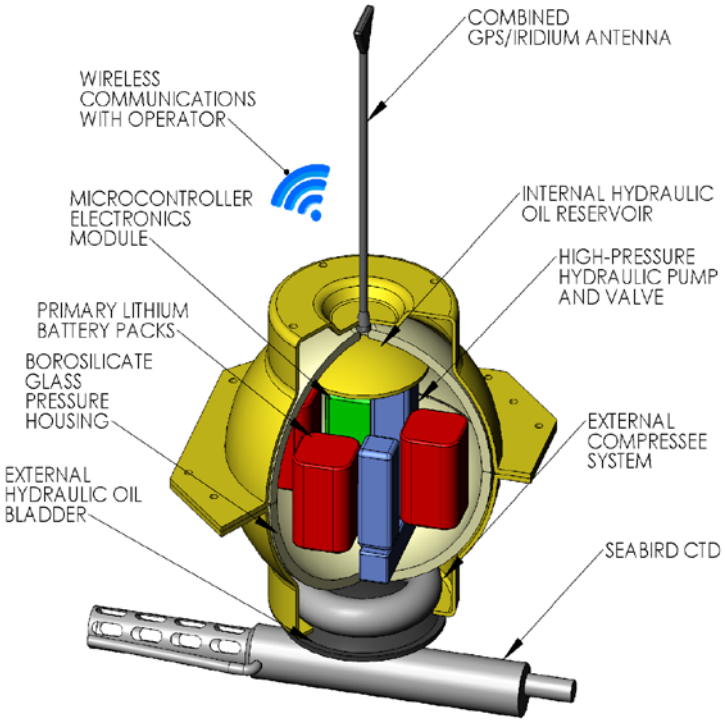
In FY 2011, the Climate Program Office made available $850,000 to begin the development of a deep ocean observing program based on Argo technology and data management systems. The potential

availability of funds was conveyed to the Program in the third quarter of the FY and received by the PIs with their FY 2011 funding in the September-October (FY 2012) period. A work plan was developed in the third and fourth quarters of FY 2011. Work began in the first quarter of FY 2012. An additional $550,000 was provided in FY 2012.

There is compelling scientific justification for extending the Argo array beyond its present 2000 m limitation to the ocean bottom. Substantial technology development problems are posed by deep floats, including pressure case selection, buoyancy and energy requirements, pump and other subsystems required to operate at or withstand high pressure, and CTD sensor stability. The Consortium will pursue two avenues with regard to deep float development and will work with Seabird Electronics on sampling and sensor stability requirements.

The University of Washington float group (S. Riser, PI) will do an initial feasibility study, and then determine whether to work collaboratively with Teledyne/Webb on a deep float or to develop a new platform locally based on deep glider technologies (with C. Eriksen). In the case of Teledyne/Webb the collaboration would include work on design of an initial prototype, deployment of prototypes and assessment of performance, one round of design modification, and purchase and deployment of modified instruments in a scientifically valuable region.

The Scripps Institution of Oceanography float group (D. Roemmich, PI, with R. Davis) will design a Deep SOLO instrument based on the SOLO-II pumping system, which has deep-ocean capability. Again, the development will include initial prototypes, deployment and assessment, design modification, and deployment of instruments as part of the Argo Program. Figure 6 is a schematic of the Deep SOLO instrument and a description of its main subsystems.



Buoyancy Engine
Internal reservoir for hydraulic oil
Pump and valve
External bladder
Compressee (increases compressibility)

Electronics
Primary lithium batteries like SOLO
Controller similar to SOLO II
Operator control thru Blue Tooth
GPS/Iridium antenna based on Spray & SOLO

Integration
Glass sphere and penetrators
Antenna mast
CTD (initially in SBE49 housing)
External cage structure (not shown)

Figure 6: *Main Subsystems of Deep SOLO float.*

The WHOI float group (B. Owens, PI) will collaborate on design, testing, and assessment of Deep SOLO, applying experience gained from the full-depth Moored Profiler. The WHOI high pressure chamber, which can hold a float while operating over the full range of ocean pressure, will be used for testing.

Seabird Electronics is developing deep-ocean versions of its profiling float CTD, in two phases. The first phase is a deep-ocean (7000 dbar) modification of the SBE41/41cp series CTD. This package is projected to be available in the summer of 2013, and suitable for use with the initial prototypes. The second phase will produce a CTD having improved stability characteristics over 5-year deployments of .001°C, .003 psu, and 0.5 dbar. G. Johnson (PI, PMEL) will liaise between the Argo Consortium and Seabird in order to balance deep float CTD engineering constraints against science requirements. Engineering constraints include minimizing CTD energy use, CTD message size, CTD volume and weight, as well as withstanding deep cycling. Science requirements include ensuring high sensor accuracy and stability, minimizing or mitigating dynamical sensor response errors, and designing adequate sampling strategies.

The Argo data system will be impacted by Deep Argo development through new requirements for real-time and delayed-mode quality control procedures and new data formats. AOML (S. Garzoli and C. Schmid PIs) will conduct tests based on shipboard CTD data to determine required modifications to density inversion, spike, and gradient tests for Deep Argo data. New decoders will be written to accommodate Deep Argo float formats.

Initial prototype Deep Argo floats may be deployed within about 1 year. However, because there are challenging developments required for both floats and sensors, the deployment of deep floats for Argo research may occur about 3 years into the project. While costs are not yet known, a working estimate is that deep floats will cost twice as much as conventional instruments, or about $35,000 each, following engineering/development costs of about $200,000 for each of the two development lines. Depending on final cost, the project will produce about 8 Deep Argo floats. These will be deployed in close proximity to small-ship support facilities but where decadal deep ocean warming signals have been detected by Purkey and Johnson (2010)

2.2 Scientific Highlights

With all of the papers using Argo data being published, highlighting any research result is challenging. The 2010 CPO Report highlighted a paper illustrating the usefulness of a truly global array in revealing the physical processes that balance the large-scale heat and freshwater budgets of the ocean, thus providing a crucial dataset for initialization of and assimilation in seasonal-to-decadal forecast models. The 2011 CPO Report highlighted work suggesting that observations from profiling floats that collect CTD data throughout the annual cycle, when the polar oceans are ice covered and when they are not, can be an important tool in understanding the interactions of the ocean, atmosphere, and sea ice in the high-latitude regions. Two recent studies capitalize on the fact that Argo provides a complete sampling of recent conditions to which geographically sparse historical data can be compared:

Roemmich, D., W.J. Gould and J. Gilson, 2012. 135 years of global ocean warming between the Challenger expedition and the Argo Programme. *Nature Climate Change*, **2**, DOI: 10.1038/NCLIMATE1461.

Schmidtko, S., and G. C. Johnson. 2012. Multi-decadal warming and shoaling of Antarctic Intermediate Water. *Journal of Climate*, **25**, 207–221, doi:10.1175/JCLI-D-11-00021.1.

The voyage (Figure 7) of the HMS Challenger, 1872–1876, was the first globe-circling study of the oceans, obtaining multidisciplinary data along a 69,000 nautical-mile track. The 135 years between

(a) HMS Challenger

(b) Cruise track of HMS Challenger

Figure 7: *HMS Challenger, 1872-1876*

the voyage of the Challenger and the Argo Program is the longest interval over which records of subsurface global-scale temperature can be compared. Roemmich et al., have taken into account all of the known temporal and spatial biases (coverage – global but not in an areal sense; location of profiles; depths of sampling; seasonal variations; etc.) and instrumental biases (calibration, pressure effects, etc.) to produce an analysis of the differences on this timescale. Figure 8 shows the spatial variability in the Argo-minus-*Challenger* temperature difference at three depths. Table 1 lists the standard deviation (s.d.) of the temperature differences at each depth with the number of stations. (Please see the reference for the methods.)

Depth (fm)	0	100	200	300	400	500	600	700	800	900	1,000
s.d. (˚C)	1.14	1.85	1.58	1.3	0.91	0.59	0.43	0.36	0.31	0.28	0.26
No. stations	273	220	220	210	202	200	176	168	168	159	149

Table 1: *Summary of data, including depth, s.d. of Argo-minus-Challenger difference and the number of Challenger stations used in the analysis.*

Argo's unprecedented global coverage permits its comparison with any earlier measurements. This first global-scale comparison of *Challenger* and modern data shows spatial mean warming at the surface of 0.59 ˚C ± 0.12, consistent with other estimates of globally averaged sea surface temperature increase. Below the surface the mean warming decreases to 0.39 ˚C ± 0.18 at 366 m (200 fathoms) and 0.12 ˚C ± 0.07 at 914 m (500 fathoms). The 0.33 ˚C ± 0.14 average temperature difference from 0 to 700 m is twice the value observed globally in that depth range over the past 50 years, implying a centennial timescale for the present rate of global warming. Warming in the Atlantic Ocean is stronger

than in the Pacific. Systematic errors in the *Challenger* data mean that these temperature changes are a lower bound on the actual values. The Roemmich et al. (2012) study underlines the scientific significance of the *Challenger* expedition and the modern Argo Program and indicates that globally the oceans have been warming at least since the late-nineteenth or early-twentieth century.

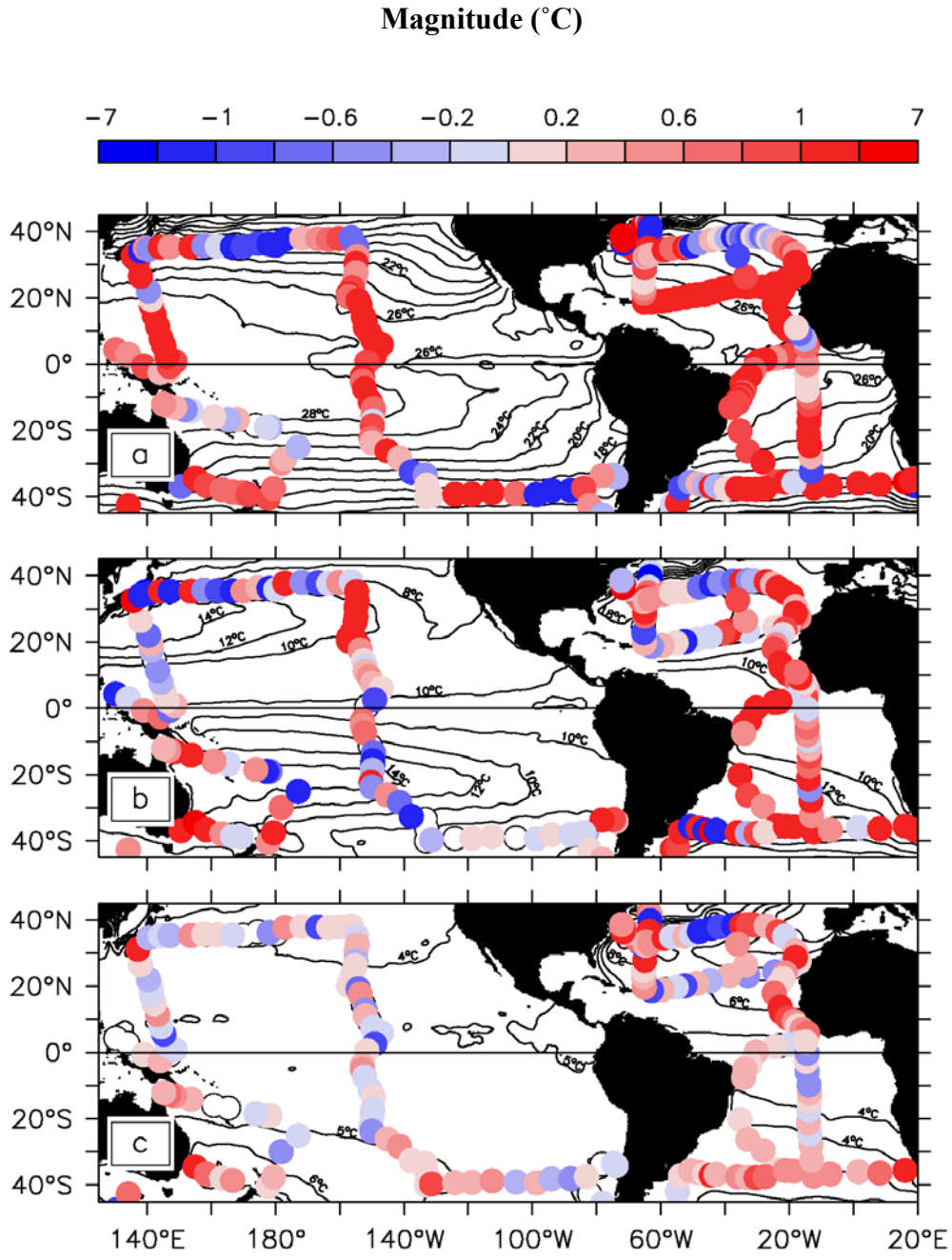


Figure 8: Spatial Differences. *Background contours indicate the mean temperature 2004-2010) from Argo data at the sea surface* (**a**), *366 m* (**b**), and 914 m (**c**). *Color spots indicate the Argo-minus-Challenger temperature differences.*

Antarctic Intermediate Water (AAIW) is a dominant Southern Hemisphere water mass that spreads from its formation regions just north of the Antarctic Circumpolar Current (ACC) to at least 20 ˚S in all oceans. The work of Schmidtko and Johnson uses an isopycnal climatology constructed from Argo conductivity-temperature-depth (CTD) profile data to define the current state of the AAIW salinity minimum (its core) and thence compute anomalies of AAIW core pressure (depth), potential temperature, salinity, and potential density since the mid-1970s from ship-based CTD profiles.

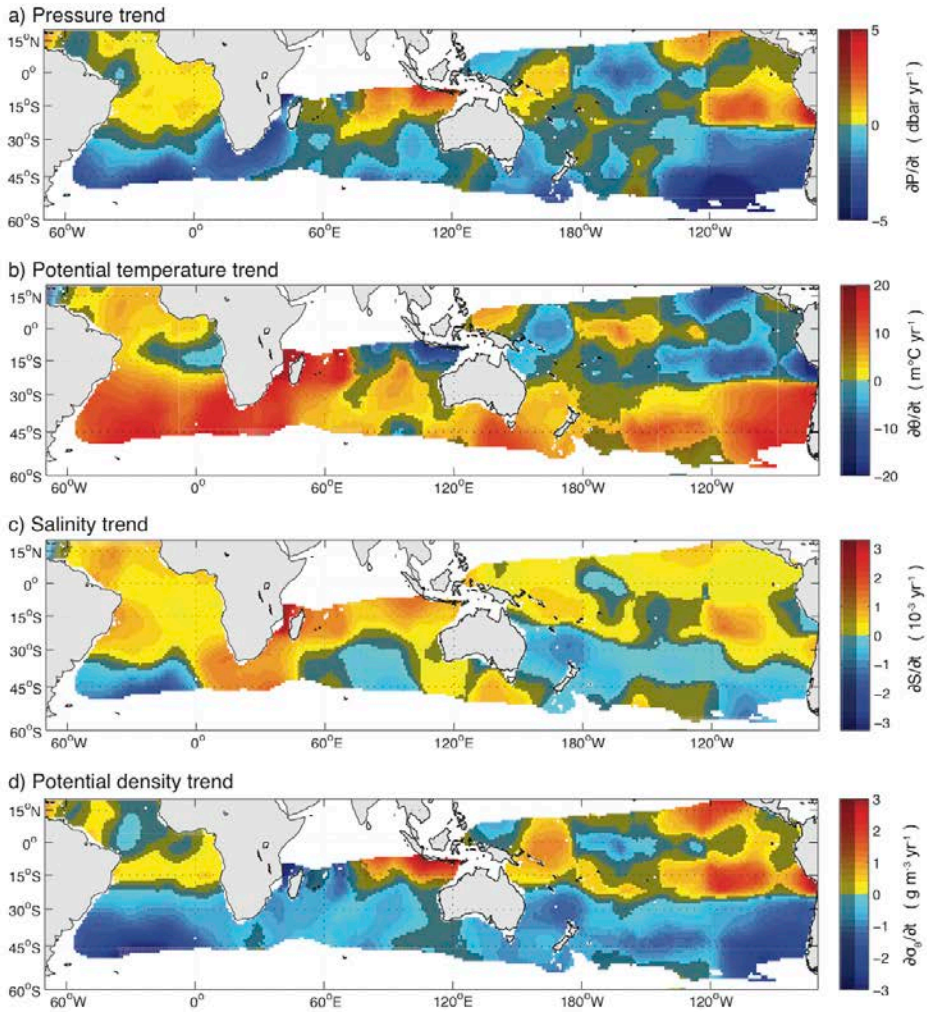


Figure 9: *Maps of linear trends over the time period of ship-based and Argo Float CTD sampling for (**a**) pressure, (**b**) potential temperature, (**c**) salinity, and (**d**) potential density. Regions where trends are not significantly different from zero at the 95% confidence level are shaded dark.*

Maps of temporal trends at the AAIW core (Figure 9) show statistically strong circumpolar shoaling (30–50 dbar decade^{-1}), warming (0.05–0.15 ˚C decade^{-1}), and density reductions (up to -0.03 kg m^{-3} decade^{-1}). These trends are strongest just north of the Antarctic Circumpolar Current (ACC) in the southeast Pacific and Atlantic Oceans and decrease equatorward. Salinity trends are generally small, with their sign varying regionally.

Bottle data were used to extend the AAIW core potential temperature analysis back to 1925 in the Atlantic and to ~1960 elsewhere. Modern, warm AAIW core conditions appear largely unprecedented in the historical record (refer to published paper for maps of present conditions): biennially and zonally binned median AAIW core potential temperatures within each ocean basin are, with the notable exception of the subtropical South Atlantic in the 1950s–1970s, 0.2–1 ˚C colder than modern values.

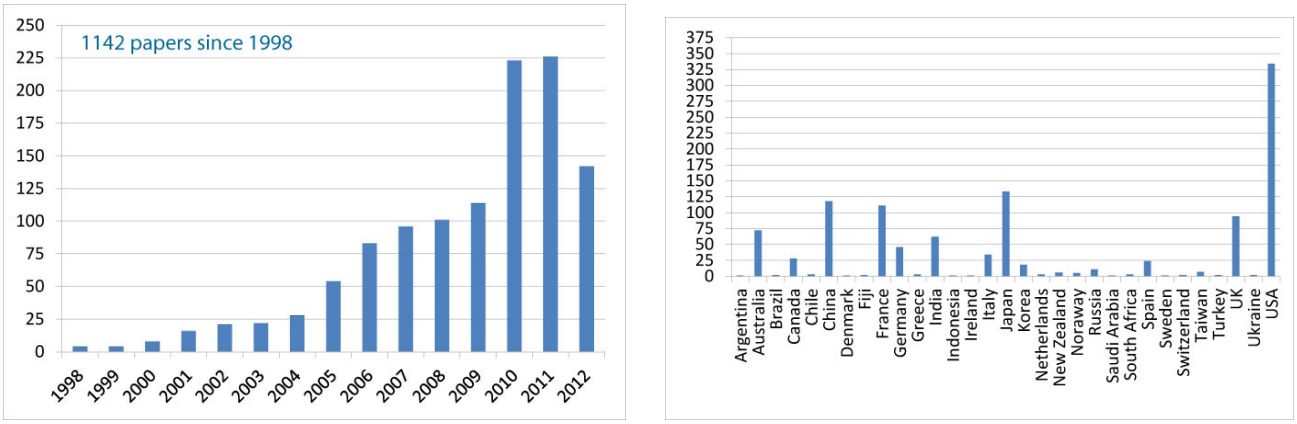
2.3 Outreach and Education

Operational Applications

At least 13 operational centers around the world are using Argo data on a routine basis (http://www.argo.ucsd.edu/Use_by_Operational.html). Operational applications include ocean state estimation, short-term ocean forecasting, atmosphere/ocean seasonal-to-interannual prediction, and coupled climate modeling. Ocean state estimation has an increasing number of valuable uses including climate monitoring, forecast initialization, fisheries and ecosystem modeling, provision of boundary conditions for regional and coastal modeling, and others. Operational centers have noted that the use of Argo data has had positive impacts in all the above applications.

Research Applications

Figure 8 shows (a) the number of research publications per year and (b) the national origin of the lead authors of papers. Approximately 968 research publications from 29 countries have resulted so far from Argo data, including 226 in 2011 alone. The growth in publications is dramatic since reasonable, global coverage was attained in the 2004–2006 period. These publications span a wide variety of research topics from small spatial-scale/short time-scale phenomena such tropical cyclone intensification, to studies of mesoscale eddies, to large-scale phenomena such as water mass variability and basin-scale ocean circulation. Argo is among the most heavily used resources in modern oceanography, comparable for example in terms of publications per year to satellite altimetry.



(a) (b)

Figure 9: *Research publications using Argo data.*

Science Education

Although the Argo project is still very new, it is proving to be an attractive educational asset for secondary, tertiary, and post-graduate levels. For secondary education, the web-based and real-time nature of the Argo data system, as well as Argo's strong climate-relevance, have been keys to engaging student interest in the oceans. Our consortium participates in a Pacific Island GOOS-sponsored initiative called SEREAD, (http://www.argo.ucsd.edu/FrEducational_use.html) that uses Argo data in existing secondary science curricula in Pacific Island countries. In post-graduate education, Argo is already providing primary data for dissertation research of graduate students in the U.S. and other countries. Central to all educational uses of Argo data is easy access and display of the data in gridded formats. US Argo has developed a PC-based Global Marine Atlas (http://www.argo.ucsd.edu/Marine_Atlas.html) allowing users to produce graphical displays of Argo data, including maps, vertical sections, and time-series plots.

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3.1. Publications by Principal Investigators

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3.2 Other Relevant Publications

Over 1142 research publications have resulted so far from Argo data (see above link), including 226 in CY 2011 alone. These publications span a wide variety of research topics from small spatial-scale/short time-scale phenomena such tropical cyclone intensification, to studies of mesoscale eddies, to large-scale phenomena such as water mass variability, basin-scale ocean circulation, and climate change. Almost none of this work would have been possible without the contributions of US Argo to building, sustaining, and utilizing the global Argo array.

See http://www.argo.ucsd.edu/Bibliography.html.

US Argo Consortium relevant web sites:

Argo Steering Team home page http://www.argo.ucsd.edu
Argo Information Center http://argo.jcommops.org
Scripps Institution of Oceanography http://sio-argo.ucsd.edu
Woods Hole Oceanographic Institution http://ursa.whoi.edu/~argo/
University of Washington http://flux.ocean.washington.edu/argo/
NOAA PMEL http://floats.pmel.noaa.gov
NOAA AOML(US DAC and South Atlantic Argo Regional Center)
http://www.aoml.noaa.gov/phod/argo/index.php

US GDAC http://www.usgodae.org

4. Administration

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Approximate Distribution of Program Labor (person-months):

Federal FTEs Supported by the Program	25.5
Non-Federal FTEs Supported by the Program	168.61
Federal FTEs Provided at No Cost to the Program	11
Non-Federal FTEs Provided at No Cost to the Program	0