

## FACILITY 1: Argo Australia

Oceans play a key role in the global climate system by storing and transporting heat and freshwater over thousands of kilometres. The heat capacity of the top three metres of the ocean is equivalent to that of all of the atmosphere, so changes in ocean heat content and freshwater fluxes play a large role in climate change and variability. Historically, a lack of sustained, high resolution observations of the atmosphere and oceans has hindered our ability to forecast climate and ocean conditions. Argo floats provide global measurements of temperature, salinity and currents in the upper 2,000 metres of the ocean. Argo data has revolutionised our ability to examine global scale ocean circulation and air-sea interactions, and to improve climate models and predictions. Argo Australia is the Australian contribution to the international Argo program.

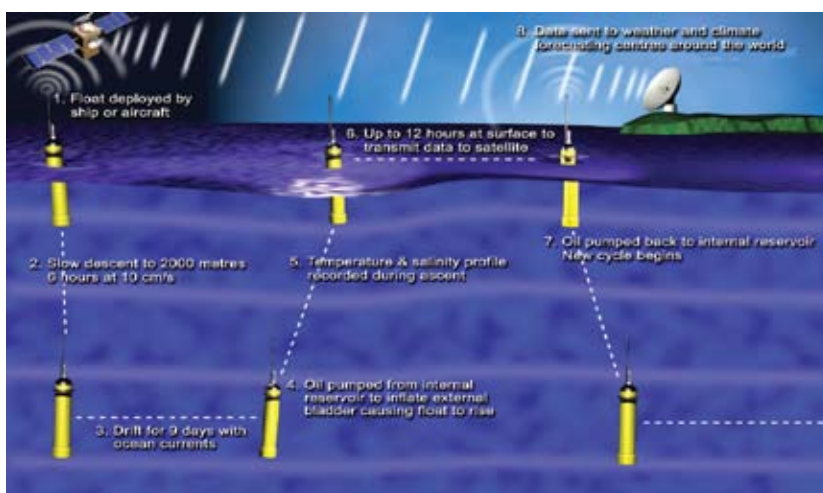


Figure 1. Schematic of the life cycle of an Argo float.

### How an Argo float works

Argo floats are autonomous instruments that are deployed from ships to measure water properties between a depth of 2,000 m and the sea surface every ten days and transmit data via satellite. After deployment, an Argo float sinks to 1,000 m depth, drifts with the current for 9 days, sinks to 2,000 m and then rises to the surface continuously measuring temperature and salinity. Buoyancy is controlled by an onboard computer that pumps oil in and out of an external bladder, altering the float volume while maintaining constant mass. This changes the

float density and allows it to cycle vertically through the water. Argo floats have a lifetime of about 5 years, although some have surpassed 7 years. Floats can operate under harsh conditions and in remote areas, such as the Southern Ocean, which are difficult to monitor using conventional platforms.

### Argo data

Argo Australia and international partners have established an extensive array of floats around Australia - from the dateline to the middle of the Indian Ocean and from the equator to Antarctica.

About half the floats in the Australian region are provided by IMOS and partners.

Argo Australia is the third largest contributor of active floats to the array (after the USA and Japan). Argo has made available over 53,000 deep ocean profiles around Australia (over 17,000 from IMOS floats), and over 500,000 globally. Data is available within 24 hours as part of the real-time data stream and highly quality-controlled data is available after 6 months, as part of the delayed-mode data stream. Argo data now comprises the single largest source of in situ ocean data and, in quantity, has exceeded all historical winter data available for the Southern Hemisphere.

### Applications of Argo data

International Argo provides data from the global oceans. From Australia's perspective, this means that both regional and remote impacts on our climate

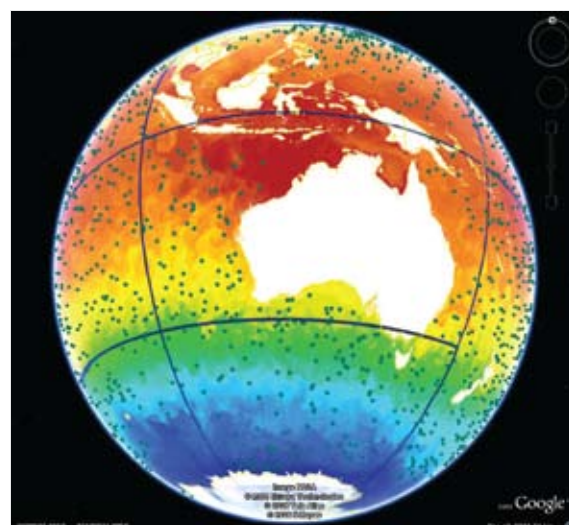
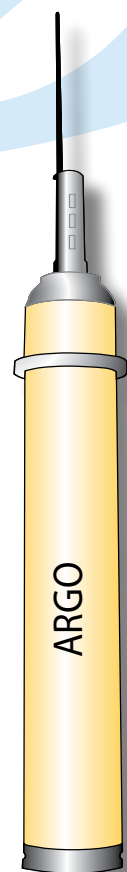


Figure 2. Argo float coverage in the Australian region in January 2009 (green dots) superimposed on a satellite Sea Surface Temperature map.

can be studied. Satellite altimeters reveal the shape of the ocean surface and together with Argo data provide the ability to monitor global ocean circulation and sea level rise. Real-time Argo data also supports seasonal climate prediction systems, e.g. seasonal climate forecasting (POAMA<sup>1</sup>) and daily ocean forecasting (BLUElink<sup>2</sup>).

IMOS Argo and Ships of Opportunity (SOOP) Facilities provide complementary data. High density SOOP transects are designed to measure ocean transports and currents, while Argo monitors large scale ocean heat and freshwater fluxes. Information from Argo is used in global change research and in assessment and management of fisheries and ecosystems. Argo data underpins marine and climate research with over 100 peer reviewed scientific

papers using Argo data currently published each year.

Argo provides insight into broadscale ocean variability; essential context for IMOS observations closer to the coast, such as by Gliders and Radar.

### Looking to the future

Sustaining Argo into the future is a priority and a major challenge. A global 3 x 3 degree network requires 3,300 floats between 60°S and 60°N. The array has reached its target density only at mid-latitudes and in the northern hemisphere. There is a shortfall of more than 500 floats in the southern hemisphere. Continued commitment from the international community is required to reach the target density and maintain the global array over the longer term. IMOS, through its support of Argo Australia, has committed

to deploying 50 floats a year in the Australasian region, and to enhancing coverage in the Southern Hemisphere.

Iridium communications are allowing faster data transfer, higher resolution profiles and two-way communication. An extension of the core mission to the high latitudes (beyond 60°S and 60°N) would ensure that Argo becomes a truly global array. Beyond measuring temperature and salinity, additional sensors on floats are making new physical, chemical and biological measurements.

### International links

The success of Argo as a global program is due to strong international support with 24 nations deploying instruments. Internationally, Argo is sponsored by the World Climate Research Programme's Climate Variability and Predictability project (CLIVAR) and the Global Ocean Data Assimilation Experiment (GODAE). It is a pilot project of the Global Ocean Observing System (GOOS).

### Partners

- Antarctic Climate and Ecosystems Cooperative Research Centre
- Bureau of Meteorology
- CSIRO Marine and Atmospheric Research
- Royal Australian Navy

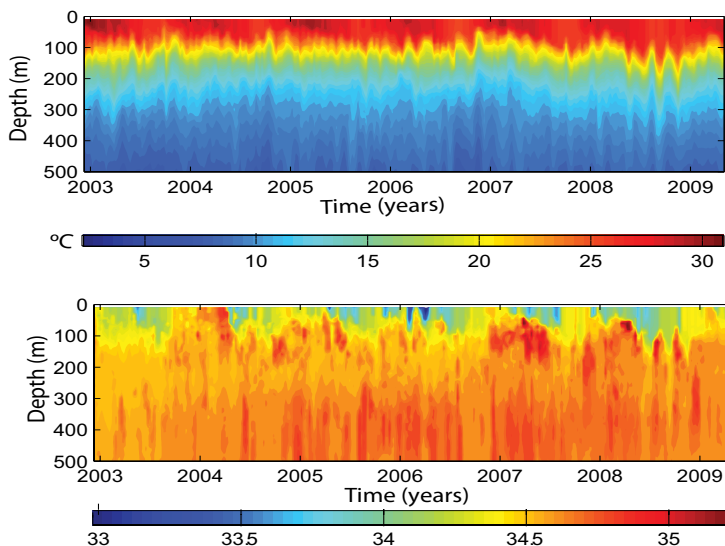


Figure 3. Example of a continuous data record from a long lived IMOS Argo float between Northwest Australia and Indonesia. The float is profiling through very warm fresh near surface layers in the early part of each year when the Northwest Monsoon is active. Achieving a 6 year lifetime for a float profiling to 2,000m in these conditions far outstrips the 3-4 year lifetime expected when Argo first began.

### More information

Argo Australia <http://imos.org.au/argo.html>

CSIRO Argo Australia operator <http://www.cmar.csiro.au/argo>

International Argo <http://www.argo.net>

<sup>1</sup> POAMA seasonal forecasting <http://poama.bom.gov.au>

<sup>2</sup> BLUElink ocean forecasting <http://www.bom.gov.au/bluelink>