the facts

CSIRO MARINE RESEARCH – UNDERSTANDING OUR OCEANS

Robotic Floats – Ocean Sentinels of the Future

Australia is making a clear investment in new robotic profiling technology that is substantially changing the way science and governments observe the world's oceans.

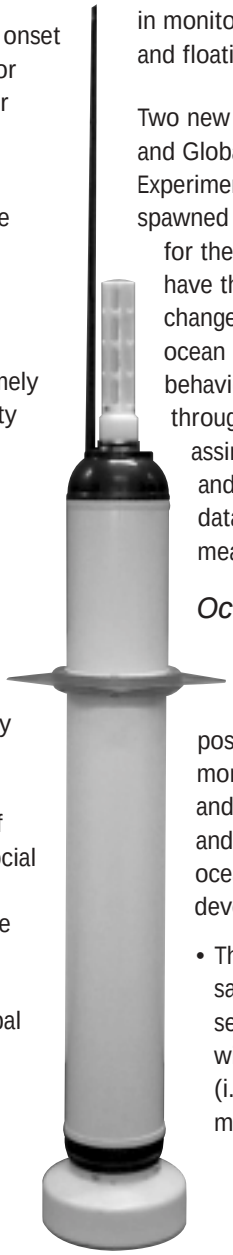
Background

As an island continent, Australia has a vested interest in monitoring and understanding the state of its regional oceans. Ocean data and research are essential to –

- develop predictions for the onset of *El Nino* and thus for major changes in rainfall and other climatic conditions;
- monitor and understand climate change and measure sea level rise;
- efficient and safe ocean transport;
- provide better and more timely information for marine safety and rescue;
- defence;
- fisheries; and
- environmental management and protection

Within Australia's marine boundaries lies ocean territory almost twice the size of the Australian continent. Outside those boundaries are areas of tremendous economic and social interest, and influence, for example, on Australian climate and rainfall.

An active member of the global ocean research community albeit with limited resources, Australia has helped shape research directions for projects such as the World Ocean Circulation Experiment (WOCE) – a decade-long snapshot of the world's oceans- and the World Climate Research Program. Both have been considerably enhanced by developments in satellite technologies, and advances in monitoring by ship, and moored and floating instruments.

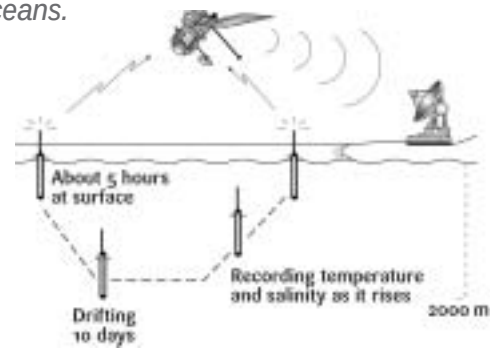


Two new generation projects, Argo and Global Ocean Data Assimilation Experiment (GODAE), have been spawned by new technology. Now, for the first time, scientists will have the capacity to observe changes in the interior of the deep ocean and general ocean behaviour as they happen, and through the GODAE receive, assimilate and develop maps and predictions based on the data within 24 hours of it being measured.

Ocean monitoring

Recent technological developments have made possible this novel approach to monitoring Australia's oceans and understanding the climatic and biological implications of ocean processes. These developments include:

- The outstanding success of satellite missions enabling sea surface height, currents, winds and ocean colour (i.e. phytoplankton) to be monitored in near real time.

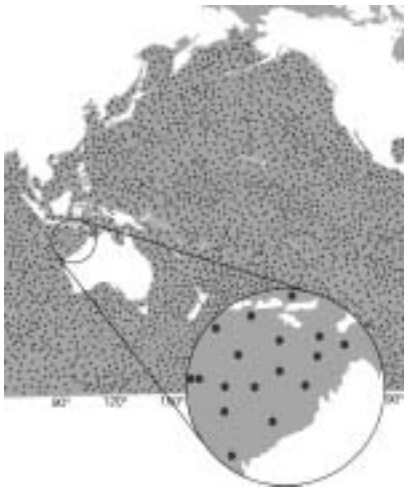


- A new capability using autonomous floats to measure temperature and salinity profiles anywhere in the upper one to two kilometres of the ocean, and new sensors to measure chemical and biological parameters from ships.
- Powerful supercomputers that can accommodate fine-scale models of the oceans.

The capability to send satellite and *in situ* observations to an analysis centre within hours and to assimilate data into ocean models will provide, for a comparatively small investment, real-time and predictive maps of Australia's oceans.

Business, industry and government will be able to use these maps and products in much the same way as we routinely use weather forecasts and data.

For example, the ocean maps can be used to monitor the influence of ocean conditions on near-shore ecosystems and data will underpin predictions of Australian climate 3-12 months in advance. Human-induced change in the oceans can be identified in the long term.



The trial regions for Australia's float deployment program.

Ocean robots

New oceans technology over the last two decades has led to the development of a specialised marine sampling instrument called a profiling float. These floats are the oceanic equivalent to weather balloons in meteorology.

Battery-powered, encased in aluminium cyclinders, and manoeuvering with the aid of a hydraulic bladder, the 1.5 metre floats have a life of up to five years. Before deployment, the floats are examined and tested at CSIRO's Hobart marine laboratories. They descend and ascend by inflating the bladder, from a depth of 2,000 metres, and sample the temperature and salinity during the hour-long journey to the surface.

There, data is relayed via satellite for analysis by oceanographers. After a few hours at the surface, the float descends back to 2,000 metres to resume the process again in 10 days time, drifting with the currents at that level. The robots are deployed about 300 kilometres apart. The international community is determined to invest around $20 million a year in order to get global coverage.

Indian Ocean

In a global pilot program begun in 1999, CSIRO marine scientists deployed 10 robotic floats in the Indian Ocean north-west of Australia. This region was selected because of its influence on rainfall across southern and western Australia, as well as being a region important for understanding global climate. The robotic floats are providing detailed, continuous ocean profiles for use in climate research.

Pacific and Southern Ocean

Seven robotic floats were deployed in the Pacific Ocean between Western Samoa and New Caledonia in July, 2001 in a joint US-Australian research project.

Despite its influence on global climate, the Southern Ocean is the most inaccessible and therefore least understood of the world's oceans. To obtain optimal coverage some 900 profiling floats would be required.

International

During the next five years, scientists from 13 countries will launch 3,000 free-floating robotic samplers, or 'floats' into the world's oceans. The world-wide Argo project will generate observations of the entire global ocean, revealing changes and unexpected variations in ocean currents and large-scale temperature and salinity patterns.

Initial interest, naturally, is in the Northern Hemisphere in the oceans near the main contributing countries but through Australia's commitment to the Argo network, the attention of the Northern Hemisphere nations is being attracted to the south.

Summary

How quickly Australia's resource, marine, shipping and coastal industries benefit from the profiling float technology is linked to collaborative international programs. Australian scientists are working hard to attract interest and research and development within its sphere of interest.

Australia led an international Argo pilot program, and through the Bureau of Meteorology Research Centre, Melbourne, is leading the development of GODAE.

Further information: www.marine.csiro.au

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