Earth Systems and Climate Change Hub

National Environmental Science Programme

climate change **science brief**

Our changing oceans: Australia's contribution to the Global Ocean Observing System

The ocean is vast, covering more than 70% of the Earth's surface and containing more than 97% of the Earth's water. It is the largest sink on Earth, absorbing heat, nutrients and carbon dioxide.

Observing and measuring the ocean is vital for managing and mitigating human impacts on our environment, understanding weather patterns and making climate and weather predictions. But the ocean extends far beyond any national boundary, making international collaboration and coordination vital.

The Earth Systems and Climate Change Hub has supported Australian participation and leadership in international ocean observing systems and initiatives helping to better understand our changing oceans.

Main image: Pat McMahon, CSIRO

Observing and measuring the ocean requires international collaboration and coordination.
Image: CSIRO/CC BY 3.0

An international collaboration: Global Ocean Observing System

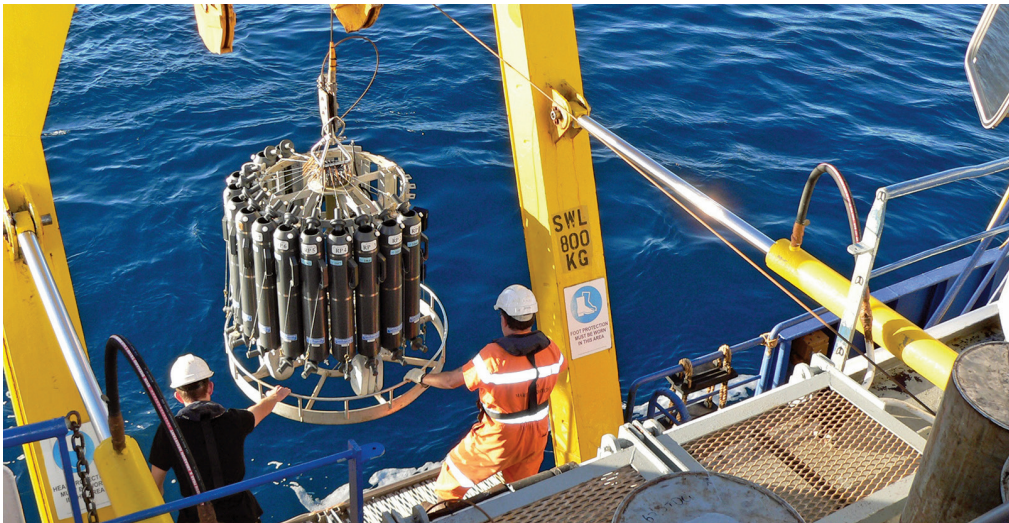
The ocean has been observed in many ways for many years, with historical observations of ocean depth and temperature available since the early 1700's. Since the 1980's, the international community has coordinated itself to improve observing technologies, data quality and data sharing. This has been achieved through the establishment of the Global Ocean Observing System (GOOS). Coordination of GOOS is provided through OceanOps (www.ocean-ops.org), which acts as a focal point for implementation and operation of relevant global ocean observing platforms.

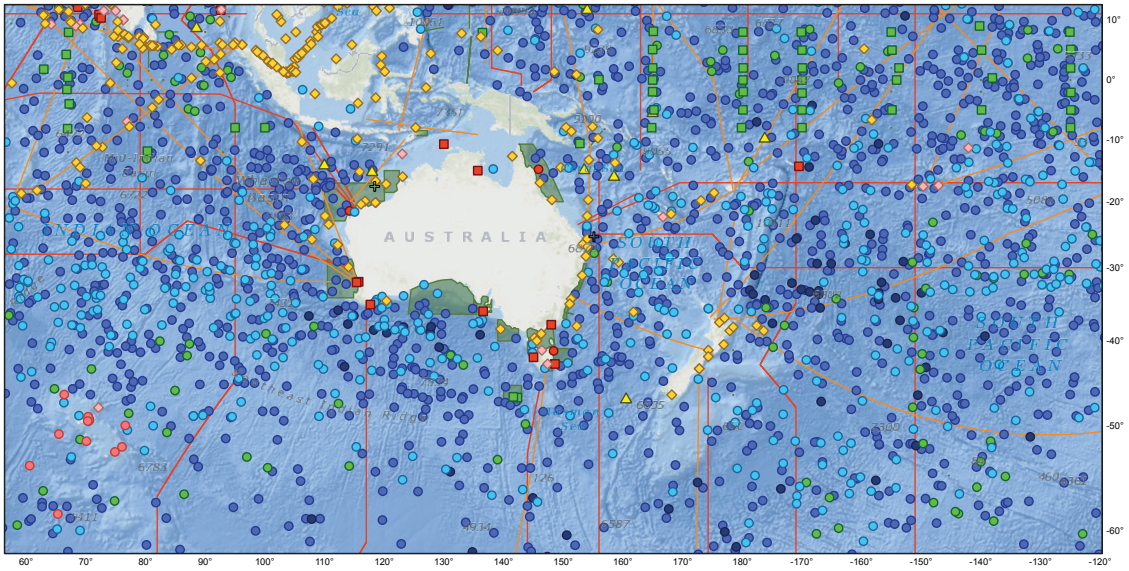
Australia's role in international efforts

Australia is leading efforts to observe the oceans of the southern hemisphere. We are a major contributor to the ocean observing system, supporting seven ocean observing networks. Australian organisations such as CSIRO, the Integrated Marine Observing System (IMOS), the Bureau of Meteorology (BoM) and universities contribute to GOOS by collection and sharing southern hemisphere ocean observations.

Australia has also provided leadership in the production of high-quality ocean data sets and synthesis products relied upon by the research and wider community. We have led the international community in the quality control procedures of this data.

The Earth Systems and Climate Change (ESCC) Hub has helped to support many of Australia's operational, data management and quality control activities of important global networks including Ships of Opportunity, Argo, GO-SHIP and OceanSITES.





Service Layer Credits:
World Ocean Reference:
Esri, GEBCO
World Ocean Base:
Esri, GEBCO, DeLorme

Generated by
www.ocean-ops.org

Designed by
Rebecca Cowley

Projection:
Mercator Auxiliary Sphere
Central Meridian: 148°

Ocean observation methods used to measure our changing ocean (April 2021)

- Core floats – Argo
- Deep floats – Argo
- Biogeochemistry floats – Argo
- Underwater gliders – OceanGliders
- Drifting buoys – DBCP
- Animal borne sensors
- Moored buoys – DBCP
- Tsunameters – DBCP
- Ocean reference stations – OceanSITES
- Automated weather stations – SOT/VOS
- Manned weather stations – SOT/VOS
- Other

Reference lines
- Repeat hydrography - GO-SHIP

- eXpendable BathyThermographs – SOT/SOOP
- Reference sites

How do we measure the ocean?

The ocean is measured by a variety of instrumentations which specialise in observing different ocean characteristics, such as ocean temperature, salinity, currents and pressure. Ocean observations can be collected via:

- Argo profiling floats and gliders.
- Sensors deployed from dedicated research vessels.
- Animal-mounted sensors (on seals, sharks and fish).
- eXpendable BathyThermographs (XBT), weather stations, drifting buoys, moorings, tide gauges and radars.

How is the data used?

Data from the Australian observation programs are available within hours of collection to ***meteorological organisations***. These and other data are also expertly quality controlled within weeks of collection and made available to the global research community via ***data delivery portals*** including the Australian Ocean Data Network and the US National Centers for Environmental Information.

The quality-controlled ocean data products have become the definitive products used in all prominent ***global ocean reanalysis activities***. Ocean reanalysis is a method of combining historical ocean observations with an ocean general circulation model.

Support through the ESCC Hub for Australian participation in these activities has been vital for the coordinated development of observational products which are then used for ocean forecasting, ocean research and ocean decision making.

Quality-controlled ocean observations are also vital for use in ***global climate assessments*** such as the Intergovernmental Panel on Climate Change (IPCC) assessment and special reports (including the recent IPCC Special Report on Oceans and Cryosphere in a Changing Climate). These climate assessments provide governments around the world with the latest credible information on climate change science to inform mitigation and adaptation policies and activities.

The future of global ocean observations

It is a major scientific undertaking to synthesise and deliver high level ocean data products based on ocean observations to support research, operational and climate applications. It is only through coordinated global activities that integrated ocean observational datasets can be developed and supported to meet user requirements and to fully utilise this data.

It is therefore vital to strengthen and fill the geographical and resource gaps in the global ocean observing system. This will help to meet the growing demand for weather and ocean services and forecast products, multi-hazard early warning systems, and climate and ocean health applications.

Careful international coordination across the national observing system networks to ensure strong ongoing collection of these critical ocean observations is required. Support through the ESCC Hub, and other Australian organisations, has been important for the production of critical ‘analysis-ready’ ocean observations which can be used to both inform further scientific research into our changing oceans and underpin critical international climate assessments.

This research was led by ESCC Hub
Project 5.7 Tracking ocean change – ocean observations and models

For more information: **Dr Bernadette Sloyan**
bernadette.sloyan@csiro.au

The Earth Systems and Climate Change Hub is funded by the Australian Government’s National Environmental Science Program