

Climate and Weather Forecasting

The global annual temperature is now increasing at twice the rate of previous periods. With our oceans absorbing significant amounts of atmospheric heat, they play a critical role in global climate and weather. Understanding ocean conditions is vital to predicting and defining current and future weather patterns. Australia has a variable climate which is sensitive to conditions in the surrounding oceans. IMOS provides essential ocean observations, including physical, biological, biogeochemical and atmospheric measurements, to help understand the state, trends and future conditions of our oceans to help understand our weather and climate.

Meteorologists and researchers use IMOS observations to predict rainfall patterns, drought, bushfire conditions and floods associated with climate drivers like El Niño, La Niña, the Indian Ocean Dipole and the Southern Annular Mode. IMOS observations also contribute to forecasts and warnings used by agriculture, fisheries, shipping, and offshore operations, and the general public when boating, surfing and swimming.

Ocean observations are critical for improving our understanding of the ocean's role in driving climate, tracking how our climate is changing and the implications for our nation. IMOS aims to provide increased knowledge of the environmental, economic, social, and cultural impacts of, and resilience to, climate change and extreme events.

Our role

IMOS contributes to Australia's climate and weather forecasting through the provision of observations that contribute to:

- The Bureau of Meteorology's forecasting model the Australian Community Climate Earth Systems Simulator (ACCESS). The model provides national weather, climate and Earth system modelling capability for operations and research;
- Bluelink, a platform developed between the CSIRO, the Bureau of Meteorology, and the Department of Defence, that produces global, regional, and littoral ocean forecasts;
- Intergovernmental Panel on Climate Change Reports;
- National State of the Climate reporting.

In 2021 an independent analysis of return on investment in IMOS by Lateral Economics concluded the potential benefits of IMOS are large relative to the cost. A major benefit is more accurate weather forecasting (e.g. cyclones) via use of IMOS data by the Bureau of Meteorology which can result in fewer unnecessary shutdowns of bulk ports and evacuations of mine sites.



Our relevance and impact

IMOS observations have contributed to Australia's climate and weather forecasting in a number of projects for example:

- IMOS data is used in models such as Bluelink, which produces a comprehensive suite of ocean forecasts. Bluelink models include ROAM-Surf, used by the Royal Australian Navy (RAN) to support amphibious operations, tailored tools to aid interpretation of nearshore forecasts; and OceanMAPS which further supports RAN decision-making.
- The Bureau of Meteorology's State of the Climate 2020 used IMOS data to contribute to this synthesis of the science informing our understanding of climate in Australia and identification of new information about Australia's climate of the past, present and future. This report informs a range of economic, environmental, and social decision-making by governments, industries, and communities.
- IMOS has developed a global ocean wind speed and direction database. The information from the database can be used to study the impacts of extreme wind speeds, the effect of climate change on weather conditions, ship routing, feasibility studies for offshore wind projects, and assisting with the design of coastal and offshore structures.
- Research using IMOS data provides an increased understanding of climate change impact and resilience. This has been demonstrated through the uptake and use of IMOS data in the significant Global Carbon Budget 2020. This bi-annually produced report is central to intergovernmental and domestic policy strategies and reports dealing with climate change knowledge, adaptation and management.
- IMOS data has been used in all major scientific reporting addressing the United Nations Framework Convention on Climate Change, to which Australia is developing its Long-term Emissions Reduction Strategy. IMOS data has been taken up and used in all the major IPCC Reports and the Emissions Gap Report 2018 (UNEP).
- IMOS data was also used in the CSIRO Report on Climate and Disaster Resilience, which was a response to the 2019-20 bushfires, where CSIRO was tasked by the Prime Minister to deliver an independent study recommending ways in which Australia can increase its climate and disaster resilience.
- IMOS data is utilised in the NCI-supported Australian Community Climate and Earth-System Simulator (ACCESS-S and ACCESS-OM2 v1.0), which is model that provides national weather, climate and Earth system modelling capability for operations and research.
- IMOS data is used in Weather Research and Forecast modelling at the University of Western Australia, which makes predictions about ocean currents, wind and wave climate, sea level variability, and weather.
- IMOS observations are some of those assimilated into the CSIRO's Climate Analysis Forecast Ensemble (CAFÉ) system. The CAFÉ system is used to predict Australia's climate over the next one to ten years. Decadal climate prediction equips decision-makers in agriculture, energy and other sectors with the knowledge to better manage risks and opportunities.

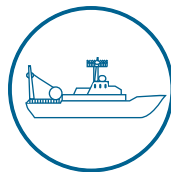
IMOS observing infrastructure applied



Argo Floats



Satellite Remote Sensing



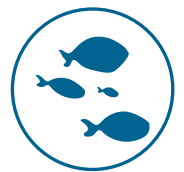
Ships of Opportunity



Deep Water Moorings



IMOS OceanCurrent



Animal Tracking



National Mooring Network



Australian Ocean Data Network

Use by stakeholders

Key stakeholders that use IMOS observing infrastructure for weather forecasting and climate modelling include:

- Bureau of Meteorology
- CSIRO
- National Oceanic and Atmospheric Administration (NOAA)
- Department of Defence

Industry links



Agriculture



Ports & Shipping



Search & Rescue



Oil & Gas Industry



IMOS provides us with critical in situ observations that our meteorologists and researchers use to ensure Australia's weather and climate services are world-class, and to provide our community with information to make critical decisions for the protection of life and property.



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