



**Australian Meteorological and Oceanographic Society (AMOS)
Position Statement on International Cooperation and Data Sharing in Meteorology and
Oceanography**

Australia has benefited greatly from more than a century of international cooperation and data exchange in meteorology. Recent scientific progress in meteorology and oceanography and the big-data¹ revolution offer exciting new opportunities for better meeting national needs for societally valuable weather, climate and ocean information. Realisation of those opportunities will require new and stronger commitment to atmospheric and oceanic science as a global public good and increased collaboration between the public, private and academic sectors in data collection to support national and international research, applications and service provision. Innovative new approaches to data sharing and analysis will be needed to ensure that maximum community benefit is derived from enhanced public and private investment in observations and data collection.

The Australian Meteorological and Oceanographic Society (AMOS) calls for nine specific actions through which the Australian Government, the meteorological and oceanographic community and public, private and academic data providers can further strengthen the national weather and climate enterprise and its value to Australia and the world.

The fluid earth sciences of meteorology, hydrology and oceanography are central to three of the fundamental responsibilities of national governments: collection and preservation of official national records, understanding the natural environment of their countries, and protection of their citizens from threats to the safety of life and property. This makes the arrangements for the conduct of atmospheric, hydrological and oceanic research and service provision a matter for national governments as well as for the meteorological, hydrological and oceanographic communities of their countries. As the main non-governmental forum for meteorology and oceanography in Australia, the Australian Meteorological and Oceanographic Society (AMOS) strongly endorses the long-standing commitment of successive Australian Governments to the fulfilment of their important national responsibilities in these fields.

The global interconnectedness of the atmosphere and ocean also makes meteorology and oceanography (and, to a lesser extent, hydrology) inherently international fields of endeavour dependent on global cooperation in the collection of observational data from around the world. As a large and sparsely populated island nation in the southern hemisphere, Australia benefits greatly from this international cooperation that provides us with access to global data from instrumentation on land, on and in the ocean, in the air, and in space. Our numerical weather prediction models and associated forecasting systems could not operate without timely access to reliable global data, some 98% of which comes to us without charge from overseas. These systems routinely deliver products that help ensure the safety and efficiency of weather-sensitive sectors

1 Particularly since the start of the satellite era, meteorology and oceanography have managed and analysed large and complex datasets for research and real-time operational purposes. The concept of 'big data' refers to datasets also that are large and that need to be analysed in real time. However, these datasets tend to be unstructured and to have low information density, and so they require novel methods of pre-processing before they can be applied to meteorological and oceanographic purposes.

(such as transport, defence, agriculture, energy and water supply) and the severe-weather warning services that reduce the impacts of bushfires, tropical cyclones, floods and severe storms. These near-real-time data are also the primary basis for the long-term climate records that support research and analysis for both public and private benefit. Free exchange of historical data is also essential for reanalysis aimed at improved understanding of climate risk and exposure. By contributing our national observational data to the global pool, Australia gains free access to several orders of magnitude more essential data, especially from the Earth-observing satellites operated by other countries.

For many decades, the governments of more than 180 countries have worked cooperatively within the framework of the intergovernmental World Meteorological Organization (WMO), in partnership with the Intergovernmental Oceanographic Commission (IOC) of UNESCO, to establish and operate the national observation networks needed

- to maintain the national and global climate record,
- to enable national and international weather, climate and ocean research,
- to support the safety of international shipping and civil aviation, and
- to ensure the provision of essential weather, climate and oceanographic services to their national communities.

The widely applauded efficiency and effectiveness of this international system of cooperation have been based on every country's willingness to make its own data available to the global information pool for the benefit of all.

Basic meteorological and oceanographic data collection, archiving, research and service provision thus constitute global public goods whose provision to societally acceptable levels can only be achieved through the direct support of governments and governments' willingness to cooperate with other countries in maintenance of an integrated global system. In Australia, these public interest responsibilities are met through the Bureau of Meteorology, in partnership with academic and other primarily publicly funded scientific organisations and programs such as CSIRO and the NCRIS (National Collaborative Research Infrastructure Scheme)-funded Integrated Marine Observing System (IMOS) and Terrestrial Ecosystem Research Network (TERN). Following a Productivity Commission Inquiry into 'Cost Recovery by Government Agencies' in 2001, the Government and the Bureau agreed that the Australian meteorological data bank should be regarded as public property accessible to all for the cost of making them available. This contributed, inter alia, to the continuing build-up of an internationally recognised academic sector in Australian meteorology and oceanography and an expanding commercial weather services industry.

In addition to the essential publicly funded role of governments, there has always been private sector involvement in the overall data system underpinning meteorological and oceanographic research, operations and services. In the past, such involvement has mostly been through the commercial provision of instrumentation and related infrastructure (often initially developed through publicly-funded research), where the government service agencies purchased the equipment and consequently owned the generated data which they then shared freely with other countries. In recent times, however, significant amounts of meteorological and oceanographic data are being generated by private companies and made available under contract or in line with limited-redistribution agreements. For example, in Australia, ground-based lightning detection is carried out by a commercial company, with clients such as the Bureau of Meteorology purchasing their data for internal use. Moreover, the scope of meteorological and oceanographic services offered by private-sector providers in many countries is expanding to include the operation of their

own meteorological satellites, running their own numerical prediction models, sophisticated analysis of crowd-sourced and other new 'big data', and the provision of information, forecasts and advice independent of the official products provided by the country's National Meteorological Service (NMS).

In these circumstances, the past distinctions between the roles of public and private agents in the collection and processing of data and in the generation of services are becoming blurred. Entirely new data sources are emerging and new approaches such as cloud-based data provision are challenging the historical data access paradigm. While these new developments present formidable scientific, technological, policy, commercial and legal challenges for the meteorological and oceanographic communities, it remains essential that they be addressed in ways which build on, rather than replace, the long-standing model of international cooperation which has provided enormous benefits to all countries and virtually all sectors of national economies. Since 1995, all WMO Member countries have been committed, through WMO 'Resolution 40', to the free and unrestricted exchange of 'essential' data necessary for services in support of safety of life and property and the operation of WMO programs. This should be maintained and all 'essential' publicly funded data, whether collected by the NMS (or other government agency) or purchased from the private sector, should continue to be exchanged internationally without restriction on their use except for purposes that would compromise the long-recognised 'single official voice' of NMSs in the provision of warnings within their own areas of responsibility. In Australia, AMOS supports the principle that private sector providers should have full access to these data for the provision of value-added services except for the issue of public warnings inconsistent with official warnings provided by the Bureau of Meteorology. Recognising the value they receive from free access to the extensive public data, private sector operators should, however, endeavour to facilitate access to their own additional data by government agencies for general community warning and other essential public purposes.

With growing national and international concern about climate change, it is especially important that Australia maintains and enhances its national climate observing networks and data archives as part of the comprehensive Global Climate Observing System needed to support the UN Framework Convention on Climate Change. Observations for climate monitoring need to be of the highest quality and consistency as they provide the baseline to which more numerous, but often less accurate, observations (such as those from lower quality, amateur and 'big-data' sources) can be anchored. Indeed conventional baseline data are also needed to ensure the calibration of satellite and other observational data essential to the accuracy of numerical weather prediction systems, used for real-time operations, reanalysis and research.

Meteorological and oceanographic data are also an important focus of the Global Earth Observation System of Systems (GEOSS) being developed by the intergovernmental Group on Earth Observations (GEO) on the foundation provided by the global observing systems sponsored and coordinated by the WMO, the IOC and the International Science Council (ISC). It will be especially important that the atmosphere and ocean communities lead the way in ensuring the robustness, openness and transparency of international data exchange under GEOSS. Australia has provided, and should continue to provide, effective southern hemisphere leadership in these efforts.

As the non-institutional professional society for atmospheric and oceanic science in Australia, AMOS is committed to strengthening the national weather and climate enterprise in the public interest and helping Australia to play a constructive and effective role in ensuring the strength,

robustness and long-term stability of international cooperation in meteorology and oceanography. To this end, AMOS calls for:

1. Sustained and stable funding of Australia's basic national meteorological, oceanographic and related terrestrial observing networks and associated infrastructure;
2. All publicly funded Australian observational data, metadata and data analyses to be readily discoverable and universally available, both nationally and internationally, for no more than the incremental costs of their reproduction and delivery;
3. Continuing Australian commitment to international coordination on issues of observational standards and data quality, consistency and reliability;
4. Widespread adoption of 'best practice' for attribution and citation of data used in meteorological and oceanographic research;
5. Strong government support for Australian participation in the WMO, IOC, ISC and other institutions and programs that facilitate international cooperation in meteorological, oceanographic and related data acquisition and sharing;
6. Development and implementation of internationally consistent policies and agreements to ensure maximum possible access to additional data (including historical satellite data and privately acquired 'big data') for public purposes, recognising the ownership rights of the private data providers;
7. Continuing commitment to establishment of a strong and effective partnership between the public, private and academic sectors in Australia;
8. Effective cooperation across the public, private and academic sectors in the development and implementation of new data (including 'big-data') sources for both public and private purposes; and
9. Active Australian participation in the ongoing international dialogue on data and related issues among practicing meteorologists, oceanographers, hydrologists, economists, information scientists and other experts through the professional channels provided by the International Forum of Meteorological Societies (IFMS) and related mechanisms.

AMOS recognises that the national and international data scene is changing rapidly. Its purpose in issuing this statement is to help provide a framework for national dialogue on the many challenging data issues facing the meteorological and oceanographic communities with a view to further enhancing Australian weather, climate and ocean science and services and strengthening the international cooperation on which they depend.