



Report of the United Nations Secretary-General on Oceans and the Law of the Sea 2019

“Ocean Science and the United Nations Decade of Ocean Science for Sustainable Development”

Contribution by the World Meteorological Organization (WMO)

(i) Advancing ocean science and identifying and addressing gaps in knowledge and ocean sciences.

We are at a critical time for advancing how we observe, understand and predict the role of the ocean in the Earth system across all timescales from weather to climate.

The move towards Earth system approaches, higher resolution models and seamless prediction systems have the potential to improve our ability to forecast and predict to meet socioeconomic needs across the full range of time horizons for decision making.

Atmospheric models are now coupled to the ocean down to weather timescales with other elements such as the cryosphere, biosphere and even human influences playing an increasing role.

These developments require significant underpinning by research and development to enable models to include increasingly complex natural processes at smaller scales and their feedbacks.

(ii) The United Nations Decade of Ocean Science for sustainable Development: initiatives, ideas, proposals, perspectives.

WMO has a strong interest in contributing to the UN Ocean Science Decade, in particular the following areas:

Societal Outcomes	WMO Priorities
<p>A safe ocean</p> <p>Human communities are protected from ocean hazards and the safety of operations at sea and on the coast is guaranteed.</p>	<p>Improved impact based weather and storm forecasts.</p> <p>Enhanced services to support marine and coastal uses and the blue economy</p>
<p>A predicted Ocean</p>	<p>Improving sub-seasonal to seasonal forecasts, towards seamless prediction</p>

Societal Outcomes	WMO Priorities
Society has the capacity to understand current and future Ocean conditions, forecast their change and impact on human wellbeing and livelihoods.	across timescales (Weather to multidecadal). Fostering forecast services for diverse socioeconomic sectors (water, agriculture, energy etc.)
A transparent and accessible Ocean All nations, stakeholders and citizens have access to ocean data and information, technologies, and are capable of making informed decisions.	Strengthening mechanisms for distribution of data products through global and regional centres in support of forecasts and other services
A clean Ocean Sources of pollution are identified, quantified and reduced, and pollutants removed from the Ocean.	Enhance capacities for monitoring atmospheric sources of ocean pollution through gas and aerosol exchange
A healthy and resilient Ocean Marine ecosystems are mapped and protected, multiple impacts, including climate change, are measured and reduced, and the provision of ocean ecosystem services is maintained.	Measuring background environmental conditions and modelling future scenarios under climate change (including ice loss, changes in ocean circulation and stratification)
A sustainable productive Ocean The provision of food supply and alternative livelihoods are secured.	Combined observations of atmospheric and ocean CO ₂ , O ₂ and nutrients deposition to better understand chemical composition of ocean water (e.g. ocean acidification) and its impacts on marine ecosystems

Given potential major Ocean Science Decade breakthroughs identified such as:

- Bolstered ocean observation systems in all basins
- Enhanced research to services value chain
- Expanded data sharing and use of data products world wide
- Advanced seamless earth system forecasts and scenarios

WMO would like to propose as part of the Ocean Science Decade:

- A period of intensified ocean observations, particularly in polar and tropical seas, to support research and applications
- A global multi-hazard alert system, including marine hazards
- Combining atmospheric and ocean measurements to improve understanding of exchange processes between the ocean and the atmosphere

As a contribution to the social outcome “A Safe Ocean”, WMO is organizing a technical workshop on “Enhancing ocean observations and research, and the free exchange of data, to foster services for the safety of life and property” (Geneva, 5-6 February 2019) as a contribution to the planning phase of the UN Ocean Science Decade. The expected

outcome of the workshop will be a set of recommendations with relevant standards and a workable list of marine meteorological and oceanographic variables, including from exclusive economic zones, indispensable for the issue of timely and accurate storm warnings for the safety of life at sea and the protection of life and property in coastal and offshore areas

(iii) The cross cutting role of ocean science in Sustainable Development Goal 14 of the 2030 Agenda for Sustainable Development.

SDG-14: 'Conserve and sustainably use the oceans, seas and marine resources for sustainable development.' <https://sustainabledevelopment.un.org/sdg14>

WMO, National Meteorological and Hydrological Services and other national entities support international efforts to monitor the Essential Ocean Variables that enable us to understand and predict changes and variability in our weather, climate and the marine environment; measurements of e.g. ocean temperature, ocean currents, ocean carbon and nutrients provide the environmental context for managing ocean health, including biodiversity and ecosystem services. Observations such as Wind Stress, Sea State and Sea Level also support coastal management and resilience, particularly for Small Island Developing States and other vulnerable regions. As the oceans continue to warm and sea levels to rise, the need for observations, research and operational services for the oceans will continue to grow.

(iv) Emerging technologies

A move towards higher resolution, and coupling of models on shorter and shorter timescales, will place new demands on the ocean observing system; requiring e.g. higher resolution observations in the upper ocean, and rapid delivery of data (for weather forecasts) and extending the observing system into the deep ocean for initialising decadal forecasts. In addition, the need to incorporate more earth system processes (such as chemistry and biology) requires routine observations of more parameters.

We are seeing significant developments in new observing technologies which could address key gaps in observations; WMO is working with partners to coordinate incorporation into the sustained observing system

- New platforms (including satellites) and autonomous vehicles for high resolution observations of the near surface ocean, and to measure remote/hostile environments such as the deep ocean, under sea ice (e.g. under ice and deep Argo and the Polar Challenge¹ prize), etc.
- New sensors are being developed to measure an increasing array of chemical variables, which means chemistry observations, traditionally confined to research vessels, can be measured from a broader range of observing platforms, including commercial and tourist vessels as well as autonomous vehicles.

(v) Science policy interface

WMO interacts with a wide range of policy and assessment actors,

¹ <https://www.wcrp-climate.org/polarchallenge>

- Within the UN e.g. Global Climate Observing System planning and reporting, including submissions to the UNFCCC, and coordinating the models used by the IPCC and UNFCCC (Coupled Model Intercomparison Project);
- Outside of the UN, for example by working in close partnership with the Arctic Council and its Working Groups and the Antarctic Treaty System.

(vi) Strengthening ocean science in developing countries

The World Climate Research Programme's CLIVAR (Climate and Oceans) project holds a number of annual workshops with a strong focus on developing countries. For example, workshops at least every other year in association with the First Institute of Oceanography in Qingdao, China, with a particular focus on Early Career Scientists from developing countries².

² <http://clivar.org/events/clivar-fio-joint-summer-school-2018>