Report of the Secretary-General on Oceans and the law of the sea

Contribution by the World Meteorological Organization to the implementation of General Assembly Resolution 73/124, "Oceans and the law of the sea"

(September 2018 to early July 2019)

A. Activities, including adoption of measures, development of programmes, etc., which have been undertaken or are ongoing in the implementation of specific provisions of General Assembly resolution 73/124 relevant to WMO.

Preamble

> *Noting with concern, in this regard, the findings by the World Meteorological Organization, in its annual Greenhouse gas bulletin, that, in 2016, carbon dioxide levels in the atmosphere surpassed 400 parts per million, and that changes in its concentration have never been recorded as happening, as based on measurements of carbon dioxide from ice core records, as fast as in the past 150 years, and the findings in its Statement on the State of the Global Climate in 2017 that global mean temperatures in 2017 were about 1.1°C above the 1850 to 1900 average,*

The 14th *WMO Greenhouse Gas Bulletin* (issued in November 2018) shows that levels of the main greenhouse gases continue increasing. The global averaged mole fraction of carbon dioxide reached a new high in 2017 at 405.5 ppm. The increase from 2016 to 2017 was equal to the averaged growth rate within the past 10 years and smaller than the one from 2015 to 2016 during the El Niño period.

According to the *WMO statement on the state of the global climate in 2018* (issued in March 2019), the year 2018 was the fourth warmest year on record, with average global temperature reaching approximately 1 °C above pre-industrial levels. 2015–2018 were the four warmest years on record, confirming that the long-term warming trend continues.

> *Noting with concern also that the World Meteorological Organization, in its Statement on the State of the Global Climate in 2017, highlighted that the world also continued to see rising sea levels, with some acceleration, and*

increasing concentrations of greenhouse gases, while the cryosphere continued its contraction, with global sea ice shrinking,

Sea level continues to rise at an accelerated rate. Over the period January 1993 to December 2018, the average rate of rise was 3.15±0.3mmyr-1, while the estimated acceleration was 0.1mmyr-2. Accelerated ice mass loss from the ice sheets is the main cause of the global mean sea-level acceleration. In the past decade, the oceans have absorbed around 30% of anthropogenic CO2 emissions. Absorbed CO2 reacts with seawater and changes ocean pH. This process is known as ocean acidification. Changes in pH are linked to shifts in ocean carbonate chemistry that can affect the ability of marine organisms, such as mollusks and reef-building corals, to build and maintain shells and skeletal material.

Ocean heat content is at a record high and global mean sea level continues to rise. Arctic and Antarctic sea-ice extent is well below average. Sea-surface waters in a number of ocean areas were unusually warm in 2018. Extreme weather had an impact on lives and sustainable development on every continent.

VIII Maritime safety and security and flag State implementation

Recognizes the importance of navigational warning services based on marine meteorological data for the safety of ships and lives at sea and the optimization of navigation routes, and notes the collaboration between the World Meteorological Organization and the International Maritime Organization for the work done in All Sea Areas around the World;

The WMO Tropical Cyclone Programme (TCP) supports the IMO/WMO Worldwide Met-Ocean Information and Warning Service (WWMIWS). During the last year, the two entities have collaborated to improve the coordination between WMO designated regional tropical cyclone centers and the National Meteorological Services (NMS) responsible for issuing the Maritime Safety Information, part of the Global Maritime Distress and Safety Services (GMDSS).

Notes with concern the severe impacts on coastal communities of extreme weather events, such as tropical cyclones and associated storm surges and waves, and other sources that cause coastal flooding. Encourages cooperative actions by relevant United Nations bodies and organizations, including the World Meteorological Organization and the Intergovernmental Oceanographic Commission through the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), to assist States in improving forecasting of such events and its application in multi-hazard early warning systems and risk management;

Tropical Cyclones (TC) under climate change environment pose new challenges to the safety and security of human lives and properties. Just to name a few,

from September 2018 to May 2019, Typhoon Mangkhut hit the Philippines, Hurricane Florence flooded the western US coast, Hurricane Leslie reached Portugal, Tropical Cyclones Idai and Kenneth smashed the Mozambique[1] and Tropical Cyclone Foni made landfall in India.

The death toll by TCs is relatively low nowadays, although they still cause huge economic loss. This should be attributed to the well-established regional coordination mechanisms for TC forecasting and early warnings in the five TC regional bodies under WMO Tropical Cyclone Programme.

These mechanisms are continually strengthened to cover all WMO Members prone to tropical cyclones and enable them to reduce loss and damages caused by tropical cyclones to the minimum.

- The number of WMO Members grouped in the five TC regional bodies has expanded to 84 since September 2018, as four countries became members of the WMO/ESCAP Panel on Tropical Cyclones[2].
- The TC early warning services delivered to decision makers and the general public for better emergency response improves steadily.

The eighteenth World Meteorological Congress (Geneva, 3–14 June 2019) adopted Resolution 16 (ex 5.1/5) [to develop guide(s)] on procedures/ mechanisms for effective support by NMHSs to their national disaster risk management, focusing on Multi-Hazard Early Warning System (MHEWS) operations, legislation and policy making and leveraging existing guidance material and good practices related to the four elements of MHEWS – from within WMO but also from its partners – with emphasis on:

(1) Risk knowledge: Institutional coordination in the areas of risk information and assessment for impact-based forecasting and warning;
(2) Detection, monitoring, analysis and forecasting of the hazards and possible consequences;
(3) Dissemination and communication of advisory and warning information and service delivery; and,
(4) Preparedness and response capabilities at all levels: Support national response and recovery planning.

IX Marine environment and marine resources

203. Notes the work of the Intergovernmental Panel on Climate Change, notes with concern its findings on the acidification of the oceans and the substantial risks to marine ecosystems, especially polar ecosystems, coral

[1] Reducing vulnerability to extreme hydro-meteorological hazards in Mozambique after Cyclone IDAI: https://library.wmo.int/index.php?lvl=notice_display&id=21402

[2] TC regional body covering Arabian Sea and the Bay of Bengal.

reefs, plankton and other organisms which have a calcareous exoskeleton, or a shell, like crustaceans, and the potentially detrimental consequences for fisheries and livelihoods, as well as the findings of the World Meteorological Organization contained in its annual Greenhouse Gas Bulletin, and notes its decision to foster collaboration with organizations and institutions that address the carbon budget of the ocean,[87] and in this regard encourages States and competent international organizations and other relevant institutions, individually and in cooperation, to urgently pursue further research on ocean acidification, especially programmes of observation and measurement, noting in particular the continued work under the Convention on Biological Diversity and to increase national, regional and global efforts to address levels of ocean acidity and the negative impact of such acidity on vulnerable marine ecosystems, particularly coral reefs;

[87] World Meteorological Organization, Seventeenth World Meteorological Congress, Geneva, 25 May–12 June 2015, resolution 46 (Cg-17).

The seventieth WMO Executive Council (EC-70, Geneva, 20–29 June 2018) approved the Science Implementation Plan of the Integrated Global Greenhouse Gas Information System (IG3IS). IG3IS represents a common framework in the use of atmospheric observations and analysis to improve understanding of the sources and sinks of greenhouse gases on the scales from national to a facility one.

EC-71 (Geneva, 17–19 June 2019) adopted the Strategic Plan of WCRP that includes advanced research on the global carbon cycle and carbon budgets.

The eighteenth World Meteorological Congress adopted Resolution 60 (ex 7.1(2)/1 on Future WMO research and supporting activities that refers to the recently established project within the Global Atmosphere Watch programme on the development of the global maps of the total deposition to address the risks for food security and biodiversity. This project builds on the previous successes of "A global assessment of precipitation chemistry and deposition of sulfur, nitrogen, sea salt, base cations, organic acids, acidity and pH, and phosphorus" delivered in 2014 and the work of the WG38 of GESAMP that delivered in 2018 the assessment "The magnitude and impacts of anthropogenic atmospheric nitrogen inputs to the ocean". The report shows that human activity is now increasing the inputs of all fixed nitrogen to the oceans by about 50% and by proportionately more in local hotspots near high emission regions in Southeast Asia, Europe and North America. Atmospheric transport is now the dominant route by which human produced fixed nitrogen reaches the open ocean beyond the continental shelf.

In 2019 WG41 of GESAMP produced the report "High Level Review of a Wide Range of Proposed Marine Geoengineering Techniques" that comprehensively examines a wide range of marine geoengineering techniques to remove carbon

dioxide from the atmosphere or boost the reflection of incoming solar radiation to space (albedo modification) or in some cases both. Further, the report recommends a) that a coordinated framework for proposing marine geoengineering activities, submitting supporting evidence and integrating independent expert assessment must be developed and b) that a greater expertise on wider societal issues is sought with the aim to establish a knowledge base and provide a subsequent analysis of the major gaps in socio-economics and geopolitics.

XI Marine science

291. Stresses the importance of increasing the scientific understanding of the oceans-atmosphere interface, including through participation in ocean observing programmes and geographic information systems, such as the Global Ocean Observing System, sponsored by the Intergovernmental Oceanographic Commission, the United Nations Environment Programme, the World Meteorological Organization and the International Council for Science, particularly considering their role in monitoring and forecasting climate change and variability and in the establishment and operation of tsunami warning systems;

18th World Meteorological Congress adopted WMO Strategic Plan whereby all Strategic Goals related to the oceans. Congress also adopted a number of Resolutions targeting better scientific understanding of the ocean, in particular for Earth system prediction whereby ocean models, coupled with atmospheric models, pay critical role. WMO is particularly strengthening its engagements with the IOC-WMO-UN Environment-ICS Global Ocean Observing System (GOOS), and approved the GOOS Strategy 2030. In doing so, Congress recognized that ocean observations are critical in the Earth system approach as defined in the WMO Strategic Plan 2020-2023, while a great number of these ocean observations are implemented by third parties outside of National Meteorological and Hydrological Services. It further recognized that the physical, biogeochemical and biological components of the GOOS support the ocean component of the Global Climate Observing System. Congress supported the establishment of a node of a distributed GOOS Office located within WMO through the consolidation of existing ocean observing activities at WMO, and additional effort to facilitate functional connections between WMO Technical Commissions and GOOS and to integrate ocean observations in WIGOS.

294. Urges States to take necessary action and to cooperate in relevant organizations, including the Food and Agriculture Organization of the United Nations, the Intergovernmental Oceanographic Commission and the World Meteorological Organization, to address damage to ocean data buoys deployed and operated in accordance with international law, including through education and outreach about the importance and

purpose of these buoys and by strengthening these buoys against such damage and increasing reporting of such damage;

Noting the IOC of UNESCO Decision EC-XLIX/3.4, Part III, under IOC and WMO guidance, the Data Buoy Cooperation Panel (DBCP) developed a regionally relevant education and outreach strategy (Strategy) that could be jointly implemented by IOC and WMO and their Member States, the Food and Agriculture Organization of the United Nations (FAO), the fisheries sector and other relevant organizations in order to substantially reduce damage through vandalism or interference with ocean data buoys.

WMO EC-70 through Decision 28 endorsed the Strategy and requested Members to actively engage, support and collaborate in the efforts of the DBCP to collect existing education and outreach materials related to national or regional mitigation of data buoy vandalism efforts.

DBCP under the WMO-IOC umbrella collect information on vandalism events annually which show gradual reduction in vandalism events due to new initiatives such as education campaigns for targeted groups i.e. fishermen, video cameras on data buoys for surveillance, alarm system on buoys, Automatic Identification System on buoys to prevent collision and protective gear around the buoys are few to mention. Some countries are working towards agreements with neighbouring countries to collectively act on vandalism event through law enforcement. Further DBCP through its Task Team on Buoy Vandalism take the lead to integrate the vandalism prevention information in the in capacity building workshops and to create a repository of education material available nationally for broader use.

The Strategy document is now available in English and Spanish and can make it available in other languages as required. The Strategy guides the continued engagement with regional, national, and local stakeholders to strengthen their efforts to reduce data buoy vandalism. It facilitates the creation of new educational materials, expanded national and international collaboration, innovative stakeholder partnerships and information sharing to support compliance. It will also help to identify needs and gaps in order to increase the effectiveness of these efforts. This strategy enhances the international approach to reduce damage to observing systems through engineering and technological modifications to buoys, regulatory policy and enforcement. The DBCP will continue to lead this effort with the goal of engaging additional and new stakeholders that can also champion efforts to reduce data buoy vandalism.

34th DBCP session in 2018 (DBCP-34), Task Team on Buoy Vandalism was requested to develop an implementation plan responding to the Strategy. DBCP-34 further requested JCOMM to establish a cross-cutting Task Team to discuss the strategy; provide any existing materials, tools and products of communication on vandalism awareness in order to prepare a guideline for new outreach materials. DBCP will continue annual reporting of vandalism events on

data buoys to track progress toward implementation of the vandalism preventative measures.

> *329. Recalls its invitation, in paragraph 326 of resolution 72/73, to the Intergovernmental Oceanographic Commission, the United Nations Environment Programme, the International Maritime Organization, the Food and Agriculture Organization of the United Nations, the World Meteorological Organization and relevant United Nations system organizations, bodies, funds and programmes, as appropriate, to assist in the implementation of the second cycle of the Regular Process with regard to the following activities: awareness-raising, the identification of experts for the Pool of Experts, technical and scientific support for the Bureau and the Group of Experts, hosting meetings of the writing teams and capacity-building;*

There were no developments since the recommendations of experts for the pool of experts in March 2018.

B. Main developments in WMO in the field of ocean affairs and the law of the sea that have occurred since the last reporting period (September 2018 to present)

Reform of WMO constituent bodies

The eighteenth World Meteorological Congress adopted a historical reform of the WMO constituent bodies to embrace a more comprehensive Earth system approach, with a stronger focus on water resources and the ocean, more coordinated climate activities and a more concerted effort to translate science into services for society. It paved the way for greater engagement with the rapidly growing private sector and more structured collaboration with development agencies.

The Congress approved a new WMO strategic plan to achieve its overarching vision: "By 2030, a world where all nations, especially the most vulnerable, are more resilient to the socioeconomic impact of extreme weather, water, climate and other environmental events; and empowered to boost their sustainable development through the best possible services, whether over land, at sea or in the air."

The Strategic Plan sets five long term goals and top overarching priorities including:

- Enhancing preparedness for, and reducing losses of life and property from hydrometeorological extremes,
- Supporting climate-smart decision making to build resilience and adaptation to climate risk,

- Enhancing the socioeconomic value of weather, climate, hydrological and related environmental services

The new governance structure is aligned to the strategic plan. Under the approved reforms, WMO different technical commissions will be replaced by two more coordinated commissions to streamline work and maximize impact.

The Commission for Observation, Infrastructure and Information Systems (Infrastructure Commission) will contribute to the development and implementation of globally coordinated systems for acquiring, processing, transmitting and disseminating Earth system observations, and related standards; coordination of the production and use of standardized analysis and model forecast fields; and development and implementation of sound data and information management practices for all WMO Programmes and their associated application and services areas. Michel Jean of Canada was elected president of the commission.

The Commission for Weather, Climate, Water and Related Environmental Services and Applications (Applications Commission). This will contribute to the development and implementation of globally harmonized weather, climate, water, ocean and environment related services and applications to enable informed decision making and realization of socioeconomic benefits by all user communities and society as a whole. Ian Lisk of the United Kingdom was elected president.

The Research Board on Weather, Climate, Water and the Environment will translate the strategic aims of WMO and decisions of the Council and Congress into overarching research priorities, and ensures the implementation and coordination of the research programmes to achieve these priorities.

The Scientific Advisory Panel will draw up opinions and recommendations to Congress and to the Executive Council on matters concerning WMO research strategies and the optimal scientific directions to support the evolution of its mandate in weather, climate, water and related environmental and social sciences.

The ocean plays an increasingly important role in all WMO activities and needs to be mainstreamed in its technical and scientific work under an Earth system perspective. Considering this, the collaboration between the meteorological and oceanographic communities is expanding and this requires a higher level of coordination and a strategic interface with both the governing bodies and the technical and scientific bodies of WMO and IOC.

Congress, through Resolution 9 (ex 4(4)/3), and the 30th IOC Assembly, through Resolution XXX-2, decided to:

- Disband the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) established in 1999

- Incorporate JCOMM functions and activities in existing and new WMO technical commissions and existing IOC bodies and co-sponsored entities such as the Global Ocean Observing System (GOOS)
- Encompass the full spectrum of WMO-IOC collaborative activities in observation, data management, research and services
- Establish the Joint WMO-IOC Collaborative Board, as a high-level, strategic coordination mechanism

The Joint WMO-IOC Collaborative Board will coordinate the collaborative development, integration and implementation of the activities related to oceanographic and meteorological observation, data and information management, services, modelling and forecasting systems as well as research and capacity development.

The Congress and IOC Assembly requested the Joint WMO-IOC Collaborative Board to:

- Facilitate the continued work of JCOMM functions and activities through WMO and IOC structures
- Maximize opportunities to co-design, co-develop and implement joint scientific and technical work across oceanography and meteorology
- Prepare a comprehensive and coordinated WMO-IOC Collaborative Strategy based on existing sectoral strategies
- Further develop the partnership and functional connections between GOOS and the WMO Integrated Global Observing System (WIGOS)

Decade of Ocean Science for Sustainable Development (2021-2030) and United Nations Ocean Conference 2020

As a contribution to the planning phase (2019–2020) of the United Nations Decade of Ocean Science for Sustainable Development (2021–2030), WMO organized 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). The key outcomes are as follows:

- The Workshop highlighted the relevance of WMO activities and applications to address socio-economic benefits, including in support of safeguarding life and property at sea;
- Key elements for a draft Congress Resolution with Critical variables and observations gaps was agreed upon and recommended, and corresponding draft Resolution on Ensuring Adequate Marine Meteorological and Oceanographic Observations and Data Coverage for the Safety of Navigation and the Protection of Life and Property in Coastal and Offshore Areas was drafted. Consequently, the 18th World Meteorological Congress adopted Resolution 45 (ex 6.1(3)/2) (Cg-18) and reaffirmed the indispensable and critical nature of routine marine meteorological and oceanographic observations used operationally by

WMO Application Areas, through the variables listed in the Annex to this Resolution, including from EEZs, to the provision of services in support of safety of navigation and the protection of life and property in coastal and offshore areas. The Resolution also recognized that there is no regulation in place for the collection of marine meteorological and oceanographic measurements within EEZs in support of operational applications of WMO, while the IOC Guidelines for the Implementation of Resolution XX-6 of the IOC Assembly Regarding the Deployment of Profiling Floats in the High Seas within the Framework of the Argo Programme (IOC Resolution EC-XLI.4) are operated effectively and fully consistently with UNCLOS;

- For data to have full benefit (e.g. for hazards, cyclones etc.), the Workshop recommended to have broader use and exchange of ocean data;
- The workshop promoted partnership with the private sector to integrate data from them for delivery of Earth system approaches/climate services, and proposed initiating a pilot project with the World Ocean Council (WOC);
- The workshop agreed on a way forward for future collaboration between WMO and IOC regarding facilitating the making of oceanographic observations in coastal regions in support of Earth System Prediction and climate services, and proposed draft Congress Resolution in this regard. Consequently, the 18th World Meteorological Congress adopted Resolution 46 (ex 6.1(3)/3) (Cg-18);
- The workshop helped clarifying the legal framework, in the view to facilitate the making of observations in coastal regions in support of WMO applications.
- The workshop recognized the importance of Observing System Simulation Experiments (OSSEs) and sensitivity analyses to be used to investigate the importance of data collected within EEZs. The workshop proposed conducting a pilot activity in this regard. Such activity will be a perfect candidate for the UN Decade of Ocean Science for Sustainable Development.
- All WMO resolutions received strong support from the 30th IOC Assembly. Specific to GOOS Strategy 2030, the Assembly adopted Decision IOC-XXX/7.1.1 - The Global Ocean Observing System. WMO as a co-sponsored is requested to consider how it will help implement the strategy. Decision notes the need to incorporate appropriate JCOMM decisions and processes regarding observations into GOOS during the transition period leading up to the disbandment of JCOMM. It welcomes the proposed establishment of a node of the GOOS Office hosted by WMO.

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As a contribution to the preparations for the United Nations Ocean Conference 2020 and the United Nations Decade of Ocean Science for Sustainable Development, WMO, as part of its eighteenth World Meteorological Congress

(Geneva, 3-14 June 2019), organized an "Ocean Dialogue" on ocean information to deliver weather, marine and climate services for a resilient and sustainable blue economy. The Congress adopted two resolutions.

Resolution 65 (ex 7.3(1)/1) - WMO and the Ocean takes stock of the variety of WMO ocean-related resolutions and decisions, strategies, programmes and activities in observation, data processing and management, science and services and recognizes the critical contributions of WMO technical commissions, programmes, co-sponsored entities and centres to the understanding of the ocean and its role in the weather and climate systems, the protection of life and property at sea and in coastal and offshore areas, the generation of socioeconomic benefits and ocean sustainability.

The variety and complexity of these ocean-related instruments and activities requires ensuring coherence and coordination for maximizing benefits to Members, optimizing resources and enhancing engagements with partner organizations. In light of the opportunities offered by the reform of constituent bodies for crosscutting theme such as the ocean and the new strategic approach to the collaboration with IOC embodied in the Joint WMO-IOC Collaborative Board, the Congress adopted a collaborative framework on the ocean as a planning tool to:

- Facilitate aggregation and enhanced impact of WMO ocean-related activities,
- Support interagency coordination and cooperation on ocean matters, including through UN-Oceans and other mechanisms,
- Contribute to the United Nations Decade of Ocean Science for Sustainable Development 2021-2030 within existing structures and available resources;

The resolution requests WMO technical commissions, the Research Board and regional associations to integrate the ocean in the continuous research-to-operations-to-services value chain, underpinned by science, with the contribution of the Joint WMO-IOC Collaborative Board.

Resolution 66 (ex 7.3(1)/2) – United Nations Ocean Conference 2020 emphasizes the priority of ocean science, based on sustained observation and information sharing, for delivering enhanced services to strengthen the resilience of societies to the socioeconomic consequences of extreme weather, climate, water and other environmental events, and underpin their sustainable development.

As a further contribution to the Decade, WMO and the International Maritime Organization (IMO) have started preparations to organize the International Symposium on Extreme Maritime Weather: Towards Safety of Life at Sea and Sustainable Blue Economies, which will be held at IMO Headquarters from 23 to 25 October 2019. The Symposium, through a programme of presentations and

discussion sessions aims at finding possible solutions to the risks created by extreme maritime weather events – those which are dangerous to any ship at sea and are a threat to life, property and the marine environment, notwithstanding the economic impacts to the global blue economy. Provisional themes of the Symposium include, among others: extreme maritime weather; SOLAS Convention requirements; end-user requirements; ship observations for met-ocean information; utilization of available and emerging technology for improved navigation; and earth-ocean prediction capability and forecasts at sea;

Climate and ocean

The World Climate Research Programme (WCRP) of WMO, IOC-UNESCO and the International Science Council continued to make progress with its ocean and climate related science activities. Through its CLIVAR (Climate and Ocean) Core Project, with project offices in China and India, science highlights over the year included an increased focus on improving understanding of regional predictions, and how El Niño will change under a changing climate. WCRP's Regional Sea Level and Coastal Impacts has focused on the co-design of activities with coastal managers and policy makers. In particular during 2019 there will be a number of focused workshops, for example on "sea level science for services" to explore what science can provide in relationship to coastal zone management (now to be held in Orleans, France in November 2019) and on the importance of land subsidence on a global scale. It was felt that a Sea Level Conference should be held in 2022/2023, with robust engagement of decision makers.