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- **OCEANS AND THE LAW OF THE SEA:**

REPORT OF THE SECRETARY-GENERAL (2021)

CONTRIBUTION BY THE WORLD METEOROLOGICAL ORGANIZATION (WMO)

TO THE IMPLEMENTATION OF GA RESOLUTION 75/239 'OCEANS AND LAW OF THE SEA'

Pursuant to United Nations General Assembly Resolution 75/239 of 31 December 2020, entitled "Oceans and the law of the sea", the information below represents the contribution of the World Meteorological Organization (WMO) to the report of the UN Secretary-General, between September 2020 and June 2021. Where relevant, reference is made to paragraphs of the Resolution at https://undocs.org/en/A/RES/75/239

INTRODUCTION

The World Meteorological Organization (WMO) is the authoritative voice on the state and behaviour of the Earth's atmosphere, its interaction with the land and ocean, the weather and climate it produces and the resulting distribution of water resources. The ocean provides essential natural resources to humankind and regulate the global climate. WMO contributes to ocean-related issues through the observation and monitoring of the ocean and climate; research on the climate and connected Earth systems; development and delivery of services for disaster risk reduction (DRR), including marine hazards; capacity development and training; and the provision of science-based information and tools for policymakers and the general public at regional and global levels.

PART A: ACTIVITIES, INCLUDING ADOPTION OF MEASURES, DEVELOPMENT OF PROGRAMMES ETC WHICH HAVE BEEN UNDERTAKEN OR ARE ONGOING IN THE IMPLEMENTATION OF SPECIFIC PROVISION OF GENERAL ASSEMBLY RESOLUTION 74/19

II Capacity Building

WMO is bolstering the capability of meteorological services to provide better marine early warnings and forecasts, and to understand their customer needs for impact-based forecasting. With significant gaps in every region for marine service delivery, WMO has designed a unique course to help meteorological services self-assess their marine capabilities. The course will be expanded globally over the next 4 years.

WMO further continues to develop the capacity of meteorological services in the area of impact-based forecasting for coastal early warnings. Online training courses on tropical cyclone forecasting and warning and messaging the risks were organized in the WMO Regional Centres in Miami Tokyo and New Delhi with the participation of all the Members of the respective Tropical Cyclone Committee, including SIDS of the Caribbean, and North Indian Ocean.

Early warning forecasts require data from ocean observations. The WMO-IOC Data Buoy Cooperation Panel (DBCP) have progressed capacity development workshops in the Pacific

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Islands, with the aim to identify gaps and enhance the awareness of available data products and predictive capability of observing systems. The workshop achieved improved assessment of capacities and requirements of Pacific Islands Nations in ocean observations and data applications for environmental, economic and social benefits, including the forecasts of tropical cyclones track and intensity, hazardous waves, and other ocean related natural disasters. DBCP integrates the vandalism prevention information in the capacity building workshops and to create a repository of education material available nationally for broader use.

VIII Maritime safety and security and flag State implementation

WMO continues its collaboration with the International Maritime Organization (IMO) and the International Hydrographic Organization (IHO) for coordinated and standardized Metocean (Meteorolology and (physics) Oceanography) information, forecasts and warning services for safety of life and property at sea, improved marine environment and sustainable management of natural resources, with due focus on Polar Regions.

WMO continuously works with its partners relating to international shipping by the WMO-IMO WorldWide Metocean Information and Warning Service (WWMIWS) as contribution to the IMO's Global Maritime Distress and Safety System (GMDSS). The WWMIWS ensures daily forecasts covering the 21 METAREAs across the globe. This fulfils the obligation of WMO Members who are contracting parties to the SOLAS Convention.

WMO has been working on recommendations from the *First WMO-IMO International Symposium on Extreme Maritime Weather - Towards Safety of Life at Sea and a Sustainable Blue Economy*. The full report of the Symposium is available on the WMO library here. The next Symposium will be hosted by the Republic of Indonesia.

IX Marine environment and marine resources

The WMO Global Atmosphere Watch (GAW) has been a long-time sponsor of GESAMP's Working Group on The Atmospheric Input of Chemicals to the Ocean (WG 38). WG 38 has published numerous studies related to the impact of atmospheric deposition of anthropogenic nitrogen to the ocean. A preliminary planning meeting was held in 2020, for a possible new WG 38 workshop entitled "The Atmospheric Input of Chemicals to the Ocean – Management and Policy Implications". This workshop would bring together appropriate players to discuss the management and policy implications of current knowledge about atmospheric inputs of nutrients and possibly other substances to the ocean and their interactions and impacts within the marine environment.

An important task for science is to inform decision-makers on the design and evolution of future observational networks. Monitoring and prediction systems are evolving fast and becoming more integrated across ocean, atmosphere and land. A relevant example is the Arctic where the air-sea-ice interaction determines a significant part of the variability of the Arctic environment. So, improving Arctic monitoring and prediction systems needs careful design of joint modelling and observational campaigns.

The Coastal Inundation Forecasting Initiative (CIFI), among other programs at WMO, are tailored to assist Members, to protect livelihoods and support the sustainable development of coastal communities' vulnerable hazards.

WMO continued strengthening regional coordination mechanisms through the regional Tropical Cyclone (TC) Committees (TCC) sessions. Lessons learnt from the management of the episodes especially related to Typhoon Goni (Western North Pacific, November 2020) and

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the 2020 Atlantic record-breaking season with notably Hurricanes Iota and Eta (Caribbean Sea, November 2020) [1]

WMO continues to contribute to the global development agenda through its programmes and initiatives. Aside from those mentioned above, it also includes the programmes for Marine Meteorology and Oceanography, Public Weather Services, Tropical Cyclone, Small Island Developing States (SIDS), Least Developed Countries (LDC), Disaster Risk Reduction, Education and Training, Capacity Development and Voluntary Cooperation. The Climate Risk and Early Warning Systems (CREWS) Secretariat is hosted by the WMO. WMO carries out its work within the context of the Sendai Framework for DRR (2015). WMO with multiple stakeholders in the UN system and beyond advocated to substantially increase the availability of and access to Multi-Hazard Early Warning Systems (MHEWS) and disaster risk information and assessments, including for marine hazards, by 2030. WMO works extensively on engaging interested stakeholders, partners and organizations to develop and facilitate the International Network for MHEWS (IN-MHEWS).

XI Marine science

WMO released its *16th Greenhouse Gas Bulletin 2019* in November 2020. The latest analysis of observations from the WMO Global Atmosphere Watch (GAW) in-situ observational network shows that globally averaged surface mole fractions for carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) reached new highs in 2019, with CO_2 at 410.5±0.2 ppm, CH_4 at 1877±2 ppb(3) and N_2O at 332.0±0.1 ppb. These values constitute, respectively, 148%, 260% and 123% of pre-industrial levels. The increase in CO_2 from 2018 to 2019 was larger than that observed from 2017 to 2018 and larger than the average annual growth rate over the last decade. For CH_4, the increase from 2018 to 2019 was slightly lower than that observed from 2017 to 2018 but still higher than the average annual growth rate over the last decade. For N_2O, the increase from 2018 to 2019 was lower than that observed from 2017 to 2018 and practically equal to the average annual growth rate over the past 10 years. The National Oceanic and Atmospheric Administration (NOAA) Annual Greenhouse Gas Index (AGGI) shows that from 1990 to 2019, radiative forcing by long-lived greenhouse gases (LLGHGs) increased by 45%, with CO_2 accounting for about 80% of this increase. Only when net fossil fuel emissions of CO_2 approach zero will the net uptake by ecosystems and oceans start to reduce CO_2 levels in the atmosphere. Even then, most of the CO_2 already added to the atmosphere will remain there for several centuries, continuing to warm our climate.

The *WMO State of the Global Climate 2020* *(WMO-No.1264)* was launched in April 2021 by the United Nations Secretary General and WMO Secretary General. The report indicates that:

- 2020 was one of the three warmest years on record, with Global mean surface temperature at 1.2 ± 0.1 °C above the 1850–1900 baseline.
- The past six years, including 2020, have been the six warmest years on record. Temperatures reached 38.0 °C at Verkhoyansk, Russian Federation on 20 June, the highest recorded temperature anywhere north of the Arctic Circle;
- Ocean heat content at various depths and the global mean sea level reached the highest values on record; Arctic sea-ice continued shrinking reaching the second lowest extent on record, at the end of the melting season in September 2020.
- Ocean acidification is increasing: Sea water is 26% more acidic than at the start of the industrial era. As the pH of the ocean declines, its capacity to absorb CO2 from the atmosphere decreases, diminishing the ocean's capacity to moderate climate change. Global efforts have been made to collect and compare ocean acidification observation data. These data contribute towards achieving Sustainable Development Goal (SDG) 14.3 and can be used to determine its associated SDG Indicator 14.3.1: "Average marine acidity (pH) measured at agreed suite of representative sampling stations";

[1] Reports of the Tropical Cyclones Committee sessions

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- More than 80% of the global ocean experienced at least one marine heatwave. Marine heatwaves harmed marine life, ecosystems and coral reefs;
- The rate of sea-level rise is increasing due to the melting of ice sheets in Greenland, Antarctica and mountain glaciers as well as the thermal expansion of sea water;
- Ocean heat content at various depths and the global mean sea level reached the highest values on record;
- Since 1950, the open ocean oxygen content has decreased by 0.5–3%.
- The number of hypoxic sites in the global coastal ocean has increased in response to worldwide eutrophication. A quantitative assessment of the severity of hypoxia on marine life at the global coastal scale requires characterizing the dynamics of hypoxia, for which there is currently insufficient data.
- A comprehensive assessment of deoxygenation in the open and coastal ocean would benefit from building a consistent, quality-controlled, open-access global ocean oxygen data set.

Sustained oceanographic and marine meteorological observations and their free and unrestricted exchange are critical to address meteorological hazards, strengthen resilience in the face of climate change and variability, and build the scientific knowledge base for sustainable development.

WMO continues strengthening the global observing systems through implementation of the WMO Integrated Global Observing System (WIGOS) and WMO Information System (WIS) and observing networks with partners.

Through three key co-sponsorship initiatives, the WMO also contributes to climate and ocean observations, monitoring and research:

- The WMO, the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the UN Environment Programme and the International Science Council (ISC) together co-sponsor the Global Climate Observing System (GCOS) and the Global Ocean Observing System (GOOS).
    - GCOS aims to ensure the provision of comprehensive, continuous, reliable climate data and information, for climate monitoring, research, projections, assessments, to support policy responses to climate change, including adaptation and mitigation.
    - GOOS coordinates observations around the global ocean for three critical themes: climate, operational services, and marine ecosystem health
- The WMO/IOC-UNESCO/ISC World Climate Research Programme (WCRP) facilitates analysis and prediction of Earth system change – including the ocean - for use in a range of practical applications of direct relevance, benefit and value to society. Its priorities include examining the ocean's role in the energy, heat, water and carbon budgets; the role of the ocean in transient climate sensitivity; physical and biogeochemical interactions in the coastal ocean; and changes to local sea level under a changing climate.

- The WMO-IOC OceanOPS supports and monitors the implementation of the global ocean observing system.

The WMO's Global Atmosphere Watch (GAW) continues its contribution on the latest trends and atmospheric burdens of the most influential, long-lived greenhouse gases (LLGHGs). The Integrated Global Greenhouse Gas Information System (IG^3IS) expands the observational capacity for GHGs, extending it to the regional and urban domains, and develops the information systems and modelling frameworks to provide information about GHG emissions to society. The implementation of IG^3IS fundamentally relies on the globally harmonized observations of GHGs, including in the ocean, and will require the development of high resolution and complex observing systems, modelling tools and data assimilation techniques. The WMO IG^3IS Science Implementation Plan is guiding the work.

With regards to space-based observations of the ocean, the WMO Space Programme interfaces with relevant ocean discussions in the Coordination Group for Meteorological Satellites (CGMS) and with the Committee on Earth Observation Satellites (CEOS).

WMO through its Global Cryosphere Watch (GCW) has initiated an international coordinated effort to evaluate, intercompare and make recommendations on the available satellite products on sea ice thickness and snow on sea ice, to take place between 2020 and 2023. The project will engage and address individual end-user requirements and other data performance critical to their application (e.g., operational users are likely to require (near) real-time [(N)RT]; data assimilation and Numeric Weather Prediction (NWP) groups are likely to need NRT data, this project will provide the framework for increased coordination and standardization of sea ice observing and data exchange best practices, recognizing the distribution of these activities across many communities, and the strong role played by the scientific communities. Forecasting for navigation in the polar and marginalized regions (e.g. Great Lakes) requires, among others, reliable data and products on sea-ice. While sea ice concentration and extent have been monitored from space for several decades, and these products are generally accurate and robust, information on ice thickness and snow depth-on-sea ice are also critical to forecasting and navigation. This is due to their integrated measure of changes in the energy budget, while snow on sea ice adds a key insulating layer and, in the Antarctic, it contributes to sea-ice volume via snow-ice formation.

The WMO-IOC Data Buoy Coordination Panel (DBCP) continues to lead efforts to reduce data buoy vandalism, including an annual reporting of vandalism events on data buoys to track progress toward implementation of the vandalism preventative measures. Some countries are working towards agreements with neighbouring countries to collectively act on vandalism event through law enforcement. Further, WMO continues to encourage 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.

The joint WMO-IOC Marine Climate Data System (MCDS) coordinates the activities of existing ocean data systems, in order to have compiled coherent met-ocean climate datasets of known quality, extending beyond the GCOS Essential Climate Variables (ECVs). The data will be of known quality collected from multiple sources to be served on a free and unrestricted basis to the end users through a global network of data centres covering different data domains. A number of data centres, namely, the World Ocean Database, the Coriolis data centre, the Atlantic Oceanographic & Meteorological Lab were certified to be part of the MCDS.

WMO Global Telecommunication System (GTS) is the communications and data management component of the WMO Information System, managed by the NMHSs that collects and distributes information critical to WMO service delivery. Due to its complex nature, access to the GTS is limited and not straight forward for the majority of the ocean observing community who are not directly connect with the NMHSs. To resolve this issue a pilot project on “Open Access to GTS” was initiated primarily focusing on data providers and data users that did not already have direct or easy access to the GTS. The pilot project proved to be an overwhelming success. This will be part of the demonstration projects of WIS2.0 which is the next generation single coordinated global infrastructure responsible for the telecommunications and data management functions of WMO.

The WMO Global Data-Processing and Forecasting System (GDPFS) is composed of three types of centres distributed around globe providing information at global, regional and national level. These centres include World Meteorological Centres (WMCs), Regional Specialized Meteorological Centres (RSMCs) including Regional Climate Centres (RCCs) and National Meteorological Centres (NMCs). The standards for data-processing and forecasting are represented in the *Manual on GDPFS* (WMO-No. 485) which is considered as the single

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source of technical regulation for all operational data-processing and forecasting systems operated by WMO Members, including designation of specialized centres. In this context, there are 24 RSMCs for marine meteorological services covering METAREAs, four RSMCs for numerical ocean wave prediction and six RSMCs for tropical cyclone forecasting, including marine-related hazards. WMO promotes an Earth System Modelling and Prediction (ESMP) approach, which implies more integration of ocean parameters into ESMP. This responds to various ocean users' needs (coastal issues, shipping, fishing etc.) and will improve the access to and use of marine products for protection of life and property at sea and along the coast.

The Polar Prediction Project (PPP) is a decade long core project of the World Weather Research Programme (WWRP) with the aim of promoting cooperative international research enabling development of improved weather and environmental prediction services for the polar regions, on time scales from hours to seasonal. PPP will end in December 2022 and is currently in the final or Consolidation stage of the three stages in the project. One of the PPP flagship activities has been the Year of Polar Prediction (YOPP) consisting of periods of enhanced observations, modelling and verification in the Arctic and the Antarctic as well as education activities, and engagement with many of the user communities of polar environmental prediction services. A face-to-face YOPP Final Summit is scheduled for 1 to 4 May 2022 in Montreal, Canada. The research in PPP is to a large degree embedded in existing value chain structures and operational at several prediction centres. PPP have supplemented and advanced scientific developments by establishing links with academia and research institutions, as well as direct coupling to important research activities and applications of research. The Southern Hemisphere component of YOPP (YOPP-SH) was originally to have only one Special Observing Period (SOP) which was in the Antarctic Summer 2018/2019. Following this SOP, it was decided to run a second SOP that captured the winter freeze and mid-winter conditions. Due to operational reasons this SOP was delayed and will now run from mid-April to mid-July 2022. To allow for data processing and analyses for the Antarctic Winter SOP in 2022 the YOPP-SH component of PPP/YOPP will now run to the end of December in 2024. The PPP has been able to generate significant third party funding for activities that have furthered WMO's objectives in the polar regions. The close coupling of PPP to EC-PHORS and thus to the WMO Executive Council has ensured high visibility for these external contributions within WMO and for WMO to have input into defining the content of the grant calls.

The Sub-seasonal to Seasonal (S2S) is a project supported by WWRP and WCRP which aims to improve forecast skill and understanding on the sub-seasonal to seasonal timescale with special emphasis on high-impact weather events. S2S prediction (forecast range larger than 2 weeks but less than a season) is now routinely performed with coupled ocean-atmosphere models because coupling of the atmosphere to the ocean becomes important for lead times longer than two weeks, contributing, for example, to predictability of monsoon variations and the Madden Julian Oscillation. In addition, satellite observations suggest that midlatitude ocean mesoscale eddy–induced Sea Surface Temperatures (SSTs) can influence the atmospheric planetary boundary layer, which may afford predictability to winter storm-track on S2S timescales. Unlike atmospheric weather, which evolves on daily time scales, ocean weather typically evolves on weekly to monthly time scales and includes marine heat waves and long-lived surges in sea level that can cause fair-weather flooding and exacerbate the flood risks of tropical and extratropical storms. Sub-seasonal prediction of regional SST variations and variations in near-surface currents is also of direct interest for a wide range of activities and enterprises including management of fisheries, offshore mining activities, ocean transportation. Sea ice is also considered as part of the coupled ocean system which, due to its insulating and reflective properties, regulates exchanges between the atmosphere and ocean. Because of its memory at the S2S timescale, prediction systems increasingly account for it, either to improve the forecasts themselves, or to provide dedicated forecasts. Sub-seasonal prediction of sea ice has wide potential applications as well (for example ship routing) but its potential has yet to be fully harnessed. The S2S database contains near real-time sub-

seasonal forecasts (up to 60 days) and re-forecasts (sometimes known as hindcasts) from 11 operational centres, since January 2015. Most of the S2S models are coupled ocean-sea ice-atmosphere models and the list of parameters available from the S2S database has always included ocean sea-surface temperature and sea-ice cover. In a recent development, since January 2020, nine new ocean and sea-ice parameters have been added to the S2S database. The availability of this extensive set of ocean and sea ice variables substantially increases the power of the database for S2S coupled system research, and to address the science questions mentioned above.

Ocean-OPS

The Ocean-OPS (WMO-IOC Joint Centre for Oceanography and Marine Meteorology in situ Observations Programmes Support) is the international hub and centre of excellence that provides vital services in monitoring, coordinating, and integrating data and metadata, across an expanding network of global oceanographic and marine meteorological observing communities. Under the guidance of the Observations Coordination Group and its stakeholders, in 2020, OceanOPS has released its new five-year Strategic Plan (2021-2025) and rebranded from JCOMMOPS to OceanOPS taking advantage from the disbandment of JCOMM and the creation of the Joint WMO-IOC Collaborative Board.

For 20 years, OceanOPS has been supporting efficient observing system operations to ensure the transmission and timely exchange of high-quality metadata and assisting with the provision of free and unrestricted data delivery to all users. OceanOPS has also been developing tools and metrics to analyse the observing networks and system trends and reporting back to stakeholders to encourage performance improvement and cost efficiency. OceanOPS' core activity is the harmonization of metadata for each observing network, individually and across the ocean observing system collectively. This will vastly increase data usability and global monitoring capacity.

Since the beginning of the Argo Program, OceanOPS has been maintaining network specific services critical to ocean observing systems implementation, such as the IOC/UNESCO warning and notification system for floats approaching Coastal States waters. OceanOPS also has responsibility for allocating unique WMO identifiers to all met-ocean platforms and for providing integrated ocean metadata to the WMO Observing Systems Capability Analysis and Review Tool (OSCAR) system. The WMO Governance Reform placed OceanOPS within the larger Earth System monitoring approach to develop synergies with cryosphere and hydrology.

OceanOPS annually coordinates and publishes the Ocean Observing System Report Card (www.ocean-ops.org/reportcard): a major publication achievement for the Observations Coordination Group and the Network experts. It communicates on the status of the GOOS and the societal values of the observing system, and encourages international collaboration, new partners, Members and Member States to join the challenge of building an integrated, sustained, innovative, globally implemented observing system that meets the growing demand for ocean services and science. It also helps the networks to raise their standards to meet integrated goals. The Report Card 2020 (published October), was the fourth edition of this communication effort focusing on the in situ and satellite ocean observation status, the UN Decade of Ocean Science for Sustainable Development, advances in emerging networks such as the animal borne ocean sensors network, ship support to science and services, and the impact of COVID-19 pandemic on ocean observations. Some statistic evaluations, carried out over the last 12 months, have shown that more than 8 thousand users accessed to the web version of the Report while the PDF version was downloaded more than 28 thousand times.

Over the past 20 years, OceanOPS has grown in visibility and demonstrated its expertise in monitoring the ocean observing system. Many activities and services have been successfully implemented and OceanOPS has become crucial for the coordination of a complex enterprise, composed of a high diversity of networks and many observing communities from around the

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world. OceanOPS is internally restructuring and moving to a more diverse and stable funding platform, thereby enabling it to focus on its strategic goals and allowing sustainable growth to meet new needs.

The proven success of OceanOPS have demonstrated the value and criticality of centralized support, coordination, and system monitoring for the global ocean observing enterprise. The 5-Year Strategic Plan will provide even more the guide for OceanOPS activities to continue that success towards a more efficient and integrated system that delivers data and information necessary for an increased range of services and research.

OceanOPS recalls the continuous challenge of completing the GOOS in Members' Exclusive Economic Zones (EEZ). The current Law of the Sea regulatory procedures are not compatible with the operational maintenance of the core GOOS networks (Argo floats and Tropical Moored Arrays in particular). Such networks have been sustained for more than two decades and can't be reasonably considered as Marine Scientific Research. OceanOPS strongly advocates for practical and multilateral solutions to facilitate the routine deployments of ~2500 ocean observations instrumentations per year, globally and regionally, and is offering its support to keep enhancing the marine observations in EEZ for Members benefits.

The article 247 of the UNCLOS (Marine scientific research projects undertaken by or under the auspices of international organizations) might offer some solution space to facilitate the maintenance of instruments in EEZs and should be piloted at regional level. Meanwhile, OceanOPS calls on all coastal states to provide fast track solutions for EEZ access and to take the opportunity to recall their willingness to welcome observing system deployments in the waters under their jurisdiction, in particular Argo floats, key observing systems for long range weather forecasts, extreme weather events, and climate analysis.

In particular, OceanOPS wishes to highlight a major cruise to complete the Argo profiling float array in the Pacific Island Countries and Territories (PICTs). 130 new units will be deployed by the Argo partners (USA and Australia) from September 2021 by the NIWA Kaharoa vessel to cover the anticipated gaps in the global array and contribute to the TPOS2020 objectives. Concerned PICTs are: New Zealand, Niue, Amercan Samoa, Tokelau, Kiribati, Marshall Islands, Federated States of Micronesia, Papua New Guinea, Solomon Islands, Fiji, Tuvalu, Wallis and Futuna.

Together with ocean acidification and an accompanying deoxygenation, ocean warming is leading to dramatic changes in marine ecosystems and the wellbeing of people that depend on them.

XIII Regional Cooperation

The WMO has been engaged as an expert service provider by the Green Climate Fund (GCF) to enhance the use of scientific methodologies for adaptation planning and vulnerability assessment in climate sensitive sectors, including linked marine and coastal. In response to the Paris Agreement call for "Strengthening scientific knowledge on climate in a manner that informs climate services and supports decision-making (Article 7, paragraph 7 (c))", the GCF initiated an integrated approach to facilitate the generation and use of climate information in decision-making.

Under the service contract, WMO is developing the concept, scientific methodology, data, tools and associated technical resources for enhancing the climate science basis for GCF funded projects, activities and National Adaptation Plans (NAPs). The project aims to facilitate the formulation of a capacity development programme at the country and local level(s) to support the application of methodology, data and tools. The climate science basis

methodology and its constituent materials were field tested in these countries during the workshops and produced the following outcomes: 1.Case study reports on fisheries and coastline management for further use in a National Adaptation Plan (NAP) or a GCF project in the country context; 2.Feedback and lessons learned to inform GCF/WMO guidelines methods, data and support needed for further climate rationale preparation globally; 3.Expanded understanding and knowledge of climate rationale requirements and preparation within the region.

WMO RA III and RA IV Ocean Side Event during RA Sessions

Two special Ocean Side Events were held during the 18th Sessions of the WMO Regional associations III (South America) and IV (North, Central America, and Caribbean) in 2020 and 2021. Members and eminent meteorological and oceanographic professionals joined to discuss ocean priorities – focussing on exploring the needs, finding the gaps, identifying priorities in ocean matters, and developing a cooperation roadmap. Details here and here.

XV Coordination and Cooperation

WMO Technical Commissions, Research Board and other

WMO's Research Board, and Technical Commissions (SERCOM and INFCOM), and the Capacity Development Panel (CDP) have been progressing ocean activities. The WMO and IOC mechanism of partnership is through the WMO-IOC Joint Collaborative Board (JCB), which has developed a Joint WMO-IOC Collaborative Strategy.

UN Oceans Conference

WMO is engaged in the preparations for the 2nd UN Ocean Conference – postponed to a later date.

UN Ocean Decade

The WMO is committed to participating in the Ocean Decade. WMO provided comments to the *Draft Ocean Decade Implementation Plan* indicating the need for greater focus on the role the ocean in weather, climate and climate change; ocean and DRR; and more attention required on Polar regions. The WMO World Meteorological Day events and products were endorsed contributions (noted below). WCRP are involved in a number of Ocean Decade activities including the Digital Twins of the Ocean (DITTO) and the Southern Ocean Regional Programme. OceanOPS and GOOS are also involved in several Decade activities, which were announced on World Ocean Day 2021.

World Meteorological Day 2021

World Meteorological Day in 2021 celebrated the theme "the ocean, our climate and weather", showcasing WMO's focus in connecting these three important components of the Earth System. Almost 600 people participated in a virtual ceremony addressed by WMO SG Petteri Taalas, UN Secretary General's Special Envoy for the Ocean Peter Thomson, UN Climate Action Assistant Secretary General Selwin Hart, and other speakers including a youth advocate from Puerto Rico, Mr Salvador Gómez-Colón, who shared his personal experiences surviving Hurricane Maria (2017). A special 'Ocean' theme WMO Bulletin was published. It demonstrates the range of ocean activities that WMO and Members are involved in. As well, WMO launched an Ocean Video summarising the breadth of WMO Ocean activities, (in all UN languages) which has since been shown at the UN Ocean Conference High Level Debate (June 1) and the UN World Oceans Day event (June 8). These publications and the World Meteorological Day event were formally endorsed WMO contributions to the Decade.

Earthshot Prize
WMO has been appointed a Nominating Agency for the Earthshot Prize . WMO has a particular interest in identifying nominees for the ocean and climate Earthshots.

World Oceans Day 2021

WMO marked World Oceans Day on 8 June (2021) with the showing of the new WMO Ocean video, as part of the UN Oceans line-up in the UN World Ocean Day event. WMO also launched its new WMO Ocean page, rolled out webnews and social media, including promotion of the WMO Bulletin – special Ocean theme, and the 2020 WMO Global Statement of Climate.

COP26

WMO participated in the Ocean Dialogue at the Subsidiary Body for Scientific and Technological Advice (SBSTA) in November 2020. Preparations are underway to ensure the WMO ocean-climate activities contribute to the discussions for 26th UN Climate Change Conference of the Parties (COP26) in Glasgow hosted by UK (Nov 2021).

PART B: COVID19 IMPACT ON OCEAN ACTIVITIES

Maritime transportation is an essential sector to the global economy during the COVID-19 situation. All WMO marine partners have urged their Members to recognize seafarers as 'key workers' and call for continuous accurate maritime weather services'. The WMO-IMO WWMIWS is operating without major impact during COVID-19, to help the global maritime community in combating this pandemic.

COVID-19 complicates the management of weather, climate and water-related hazards and makes early warnings systems against multiple hazards even more important, especially in the tropical cyclone seasons. Examples like Typhoon Goni (Western North Pacific, November 2020) across Philippines and Viet Nam, Hurricanes Iota and Eta (Caribbean Sea, November 2020) in Nicaragua and Honduras, Tropical Cyclones Yasa (South Pacific, December 2020) across the Pacific Islands and Seroja (South-East Indian Ocean, April 2021) in Indonesia and Timor-Leste showed the benefit of the well-established WMO global and regional coordination mechanisms for tropical cyclone forecasting and warnings, that enabled Members to receive reliable and timely information based on impacts and in multi-hazard approach. It provided early warnings for vulnerable coastal communities.

Limited immediate impact on ocean observation data flows, observations from commercial ships, risk of degrading autonomous platforms, drifters and profiling floats show a declining trend, which will degrade forecasts and create gaps in the climate record. The OceanOPS is maintaining a watch on the drops in data, deployments, cruises, etc at here.

2. ACRONYMS

AGGI	Annual Green House Gas Index
CDP	Capacity Development Panel
CEOS	Committee on Earth Observation Satellites
CG	World Meteorological Congress
CGMS	Coordination Group for Meteorological Satellites
CIFDP	Coastal Inundation Forecasting Demonstration Project
CIFI	Coastal Inundation Forecasting Initiative

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COP	Conference of Parties
CREWS	Climate Risk & Early Warning Systems
DBCP	the WMO-IOC Data Buoy Cooperation Panel
DITTO	Digital Twins of the Ocean
DRR	Disaster Risk Reduction
EC	Executive Council
ECV	Essential Climate Variable
EEZ	Exclusive Economic Zone
ESMP	Earth System Modelling and Prediction
FAO	Food and Agriculture Organization
FSO	Forecast Sensitivity to Observations
GAW	Global Atmosphere Watch
GCF	Green Climate Fund
GCOS	Global Climate Observing System
GCW	Global Cryosphere Watch
GDPFS	Global Data-processing and Forecasting System
GESAMP	Group of Experts on the Scientific Aspects of Marine Environmental Protection
GHG	Greenhouse Gas
GMDSS	Global Maritime Distress and Safety System
GMSL	Global Mean Sea Level
GOOS	Global Ocean Observing System
GTS	Global Telecommunication System
IG^3IS	Integrated Global Greenhouse Gas Information System
IHO	International Hydrographic Organization
IMO	International Maritime Organization
INFCOM	Commission for Observation, Infrastructures and Information Systems
IN-MHEWS	The International Network for Multi-Hazard Early Warning System
IOC-UNESCO	Intergovernmental Oceanographic Commission of UNESCO
IPCC	Intergovernmental Panel on Climate Change
ISC	International Science Council
JCB	Joint WMO-IOC Collaborative Board
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
JCOMMOPS	The JCOMM insitu Observations Programme Support Centre
LDC	Least Developed Countries
LLGHGs	Long-Lived Greenhouse Gases
MCDS	Marine Climate Data System
METAREA	Geographical sea region for the purpose of coordinating the transmission of meteorological information to mariners on international voyages through international and territorial wate
Metocean	Meteorology and (physics) Oceanography
MHEWS	Multi-Hazard Early Warning System
NAP	National Adaptation Plan
NMC	National Meteorological Centre
NMHS	National Meteorological and Hydrological Services
NOAA	National Oceanic and Atmospheric Administration, USA
NRT	(Near) Real-Time
NWP	Numerical Weather Prediction
OceanOPS	WMO-IOC Joint Centre for Oceanography and Marine Meteorology in situ Observations Programmes Support (OceanOPS, formerly named JCOMMOPS)

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OSCAR	Observing Systems Capability Analysis and Review Tool
OSEs	Observing System Experiments
PICT	Pacific Island Countries and Territories
PPP	Polar Prediction Project
RCC	Regional Climate Centres
RSMC	Regional Specialized Meteorological Centre
S2S	Sub-seasonal to seasonal
SBSTA	Subsidiary Body for Scientific and Technological Advice
SC-MMO	Standing Committee on
SDG	Sustainable Development Goal
SERCOM	Commission for Weather, Climate, Water and Related Environmental Service Applications
SIDS	Small Island Developing States
SOLAS	International Convention for the Safety of Life At Sea
SOP	Special Observing Period
SST	Sea Surface Temperature
TC	Tropical Cyclone
TCC	Tropical Cyclone Committee
TPOS	Tropical Pacific Observing System
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	UN Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WCRP	World Climate Research Programme
WG	Working Group
WIGOS	WMO Integrated Global Observing System
WIS	WMO Information System
WMC	World Meteorological Centre
WMO	World Meteorological Organization
WWMIWS	the WMO-IMO World-Wide Metocean Information and Warning Service
WWRP	World Weather Research Programme
YOPP	The Year Of Polar Prediction