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**AGENDA ITEM 6: EARTH SYSTEM OBSERVATIONS AND PREDICTIONS**

**AGENDA ITEM 6.1: WMO Integrated Global Observing System**

# MARINE OBSERVATIONS

***p.1 Draft Resolution 6.1(3)/2 (Cg-18)*** *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*

***p.6 Draft Resolution 6.1(3)/3 (Cg-18)*** *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*

***p. 8 Draft Resolution 6.1(3)/4 (Cg-18)*** *Ocean observations in support of Earth System Prediction and WMO support to GOOS Strategy 2030 (incl. Tropical Pacific Observing System 2020)*

**Draft Resolution 6.1(3)/2 (Cg-18)**

**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**

THE WORLD METEOROLOGICAL CONGRESS,

**Noting** Recommendation 14 (EC-70), and subsequent work of JCOMM and its Observations Coordination Group (OCG) in liaison with the IOC-WMO-UN Environment-ICS Global Ocean Observing System (GOOS) Steering Committee,

**Recalling**:

(1) Article 2 of the Convention of the World Meteorological Organization, committing Members: “(a) To facilitate worldwide cooperation in the establishment of networks of stations for the making of meteorological observations as well as hydrological and other geophysical observations related to meteorology … ”, and (b) “To promote the establishment and maintenance of systems for the rapid exchange of meteorological and related information”,

(2) The United Nations Convention on the Law of the Sea of 10 December 1982 (UNCLOS), in particular the provisions of Part XIII on marine scientific research, which require States and competent international organizations to promote and facilitate marine scientific research, including through cooperation, in order to increase scientific knowledge of the marine environment as a critical underpinning of effective measures to preserve the marine environment and ensure the sustainable use of ocean resources for the benefit of all mankind,

(3) The report of the Third Committee of the Third United Nations Conference on the Law of the Sea (1973–1982), which included the letter sent on 25 August 1980 to the Secretary-General of WMO by the Chair of the Committee expressing that in his opinion the provisions of Part XIII of UNCLOS on marine scientific research would not create any difficulties and obstacles hindering adequate meteorological coverage from the ocean areas, including areas within the exclusive economic zones, carried out both in the framework of existing international programmes and by all vessels, since such activities had already been recognized as routine observation and data collecting which was not covered by Part XIII and that they were in the common interest of all countries and had undoubted universal significance, as they are indispensable for the issue of timely and accurate storm warnings for the safety of navigation as well as for the protection of life and property in coastal and offshore areas,

(4) the present Marine Meteorology and Oceanography Programme and Tropical Cyclone Programme, which use both vessels, under and the Voluntary Observing Ship (VOS) Scheme, and operational surface marine meteorological observing platforms (e.g. drifting buoys, unmanned surface vehicles), and strive to provide adequate meteorological coverage from the ocean areas, including areas within the exclusive economic zones, falling therefore under the content and the spirit of the letter mentioned in paragraph (3) above,

(5) Resolution 9 (Cg-IX) – United Nations Conference on the Law of the Sea, which requested the Executive Council and the Secretary-General: (a) To arrange, in close consultation with the president of the Commission for Marine Meteorology (now Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology), for a continuing review of the implications of the legal provisions of the Convention on the ocean-related activities of WMO with a view to informing the United Nations and Members of WMO, as appropriate; and (b) To take action, as necessary, to ensure that the ocean-related activities of WMO, both operational and scientific, are undertaken under the most favorable conditions,

(6) Resolution 40 (Cg-XII) – WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities, which recognizes marine meteorological observations as essential data, and which are thereby freely exchanged in real-time among all countries for the general benefit to all countries,

(7) The International Convention for the Safety of Life at Sea (SOLAS, 1974) as amended,

**Further noting**:

(1) The *Technical Regulations* (WMO-No. 49), Volume I, Part I,

(2) The *Manual on the WMO Integrated Global Observing System* (WMO-No. 1160),

(3) The *Manual on Marine Meteorological Services* (WMO-No. 558), Volume I, Part I, defining WMO Members’ responsibility for issuing warnings for high seas and coastal waters according to internationally agreed procedure,

**Welcoming** the outcome and recommendations of the WMO Technical Workshop on enhancing ocean observations and research, and the free exchange of data, to foster services for the safety of life and property ([Ocean Safe](https://public.wmo.int/en/events/meetings/technical-workshop-enhancing-ocean-observations-and-research-and-free-exchange-of), Geneva, 5-6 February 2019), which was organized as a contribution to the planning phase (2019–2020) of the United Nations Decade of Ocean Science for Sustainable Development (2021–2030),

**Considering**:

(1) That adequate marine meteorological data coverage from ocean areas, including those from the exclusive economic zones (EEZs), is 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,

(2) That the SOLAS Convention, Chapter V, Safety of Navigation, Regulation 5, specifies that the contracting governments undertake, inter alia, to encourage the collection of meteorological data by ships at sea and to issue warnings of gales, storms and tropical storms,

(3) That VOS Scheme, which has undergone technological developments, is even more important today, not only to ensure safety of navigation and protection of life and property in coastal and offshore areas, but also to face other concerns, in particular the consequences of climate change,

(4) That Members of WMO have undertaken the responsibility of issuing warnings for the high seas and coastal waters according to internationally agreed procedures, including those based on advisories by Regional Specialized Meteorological Centres and Tropical Cyclone Warning Centres,

(5) That WMO-coordinated research programmes require extensive marine meteorological and oceanographic data sets from the world ocean, including EEZs,

(6) That meteorological observations from satellites over the oceans, including over EEZs, are routinely made available for operational purposes,

(7) That i*n situ* observations over the oceans, from surface marine meteorological networks (e.g. VOS, data buoys), are indispensable for the generation of forecasts and services, as some of the marine meteorological and oceanographic observations, such as sea-level pressure, sub-surface temperature and salinity profiles, cannot currently be adequately measured from space,

(8) That *in situ* observations, for example sea surface temperature, wind and waves are also essential for calibration and validation of satellite data,

(9) That marine meteorological and oceanographic observations included in numerical models contribute to improving prediction skills at all time scales,

(10) That marine observing platforms, such as voluntary observing ships, data buoys, uncrewed surface vehicles, Argo profiling floats and sub-surface gliders are providing meteorological observations primarily from data sparse areas of the ocean,

**Recognizing**:

(1) That since Resolution 9 (Cg-IX) was adopted, the observational user requirements of operational WMO applications, including global and high-resolution numerical weather prediction and sub-seasonal to longer-range prediction, and climate services have substantially evolved, and are now increasingly relying on marine meteorological and oceanographic observations,

(2) The future direction of WMO, as part of the Strategic Plan, in support of Earth system prediction, which coupled with ocean models will be relying greatly on marine meteorological and oceanographic data made routinely available to WMO,

(3) That technological advances can now provide *in situ* observational data of the requisite enhanced quality and spatial and temporal resolution, from the world oceans, including from EEZs,

(4) 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,

**Reaffirms**:

(1) 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;

(2) The critical importance of the VOS Scheme and operational surface marine meteorological observing platforms (e.g. drifting buoys, unmanned surface vehicles), hereinafter called surface observing platforms, for ensuring the provision on routine basis of adequate marine meteorological observations and data coverage, noting that:

(a) Voluntary observations from ships have been at the core of WMO and its predecessor activities since the 1853 Maritime Conference held at Brussels for devising a uniform system of meteorological observations at sea and have been regulated by WMO according to 1974 SOLAS Convention and previous SOLAS Conventions,

(b) The VOS Scheme and surface observing platforms are not covered by UNCLOS Part XIII on marine scientific research and can consequently be freely operated in the EEZs,

(c) The VOS Scheme and surface observing platforms are supported by consistent practices of Members according to WMO Technical Regulations,

(d) While not covered by UNCLOS Part XIII, the operation of the VOS Scheme and surface observing platforms fully complies with UNCLOS general principles, such as peaceful use of the sea, protection of human life at sea, dissemination of information;

(3) The need to further strengthen existing co-operation and activities under surface observing platforms;

(4) The fact that observations from the VOS Scheme and surface observing platforms are made in the context of agreed, long-standing operational systems and that they are freely exchanged among, and are of general benefit to, all countries;

(5) The fact that VOS observations are made, on a voluntary basis under the VOS Scheme, by merchant vessels engaged in normal trading activities, whose officers should be reassured, where necessary, of the continuing legality and importance of their work in this regard;

**Requests** the Joint WMO-IOC Board, in close consultation with the technical commissions and the Research Board to keep reviewing the implications of the legal provisions under ocean-related instruments (e.g. UNCLOS, SOLAS, Polar Code) on the ocean-related activities of WMO with a view to informing the Members of WMO and interested United Nations organizations, as appropriate;

**Requests** the Executive Council to include a reference to UNCLOS and other relevant ocean-related legal instruments in Part 3 (Impacts of international agreements) of the WMO Statement on the Role and Functions of National Meteorological and Hydrological Services;

**Urges** Members:

(1) To facilitate and promote marine meteorological and related oceanographic observational and research programmes over the ocean for operational purposes, in particular from within EEZs;

(2) To take, as necessary, action to ensure that the ocean-related activities of WMO, both operational and scientific, are undertaken under the most favorable conditions;

(3) To adopt legislation encouraging the collection of marine meteorological and oceanographic data, as listed in the Annex to this Resolution, by surface observing platforms and to arrange for their dissemination and exchange in real-time;

(4) Where Marine meteorological observations are generally made on a voluntary basis under the VOS Scheme by vessels engaged in their normal activities, to reassure their officers, where necessary, of the continuing legality and importance of their work in this regard;

(5) To support the referring of this Resolution in the Resolution on Oceans and the Law of the Sea to be adopted by the seventy-fourth session of the United Nations General Assembly.

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This Resolution replaces Resolution 9 (Cg-IX), which is no longer in force.

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**Annex to Draft Resolution 6.1(3)/2 (Cg-18)**

**Marine meteorological and oceanographic variables, which observations are critical for the safety of navigation and the protection of life and property in coastal and offshore areas**

Observations of the following marine meteorological and oceanographic variables, including from within exclusive economic zones, are used operationally by WMO Applications and are critical for those Applications to allow WMO to deliver the services in support of the safety of navigation and the protection of life and property in coastal and offshore areas:

* Sea level pressure,
* Surface wind speed and direction,
* Surface air temperature,
* Surface relative humidity,
* Precipitation at the surface,
* Sea surface temperature,
* Sea surface salinity,
* Sea surface currents,
* Directional and non-directional wave observations,
* Visibility,
* Sea-ice,
* Ice accretion,
* Sub-surface temperature and salinity,
* Sea level,
* Atmospheric composition,
* Atmospheric temperature, humidity and wind profiles,
* All other ocean surface and atmospheric observations that are needed to derive fluxes between the ocean and the atmosphere.

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**Draft Resolution 6.1(3)/3 (Cg-18)**

**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**

THE WORLD METEOROLOGICAL CONGRESS,

**Recalling** draft Resolution 6.1(2)/5 (Cg-18),

**Noting** a 20-year history of work by the Intergovernmental Oceanographic Commission of UNESCO (IOC) to develop a cooperative framework regarding the sharing of ocean data in Exclusive Economic Zones (EEZs), in particular:

1. IOC Resolution XX-6 (1999, "The Argo Project"), defining the Argo profiling float network and its implementation "fully consistent with the UNCLOS [United Nations Convention on the Law of the Sea]," as a part of the Global Ocean Observing System and the Global Climate Observing System,
2. IOC Resolution EC-XLI.4 (2008, "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"), defining a framework for notification of coastal IOC Member States of Argo profiling floats likely to enter their EEZ,
3. Decision IOC/EC-LI/4.8 (2018, "Evolving Capabilities of the Argo Global Array of Profiling Floats"), agreeing to the continued use of the guidelines defined in IOC Resolution EC-XLI.4 for six new biogeochemical parameters, and to a framework for approval of additional new parameters,

**Noting further** that the Argo Information Centre at the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology *in situ* Observations Programme Support Centre (JCOMMOPS) plays an important role in ensuring the above guidelines are implemented,

**Acknowledging** that the IOC-WMO-UN Environment-ICS Global Ocean Observing System (GOOS) and the JCOMM Observations Coordination Group (OCG) are presently undertaking work to identify issues related to the implementation of sustained ocean observing in EEZs, under the provisions of UNCLOS,

**Noting with satisfaction** Argo's pioneering free and open data policy, in compliance with the IOC Oceanographic Data Exchange Policy (IOC Resolution XXII-6),

**Recognizing that**:

1. National Meteorological and Hydrographic Service operational forecast models and services increasingly rely on sustained global data streams of subsurface ocean observations, to improve the skill of their forecasts, and to provide services that save lives and protect property, and support the blue economy,
2. WMO and IOC research, notably on climate and its impacts, depends on the availability of global sustained ocean observation data streams,
3. The UN Framework Convention on Climate Change call on Parties to strengthen systematic observation of climate (Article 5),
4. The increasing need to develop 'ecological' early warning systems, providing alerts for stakeholders and managers and combining ocean model and in situ observations, for example for harmful algal blooms and coral bleaching events,

**Further recognizing** that:

1. many of these oceanographic data streams are implemented and funded by national oceanographic research agencies and organizations working outside the operational framework of National Meteorological and Hydrographic Services,
2. many oceanic processes move across EEZ boundaries, and
3. the interrelated nature of the ocean, signifying that oceans and seas present a special case as regards to the need for international coordination and cooperation;

**Confirms** the importance of:

1. Respecting the relevant legal frameworks for the taking and sharing of ocean data in waters under national jurisdiction,
2. Full consultation and exchange of views with WMO Members,
3. Informing all WMO Members and IOC Member States of these activities through the UN General Assembly Resolution on Oceans and Law of the Sea;

**Decides** that:

1. WMO work through its forecasting systems and services activities to identify the requirements for subsurface ocean variables to improve the quality of these forecasts and services,
2. WMO work closely with the IOC in order to explore mechanisms that make the highest-impact subsurface ocean data freely available,
3. WMO work to build the capacity of all Members to use the resulting forecast systems and services for societal benefit;

**Requests** Technical Commissions and Research Board to include the above Decision in their work programme;

**Urges** Members to extend bilateral and multilateral cooperation in research, observations, forecasting, services and capacity development, in order to make ocean data more freely available.

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## Draft Resolution 6.1(3)/4 (Cg-18)

### Ocean observations in support of Earth System Prediction and WMO support to GOOS Strategy 2030 (incl. Tropical Pacific Observing System 2020)

THE WORLD METEOROLOGICAL CONGRESS,

**Recalling** WMO’s co-sponsorship of the Global Ocean Observing System together with IOC, UN Environment, and the International Science Council (ISC),

**Noting**

1. Decision 33 (EC-70) on WMO Contribution to the IOC-WMO-UN Environment-ISC Global Ocean Observing System (GOOS),
2. Resolution 9.3.4/3 (Cg-18) on Joint WMO-IOC Advisory Board, which decides to incorporate appropriate JCOMM functions and activities on observation and operational ocean forecasting systems into the IOC-WMO-UN Environment-ISC Global Ocean Observing System (GOOS), with enhanced connections to the WMO Commission for Observation, Infrastructure and Information Systems,
3. Resolution 3(1)/1 (Cg-18), WMO Strategic Plan,
4. the draft GOOS 2030 Strategy to be submitted to IOC of UNESCO 30th Assembly (26 June - 4 July 2019) for approval,
5. the [second Tropical Pacific Observing System (TPOS) 2020 report](http://tpos2020.org/) and its recommendations, which are now being considered by TPOS stakeholders,
6. [GCOS 200 (GOOS 214)](https://unfccc.int/sites/default/files/gcos_ip_10oct2016.pdf), the Global Observing System for Climate: Implementation Needs,

**Noting further** that the Joint WMO-IOC Advisory Board will advise GOOS, the Technical Commissions, and the Research Board on how to achieve the relevant objectives of the Board,

**Having considered** Recommendation 13 (EC-70) on the Tropical Pacific Observing System 2020,

**Recognizing** that WMO’s participation in draft GOOS Strategy 2030 will require Members’ engagement with partner oceanographic organizations at regional and national levels,

**Recognizing** 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,

**Recognizing further** that the physical, biogeochemical and biological components of the GOOS are supporting the ocean component of the Global Climate Observing System,

**Reaffirms** the important contribution of sustained ocean observations to achieving WMO Strategic Objective 2.1, and **further reaffirms** its co-sponsorship of GOOS;

**Decides**

1. to approve the GOOS 2030 Strategy, subject to its parallel approval by IOC 30th Assembly;
2. to contribute to implementation of the GOOS 2030 Strategy, including through the fostering of appropriate interfaces into the two new WMO Technical Commissions and the Research Board;
3. to encourage further dialogue with GOOS and its associated observing system community in the development and evaluation of the ocean observing system to meet WMO’s regional and global requirements, and to improve delivery of WMO services and applications;

**Supports** establishment of a node of a distributed GOOS Office located within WMO;

**Adopts** Recommendation 13 (EC-70) on TPOS 2020;

**Supports** the recommendations of the second TPOS 2020 report;

**Requests**

1. Members to engage in GOOS implementation according to GOOS 2030 Strategy, and partners with relevant ocean observing organizations at the regional and national levels;
2. Members to take the TPOS 2020 report and its recommendations into account when planning their contribution to the Tropical Pacific Observing System;
3. The Technical Coordination Committee to provide advice on the needed interfaces between GOOS and the WMO Technical Commissions and the Research Board;
4. The Technical Commissions, the Research Board, the Joint WMO-IOC Advisory Board, and GOOS to include the TPOS 2020 second report recommendations into their respective work programmes as appropriate.

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