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| WEATHER CLIMATE WATER | **World Meteorological Organization**  **COMMISSION FOR OBSERVATION, INFRASTRUCTURE AND INFORMATION SYSTEMS**  **Third Session** 15 to 19 April 2024, Geneva | **INFCOM-3/Doc. 8.5(1)** |
| Submitted by: Chair of AG-Ocean  22.II.2024  **DRAFT 1** |

**AGENDA ITEM 8: TECHNICAL DECISIONS**

**AGENDA ITEM 8.5: Cross-systems**

# ENGAGEMENT PLAN of the advisory group on the ocean

# (AG-Ocean)

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| **Summary** |
| **Document presented by:** Chair of AG-Ocean  **Strategic objective 2024–2027:** 1.1, 1.4, 2.1, 2.2, 2.3, 4.3, 5.1, 5.3  **Financial and administrative implications:** Within the parameters of the Strategic and Operating Plans 2024–2027.  **Key implementers:** INFCOM, in collaboration with UNESCO-IOC  **Time frame:** 2024–2027  **Action expected:** Approve the AG-Ocean Engagement Plan |

# DRAFT DECISION

## Draft Decision 8.5(1)/1 (INFCOM-3)

### AG-Ocean Engagement Plan

**The Commission for Observation, Infrastructure and Information Systems decides:**

(1) To approve the Engagement Plan prepared by the Advisory Group on the Ocean (AG‑Ocean) and its applicable recommendations;

(2) To request the Management Group of the Commission for Observation, Infrastructure and Information Systems (INFCOM) and Standing Committees to assist AG-Ocean to implement relevant recommendations;

(3) To request the president of INFCOM to consult with the Commission for Weather, Climate, Hydrological, Marine and Related Environmental Services and Applications (SERCOM) and the Research Board and to engage with stakeholders listed in the Engagement Plan provided in the [annex](#annex) to assist with implementing relevant recommendations, bringing any governance-related recommendations to the Joint WMO-IOC Collaborative Board;

(4) To authorize the president of INFCOM to approve, as required, updates to the Engagement Plan of the AG-Ocean during the intersessional period.

See the [annex](#_Annex_to_draft_1) to the present decision.

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Decision justification: The Advisory Group on the Ocean (AG-Ocean) was established by draft [Resolution 2 (INFCOM-2)](https://library.wmo.int/idviewer/66287/59) - Establishment of standing committees, study groups and advisory groups of the Commission for Observation, Infrastructure and Information Systems (Infrastructure Commission). Its objective is to provide overall coordination on the application of ocean monitoring, including observations, data and prediction across the WMO and the ocean infrastructure community. The Engagement Plan is the first output of AG-Ocean. The Engagement Plan articulates priority focus areas based on issue, gap and opportunity analysis drawing on key strategic documents, knowledge and expertise within AG-Ocean, and stakeholder input. The latter comes from WMO, IOC and other relevant bodies. The overall goal of the Engagement Plan is to help establish long-term, operational working arrangements between the WMO and the ocean infrastructure community for the benefit of all nations.

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## Annex to draft Decision 8.5(1)/1 (INFCOM-3)

**Engagement Plan of the Advisory Group on the Ocean (AG-Ocean)**

### Introduction

The complementary strategic initiatives of the World Meteorological Organization ([WMO](https://library.wmo.int/records/item/68578-wmo-strategic-plan-2024-2027)), the Intergovernmental Oceanographic Commission ([IOC](https://www.ioc.unesco.org/en/mission-and-objectives)), the Global Ocean Observing System ([GOOS](https://www.goosocean.org/index.php?option=com_content&view=article&id=280&Itemid=419))[[1]](#footnote-2) and the UN Decade of Ocean Science for Sustainable Development 2021–2030 ([UN Ocean Decade](https://oceandecade.org/)) highlight the interconnectedness of the Earth's systems. They all strive for a resilient Earth by 2030, sharing a focus on a globally integrated observation network, data exchange and predictions for weather, ocean, and climate.

WMO prioritizes optimizing data acquisition, improving data access and management, and enabling prediction products, while IOC emphasizes strengthening observing systems, promoting open data access, and building scientific solutions for ocean challenges. The UN Ocean Decade catalyses ocean knowledge co-creation, innovation, and solutions across diverse stakeholders, aiming for a thriving, healthy and sustainable ocean by 2030; and the GOOS 2030 Strategy champions a comprehensive suite of observations, accessible data, and predictions of the ocean's future to safeguard life and manage resources sustainably. Although the specific strategic pillars differ among these high-level documents, all strategies converge on three key elements – observations, data and prediction:

* Strengthening Observations: Building a comprehensive observation system from satellites to underwater sensors while filling data gaps with new and existing technologies;
* Improving Data Management and Access: Standardizing measurements, promoting open access, and developing robust management systems for efficient data sharing;
* Enabling Prediction and Informed Decisions: Coupling real-time data with powerful models to generate accurate forecasts for weather, ocean, and climate, empowering informed decisions (and services) for a resilient future.

Further support for this convergence can also be found in a GOOS-commissioned report ([Smith, 2021](https://eur01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fdrive.google.com%2Ffile%2Fd%2F13SLTbUgikcOYhQc1XSJU9JpKWSpEkHEz%2Fview%3Fusp%3Dsharing&data=05%7C02%7Ccgallage%40wmo.int%7Ce3d7de8261c64356bba208dc186dd27e%7Ceaa6be54468740c49827c044bd8e8d3c%7C0%7C0%7C638412107221358615%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=7QWr%2F0pxRmQw5etOZAwuKyBIaBqxO7WSPb2OtroMCCs%3D&reserved=0)), which reviewed the support structures for global and regional ocean observation.

As part of the WMO Reform and to better align the work of WMO and the IOC, the Joint WMO-IOC Collaborative Board (JCB) was formed. JCB works to foster teamwork and engagement across various structural and organizational levels of the WMO and IOC to improve forecasting, understanding, and management of the Earth's weather, climate, and ocean systems. The JCB's six-pronged high-level strategy focuses on enhanced collaboration, better knowledge and prediction, effective early warning systems, sustainable development and climate action, capacity building and training, and joint regional approaches.

Guided by these various strategic initiatives, there is a need to ensure that the actors driving these separate strategic agendas are leveraging each other's capabilities. This need, coupled with the recognized importance of the ocean in the WMO’s Earth system approach to addressing weather, climate and water, resulted in the WMO establishing the [Advisory Group on the Ocean](https://community.wmo.int/en/governance/commission-membership/commission-observation-infrastructure-and-information-systems-infcom/infcom-management-group/advisory-group-ocean) (AG-Ocean) through the approval of [Resolution 2 (INFCOM-2)](https://library.wmo.int/idviewer/66287/59) in October 2022.

### Advisory Group on the Ocean (AG-Ocean)

2.1 The role of the AG-Ocean

The role of AG-Ocean is to ensure that the connections between WMO infrastructure and ocean infrastructure (observation, data and prediction systems) are developed and strengthened in a way that is enabling for both. This means ensuring that WMO effectively draws on and contributes to ocean capability (infrastructure and human capability) in advancing Earth system approaches for its priority applications, considering existing structures and partners, identifying gaps, and developing strategies for addressing them.

2.2 The scope of the AG-Ocean

The AG-Ocean's [terms of reference](https://community.wmo.int/en/governance/commission-membership/commission-observation-infrastructure-and-information-systems-infcom/infcom-management-group/advisory-group-ocean) from WMO are detailed and broad ranging. Importantly, AG-Ocean has been established as an advisory group (rather than an expert team or study group). To ensure that AG-Ocean focuses on adding real value, it is important that it prioritizes engagements that maximize impact and value of weather, ocean, climate and hydrological services for users where and when it matters most.

It is crucial to remember that AG-Ocean operates within a larger ecosystem of WMO bodies, research institutions, and international partners. Its effectiveness depends on its ability to collaborate effectively with other stakeholders, share best practices, and leverage existing initiatives to maximize its impact. It is also important to note that AG-Ocean represents a small expert community with limited resources.

In order to maximize the effectiveness of the engagement detailed below, AG-Ocean may need to evolve in affiliation from being solely governed by INFCOM to a structure that has more buy-in, legitimacy – and therefore governance – from the bodies it is engaging at the working and technical level. These include particularly GOOS and the IOC International Oceanographic Data and Information Exchange ([IODE](https://www.iode.org/)) as standing intergovernmental programmes, the Joint WMO-IOC Collaborative Board (JCB), and some of the other stakeholders identified below.

### The Engagement Plan

The AG-Ocean Engagement Plan is the first step in a multistep time frame to strengthen and improve working connections between meteorological and oceanographic infrastructure in the context of the Earth system. The engagement plan focuses around three themes in line with the broader strategic context outlined above: Observations, Data and Prediction. It articulates priority focus areas based on issue, gap and opportunity analysis drawing on key strategic documents, knowledge and expertise within AG-Ocean, and stakeholder input (see [appendix](#_APPENDIX) for details). The goal of the engagement plan is to help establish long-term, operational working arrangements between the WMO and the ocean infrastructure community for the benefit of all nations.

Implementation of the engagement plan is proposed to be led by key actors that exist within current WMO, IOC, co-sponsored and other relevant bodies. Some of the recommended actions will also be the responsibility of AG-Ocean. Note that AG-Ocean will be primarily playing the role of advocacy to ensure that recommended actions are being enacted and fulfilled.

The following sections provide both the summary and the details of the proposed focus areas within each theme.

### Engagement Plan Themes

***THEME 1: Ocean Observations – Towards an Integrated, Sustained, Resilient and Responsive Observing System***

Present ocean observing systems face challenges in sustainability and integration, limiting their ability to fully support weather, ocean, and climate science, prediction, and services. [There are intersecting observing programs and initiatives which have overlapping interests and activities within the WMO and the ocean community.] The purpose of this theme is to strengthen connections between the observing component of WMO and ocean infrastructure to enable a comprehensive, sustained observation system while capitalizing on synergies and collective strengths to advance the cause of ocean observing and avoid disconnections or duplication of effort.

AG-Ocean proposes the following focus areas:

1. Strengthening connections between the IOC and WMO observing communities;
2. Identifying observing gaps for WMO RRR Application Areas;
3. Ocean in GBON implementation and expansion; and
4. Strengthening regional collaboration for observing systems benefits.

***THEME 2: Data and Information – Towards FAIR, Free, Open and Unrestricted data***

While existing data strategies (in particular, the [*WMO Unified Policy for the International Exchange of Earth System Data*](https://library.wmo.int/records/item/58009-wmo-unified-data-policy) and the [*IOC Data and Information Exchange Policy*)](https://unesdoc.unesco.org/ark:/48223/pf0000372267.page=114) and initiatives have their distinct focus and audience, they converge in their vision of a global ocean data system that is FAIR (Free, Accessible, Interoperable, Reusable), free, open and unrestricted for a diverse set of stakeholders. This theme reaches across existing efforts to fill gaps, needs and requirements to strengthen and enable better integration and delivery of data and information for products and services of mutual benefit.

AG-Ocean proposes the following focus areas:

1. Governance, coordination and support structures;
2. Implementation of WIS 2.0 for Ocean data;
3. Integration of the Marine Climate Data System (MCDS) into WMO and IOC structures, and alignment with WMO climate data management; and
4. Connection of ocean and WMO metadata tools and the role of OceanOPS[[2]](#footnote-3).

***THEME 3: Prediction Systems – Towards seamless Earth system prediction***

WMO, IOC and the ocean community have complementary prediction activities in marine meteorology, oceanography, and climate. Challenges exist in defining user needs, sustaining observing systems for assimilation and validation purposes, and ensuring model product exchange and governance to enable prediction and informed decisions. This theme focuses on bringing together cross-domain activities to enable models to generate accurate forecasts for weather, ocean, and climate, empowering informed decisions (and services) for a resilient future.

AG-Ocean proposes the following focus areas:

1. Governance, coordination and support structures;
2. Observing system evaluation and ocean prediction requirements for observations;
3. Ocean prediction products and guidance on the products use for early warning and maritime safety; and
4. Ocean analysis and forecasts evaluation.

### Detailed Focus Areas

5.1 Observations

5.1.1 Strengthen connections between IOC and WMO observing communities

*Issue:*

Priority areas for observations have historically not always aligned between WMO and IOC. However, in recent years the connection between the oceans and atmosphere has become clearer and for WMO the integration of the ocean has become more critical for its key functions including global numerical weather prediction (NWP). While efforts are ongoing to align ocean activities between the two agencies, others remain unclear. The lack of awareness, connections and prioritization within the ocean observing community between IOC and WMO is leading in some cases to duplication and confusion in the products provided and priorities needed for observations.

*Recommended Action*:

(R1) Develop a roadmap to:

(a) Align overlap of IOC and WMO observing community priority areas and

(b) Provide recommendations on priority engagements and their implementation.

This roadmap will be presented to JCB for its advice on implementation.

*Outcome*:

User needs are met by a fit-for-purpose, sustained ocean observing system underpinned by strong and harmonized connections (including roles and responsibilities) between the WMO and the ocean observing community.

*WMO Strategic Objectives:*

Goal 2: Objective 2.1 – Optimize the acquisition of Earth system observation data through the WMO Integrated Global Observing System (WIGOS);

Goal 5: Objective 5.1 – Optimize WMO constituent body structure for more effective decision-making

*JCB Strategic objectives:*

Communicate and engage for mutual strategic reinforcement; and support and leverage priority/complimentary initiatives in the value chain.

*Partners/Stakeholders:*

JCB, INFCOM – SC-ON, JET-EOSDE, SERCOM – SC-MMO, SC-CLI, the WMO Integrated Processing and Prediction System (WIPPS), Research Board, GOOS and its OCG

*Lead:*

AG-Ocean Observations Team

5.1.2 Filling observing gaps within WMO RRR Application Areas

*Issue:*

The [WMO RRR process](https://community.wmo.int/en/rolling-review-requirements-process-2023-version) compiles information about requirements for observations, about observing system capabilities, and draws on experts to provide statements of guidance to support observing network design. Beyond WMO, the ocean observing community does not have a systematic framework for setting requirements across all application areas and evaluating the impacts on the observing system. Notable exceptions include the Ocean Observations Panel for Climate (OOPCs) climate requirements via the Global Climate Observing System (GCOS), projects such as the Tropical Pacific Observing System (TPOS), and ETOOFS identification of observing requirements. Some UN Ocean Decade programs, such as the GOOS Observing System Co-Design Programme, are increasing the development of observing system requirements and targeted development activities. Observing requirements within the WMO application areas are defined and gaps in observing systems highlighted. The ocean community lacks both clarity on the WMO RRR and design of the observing system and clear dialogue to fill identified gaps within all application areas.

*Recommended Action:*

(R2) Develop a sustainable dialogue that

(a) Develops an overall view of the ocean observing gaps identified for WMO application areas; and

(b) Identifies processes to prioritize gaps and lead to the design of systems and networks.

A brief report will outline the gaps (identified by application areas) and provide recommendations for prioritization for consideration to JET-EOSDE (Joint Expert Team on Earth Observing System Design and Evolution) activities and actions.

*Outcome:*

Enhanced climate and weather predictions and more effective and robust observing systems driven by dialogue between the ocean observing community and WMO application area points of contact

*WMO Strategic Objectives:*

Goal 2: Objective 2.1 – Optimize the acquisition of Earth system observation data through the WMO Integrated Global Observing System (WIGOS);

Goal 1: Objective 1.4 – Enhance the value of and innovate in the provision of decision-supporting weather information and services;

Goal 5: Objective 5.1 – Optimize WMO constituent body structure for more effective decision-making.

*JCB Strategic objectives:*

Communicate and engage for mutual strategic reinforcement; Meet service needs and respond to change; and Support and leverage priority/complimentary initiatives in the value chain.

*Partners/Stakeholders:*

JET-EOSDE & application area points of contact, GCOS, UN Ocean Decade (Ocean Observing System Co-Design, Ocean Best Practices System (OBPS))

*Lead:*

AG-Ocean Observations Team

*5.1.3 Ocean in GBON implementation and expansion*

*Gap:*

The Global Basic Observing Network ([GBON](https://community.wmo.int/en/activity-areas/wigos/gbon)) is a new WMO approach to network design, for the first time placing an obligation of Members to take and share observations at a minimum horizontal resolution. It is aimed at establishing a foundational framework for systematic and sustained global observations for global NWP and climate reanalysis. Within GBON, only observations of sea level pressure (SLP) and sea surface temperature (SST) are now part of the WMO Technical Regulations, and only for areas of Exclusive Economic Zones (EEZ). Ocean observations integration into GBON is a primary request from WMO Members and the ocean community. A subgroup of the Task Team for GBON is proposing guidance for the implementation and compliance monitoring of the present marine surface observations in EEZ. This group is not working on GBON expansion.

GBON expansion into the ocean requires advancements in the areas of statements of requirements for ocean observations for WMO applications, the development of GBON technical guidance, metadata submission to the Observing Systems Capability Analysis and Review Tool ([OSCAR](https://space.oscar.wmo.int/)), and further development of WMO Integrated Global Observing System ([WIGOS](https://community.wmo.int/en/activity-areas/WIGOS)) data quality monitoring for ocean observations. Regulatory and technical guidance will need to evolve and mature to support WMO Members’ efforts for ocean observations beyond EEZs and beyond the surface variables now included in GBON. This potentially opens the opportunity for support to Least Developed Countries and Small Island Developing States from the Systematic Observations Financing Facility ([SOFF](https://wmo.int/activities/systematic-observations-financing-facility-soff)). There is a general lack of awareness amongst the ocean community of GBON functions, requirements, implementation and opportunities for engagement and the pathways for expansion of the oceans in GBON.

*Recommended Actions:*

(R3) Produce a concept note to raise awareness of current GBON ocean requirements and procedures for GBON expansion; and

(R4) Produce a set of recommendations to INFCOM on GBON expansion for the ocean.

*Outcome:*

Improved numerical weather prediction through the contribution of an expanded GBON through (i) better integration of ocean observations and (ii) expansion of ocean application areas.

*WMO Strategic Objectives:*

Goal 2: Objective 2.1 – Optimize the acquisition of Earth system observation data through the WMO Integrated Global Observing System (WIGOS);

Goal 1: Objective 1.4 – Enhance the value of and innovate in the provision of decision-supporting weather information and services;

Goal 4: Objective 4.3 – Scale up effective partnerships for investment in sustainable and cost-efficient infrastructure and service delivery.

*JCB Strategic Objectives:*

Communicate and engage for mutual strategic reinforcement; and cooperate in capacity development where there is mutual benefit.

*Partners/Stakeholders:*

SC-ON: JET-EOSDE, TT-GBON-Next, GOOS/OCG, Member States, INFCOM (incl. alignment of GBON expansion with hydrology and cryosphere communities).

*Lead:*

AG-Ocean Observations Team

*5.1.4 Strengthening regional collaboration for observing systems benefits*

*Opportunity:*

Regional structures are critical for service provision in that they are where user demand for meteorological, climate and ocean services are greatest. WMO, IOC and GOOS regional structures are not well aligned, geographically or strategically. Key examples of effective national/regional alliances include the U.S. Integrated Ocean Observing System ([IOOS](https://ioos.noaa.gov/)) and Integrated Marine Observing System ([IMOS](https://imos.org.au/)). However, only [EuroGOOS](https://eurogoos.eu/) can be put forward as a strong and successful model for regional collaboration and coordination of support, despite significant efforts elsewhere. A lack of regional granularity in WMO ocean application areas has contributed to a gap in local collaboration and knowledge transfer to meet regional needs. Leveraging IOC and WMO regional structures around priority areas can strengthen regional collaborations and implementation and knowledge exchange and more targeted delivery of products and services.

*Recommended Action:*

(R5) Development of a set of recommendations (based on a case study) on how regional bodies within WMO and IOC could work together to strengthen the observing system, knowledge growth and integration, and service delivery. Recommendations to be made to WMO INFCOM and [SERCOM](https://community.wmo.int/en/governance/commission-membership/sercom), regional bodies of WMO and IOC, GOOS regional alliances, and Tropical Cyclone panel. Suggested case study: Typhoon/TC EW4ALL in the Indian Ocean, with a link to GOOS Ocean Observing Co-Design.

*Outcome:*

Enhanced user impact and value of fit for purpose observing systems through more targeted products and services, underpinned by greater regional collaboration and co-designed prioritized focus areas.

*WMO Strategic Objectives:*

Goal 2: Objective 2.1 – Optimize the acquisition of Earth system observation data through the WMO Integrated Global Observing System (WIGOS);

Goal 1: Objective 1.1 – Strengthen national multi-hazard early warning/alert systems and extend reach to better enable an effective response to the associated risks; and

Goal 4: Objective 4.3 – Scale up effective partnerships for investment in sustainable and cost-efficient infrastructure and service delivery.

*JCB Strategic Objectives:*

Communicate and engage for mutual strategic reinforcement; Meet service needs and respond to change; Support and leverage priority/complimentary initiatives in the value chain; Cooperate in capacity development where there is mutual benefit; and Take joint regional approaches.

*Partners/Stakeholders:*

WMO Regional Associations, GOOS Regional Alliances, IOC subcommissions, WMO typhoon committees

*Lead:*

AG-Ocean Observations Team

5.2 DATA

5.2.1 Governance, coordination, and support structures

*Issue:* The current landscape of ocean data management reveals a critical need for improved transparency and coordination. Under [JCOMM](https://community.wmo.int/en/activity-areas/Marine/JCOMM), the Data Management Program Area provided a governance and coordinating structure. Several groups and expert teams such as the Data Management Coordination Group (DMCG), Expert team on Marine Climatology (ETMC), the Inter-Program Expert Team on Integrated Marine Meteorological and Oceanographic Services within WMO and IOC Information Systems (IPET-MOIS) and others ensured coordination and continuing development of data management related issues and strategic guidance. With the WMO reform process, the Data Management Program Area and the associated expert teams were dissolved, and their function was not replaced by new structures or dedicated expert teams.

Though valuable efforts are underway across organizations like the IOC International Oceanographic Data and Information Exchange ([IODE](https://www.iode.org/)) and WMO, fragmented conversations and separate agendas are hindering progress. Additionally, a unified approach must both avoid overregulation and focus on the coordination of implementation (rather than defining standards etc.), allowing agile development and implementation of data management structures that maximize the interoperability between WMO and IOC systems. The current lack of unified direction risks leaving critical gaps in data accessibility, interoperability, and overall effectiveness.

*Recommended Actions:*

(R6) Produce an overview of current activities and open issues related to ocean data management (based on SG-OOIS, considering, among others, the GOOS Observations Coordination Group ([OCG](https://goosocean.org/who-we-are/observations-coordination-group/)) data management implementation strategy and IODE/UN Ocean Decade projects, like the Ocean Data Information System (ODIS)); and

(R7) Develop a proposed governance framework for continuous coordinated oversight of ocean data activities. This framework will include a strategic overview diagram to visualize how all ocean data strategies connect and a proposal for a framework for coordinated oversight of ocean data activities. The overall focus should be on coordination of the implementation of data management (based on agreed open standards).

*Outcome:*

Greater access to fit for purpose ocean data through clearer governance and oversight of ocean data management across WMO and the key ocean community structures/initiatives.

*WMO Strategic Objectives:*

Goal 2: Objective 2.2 – Improve and increase access to, exchange and management of current and past Earth system observation data and derived products through the WMO Information System

*JCB Strategic Objectives:*

Communicate and engage for mutual strategic reinforcement; Meet service needs and respond to change; and support and leverage priority/complimentary initiatives in the value chain.

*Partners/Stakeholders:*

SC-IMT (data and data exchange, incl. discovery metadata), GOOS OCG, IODE, SC-ON, JCB for high-level governance and coordination

*Lead:*

Partners/stakeholders (AG-Ocean Data Team to initiate), with outputs related to governance to be brought to JCB

5.2.2. Implementation of WIS 2.0 for Ocean data

*Opportunity:*

Integrating ocean data into the next-generation WMO Information System (WIS 2.0) is crucial for unlocking the full potential of the WIGOS. Yet, ocean data is often fragmented, siloed, and difficult to access, hindering our understanding and ability to predict global environmental changes. By incorporating ocean data into WIS 2.0, we can leverage its robust infrastructure and standardized protocols. Including ocean data in WIS 2.0 is a step towards a future where ocean data is readily accessible, seamlessly interoperable, and utilized for the benefit of our planet and its inhabitants.

Strengthening the links between WIS 2.0 and IODE ODIS is of particular importance in the context of making ocean data available through WIS 2.0. Both WIS 2.0 and ODIS share the common goal of optimizing ocean data management and sharing. They both encourage interoperability through standardized formats and protocols, and they both advocate for open access and transparency. Additionally, both recognize the importance of collaboration and engagement with stakeholders. However, their unique strengths and areas of focus position them as complementary tools within the broader ocean data landscape. WIS 2.0 provides the core infrastructure for data delivery, while ODIS offers a comprehensive environment for discovery, collaboration, and knowledge sharing. By leveraging their combined strengths, the full potential of ocean data can be unlocked for a more informed and sustainable future.

It is important to note that WIS 2.0 (and ODIS) is not restricted to real-time data exchange. The scope of WIS 2.0 is broader and more flexible than the current global telecommunication system (GTS). A central pillar in the system are standards for the exchange of (meta) data allowing the discovery of data and information. Next to mechanisms for operational data exchange implemented in the WIS 2.0 architecture, the discovery metadata standards allow linking to delayed mode/climate data archives. Potential ocean data providers and users of ocean data through WIS 2.0 are not aware of the possibilities and benefits of WIS 2.0. The different pathways of ingesting and accessing real time and delayed mode data streams into WIS 2.0 need to be clearly laid out to data providers as well as data users.

*Recommended Actions:*

(R8) Raise awareness of WIS 2.0 in the ocean community, through outreach and demonstration activities, with the goal of including more ocean data in WIS 2.0 and

(R9) Establish a mechanism to coordinate the workplans and implementation of WIS 2.0 and ODIS to make ocean data more accessible.

*Outcome:*

Raise awareness of WIS 2.0 in the ocean community and establish a mechanism to coordinate the implementation of WIS 2.0 and ODIS to a future where ocean data is readily accessible, seamlessly interoperable, and utilized for the benefit of our planet and its inhabitants.

*WMO Strategic Objectives:*

Goal 2: Objective 2.1 Optimize the acquisition of Earth system observation data through the WMO Integrated Global Observing System (WIGOS); and

Objective 2.2 – Improve and increase access to, exchange and management of current and past Earth system observation data and derived products through the WMO Information System.

*JCB Strategic Objectives:*

Communicate and engage for mutual strategic reinforcement; develop standards and best practices; meet service needs and respond to change; and support and leverage priority/complimentary initiatives in the value chain.

*Partners/Stakeholders:*

GOOS OCG for Pilot projects, SC-IMT, IODE/ODIS

*Lead:*

GOOS/OCG and SC-IMT (AG-Ocean Data Team to initiate), with outputs related to governance to be brought to JCB

5.2.3 Integration of MCDS into WMO and IOC structures, and alignment with broader WMO climate data management

*Issue:*

Building on more than 150 years of international collaboration and exchange of marine observations and data, MCDS establishes a unified WMO/IOC path for acquisition and for sharing of relevant public access delayed mode global marine meteorological and oceanographic data. By leveraging existing resources and data exchange systems, MCDS defines a coordinated and harmonized structure from data acquisition to delivery of climatological datasets and products to users. An important forum for engagement with the ocean community in this context was the series of the Workshop on Advances in Marine Climatology (CLIMAR) that ran under the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM). These provided oversight of recent developments and valuable community feedback on the MCDS and marine climate data.

MCDS is regulated through the [Guide](https://library.wmo.int/idurl/4/35920?offset=1) (WMO-No 471)/the [Manual](https://library.wmo.int/idurl/4/41592?offset=1) (WMO-No. 558) to Marine Meteorological Services defining the basic structure, existing centres, and accreditation procedure for new centres.

However, tasks and responsibilities defined in these regulations have been fragmented among WMO (and IOC related) structures after the WMO reform. Hence, the WMO internal governance of the MCDS and other climate data need clarity to enable further development of the system.

*Recommended Actions:*

(R10) Evaluate the current state of the MCDS and propose a future Joint WMO-IOC governance. This will include:

(a) highlighting benefits of the system; (b) the intended purposes and recommendation if a reshaping/refocus is needed; and (c) opportunities for learning from the MCDS in the context of developing climate data management systems;

(R11) Revive CLIMAR meetings as a platform for experts and exchange on end-to-end use of data.

*Outcome:*

Strengthened and efficient IOC-WMO governance structures for the MCDS and clear WMO internal responsibilities regarding climate data management including further successful evolution of the MCDS.

*WMO Strategic Objectives:*

Goal 2: Objective 2.2 – Improve and increase access to, exchange and management of current and past Earth system observation data and derived products through the WMO Information System.

*JCB Strategic Objectives:*

Communicate and engage for mutual strategic reinforcement; develop standards and best practices; meet service needs and respond to change; and Support and leverage priority/complimentary initiatives in the value chain.

*Partners/Stakeholders:*

SC-IMT and IODE (include representatives from GOOS, GOOS-GCOS/OOPC, GCOS/AOPC),

*Lead:*

Partners/stakeholders (AG-Ocean Data Team to initiate), with outputs related to governance to be brought to JCB

5.2.4 Connection of Ocean and WMO metadata tools and the role of OceanOPS

*Opportunity:*

OSCAR is WMO's global repository of surface and space observing system capabilities. OSCAR is a web-based tool in which metadata is registered, managed and archived. It records observing system requirements and allows critical reviews of how well actual capabilities address requirements. This aids in the assessment of where, how, and why observations are made. OSCAR is a component of the Rolling Requirements Review process in identifying capacity and supporting assessment of gaps, and provides information important to the WIGOS Data Quality Monitoring System. Ocean observation systems metadata currently flows to OSCAR through OceanOPS and OceanOPS was identified at JCOMM-5 as the authoritative source for such metadata from the global observing networks.

The scope of OceanOPS is larger than just metadata. OceanOPS is also responsible for issuing [WSI](https://library.wmo.int/idurl/4/55696?offset=1) / SOT-IDs for ocean observing platforms, implementing and monitoring key performance indicators, and fulfilling tasks comparable to Regional WIGOS Centres, but for the global ocean. With these capabilities, OceanOPS provides important functions that are required for seamless integration of ocean data in WIGOS. Hence, full interoperability of OceanOPS with WIGOS is necessary and should be reflected in the OceanOPS workplan and the regulatory material in the WIGOS framework. It should also be ensured that all Members are aware that metadata handled by OceanOPS, shall be registered through OceanOPS (to avoid duplications in OSCAR) – or reconciliation mechanisms need to be put in place.

*Recommended Actions:*

(R12) Develop recommendations for a full implementation of the GOOS OCG Cross-Network Data Implementation Strategy (addressing, among others, metadata harmonization and harvesting) and

(R13) Align the work plans of GOOS/OCG and INFCOM/SC-ON and set up sustained coordination and governance to align workplans with WIGOS and WIS 2.0.

*Outcome:*

Clearer governance structures for OceanOPS and better connection of OceanOPS services with WMO systems to enhance seamless integration of ocean data in WIGOS

*WMO Strategic Objectives:* Goal 2:

Objective 2.2 - Improve and increase access to, exchange and management of current and past Earth system observation data and derived products through the WMO Information System

*JCB Strategic Objectives:*

Communicate and engage for mutual strategic reinforcement; develop standards and best practices; meet service needs and respond to change; support and leverage priority/complimentary initiatives in the value chain; and cooperate in capacity development where there is mutual benefit.

*Partners/Stakeholders:*

GOOS, GOOS/OCG, SC-ON (ET-WT, ET-SON), OceanOPS

*Lead:*

OCG-Executive and SC-ON ([ET-WT](https://community.wmo.int/en/governance/commission-membership/commission-observation-infrastructure-and-information-systems-infcom/standing-committee-earth-observing-systems-and-monitoring-networks-sc/expert-team-wigos-tools-et-wt)) (AG-Ocean Data Team to initiate), with governance aspects to be brought to JCB

5.3 Prediction

5.3.1 Governance, coordination and support structures

*Opportunity:*

Currently, ocean prediction coordination inside the WMO and IOC is limited to the [ETOOFS](https://goosocean.org/who-we-are/expert-team-on-operational-ocean-forecast-systems-etoofs/) (which sits under GOOS), and to various connections in the context of Earth System prediction and WMO application areas. At the same time, the broader ocean prediction community is dynamic and growing (as demonstrated through the development of the Decade Collaborative Centre (DCC) on Ocean Prediction). AG-Ocean has an opportunity to proactively support and influence the development and integration of ocean prediction coordination with WMO structures in a way that is beneficial to advancing the development of ocean prediction capability and systematic delivery to the broadening range of applications.

*Recommended Actions:*

(R14) Establish a functional link between ETOOFS and [SC-ESMP](https://community.wmo.int/en/governance/commission-membership/infcom/management-group/sc-esmp)/[WIPPS](https://community.wmo.int/en/activity-areas/wmo-integrated-processing-and-prediction-system-wipps); (includes establishing a mechanism to keep the [ETOOFS Guide](https://goosocean.org/document/30656) up to date as a joint IOC-WMO publication for the ocean community; and guiding the Expert Team on Operational Ocean Forecasting Systems (ETOOFS) engagement in development of the WIPPS-led rolling review of requirements for ocean related products and forecasts for agreed application areas, in coordination with relevant SERCOM standing committees);

(R15) Work with DCC Ocean Prediction to explore connections with Earth system prediction research (through [WWRP](https://community.wmo.int/en/activity-areas/wwrp)/[WCRP](https://www.wcrp-climate.org/)); and

(R16) Initiate and sustain discussions regarding the longer-term development of a standing structure for ocean prediction including its interfaces with broader Earth system prediction coordination, including research (WWRP/WCRP) and operational (WIPPS) systems.

*Outcome:*

Strengthened systematic international coordination of ocean prediction, optimizing Earth system integration and service delivery to society through strengthened partnerships (research to operations, across Earth system and with services/application areas).

*Relevant WMO strategic objectives:*

Goal 2: Objective 2.3 Enable access to and use of numerical analysis and Earth system prediction products at all temporal and spatial scales from the WMO Integrated Processing and Prediction System;

Goal 5: Objective 5.3 Advance equal, effective and inclusive participation in governance, scientific cooperation, and decision-making.

*Relevant JCB strategic focus area:*

Communicate and engage for mutual strategic reinforcement; and Meet service needs and respond to change.

*Partners/Stakeholders:*

ETOOFS / DCC Ocean Prediction and WIPPS / SC-ESMP;

*Lead:*

ETOOFS and SC-ESMP (AG-Ocean Prediction Team to initiate), with governance-related issues to be brought to JCB

5.3.2 Observing System Evaluation and Ocean Prediction Requirements for observations

*Opportunity:*

TheWIGOS Rolling Review of Requirements (for Observations) is being restructured in the context of Earth system approaches. There is a need and opportunity to organize and coordinate the collection and review of observation requirements from the ocean prediction community to feed the WMO Rolling review of requirements in coordination with SERCOM.

*Recommended Action:*

(R17) That ETOOFS is the point of contact within GOOS to collect ocean observation requirements from the ocean applications community, in collaboration with OceanPredict.

*Outcome:*

Ocean prediction is improved through access to fit for purpose observations

*Relevant WMO strategic objectives:*

Goal 2: Objective 2.1 Optimize the acquisition of Earth system observation data through WIGOS.

*Relevant JCB strategic focus area:* Support and leverage priority/complimentary initiatives in the value chain.

*Partners/Stakeholders:*

ETOOFS, OceanPredict (Observing System Evaluation Task team and the Operational System working groups) and UN Decade project SynObs.

*Lead:*

ETOOFS (AG-Ocean Prediction Team to initiate)

5.3.3 Responding to authoritative guidance on requirements for ocean prediction products

*Gap:*

UN and WMO urge all Members to enhance services for the protection of life and property, through several high-profile mechanisms. For example, inter alia*,* implementation of the UN Early Warning for All (EW4ALL) initiative, the International Maritime Organization (IMO)/International Hydrographic Organization regulations and the WMO Unified Data Policy. A set of ocean prediction products should be defined and made available to meet these key user requirements.

*Recommended Actions:*

(R18) Support the development of the rolling review of requirements for ocean related products and forecasts for agreed application areas – as part of this, identify the essential ocean products and their formats (using the ‘core data’ in the [*Manual on WIPPS*](https://library.wmo.int/records/item/35703-manual-on-the-global-data-processing-and-forecasting-system?offset=2) (WMO-No. 485) to support Members in warning for ocean related hazards (as per [WMO-No. 471](https://library.wmo.int/idurl/4/35920?offset=1)));

(R19) Ensure that the ‘core data’ from the ocean prediction systems are disseminated on a free and unrestricted basis; and

(R20) Explore how to support strengthened links between ETOOFS and relevant SERCOM activities

*Outcome:*

WMO Members have fit for purpose warnings products and services for ocean related hazards to enhance protection of lives and property.

*Relevant WMO strategic objectives:*

Goal 1: Objective 1.1 Strengthen national multi-hazard early warning/alert systems and extend reach to better enable an effective response to the associated risks;

Goal 2: Objective 2.3 Enable access to and use of numerical analysis and Earth system prediction products at all temporal and spatial scales from the WMO Integrated Processing and Prediction System.

*Relevant JCB strategic focus areas:*

Meet service needs and respond to change; and Support and leverage priority/complimentary initiatives in the value chain.

*Partners/Stakeholders:*

WIPPS (SC-ESMP), ETOOFS, OP DCC, SERCOM SC-MMO, ET-MS, Metarea Coordinators, IMO, IHO

*Lead:*

WIPPS/SC-ESMP and ETOOFS (AG-Ocean Prediction Team to initiate), in close coordination with SC-MMO, and with governance-related recommendations being brought to JCB

5.3.4 Ocean analysis and forecasts evaluation

*Opportunity:*

The limited interaction between the ocean and Earth system prediction communities extends to forecast evaluation. This restricts the ability to learn and adopt new ways to enhance prediction skill. To address this, there exist significant opportunities to share experience, methods and best practices for model analysis, forecast evaluation and verification across Earth system components, through both research and operational activities focusing on the ocean domain.

*Recommended actions:*

(R21) Establish robust communication channels between relevant groups involved in evaluations;

(R22) Agree on best practices for evaluation of analysis and forecasts; and

(R23) Support the transition from research to operation of standardized and agreed evaluation metrics for ocean prediction.

*Outcome:*

Enhanced (more accurate and impactful) products and services underpinned by a) a coordinated systematic evaluation of ocean and Earth system prediction skills across research and operations and across timescales, and b) strengthened interaction between research and operational activities.

*Relevant WMO strategic objectives:*

Goal 2: Objective 2.3 Enable access to and use of numerical analysis and Earth system prediction products at all temporal and spatial scales from the WMO Integrated Processing and Prediction System.

*Relevant JCB strategic focus areas:*

Develop standards and best practices; and Support and leverage priority/complimentary initiatives in the value chain.

*Partners/Stakeholders:*

Ocean Prediction DCC, GOOS/ETOOFS, OceanPredict Intercomparison and Validation Task Team and OS WG, WWRP panel JWGFVR

*Lead:*

ETOOFS to lead the discussion on operational verification metrics for real time production and reanalysis with the relevant WMO groups, especially SC-ESMP, WWRP Joint Working Group on Forecast Verification Research and OceanPredict Intercomparison and Validation Task Team. (AG-Ocean Prediction Team to initiate).

## APPENDIX

**Stakeholder engagement: Ongoing assessment of synergies and links between Ocean Infrastructure and WMO activities through bilateral calls**

AG-Ocean needs to undergo strategic engagement with key bodies both within WMO (including Services Commission and Research) and outside of WMO to guide effort within observation, Data and Prediction activities.

Stakeholder engagement has commenced and a summary of those conversations with relevant chairs/leads is below (note these conversations are only the start of ongoing stakeholder consultation – it is envisaged that AG-Ocean will connect with stakeholders on a regular basis):

| Group | Key Messages |
| --- | --- |
| INFCOM President | Small Ocean community plus overlapping committees across WMO and ocean community leading to duplication and confusion.  Leverage existing committees where possible  Fragile funding for ocean observing. Need more resilient system responsive to member needs  Consider strengthening partnerships (not just within GOOS and WMO) where appropriate |
| SC-ON/SC-MINT | Identify connections between structures/with partners rather than avoid reliance on single individuals.  Encourage succession planning and knowledge transfer  Regular updates on new initiatives and early engagement to enable consultation.  Strengthen collaboration with SC-MINT on international standardization and integration of measurements  Assign AG-Ocean members lead roles for key areas of engagement |
| SC-ESMP (WIPPS) | Importance of having access to the right expertise on the ocean side.  Understanding what matters to the ocean (prediction) community, particularly observing and product requirements  Mechanisms of interaction and information exchange are needed. |
| SC-IMT | AG-Ocean can help advise on adapting WIS 2.0 training material and benefits for data sharing and on identifying where WIS 2.0 can improve data access and exchange.  Supporting ocean data centres in becoming WIS 2.0 centres can facilitate improved data accessibility  Need to strengthen connection between WIS 2.0 and IODE/ODIS and GOOS/OCG. |
| GOOS | GOOS needs to adapt and evolve, engage beyond scientific community.  Communicate scope of programme and prioritize AG-Ocean can help amplify GOOS’s voice at WMO. Potential to leverage GBON/SOFF to support Least Developed Countries.  GOOS relies heavily on non-mandated positions. Poses a challenge for sustainability, |
| OOPC (GOOS/GCOS/WCRP) OCG (GOOS) | Identify where ocean observations are crucial for WMO success.  Engage in GOOS reform and recommendations for strengthening contributions  Assessment of ocean integration across WMO programmes. Develop ocean components of GBON and the Global Greenhouse Gas Watch (GGGW). Enhance ties for applications such as weather, extreme events, climate monitoring.  Increased ocean voice in WMO Bodies |
| DCO Observation  DCO Data Sharing  DCC Ocean Prediction | Infrastructure challenge coordination activities in the decade well aligned with pillars of infrastructure. Potential for WMO to leverage transformational activities of the decade to make advances.  WMO could support/advise and collaborate on experiences in areas such as Inter alia, regional coordination and engagement, co-design activities.  Potential to consider these ocean focused activities in the context of Earth system approaches and broader links and developments that could be leveraged. |

Key stakeholders still to engage:

| Group | Priority Topics to discuss |
| --- | --- |
| Services Commission (President) | Discuss strategy for engagement in SERCOM on issues related to delivery of ocean information |
| GOOS/ETOOFS | Discuss formalizing link to WMO, engagement in broader Earth system Prediction discussions |
| IODE | Discuss ways to align and prioritize related WMO activities with respect to ocean data management and exchange |
| SERCOM/SC-MMO and other priority SCs | Based on discussion with SERCOM President |
| Research Board | Strategic priorities regarding ocean's role in advancing Earth system prediction |
| G3W | Meet with Lead and Ocean writing team lead to discuss positioning of ocean in plans and engagement of ocean expertise, potential strategies for engaging with funders |
| IOCCP (GOOS-SCOR) | Discuss initial engagement in G3W and how AG-Ocean can support |
| AG-GCW | Discuss role of AG’s in INFCOM and explore synergies (e.g. Sea Ice) |
| JCB | Discuss roles and responsibilities, joint priorities, working arrangements and how AG-Ocean will intersect with JCB in the future |

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1. Led by IOC/UNESCO and co-sponsored by the WMO, the United Nations Environment Programme, and the International Science Council [↑](#footnote-ref-2)
2. The WMO- IOC Joint Centre for Oceanography and Marine Meteorology in situ Observations Programmes Support [↑](#footnote-ref-3)