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| WEATHER CLIMATE WATER | **World Meteorological Organization**  **COMMISSION FOR OBSERVATION, INFRASTRUCTURE AND INFORMATION SYSTEMS**  **Second Session** 24 to 28 October 2022, Geneva | **INFCOM-2/Doc. 6.5(1)** |
| Submitted by: Chair of SG-OOIS  23.IX.2022  **DRAFT 1** |

**AGENDA ITEM 6: TECHNICAL REGULATIONS AND OTHER TECHNICAL DECISIONS**

**AGENDA ITEM 6.5: Study Group on Ocean Observations and Infrastructure Systems (SG-OOIS)**

# Recommendations of the Study Group on Ocean Observations and Infrastructure Systems (SG-OOIS)

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| **Summary** |
| **Document presented by:** Chair of SG-OOIS  **Strategic objective 2020–2023:** 2.1, 2.2, 2.3  **Financial and administrative implications:** Within the parameters of the Strategic and Operational Plans 2020–2023, will be reflected in the Strategic and Operational Plans 2024–2027.  **Key implementers:** INFCOM, with support of Regional Associations  **Time frame:** 2023–2027  **Action expected:** Review the proposed draft recommendations. |

# DRAFT DECISION

## Draft Decision 6.5(1)/1 (INFCOM-2)

### Recommendations of SG-OOIS

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

(1) To approve the final report of the Study Group on Ocean Observations and Infrastructure Systems (SG-OOIS) and its 33 recommendations, noting that recommendation B7 (Advisory Group on Ocean) is handled under [draft Resolution 5.2/1 (INFCOM-2)](https://meetings.wmo.int/INFCOM-2/English/Forms/AllItems.aspx?RootFolder=%2FINFCOM%2D2%2FEnglish%2F1%2E%20DRAFTS%20FOR%20DISCUSSION&FolderCTID=0x012000DFD47F9206CDD640A4FDFBAA2EB0EF6E&View=%7BDBBC48FA%2DBEE2%2D4A94%2D8905%2DFBE98B87E342%7D);

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

(3) To request the president of the Commission for Observation, Infrastructure and Information Systems to engage with stakeholders listed in the report in order to implement relevant recommendations, with a priority on the collaboration among regional entities and the establishment of a Global Ocean Observing System (GOOS) satellite coordinator.

See the [annex](#_Annex_to_draft_1) to the present decision and [INFCOM-2/INF 6.5](https://meetings.wmo.int/INFCOM-2/InformationDocuments/Forms/AllItems.aspx).

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Decision justification: The Study Group on Ocean Observations and Infrastructure Systems (SG-OOIS) objective was to propose effective and sustainable functional connections between WMO and IOC-GOOS bodies, after WMO Reform. There are 33 recommendations in areas such as services requirements, observations, data management, strategy and communication, regional approaches, capacity development and research. Those recommendations being targeted to INFCOM, GOOS, Joint Collaborative Board (JCB) and UNESCO IOC, it is suggested that P/INFCOM or the Management Group lead conversations with those partners, without allocating detailed tasks at this stage.

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[Annex: 1](#_Annex_to_draft_1)

## Annex to draft Decision 6.5.1(1)/1 (INFCOM-2)

**Study Group on Ocean Observations and Infrastructure Systems**

**(SG-OOIS)**

**FullReport, September** **2022**

# Executive Summary

The Study Group on Ocean Observations and Infrastructure Systems (SG-OOIS) was established in 2020 by the Commission for Observation, Infrastructure and Information Systems (INFCOM) to propose optimal functional connections between WMO and IOC-GOOS bodies, programs and systems. In order to ensure the objectives defined by WMO Members after WMO Reform, aiming at ensuring effective and sustainable ocean observing infrastructures in the context of the WMO Earth System approach, can be met. Ensuring such connections is timely, allowing the identification of linkages to key developments such as Global Basic Observing Network (GBON), the new approach for the Rolling Review of Requirements (RRR), actions in the UN Decade of Ocean Science for Sustainable Development, and the GOOS 2030 Strategy.

The group met virtually 18 times during the pandemic and liaised regularly with major partners and with WMO and IOC secretariats. SG-OOIS identified eight major areas where functional connections are requested and issued 33 recommendations in eight main domains. The most important are to improve the connection among WMO and GOOS regional bodies and the establishment of new functional connections to the revised RRR process. Further the SG-OOIS recommends the setting up of an Advisory Group on Ocean (AG Ocean), which would function as an entry point for INFCOM technical developments, ensuring a smooth translation of requirements from the ocean observing communities into INFCOM activities, and the other way around from INFCOM outputs into ocean outcomes, supporting the work of, inter alia*.*, the Observations Coordination Group (OCG) and the GOOS Steering Committee.

All recommendations are summarized below:

| **Recommendation** | **Lead body** |
| --- | --- |
| 1. **Services requirements** |  |
| A1. GOOS focal point/s (Ocean Observations Physics and Climate (OOPC) and OCG, to facilitate connection to expert panel for input and overview on observing requirements and to networks regarding capacity and fulfilment) to be identified for RRR activity. The GOOS community to be represented in JET-EOSDE[[1]](#footnote-2) (possibly through the focal point/s) | GOOS, WMO JET-EOSDE |
| A2. GOOS (OOPC/OCG) to engage in the development of the relevant Statement of Guidance (RRR SoG’s) in relation to the gap analyses, current status and envisioned opportunities of enhancement in the observing networks.  A3. GOOS (OCG/OOPC) to review SoG’s and input into value assessment design. If this requires OSSE or OSE experiments, input from the OCG and relevant networks towards OSSE/OSE experiments should be sought through the OCG.  A4: GOOS (OCG) and SC-ON respond to SoG’s with joint plans on supporting networks/systems evolution and priorities.  A5 GOOS, through OCG and OceanOPS, to support the implementation of relevant SoG’s with status report/view, dependent on the availability of resources to undertake this work. | GOOS, WMO SC-ON |
| A6. WMO JET-EOSDE to consider if the GOOS Ocean Decade Programme Ocean Observing Co-Design could take on the requirement scoping of some areas for improvement where marine observations are vital. Tropical storms, storm surge, and ocean carbon cycle are already underway as use area Co-Design Exemplar Projects, with input from the Numerical Weather Predication (NWP). Others can be co-designed. | SC-ON/  JET-EOSDE |
| A7. Foreseen WMO AG Ocean (see B5) to engage with GOOS (Expert Panels/OCG/Ocean Observing Co-Design Programme) and support development of pilot projects in areas of common interest, with a focus on RRR implementation and regional needs. | AG Ocean[[2]](#footnote-3) |
| A8. GOOS to consider establishing a Coordinator of Satellite Data. | GOOS |
| 1. **Observations** |  |
| B1. A senior WMO Integrated Global Observing System (WIGOS) Secretariat member to be included in the OCG Exec meetings. | GOOS |
| B2. A marine observations focal point is created in the INFCOM secretariat | WMO Secretary-General |
| B3. GOOS to consider whether a strengthened connection to SC-ON is appropriate, and how this might best be supported.  SOT and DBCP to maintain membership in, and/or assigned functional connections with, SC-ON, SC-IMT and SC-MINT | GOOS |
| B4. Representation of OceanOPS and GOOS (data expert) in ET Metadata Standards | OCG/  OceanOPS |
| B5. WMO INFCOM to establish an Advisory Group on Ocean (AG Ocean), ensuring sufficient WMO Secretariat support to aid AG Ocean members in their work. | INFCOM |
| 1. **Data management** |  |
| C1. Invite IOC and WMO to discuss through JCB the form of future collaborations on data and information management and ocean best practices aspects. | JCB |
| C2. In collaboration with WMO INFCOM and IODE, keep the mapping of data pathways created by GOOS (OCG) updated, as support is available to do so. | GOOS |
| C3. Invite WMO INFCOM, GOOS (OCG) and IODE to start a dialogue on the further development of Marine Climate Data System (MCDS). | INFCOM, GOOS |
| C4. Nominate WMO INFCOM representative/s and contact IOC IODE to join the Steering Group on IOC IODE Ocean Data and Information System (ODIS). | INFCOM (MG), IODE |
| C5. Invite WMO INFCOM, GOOS (OCG) and IODE to cooperate closer for capacity development in data management. | INFCOM, IODE, GOOS |
| C6. WMO INFCOM to join the efforts to coordinate the data-related activities under the UN Decade of Ocean Science for Sustainable Development (2021–2030). IODE to invite WMO INFCOM experts to join the IODE Intersessional Working Group to propose a strategy on Ocean Data and Information Stewardship for the Ocean Decade (IWG-SODIS) | IODE |
| C7. Membership of IODE experts in ET-IM, ET-AC and ET-W2WPE, and of GOOS (OCG/data expert) to SC-IMT (as appropriate for the agenda); will also be a recommendation to IODE-27 (Feb. 2023) and the JCB. | GOOS, IODE, INFCOM |
| 1. **Communication and supporting mutual strategic reinforcement/alignment** | |
| D1. Actively use WMO membership in GOOS SC to identify one new initiative per year for GOOS-WMO co-development. | INFCOM (MG) |
| D2. Support NMHS’s and partners’ engagement in the sustained observation and exchange in EEZ’s in compliance with the GBON | INFCOM |
| D3. Support engagement with industry and citizen science initiatives. | INFCOM |
| D4. Consider possible joint case studies for communication, for example, to demonstrate the value of observations to numerical weather prediction and safety of life at sea. | INFCOM, GOOS |
| D5. Contribute to the JCB Webinar Series The GOOS: Oceans of Data for Earth System Predictions | INFCOM, GOOS |
| 1. **Taking joint regional approaches** |  |
| E1. High-level mandate to WMO Regional Offices in order to promote input from GRA's and/or oceanographic services to Regional Associations' Management Groups.  Effective mechanisms evolved to have mutual participation of regional activities among the respective WMO-RAs & GRAs. | WMO (Secretary-General), GOOS (GRAs) |
| 1. **Cooperation in capacity development** |  |
| F1. Assess and enhance capacity development at regional level using existing activities (e.g., use a WMO call for UN Decade Project capacity development for forecast on storm surge and cyclone; flood warning / inundation, …). Identify a pilot project as a starting point. | WMO (Regional Associations) GOOS (GRAs) |
| 1. **Research** |  |
| No specific recommendation. |  |
| 1. **Standards and best practices development** |  |
| H1. Communications and coordination related to the Standards and Best Practices Project to be carried out by the WMO Secretariat; Ocean Best Practice System representative (chair or similar) to be invited on a regular basis to present to SC-MINT / ET-SSM to connect on ocean matters. | WMO INFCOM / Secretary-General |
| H2. Recommend WMO INFCOM to contribute to Ocean Best Practices System repository and investigate existing practices to be applied. | INFCOM, IOC (GOOS/ IODE) |

Those recommendations will be submitted to relevant bodies.

# report

* + - 1. The Study Group on Ocean Observations and Infrastructure Systems (SG-OOIS) was established in April 2020 by the Commission for Observation, Infrastructure and Information Systems (INFCOM) at its First Session for the first intersessional period, up to INFCOM-2 in October 2022. As from its [Terms of Reference](https://community.wmo.int/governance/commission-membership/commission-observation-infrastructure-and-information-systems-infcom/commission-infrastructure-officers/infcom-management-group/study-group-ocean-observations-and-infrastructure-systems-sg-oois), the SG-OOIS general goal is to **propose optimal functional connections between the WMO and IOC-GOOS bodies, programs and systems to ensure delivery on the objectives defined by WMO Members**. Composed of 16 [members](https://community.wmo.int/governance/commission-membership/commission-observation-infrastructure-and-information-systems-infcom/commission-infrastructure-officers/infcom-management-group/study-group-ocean-observations-and-infrastructure-systems-sg-oois), SG-OOIS reports directly to the INFCOM Management Group (INFCOM MG) according to its ToRs.Links to other bodies such as JCB goes through INFCOM MG.
      2. This report has been submitted for information, comments and guidance to INFCOM MG on May 31 2022. This version is integrating all comments and will be submitted formally to INFCOM-2 and GOOS SC-12 for approval of relevant recommendations. It is to be considered to get guidance from JCB through circulation.

## Background

* + - 1. SG-OOIS seeks for *an improved governance* in the context of [WMO Governance Reform](https://public.wmo.int/en/governance-reform), including the proper links to GOOS, of those processes and value chains in WMO and co-sponsored systems that are impacted by *ocean observations*, spanning in-situ as well as space-based subsystems of WIGOS. After Joint Commission for Oceanography and Marine Meteorology (JCOMM) disbandment, OCG and the Expert Team on Operational Ocean Forecasting Systems (ETOOFS) report to GOOS. Segments in the value chain reflected in the INFCOM organizational structure are related to observational infrastructure, observations, data management, including technological developments, and within the SG-OOIS scope. In order to improve the available mechanisms in WMO to account for the new status of ocean observations and infrastructure, to identify and help fix any gaps in the communications between GOOS and INFCOM, and to inform policy changes and ensure situational awareness of items under review, SG-OOIS should help build strong and appropriate links for bodies in the new WMO structure to GOOS and JCB, and key GOOS components. Other relevant bodies with common interests within the scope of GOOS are OOPC, co-sponsored by GOOS, GCOS and WCRP), the Global Climate Observing System (GCOS) and the World Climate research Programme (WCRP), the Biogeochemistry (BCG) Panel, the GOOS Regional Alliances (GRA’s), the WMO Regional Associations (RA’s), and the International Oceanographic Data and Information Exchange (IODE) Programme of the Intergovernmental Oceanographic Commission" (IOC) of UNESCO.
      2. GOOS, led by the IOC and co-sponsored by WMO, UNEP and ISC, has been playing a central role in facilitating the development of the integrated sustained Global Ocean Observing System ([Annex 2](#_Annex_2_-)). WMO is both a sponsor and partner of GOOS in this endeavour and the national met services are users of ocean data from this ocean observing system. Among the six components of GOOS are:

(1) The GOOS Regional Alliances (GRA), fifteen regional bodies of GOOS, which are similar to Regional Associations of WMO;

(2) Three GOOS Expert Panels, OOPC Panel, Biogeochemistry (BGC) Panel and the Biological and Ecological (BioEco) Panel. These undertake work similar in part to the WMO Research body and WCRP, being closely linked to the scientific community, and also have a key role in identifying the requirements for Essential Ocean Variables (EOVs) and relevant Essential Climate Variables (ECVs) similar to GCOS and the WMO RRR. OOPC works closely with GCOS;

(3) OCG undertakes coordination across the 12 global ocean observing networks, coordinating, strengthening and supporting the development of standards and frictionless data flow. It manages OceanOPS[[3]](#footnote-4), an operational facility that monitors the ocean observing system and supports the work of the OCG. The work of the OCG is similar to parts of INFCOM;

(4) ETOOFS, the Expert Team on Operational Ocean Forecasting, is a strategic body with a role similar to the modelling section under INFCOM;

(5) The GOOS Projects are similar to pilots in WMO, aiding observing innovation.

* + - 1. GOOS is not structured in the same way as WMO, however, there are many similar functions, and appropriate connections for both efficient function and joint (strategic) planning need to be identified.
      2. The ambitious GOOS Strategy 2030 envisions a fully integrated global observing system ranging across the value chain that extends from observations, through data management systems, scientific analysis and forecast, to end users. This 2030 Strategy guides the work of GOOS. Stronger connections to IODE will be secured as well.
      3. After the WMO Reform and disbandment of the WMO-IOC JCOMM, OCG and Expert Team on Operational Oceanography (ETOOFS) were transferred to GOOS – yet non-officially, other Expert Teams to WMO SERCOM and the WMO-IOC JCB was formed. With these changes that took place in 2019, there are opportunities to create new connections to support the strategic aims of both WMO and IOC.
      4. The WMO Reform and disbandment of JCOMM determined the following, through [Resolution 9 (Cg-18)](https://library.wmo.int/doc_num.php?explnum_id=9827/#page=58) of WMO, and from IOC:

(1) To incorporate appropriate JCOMM functions and activities on observation and operational ocean forecasting systems into the IOC-WMO-UN Environment-ISC GOOS, with functional connections to the Commission for Observation, Infrastructure and Information Systems (INFCOM);

(2) To incorporate appropriate JCOMM functions and activities on data management and processing into the Commission for Observation, Infrastructure and Information Systems, with a close connection to the work of the IOC IODE;

(3) To incorporate appropriate JCOMM functions and activities on services into the Commission for Services and Applications, with a close connection to relevant IOC activities in early warning and services;

(4) To establish the JCB, as a high-level coordination mechanism with broader engagement of the key relevant bodies of the WMO and IOC ([terms of reference](https://public.wmo.int/en/governance-reform/joint-wmo-ioc-collaborative-board)).

* + - 1. The above-mentioned JCOMM functions and activities are fully described in the paper by Pinardi et al (2019), “[The Joint IOC (of UNESCO) and WMO Collaborative Effort for Met-Ocean Services](https://www.frontiersin.org/articles/10.3389/fmars.2019.00410/full)”.
      2. The goal of SG-OOIS activities is to identify and help establish the necessary functional connections in order to augment IOC/GOOS through WMO members’ engagement, to highlight the role of GOOS coordination and the benefits it brings to WMO, support the relevant flow of information from within WMO structures to relevant parts of GOOS, and help facilitate the seamless integration of GOOS into the value chain of WMO sponsored and co-sponsored programs, and vice versa, in a post-JCOMM world. A common aim for GOOS and WMO is to improve the WMO service delivery through the development of a fit for purpose Global Ocean Observing System, and to deliver the needed ocean observations through strong connections with appropriate WMO systems. SG-OOIS submits recommendations to INFCOM after consultation with ocean communities, having considered the overall guidance of JCB.

## Outcomes and Recommendations:

* + - 1. SG-OOIS identified functional connections along the value chain of ocean observations among GOOS, IODE and the WMO, with focus on the INFCOM structure. Those recommendations are detailed below, and graphically summarized in the [Annex 1](#_Annex_1:_Summary).

12. In order to guide an assessment of the functional and strategic connections between WMO and GOOS, the SG-OOIS looked at the identified high-level objectives of both organizations, as expressed in the WMO Primary Objectives and the GOOS priorities for the partnership based on the GOOS 2030 Strategy and Roadmap for Implementation, plus the output from the WMO/IOC Joint Collaborative Boards (Approaches for Collaboration in the Joint Strategy). The structure of the analysis then reflects the common objectives and identified joint high priorities. The next section examines these connections using this structure (titled sections and aims) in the agreed priority order. In [Annex 3](#_Annex_3:_SG-OOIS) there is a detailed description of the rationale behind the structure of the analysis and the process towards the outcomes described in the following section.

13. SG-OOIS needs to identify working arrangements and functional connections as depicted in Figure 1. Further, WMO will need to consider how partnership on ocean observing could be best coordinated across WMO (INFCOM, SERCOM, Research Board, Capacity Development Panel, etc.), and for ocean activities in general across groups in WMO and co-sponsored programs. This could be through a specific and new WMO Secretariat resource, or by a cross-cutting Advisory Group (AG), to be resourced, or by giving this responsibility to an existing group that has the resource to support this.

**Recommendations for connection under eight high-level aims**

14. [Annex 3](#_Annex_3:_SG-OOIS) compiles the rationale of the analysis and the process towards the outcomes described in this section. The SG-OOIS has aligned aims, connections, and outputs to the identified high-level objectives based on the Approaches for Collaboration in the WMO/IOC Joint Collaborative Strategy, IOC priorities for WMO-GOOS partnership based on the GOOS 2030 Strategy and Roadmap for Implementation, and WMO Primary Objectives.  The list below reflects the agreed priority order:

### Meeting service needs and responding to change;

1. Supporting and leveraging priority/complementary initiatives in the value chain: Observations;

### Supporting and leveraging priority/complementary initiatives in the value chain: Data Management;

### Communicating and engaging for mutual strategic reinforcement;

### Taking joint regional approaches;

### Cooperation in capacity development where there is mutual benefit;

### Supporting and leveraging priority/complementary initiatives in the value chain: Research;

### Standards and best practices development.

**Recommendations:**

### Aim: Meeting service needs and responding to change

#### A 1 to 6. Recommendations on how to connect ocean observing systems (GOOS elements) to the RRR process

15. The WMO’s RRR process gathers user requirements under new groupings and [updated application areas](https://wmoomm.sharepoint.com/:w:/s/wmocpdb/ERXiTQEX5f5Ct6_30BHeGU0BhxMQx2FeK2yFQ1COss9_Xg?e=E1O1oJ) according to the Earth System approach. RRR is evolved through workshops every four years to discuss requirements with observing providers and current status.

16. GOOS should provide high-level input to the appropriate WMO bodies. For the application areas where the ocean plays a significant role or where expertise is outside WMO, we strongly recommend OOPC is consulted to provide recommendations for members to represent GOOS in these application areas. These contacts can liaise with other parts of GOOS as needed.

17. The monitoring of how requirements are met, and discussion of barriers to implementation, take place through SoG for the different application areas. It is suggested that GOOS, through OOPC and OCG, are involved in the development of the ocean part of SoG. Enabling GOOS and INFCOM to collaborate to respond to the SoG and find solutions, as required.

18. The Joint Expert Team on Earth Observing System Design and Evolution (JET-EOSDE) under the Standing Committee on Earth Observing Systems and Monitoring Networks (SC-ON) owns the RRR process and its evolution. It would be important that GOOS, through OOPC and OCG, is a part of JET-EOSDE to advise from an ocean perspective.

19. Note that GOOS is evolving and that under the Decade of Ocean Science for Sustainable Development (Ocean Decade) the development of co-design processes, in some senses analogous to the RRR, is already underway under the GOOS Ocean Observing Co-Design Programme. As this Programme evolves, it could provide input to the RRR or an opportunity to co-design some ocean related elements of the RRR with the ocean community under the Co-Design Programme. INFCOM / JET-EOSDE should engage with the development of this Programme, to strengthen implementation and avoid duplication of effort.

**Connections recommended:**

20. A seat in JET-EOSDE represents the ocean domain in a broad sense. This representative should be connected to GOOS, more specifically to OOPC. JET-EOSDE should further engage with GOOS through WMO’s senior representative in OCG Exec for interaction on the SoG’s, including interaction with the networks regarding feasibility, system capabilities assessment, and when issued to support networks status report and implementation/coverage view through OceanOPS.

21. An OCG designated interface for the SoGs is to be explored to make sure relevant information passes swiftly to the relevant networks and providing a space for discussion – noting that the OCG Executive Team already has a Vice-chair for WMO, which could be an appropriate focal point.

22. GCOS is sponsored by WMO, IOC, UNEP and ISC, and itself sponsors OOPC; OOPC is sponsored in addition by GOOS and WCRP. OOPC provides a natural link to the WMO requirements gathering process for global climate monitoring requirements of surface and below surface ocean observations and AOPC for the atmospheric component over the ocean. Within GOOS the OOPC is already and currently the focal point for all the GOOS Panels for the GCOS requirements process. The [proposed new concept for application areas](https://wmoomm.sharepoint.com/:w:/s/wmocpdb/ERXiTQEX5f5Ct6_30BHeGU0BhxMQx2FeK2yFQ1COss9_Xg?rtime=23cp9b_h2Ug) considers OOPC’s ownership of observation requirements for climate and ocean physics monitoring in the ocean domain, and it is suggested that OOPC provides recommendations for ocean connections into these application areas. However, there is scope to reinforce for emerging areas of climate adaptation, climate services, energy services, etc.

23. The SERCOM Standing Committee on Marine Meteorological and Oceanographic Services (SC-MMO) and its Expert Team on MetOcean Requirements (ET-MOR) link to the RRR. The requirements for these services would be connected to GOOS through the suggested OOPC/OCG RRR connections, and also through JET-EOSDE.

24. This flow of information into and out of the RRR process must be ensured so that GOOS has visibility of the RRR results, can comment as appropriate and work with the global networks, GRA’s, the GOOS National Focal Points, and with national weather prediction services towards implementation.

**Recommended actions:**

1. GOOS focal point/s (OOPC and OCG, to facilitate connection to expert panel for input and overview on observing requirements and to networks regarding capacity and fulfilment) to be identified for RRR activity. The GOOS community to be represented in JET-EOSDE[[4]](#footnote-5) (possibly through the focal point/s).
2. GOOS (OOPC/OCG) to engage in the development of the relevant Statement of Guidance (RRR SoG’s) in relation to the gap analyses, current status and envisioned opportunities of enhancement in the observing networks.
3. GOOS (OCG/OOPC) to review SoG’s and input into value assessment design. If this requires OSSE or OSE experiments, input from the OCG and relevant networks towards OSSE/OSE experiments should be sought through the OCG.
4. GOOS (OCG) and SC-ON respond to SoG’s with joint plans on supporting networks/systems evolution and priorities.
5. GOOS, through OCG and OceanOPS, to support the implementation of relevant SoG’s with status report/view, dependent on the availability of resources to undertake this work. This noting that OceanOPS 2021–25 Strategic Plan objective 1.3 is to implement and report "system level" metrics for monitoring the adequacy of the system versus requirements and applications.
6. WMO JET-EOSDE to consider if the GOOS Ocean Decade Programme Ocean Observing Co-Design could take on the requirement scoping of some areas for improvement where marine observations are vital. Tropical storms, storm surge, and ocean carbon cycle are already underway as use area Co-Design Exemplar Projects, with input from NWP. Others can be co-designed.

25. Cryosphere and atmospheric requirements pertinent to ocean observing networks information will also follow the same pathways outlined above.

**Expected Outcomes:**

(1) GOOS will have visibility of the RRR process through the OOPC suggested GOOS take the lead for relevant application areas and through review of the SoG will have visibility of the results. GOOS will also have visibility through OOPC membership of JET-EOSDE;

(2) OOPC, (and ETOOFS), AOPC and SC-MMO have ownership (leadership) on the definition of the requirements;

(3) GOOS and WMO INFCOM work together in implementation planning, through OCG and SC-ON, including for GBON.

(4) OceanOPS will develop the appropriate tools to evaluate system performance vs requirements, in close cooperation with WMO led initiatives such as GBON and OSCAR.

#### A.7 Recommendations regarding connections between GOOS and appropriate components of the WMO Research for future view

**Connections needed:**

26. Each [Application Area](https://wmoomm.sharepoint.com/:w:/s/wmocpdb/ERXiTQEX5f5Ct6_30BHeGU0BhxMQx2FeK2yFQ1COss9_Xg?e=E1O1oJ) in the RRR includes a consideration of the observations required to enable research into its future activities and evolving usage of observations. Connection to the relevant application areas (as identified above) is needed in this sense.

An Ocean Observing Co-Design exemplar project area – influenced by the research community – could provide a vehicle for action

**Recommended action:**

1. The foreseen WMO AG Ocean (see recommendation B5) to engage with GOOS (Expert Panels/OCG/Ocean Observing Co-Design Programme) and support development of pilot projects in areas of common interest, with a focus on RRR implementation and regional needs.

#### 27. It must be ensured that for GOOS will receive feedback on impact/value of elements of observing system expansion on services innovations to support investment.

28. The feedback needed is expected to come through RRR’s SoG. GOOS OCG and OOPC will review the SoG and so input into any value assessment can be provided at this stage. If the assessment involves OSSE or OSE experiments, input from the OCG and relevant networks (through OCG) should be sought.

#### A.8 Recommendations on connections between WMO-GOOS-satellite community and how this integrates with RRR

29. The motivation in this section is to develop linkages between WMO Space Program coordination of operational satellite atmosphere and ocean observations and GOOS coordination of in-situ ocean observations. Such linkages would strengthen global ocean observing and, simultaneously, enhance the Reform WMO focus on connecting the ocean, climate and weather.

30. In the former JCOMM, a Satellite Data Coordinator had the role of coordinating satellite ocean data requirements, acting as liaison with the CBS ET-SAT and IPET-SUP and with CEOS and CGMS, and reporting to the chair of the SFSPA Coordination Group and to OCG. After the WMO Reform, CBS ET-SAT and IPET-SUP functions are subsumed in the overall INFCOM SC-ON Expert Team on Space Systems and Utilization ([ET-SSU](https://community.wmo.int/governance/commission-membership/commission-observation-infrastructures-and-information-systems-infcom/commission-infrastructure-officers/infcom-management-group/standing-committee-earth-observing-systems-and-monitoring-networks-sc/expert-team-space#:~:text=Expert%20Team%20on%20Space%20Systems%20and%20Utilization%20(ET-SSU))). SFSCG is subsumed by SERCOM SC-MMO.

31. Note that there are satellite connections established with the GOOS Expert Panels for work on defining relevant EOVs, for example SST, SSS and Ocean Colour, and another area of collaborative satellite/in-situ observations is through the new Marine Debris EOV.

**Connections needed:**

(1) To liaise GOOS Steering Committee, CEOS, CGMS, WMO Space Program, WIGOS, WMO INFCOM Coordinator of Satellite Data, WMO INFCOM ET-SSU, and WMO INFCOM Advisory Group on Ocean (see below);

(2) To provide GOOS representation in CEOS and subsidiary activities, e.g., virtual constellations;

1. To provide GOOS representation in CGMS and subsidiary activities, e.g., scatter meter task team.

**Recommended actions:**

(1) To reduce functional gaps to utilize satellite and in-situ ocean networks in the GOOS 2030 Strategy and to enable Reform WMO Earth System connections with in-situ and satellite ocean observing systems, the SG-OOIS recommends **GOOS to consider establishing a Coordinator of Satellite Data**. Potential terms of reference (ToR) of the GOOS Coordinator of Satellite Data are:

(a) To coordinate satellite data requirements within GOOS, emphasizing GOOS EOVs, and within the UN Decade of Ocean Science for Sustainable Development;

(b) To develop protocols for integration of operational and non-operational satellite ocean observations and in-situ ocean measurements, including calibration and validation;

(c) To liaise with GOOS Steering Committee, CEOS, CGMS, WMO Space Program, WIGOS, WMO INFCOM Coordinator of Satellite Data, WMO INFCOM ET-SSU, and WMO INFCOM Action Group on the Ocean;

(d) To increase efficiencies of in-situ and satellite ocean observing partnerships;

(e) To mitigate challenges and explore opportunities for integration of non-operational limited-duration observations with operational sustained measurements; and

(f) To develop a GOOS Ocean Satellite Data Task Team to support ToR. INFCOM will submit a request to GOOS to consider establishing a Coordinator of Satellite Data.

**Expected Outcome:**

(1) Greater efficiency and an integrated satellite and in-situ ocean observing system. OceanOPS should have the necessary resources to secure technical capabilities to monitor satellite based observations.

### Supporting and leveraging priority/complementary initiatives in the value chain: Observations

#### B.1 to B.3 Recommendations on an optimal structure for efficient functional connections between GOOS and WMO-related bodies and systems – WIGOS, GBON, Global Data Processing and Forecasting System (GDPFS)

**Connections needed:**

(1) Strategic WIGOS-OCG connection – Senior WIGOS member involvement in OCG Exec and OCG Group discussions, and vice versa. Bringing to the table ideas, opportunities, and issues from both sides.

30. When marine observations are considered a part of GBON (see GOOS SC\_10 Part 2 Decision 3) specific additional connections to the OCG Executive will need to be considered and developed. For now and as a transition phase, SOT and DBCP are practical interfaces to GBON and are requested to report/liaise with OCG Exec*.*

31. Connection between GOOS ETOOFS and GDPFS is suggested via AG Ocean and Secretariats to make sure requirements from ETOOFS are understood and integrated into GDPFS developments.

32. Currently information flows fromSC-ON to OCG Executive through a senior WIGOS member, and through a WIGOS – OCG connection for a broad range of issues. In addition, there are ocean community connections on SC-ON to help guide discussions, and from DBCP and SOT.

33. SG-OOIS suggest that ocean related recommendations from SC-ON could be channelled through the WIGOS-OCG connection and that SC-ON could ask GOOS on an ad hoc basis for specific input on ocean issues, though a direct connection between GOOS and SC-ON could also be useful.

34. A marine observations focal point is identified in WMO to support the flow of information from the various groups in WMO, and for GOOS to connect to*.* This focal point should also be responsible for the MCDS.

Data connectionsare further discussed below.

**Recommended action:**

B.1. A senior WIGOS Secretariat member to be included in the OCG Exec meetings.

B.2 A marine observations focal point is created in the INFCOM (WMO) secretariat.

B.3 GOOS to consider whether a strengthened connection to SC-ON is appropriate, and how this might best be supported.

SOT and DBCP to maintain membership in, and/or assigned functional connections with, SC-ON, SC-IMT and SC-MINT.

**Expected Outcome:**

(1) GOOS contributing to Earth System integration in INFCOM, smooth connection between WIGOS and relevant parts of GOOS.

#### Recommendations on an optimal structure for efficient functional connections between GOOS networks SOT and DBCP and WMO-related bodies and systems

**Connections needed:**

35. For overview of plans, such as the Plan for the WIGOS Initial Operational Phase (2020–2023), it would be useful to connect GOOS in a broad sense to SC-ON, with DBCP and SOT*.*

36. DBCP and SOT to maintain connection to SC-ON, and report back to OCG. This connection is important for the SOT and DBCP with respect to instrument standards, and policies/statements on establishing networks, observation standards, delivery and quality.

37. The SOT and DBCP provide, among their other tasks, a forum for the Members (and other stakeholders) to coordinate their approach to the regulations, both in meeting their obligations and in influencing the regulations. For this reason, connections to SC-ON and SC-MINT should be maintained.

38. OceanOPS supports the metadata collections for DBCP and SOT, see below.

39. Remote marine *in-situ* stations is important for ocean inputs and long-range transport of air pollutants. Moored buoys and ship-borne observations through all OCG network, and especially DBCP/SOT/OceanSITES could be explored to have additional data collection for WMO Global Atmosphere Watch (GAW) through GOOS/OCG. In addition, connecting GAW to a GOOS OOPC programme such as SCOR-OASIS (Observing Air-Sea Interactions Strategy), can contribute to mitigate observational gaps in systematic marine surface data, such as solar radiation data. Cryosphere and atmospheric requirements pertinent to ocean observing networks will also follow the same pathways outlined above, i.e. from WIGOS and SC-ON, to GOOS OCG for discussion.

**Recommended action:**

(1) OGC networks, and especially DBCP and SOT, maintain membership in, and/or assigned functional connections with, SC-ON and SC-MINT;

(2) Networks, including DBCP and SOT, will also have connections to other bodies (reference the list from SOT table).

**Expected Outcomes:**

(1) GOOS networks SOT and DBCP remain well connected to WMO-related activities. Enhance data sources for ocean inputs and long-range transport of air pollutants from marine *in-situ* stations.

#### Recommendations on the structure in WMO to oversee, main function of connection and identify new or limited needs for connection – a focal point for ocean related issues across the value chain

**Connections needed:**

(1) WIGOS Metadata Standards are implemented through OceanOPS and so connection between OceanOPS and ET Metadata Standards which is under SC-IMT should be maintained;

(2) Intermittent connection between SC-ON and OceanOPS (request input on an as required basis) should exist for the following areas: metadata, OSCAR and WDQMS and WIGOS identifiers.

40. Earth system integration will eventually need connection to GOOS at the activity level in ET’s, e.g. to support the extension of the tiered networks concept[[5]](#footnote-6) to the oceans domain. However, at this stage a higher level strategic planning connection is required to discuss the impact of the ongoing evolution of this approach and vice versa the impact of the ongoing evolution in GOOS. Ideally, there should be a convergence of ideas and approaches.

41. This strategic direction/convergence could be performed by an Advisory Group on Ocean (AG Ocean). The major purpose of the AG Ocean would be to provide a broader perspective to enhance these WMO-GOOS-IODE connections, as follows:

1. Overview the function of the ocean data value chain, from collection to applications, use and impact, with a feedback process enabling the operationalization of outputs generated by relevant Standing Committees;
2. Advises INFCOM MG on needs, priorities and coordination of ocean components of Earth Observation System;
3. Aggregation of technical outputs from INFCOM standing committees into integrated outcomes for the ocean community, in coordination with relevant SERCOM bodies, the WMO Research Board (RB), GOOS Steering Committee and OCG.

41. AG Ocean could be a facilitator, the entry point/interface of INFCOM for the ocean observing community and ocean infrastructure suppliers, translating needs from the community into actions of relevant INFCOM bodies and supporting the transformation of technical outputs of INFCOM into outcomes useful for the ocean.

42. AG Ocean is an INFCOM body, enhancing the effectiveness of existing coordination mechanisms, especially between WMO and IOC, without creating any new layer that may collide with mechanisms already in place, like RRR.

43. It would maintain and monitor all identified functional connections within INFCOM and help ensure sustained access to ocean observations and infrastructure, data, and information to enable the effective delivery of the goals of the WMO Strategic Plan and to support Members’ efforts to unify operational prediction systems using a fully coupled Earth system model approach.

44. The AG Ocean would also maintain and track partnership with joint and co-sponsored activities and organizations such as UN Ocean Decade, GOOS and IODE through different bodies such as JCB at strategic level and OCG at operational level. Proposed terms of reference for AG Ocean are presented in [Annex 4](#_Annex_4:_Proposed).

45. WMO being a member-driven organization, AG Ocean must be composed by country and partner representatives. This said, WMO Secretariat will ensure day-to-day connections to the relevant WMO bodies and act, on behalf of AG Ocean, as a representative/observer for relevant events and governance meetings, as well as a conduit to the main foci for WMO-GOOS connections, namely OOPC, OCG, OceanOPS, GOOS Office, BGC Panel, ETOOFS, and to be an entry point for WMO entities to find connections or advice regarding the GOOS community.

**Recommended actions:**

B.4 Representation of OceanOPS and GOOS (data expert) in ET Metadata Standards;

B.5 WMO INFCOM to establish an Advisory Group on Ocean (AG Ocean), ensuring sufficient WMO Secretariat support to aid AG Ocean members in their work.

**Expected Outcome:**

(1) Integration across the value chain of activities related to ocean observations infrastructure.

### Supporting and leveraging priority/complementary initiatives in the value chain: Data Management

#### C1 Recommendations on an optimal structure for efficient functional connections between GOOS, IODE and the WMO Information System (WIS) WMO-related bodies and systems around frictionless flow of data and metadata across all oceanographic and marine meteorological variables in the WMO Data Policy

**Connections needed:**

(1) JCB to be maintained as the main platform for the strategic dialogue between WMO and IOC;

(2) Cooperation between WMO and IOC in the UN Decade programmes and projects (Ocean Observing Co-Design, CoastPredict, DITTO, Ocean Data 2030, Ocean Practices for the Decade, Ocean Teacher Global Academy, ETR, Global Campus, CONECT, etc.).

**Recommended actions:**

C.1 Invite IOC and WMO to discuss through the JCB the form of future collaborations on data and information management and ocean best practices aspects;

C.2 In collaboration with WMO INFCOM and IODE, keep the mapping of data pathways created by GOOS (OCG) updated, as support is available to do so. OceanOPS will support this effort;

C.3 Invite WMO INFCOM, GOOS (OCG) and IODE to start a dialogue on the further development of MCDS. This with the support of OceanOPS;

C.4 Nominate WMO INFCOM representative/s and contact IOC IODE to join the Steering Group on IOC IODE ODIS;

C.5 Invite WMO INFCOM, GOOS (OCG) and IODE to cooperate closer for capacity development in data management;

C.6 WMO INFCOM to join the efforts to coordinate the data-related activities under the UN Decade of Ocean Science for Sustainable Development (2021–2030). IODE to invite WMO INFCOM experts to join the IODE Intersessional Working Group to propose a strategy on Ocean Data and Information Stewardship for the Ocean Decade (IWG-SODIS);

C.7 Membership of IODE experts in ET-IM, ET-AC and ET-W2WPE, and of GOOS (OCG/data expert) to SC-IMT (as appropriate for the agenda); will also be a recommendation to IODE-27 (Feb. 2023) and the JCB.

**Expected Outcomes:**

1. New collaborative activities between GOOS (OCG), WMO and IOC on data & information management, with the support of OceanOPS;
2. Jointly maintained «ocean data flows map»;
3. Wider recommendations of multi-community best practices for data and metadata management;
4. Wider support and development of MCDS;
5. Coordinated capacity development activities on data management;
6. Co-development of the data, information, and digital knowledge management; framework through the closely connected development of WIS 2.0 and ODIS;
7. Contribution to the societal benefits of the UN Decade though the WIS 2.0 and ODIS/OIH.

### Communication and supporting mutual strategic reinforcement/alignment

#### D.1 Actively use WMO membership in GOOS SC to identify one new initiative per year for GOOS-WMO co-development.

**Connections needed:**

(1) Active engagement in GOOS SC, WMO Sponsor and SC member, with a view to a) guide development, b) support and directly engage WMO in 'attractive' projects and programmes. GOOS Leadership able to approach INFCOM leadership with ideas and vice versa.

#### D.2 – D.3 Recommend functional connections to support the expansion of observations, including in areas under national jurisdiction. (e.g. with SC-ON, GBON, SOFF, WMO Data Policy)

**Connections needed:**

* + - 1. Expand GBON to include marine observations for weather, hazard warning and climate applications and what would be required of GOOS OCG and the global networks to support this development

46. There could be a strong role for SOFF in this space, as well as for the GOOS Ocean Decade Observing Together Programme, in supporting development of observing capacity for sustainable development.

47. GOOS to contribute to the TT-GBON on the implementation of GBON in Exclusive Economic Zones (EEZs) WMO to contribute to IOC-led initiatives related to the taking of ocean observations in State’s EEZs and consider what action it could take to support this, including through GBON. See the Report from the Experts Workshop on Observations in Areas under national jurisdiction.

48. A small group convened under AG Ocean to work this pathway out could be a useful pathway. This would crosscut many activities.

**Recommended actions:**

D.2 Support NMHS’s and partners’ engagement in the sustained observation and exchange in EEZ’s in compliance with the GBON;

D3. Support engagement with industry and citizen science initiatives. GOOS MTS Industry Dialogue and WMO INFCOM SC-ON engagement with the Association of Hydro-Meteorological Equipment Industry (HMEI) are notable efforts in that direction to engage industry with national/government agencies.

**D.4-D.5 – Recommendations on how to promote stronger engagement of Members in ocean observations and infrastructure.**

**Connections needed:**

(1) WMO to initiate and strengthen the messaging around the need for ocean observations, GOOS partnership, the future needs and how members can help (Data Policy mandates). There could be a forum where members seek to make connection with regional/national GOOS representation to coordinate support, and/or national lobbying – GOOS National Focal Points and GRAs Engagement of WMO members with Ocean Decade GOOS Programmes – also has potential;

(2) At national level, establish a communication channel between GOOS National Focal Point and WMO Permanent Representatives to help build working level connections between the national meteorological services and marine/oceanographic institutes. Provide success stories that come from this cooperation – e.g. India monsoon forecasts.

**Recommended actions:**

D.4. Consider possible joint case studies for communication, for example, to demonstrate the value of observations to numerical weather prediction and safety of life at sea;

D.5. Contribute to the [JCB Webinar Series The Global Ocean Observing System](https://contacts.wmo.int/_entity/sharepointdocumentlocation/9e51bf07-82a6-ea11-a812-000d3aafe55d/7b138792-1090-45b6-9241-8f8d96d8c372?file=10%2029%202021%20DRAFT%20Webinar%20Series%20The%20Global%20Ocean%20Observing%20System-Oceans%20of%20Data%20for%20Earth%20System%20Predictions.ppt&amp;folderPath=%2FGroup%20Members%2FMeetings%2FMeeting%2016-29%20October%202021): Oceans of Data for Earth System Predictions

Missing that connection with regional/national GOOS representation to coordinate support, and/or national lobbying – GOOS National Focal Points and GRAs Engagement of WMO members with Ocean Decade GOOS Programmes would be useful.

### Taking joint regional approaches

#### Recommendations on functional connections to engage with Members in all regions to regularly review and clarify their requirements related to ocean observations for service improvement

Connections needed:

(1) Evolve working level interaction between WMO Regional Associations (WRA) and GRA; having input from ocean representatives in WRA management groups (MG) is important and can help shape regional priorities for the ocean. There is the need for a high-level mandate to connect GOOS and WRA MG.

**Recommendation:**

E.1. High-level mandate to WMO Regional Offices in order to promote input from GRA's and/or oceanographic services to Regional Associations' Management Groups.

Effective mechanisms evolved to have mutual participation of regional activities among the respective WMO-RAs & GRAs.

49. JCB already initiated an enhanced collaboration among WRA and GRA in key topics such as capacity building and observation strategy.

### Cooperation in capacity development where there is mutual benefit

#### F1 Recommendations for the assessment of capabilities of Members with regards to the use of ocean data and ocean observing for services

**Connections needed:**

(1) In line with the review of the WMO regional concept (Cg-Ext, with a view to better align activities of WRA with the work of the technical Commissions), reflect the high-level objectives of the WRA's on ocean in the regional technical structures and work plans. Any assessment of members would need to be undertaken by WMO; however GOOS SC and successful Met/Ocean Offices could aid with defining that assessment. GOOS could aid in supply/development of ocean material. Potential to use other capacity output from GOOS and IODE OTGA. For example GOOS ETOOFS has just completed a successful online training programme, through OTGA, this for example could have been promoted through relevant WMO channels to entrain interested organizations;

(2) The ETOOFS guide for operational ocean forecasting will soon be released, and this could be another area of cooperation. The aim is that this also becomes a WMO guide.

**Recommended actions:**

F.1 Assess and enhance capacity development at regional level using existing activities (e.g., use a WMO call for UN Decade Project capacity development for forecast on storm surge and cyclone; flood warning / inundation, …). Identify a pilot project as a starting point.

### Supporting and leveraging priority/complementary initiatives in the value chain: Research

**Connections needed:**

(1) An overview of long-term strategic direction is provided through the JCB, and partially through WMO involvement at a strategic level as a sponsor in GOOS Steering Committee.

(2) Suggest that an annual high-level meeting with the Ocean Expert Vice-chair of INFCOM; INFCOM (including capacity development champion), SERCOM, RB, GOOS leadership, WMO SC member, and possibly OOPC, OCG and OceanOPS, would be useful. This could review the outcomes of SG Oceans and look for co-opportunities to action pilots or improve services/delivery. This would be analogous to the previously held JCOMM Management meetings.

49. There is no specific recommendation for this, noting that senior level oversight/interaction on this topic is in place at JCB level.

### Standards and best practices development

#### H1 Recommendations on how to promote stronger engagement of Members in ocean observations and infrastructure, particularly related to Standards and Best Practices

**Connections needed:**

1. DBCP and SOT connection to SC-MINT for standards for the instrumentation, including for instrument standards with respect to quality, calibration, measurement uncertainty, and traceability. It would be useful if documents can be also connected to the Ocean Best Practices System. Suggest this is a role for OCG focused WMO Secretariat. Under SC-MINT there is ET-SSM and suggest DBCP and/or SOT have connections to this to advise for marine and report back to OCG Exec Vice-chair Standards and Best Practices on any issues that require attention. SOT needs to be connected to ET-QTC and ET-MU, which do calibration and uncertainty of measurements – continued connection and report to OCG Exec if any action is required. A standards and best practices focal point on WMO and GOOS sides respectively may be needed.

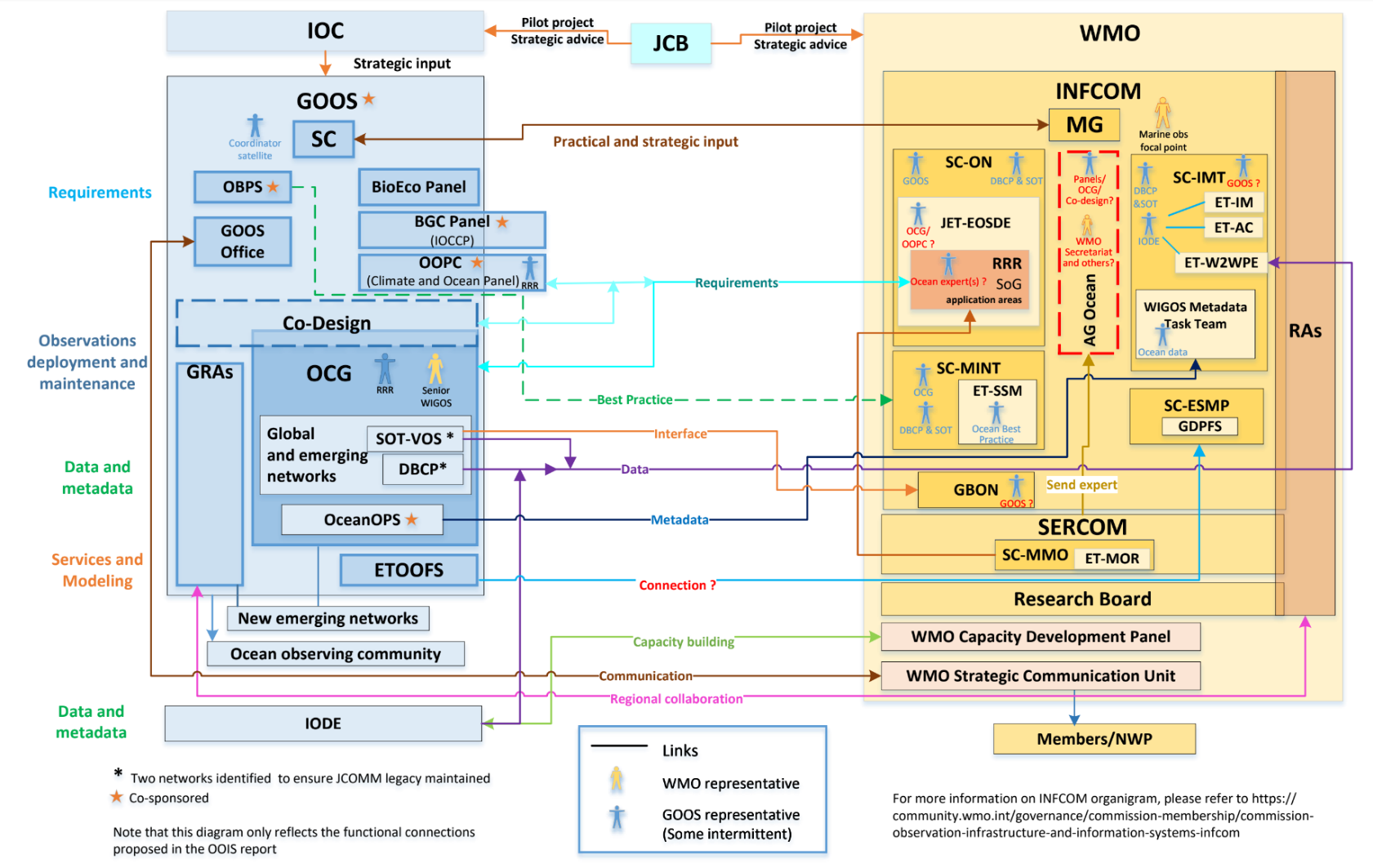
**Recommended actions:**

H.1 Communications and coordination related to the Standards and Best Practices Project to be carried out by the WMO Secretariat; Ocean Best Practice System representative (chair or similar) to be invited on a regular basis to present to SC-MINT / ET-SSM to connect on ocean matters;

H.2 Recommend WMO INFCOM to contribute to Ocean Best Practices System repository and investigate existing practices to be applied.

# Annex 1: Summary of proposed new functional connections

Note: Existing functions and bodies that are not impacted are not shown for the sake of simplicity.



# Annex 2: The Global Ocean Observing System (GOOS)

1. Established in 1991, the GOOS under the IOC of the UNESCO coordinates observations around the global ocean for three critical themes: climate, operational services, and marine ecosystem health and to build a network around independently managed and independently funded observing elements (satellites, buoys, scientists, etc.). In 2012, success, coupled with growing concerns led to the development of the visionary **Framework for Ocean Observing:** a guide to meet the needs of multiple stakeholders. GOOS mandate is to contribute to the UNFCCC Convention on climate change, the UN convention on biodiversity and the IOC/WMO mandates to provide operational ocean services, respectively.

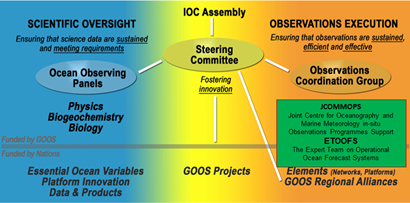
2. Today, GOOS has four key components:

(1) Expert panels for physics, biogeochemistry, and biology and ecosystems that synthesize across requirements and provide guidance on observing system design;

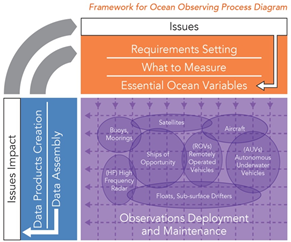
(2) OCG, OceanOPS and GRA’s that implement observing systems and ensure the flow of observations across the global networks and regional observing structures;

(3) GOOS Projects that advance innovation and expand into new areas for the observing system; and

(4) Core coordination through the GOOS Steering Committee and a distributed GOOS Office.



3. **GOOS Framework**:GOOS utilizes the Framework for Ocean Observing to guide its implementation of an integrated and sustained ocean observing system. Framework concepts are: Requirements, EOVs, Observations, Readiness and Evaluation In fact, the Framework guides the path from the science-driven requirements resulting from societal issues, identifying the observations deployment and maintenance needed for the production of impactful and relevant tools to address those issues. To maintain an ocean observing system that is fit for purpose, the outputs (publications, data products, ocean services) must properly address the issues that drove the original requirements. The observing system is under constant evaluation to discern changes in readiness and identify risks to its sustainability. Evaluation is based on a series of metrics, assessing system implementation, performance, data delivery, and impact



GOOS actions are executed through international collaboration of a diverse collection of scientific experts across the world.  GOOS works through partners such as The Partnership for Observation of the Global Ocean (POGO), The Global Ocean Acidification Observing Network (GOA-ON), GODAE OceanView (OceanPredict) and The GEO Blue Planet Initiative. GOOS and partners have launched Tropical Pacific Observing System in 2020 project TPOS2020 and developing projects such as Deep Ocean Observing Strategy (DOOS) and Mediterranean Sea-Level Change And Tsunamis (MESCAT) iN FACT GOOS is the oceanographic component of GEOSS, the Global Earth Observing System of Systems.

4. **GOOS Expert Panels** identify the system requirements in terms of EOVs, marine ECVs) and observing networks, based on their level of scientific and societal relevance as well as on how feasible they are to observe. **GRAs** are coalitions of nations and/or institutions which share GOOS principles and goals, but are mostly concerned with local priorities and organized around regional seas or coastal environments. Fifteen GRAs (two more *emerging ‘like GRAs’ CIOOS, SAEON)*represent different regions of the globe, emphasizing regional priorities, differing by need, resources and culture. Some GRAs emphasize data sharing or regional capacity development, while others are building out extensive observation systems with dedicated marine service goals, such as oil spill response capabilities or Typhoon forecasting. GOOS has had as its major goal, the task of globally unifying national observation systems to allow national needs to drive and benefit from the added value of participating in a global system. GRAs were introduced to integrate national needs into regional systems and to deliver at a global level.



5. Under GOOS OCG provides a mechanism for international coordination of oceanographic and marine meteorological observing, and its data management and delivery, while ETOOFS focuses on ocean forecast systems and services. OceanOPS, previously **OceanOPS –** The World Meteorological Organization (WMO)- IOC Joint Centre for Oceanography and Marine Meteorology in-situ Observations Programmes Support (OceanOPS), grew out of the need for improved technical coordination across a number of such communities, e.g., to assist in deploying observing programs (e.g. Argo floats and drifters); assist in developing and tracking timely exchange of data and metadata; and to monitor the status and growth of the system. JCOMM was disbanded, JCOMMOPS was rebranded into OceanOPS, which sits under OCG, of GOOS, as a joint WMO-IOC support centre. OceanOPS mission is to monitor and report on the status of the Global Ocean Observing System and networks, to use its central role to support efficient observing system operations, to ensure the transmission and timely exchange of high-quality metadata, and to assist free and unrestricted data delivery to users across operational services, climate and ocean health.

6. OceanOPS 2021–2025 strategic goals are: 1. Monitoring to improve the Global Ocean Observing System performance, 2. Leading metadata standardization and integration across the global ocean observing networks, 3. Supporting and enhancing the operations of GOOS, 4. Enabling new data streams and networks, and 5. Shaping the OceanOPS infrastructure for the future.

7. **GOOS Strategy 2030 and Implementation Plan:** The GOOS Strategy 2030 envisions a fully integrated global observing system ranging across the value chain that extends from observations, through data management systems, scientific analysis and forecast, to end users via information, data and decision-making services. Under the 2030 Strategy, the eleven Strategic Objectives provide guidance on priorities for the development of a more user-focused and integrated system, and for the core work of GOOS itself. These Strategic Objectives are grouped into “system integration and delivery” “deepening engagement and impact”, and “building for the future,” The Implementation Plan provides a framework within which nations, partners and sponsors can envision actions towards achieving the 2030 Strategy. It will be a co-design process and anticipates evolving governance for an expanded observing system. Broad-scale observations require a global effort and international collaboration. The GOOS partners have diverse expertise that elaborate standards and best practices on observing systems, conduct monitoring of the observing networks, and align their operations with the GOOS strategic planning.

8. GOOS recognizes that to build the capacity of less-developed countries requires assistance in promoting technology transfer, providing practical training, and raising awareness of decision makers. GOOS has succeeded in coordinating a collaborative system of sustained observations unified by GOOS principles.

**Background documents:**

1. The GOOS 2030 Strategy;
2. A Roadmap for the Implementation of the GOOS 2030 Strategy;
3. A 5-Year Strategic Plan for OceanOPS (2020–2025).

# Annex 3: SG-OOIS Work Programme Priorities

**Actions and deliverables from Terms of Reference:**

(1) Propose and help establish **efficient functional connections** between GOOS and GCOS, the Global Cryosphere Watch (GCW), GAW, WIGOS, WIS, the IOC IODE and GDPFS;

1. Provide recommendations on the **functional connections**:
2. **To engage with Members** in all regions and review and clarify their ocean requirements related to ocean observations, for WMO-related strategic needs including NWP, Earth system modelling, including for the safety of life at sea, and climate prediction and monitoring (with SERCOM SC-MMO);
3. **To identify the observations and data requirements** including issues related to Exclusive Economic Zones (EEZ) needed to support these forecasting systems, models, assessments and key monitoring products (e.g., IPCC assessments; State of the Climate Reports) (with SC-ON and GBON);
4. **To assess capabilities** of Members with regard to the use of ocean data and ocean observing for services, and explore capacity development activities that are required;
5. **To promote stronger engagement** of Members, especially those in developing countries, in ocean observations and infrastructure systems.

(3) In order to **strengthen the end-to-end value chain** from observations to data distribution, forecasting systems, services and applications:

1. Consider contributions to the GOOS Strategy and Implementation Roadmap;
2. Address the expected outputs from the Joint WMO-IOC Strategy for Ocean Data Management;
3. Potential to explore new partnerships for accessing ocean data sources and products that are now available to WMO Members in real-time and delayed mode.

**Required Outputs:**

1. Recommendations on an **optimal structure for efficient functional connections** between GOOS and WMO-related bodies and systems;
2. Recommendations on the **role and functions of WMO** in relation to GOOS;
3. Recommendations on how to:
   * + - 1. Promote stronger **engagement** of Members in ocean observations and infrastructure;
         2. Assess **capabilities** of Members with regards to the use of ocean data and ocean observing for services;
         3. Include ocean observing in the RRR process

1. While considering the WMO’s objectives for the group in the ToR’s and the GOOS Strategy 2030 and Implementation Roadmap, as well as the main opportunities identified from the contribution of WMO’s engagement in the draft document “*Identifying Future Connection between OCG, WMO and GOOS, post-JCOMM”* (JCOMM Observations Coordination Group, October 2019), the vision for the group work path was built as:

***As the ocean component in the Earth System approach of the WMO, the GOOS is seamlessly integrated in the WMO sponsored and co-sponsored programs’ value chain, and strengthened through WMO Members´ engagement and support.***

2. Acknowledging the much broader scope of the GOOS, the partial view of GOOS noted in the above vision nonetheless reflects the priority to SG-OOIS. Functionality of the GOOS in the scope of the Earth System approach of WMO should be similar to other system components like GCW, GAW, with the particularity that GOOS is a co-sponsored program managed and led by another body in the UN system, the IOC. The WMO/IOC JCB provides high-level guidance.

3. SG-OOIS took note of the third draft of the *WMO/IOC Joint Collaborative Strategy* delivered to INFCOM MG April 2021, and the six approaches for collaboration as a framework to its work. SG-OOIS’s required action is to map these approaches into a suitable scenario for targeted action towards their implementation. The INFCOM MG agreed on the need to define strategies in more refined way than what is proposed in the current version of the Joint Collaborative Strategy, identify the various groups involved on both sides, and assure proper interfaces and coordination/synergies and avoid duplication. For example, the Ocean Best Practices Group of IOC needs to be better connected with INFCOM.

**Approaches for collaboration (WMO/IOC Joint Collaborative Strategy)**

1. Communicating and engaging for mutual strategic reinforcement;
2. Standards and best practices development;
3. Meeting service needs and responding to change;
4. Supporting and leveraging priority/complementary initiatives in the value chain – Research, Observations, Data Management, Predictions, Services;
5. Taking joint regional approaches;
6. Cooperation in capacity development where there is mutual benefit.

4. The Group proposed to have high-level objectives for WMO and GOOS identifying what WMO and GOOS want to achieve. There could be common requirements as well as non-common ones. IOC through its representation at SG-OOIS provided a proposal to agree on joint Primary Objectives of the GOOS engagement with WMO, including their expectations for this partnership and priorities. This was a very helpful baseline to build SG-OOIS’s recommendations on the role of WMO and further contributions to GOOS Strategy and Implementation Roadmap.

**IOC priorities for WMO-GOOS partnership**

1. Improving delivery of relevant services; weather forecasts, early warning, climate assessments, seasonal forecasts (“seamless”);
2. Understand/improve design/responsiveness of observing system – feedback loops (ObsCoDe, RRR);
3. Co-funding (oceanography/met) of key strategic infrastructure for delivery of WMO services now and future aspirations;
4. Seamless data and metadata flow to service providers (meteorological and oceanographic) through WIS;
5. Joined up thinking about observing platform implementation, including national investment – opportunities outside ‘core’ network roles;
6. Using the power of WMO’s regulatory environment to help improve exchange of ocean data in EEZs [also potential engagement in GBON / SOFF];
7. Understanding the value chain and support in evaluating priority investment areas through the ObsCoDe Ocean Decade programme;
8. Support in articulating the need/value for investment in the ocean observing system – advocacy; Potential for powerful joint communications work;
9. Joint support for OceanOPS;
10. Capacity development for ocean related services;
11. Some connection on future envisioning;
12. Ensure the needed functional connections between DBCP, SOT and WMO.

5. The Group prioritized the expectations from WMO and GOOS in order to identify priority connections and congregate activities. RRR, OceanOPS interface to WIGOS, real-time data sharing (guidelines, procedures under WIS), close relation to the forecasting systems (GDPFS), long-term sustainable support for the ocean observing systems, increase awareness and importance of ocean in Earth System approach are core activities which needs to be highlighted in connections. SG-OOIS aligned these strategic views with WMO Primary Objectives below:

|  |
| --- |
| WMO Primary Objectives |
| Earth System Monitoring – sustainable infrastructure for adequate Ocean observations for earth system monitoring and prediction (network implementation, S&BP, etc.) |
| WIGOS/OSCAR Surface – Integration of Ocean observations information into one overall system to the extent possible (Metadata harmonization/submission, WSI, Quality monitoring, etc) |
| WIS – improving near-real-time data distribution and linking the regional/coastal and global/network data services to improve data discovery and use. Making the quality-controlled data products freely available for the community ((i.e. Open-GTS, MCDS, etc.) |
| RRR – better integrate ocean community in the process to further develop requirements based on application areas |
| Environmental Stewardship – integrate new technologies that reduces the impact to the environment |
| Research to operation – Enhance the science-for-service value chain ensuring scientific and technological advances improve predictive capabilities |
| Capacity Development – Enhancing service delivery capacity of developing countries to ensure availability of essential information and services needed by governments, economic sectors and citizens |

## Alignment of WMO-IOC high-level objectives on their collaboration

6. Based on the Approaches for Collaboration in the WMO/IOC Joint Collaborative Strategy, IOC priorities for WMO-GOOS partnership and WMO Primary Objectives, SG-OOIS aligned high-level objectives for revised Work Programme Priorities. The goal of SG-OOIS activities is to augment IOC/GOOS through WMO members’ engagement and help facilitate the seamless integration of GOOS into the value chain of WMO sponsored and co-sponsored programs in a post-JCOMM world.

| **High-level objective (priority order)** | **SG-OOIS related output** |
| --- | --- |
| **Meeting service needs and responding to change** | Recommendations on how to include ocean observing in the RRR process |
| Recommendations regarding connections between GOOS and appropriate components of the WMO Research for future view |
| Recommendations on connections for GOOS to receive feedback on impact/value of elements of observing system expansion on services innovations to support investment. |
| Recommendations on connections between WMO-GOOS-satellite community and how this integrates with RRR |
| **Supporting and leveraging priority/complementary initiatives in the value chain: Observations** | Recommendations on an optimal structure for efficient functional connections between GOOS and WMO-related bodies and systems – WIGOS, GBON, GDPFS |
| Recommendations on an optimal structure for efficient functional connections between GOOS networks SOT and DBCP and WMO-related bodies and systems |
| Recommendations on the structure in WMO to oversee, main function of connection and identify new or limited needs for connection – a focal point for ocean related issues across the value chain |
| **Supporting and leveraging priority/complementary initiatives in the value chain: Data Management** | Recommendations on an optimal structure for efficient functional connections between GOOS, IODE and WIS WMO-related bodies and systems around frictionless flow of data and metadata across all oceanographic and marine meteorological variables in the WMO Data Policy |
| **Communicating and engaging for mutual strategic reinforcement** | Recommendations on the role and functions of the WMO in relation to the Global Ocean Observing System, including the GOOS Strategy, and Implementation Roadmap, and the Ocean Decade Programmes |
| Recommend functional connections to support the expansion of observations, including in areas under national jurisdiction. (e.g. with SC-ON, GBON, SOFF, WMO Data Policy res 42); |
| Recommendations on how to promote stronger engagement of Members in ocean observations and infrastructure |
| **Taking joint regional approaches** | Recommendations on how to promote stronger engagement of Members in ocean observations and infrastructure |
| Recommendations on functional connections to engage with Members in all regions to regularly review and clarify their requirements related to ocean observations for service improvement |
| Recommendations for the assessment of capabilities of Members with regards to the use of ocean data and ocean observing for services, find potential pilot or project |
| **Cooperation in capacity development where there is mutual benefit** | Recommendations on how to assess capabilities of Members with regards to the use of ocean data and ocean observing for services |
| **Supporting and leveraging priority/complementary initiatives in the value chain: Research** | Recommendations on an optimal structure for efficient functional connections between GOOS and WMO-related bodies and systems, around the area of research, development and future directions |
| Recommendations for some senior level oversight or interaction on this topic |
| **Standards and best practices development** | Recommendations on how to promote stronger engagement of Members in ocean observations and infrastructure, particularly related to Standards and Best Practices. |

# Annex 4: Proposed AG Ocean Terms of Reference

**Purpose**

1. Under the authority of the INFCOM Management Group (MG), the AG Ocean will provide overall coordination on the application of ocean monitoring, including but not limited to observations, data management, data sharing, data utilization and products, to the activities related to the terms of reference of the Infrastructure Commission; it will function under the general terms of reference of advisory groups and carry out relevant tasks, to:

(a) Advise the INFCOM Management Group on ocean observation related matters by translating gathered needs from and for the ocean community into suggested activities of INFCOM bodies – and SERCOM as appropriate – together with the three INFCOM coordinators;

(b) With the support of the WMO Secretariat, provide advice to the INFCOM MG on the integration of ocean information for the delivery of the objectives of the WMO Strategic Plan and making sure functional connections as established by JCB are working, maintained and monitored, including in the engagements with SERCOM, RB (including WCRP and WWRP), GCOS (especially OOPC), JCB, and the GOOS OCG;

(a) Serve as focal point for ocean observing infrastructure: catalyse and support the operationalization of the infrastructure component of the JCB joint strategy and make sure requirements from users are met;

(d) Guide, oversee, and monitor the integration of ocean observations into WIGOS, including WIGOS Station Identifiers, OSCAR, RRR, Status of Guidance, GBON for ocean), the WIS and the utilization of ocean data and integrated products in the GDPFS framework, aligned with the needs of specific services;

(e) Contribute to the delivery of the WMO Operating Plan on all aspects related to ocean by working directly with the relevant substructures of the Commission;

(f) Supports the INFCOM vice-chair in charge of ocean for development of cross-cutting Earth System activities. Establish and maintain mutually beneficial engagements and facilitate the exchange of information on the ocean among scientists and practitioners and between operational and scientific communities of Members and partners, aligned with the scope of work;

(g) Establish the necessary time-limited Expert Teams and Task Teams to support development of integrated activities, within the available resources;

(h) Explore/Establish effective links with regional activities (WRA and GRA’s).

**Composition**

2. The AG Ocean will be comprised of up to 15 experts representing the relevant Expert Teams of all Standing Committees of INFCOM, the Standing Committee on Marine Meteorological and Oceanographic Services (SC-MMO) of SERCOM, RB, WRA, GOOS panels, OCG, GRA’s, and other WMO partners.

AG Ocean will be led by a Chair and a Vice-chair who will be members of the INFCOM MG.

3. The appointment of Chair and Vice-chair and the nomination and approval of membership will be made according to the rules of procedure of the Commission.

4. The engaged experts will be required to cover all components of ocean monitoring systems. The relevant expertise will be required to cover but will not be limited to ground observations, remote sensing and satellite observations, data assimilation, data and metadata management, and relevant data applications. Expert Teams and Task teams will be established as necessary.

**Modalities of work**

* One face-to-face meeting during the intersessional period (i.e. 2-year cycle), prior to the next technical commission session. Otherwise by electronic correspondence and tele/video conference.

5. AG Ocean will continue until the next ordinary session of the Commission and can be re-established if necessary.

**Deliverables**

6. Deliverables aligned with the WMO Operating Plan 2020–2023. The AG Ocean will facilitate relevant Expert Teams activities and will help their operationalization for better outcomes to Members and partners.

# Annex 5: Glossary

| **Acronym** | **Name** | **Description** |
| --- | --- | --- |
| AOPC | Observing Air-Sea Interactions Strategy | Established by GCOS for input concerning atmospheric observations for climate |
| AG Ocean | INFCOM’s Advisory Group on Ocean | See Term of references in this document |
| CEOS | Committee on Earth Observation Satellites | International coordination of civil space-based Earth observation programs and promotion of exchange of data |
| CGMS | Coordination Group for Meteorological Satellites | Group that globally coordinates meteorological satellite systems |
| DBCP | Data Buoy Cooperation Panel | International program coordinating the use of autonomous data buoys to observe atmospheric and oceanographic conditions |
| EEZ | Exclusive Economic Zone |  |
| ET-AC | Expert Team on Audit and Certification, under INFCOM SC-IMT | Assessment of WMO Operational Centres |
| ET-IM | Expert Team on Information Management, under INFCOM SC-IMT | Maintain and develop recommended practices and technical guidance material for information management and data rescue, update standards and guides, develop open-source Climate data management System |
| ET-MOR | Expert Team on MetOcean Requirements, under SERCOM SC-MMO | Defines requirements for marine services |
| ET-SSM | Expert Team on Surface and Sub-surface Measurement, under INFCOM SC-MINT | Develop and maintain guidance material, best practices, standards and specifications related to surface/sub-surface measurements, monitor emerging technologies, promote developments of technologies. |
| ET-SSU | Expert Team on Space Systems and Utilization, under INFCOM SC-ON | Undertake tasks and provide advice on and support for the implementation of the WMO Space Programme Strategy and Work Plan |
| ET-W2WPE | Expert Team on WIS2    WMO Programmes    Engagement, under INFCOM SC-IMT | Implementation of WIS 2.0 taking into account requirements from all WMO programmes. |
| ETOOFS | Expert Team on Operational Ocean Forecasting Systems, under GOOS | Manage the guide on forecast systems, values of ocean products and services from short-term to seasonal forecasting, international standard, … |
| DITTO | Digital Twins of the Ocean | UN Decade program |
| GAW | Global Atmosphere Watch Programme |  |
| GBON | WMO Global Basic Observing Network |  |
| GCOS | Global Climate Observing System |  |
| GDPFS | Global Data Processing and Forecasting System | WMO mechanism for meteorological analyses and forecast products |
| GOOS SC | GOOS steering committee | Govern and coordinate components of GOOS to achieve objectives of the Global Ocean Observing System 2030 Strategy |
| GRA | GOOS Regional Alliances | Integration of national needs into regional systems and deliver benefits of GOOS programmes at a regional, national and global level |
| INFCOM MG | Commission for Observation, Infrastructure and Information Systems (INFCOM) Management Group | Oversight and coordination of INFCOM strategy and activities, appointment of experts |
| IOC | Intergovernmental Oceanographic Commission of UNESCO | United Nations body responsible for supporting global ocean science and services |
| IODE | International Oceanographic Data and Information Exchange | Facilitating exchange of oceanographic data and information between participating Member States, and by meeting the needs of users for data and information products |
| IODE OTGA | Ocean Teacher Global Academy | Web-based training platform for IOC programmes |
| ISC | International Science Council | Non-governmental organization with over 200 international scientific unions and associations as well as national and regional scientific organizations including academies and research councils |
| IWG-SODIS | Intersessional Working Group for Strategy for Ocean Data and information Stewardship | Recommendations on shaping global digital stewardship cultures to support an interoperable digital ecosystem for the Decade |
| JCB | Joint WMO-IOC Collaborative Board | Coordinate, through a quadrennial WMO-IOC collaborative strategy, the collaborative development, integration and implementation of the activities related to oceanographic and meteorological observation, data and information management, services, modelling and forecasting systems as well as research and capacity development carried out by WMO and IOC, provide strategic advice, review workplans, engage with stakeholders. |
| JCOMM | Former joint WMO-IOC Commission for Oceanography and Marine Meteorology, essentially replaced by JCB |  |
| JET-EOSDE | INFCOM’s Joint Expert Team on Earth Observing System Design and Evolution | Redefine and carry out the Rolling Review of Requirements in light of WMO’s Earth System approach, review data requirements, review the implications of SoG, develop the workplan of the WIGOS Vision 2040, review OSCAR, lead GBON implementation and expansion. |
| MCDS | Marine Climate Data System | International exchange, quality control and archival of delayed mode marine climatological data |
| NMHS | National Meteorological and hydrological Services |  |
| OBPS | Ocean Best Practices System | Global system to enhance management of methods as well as support the development of ocean best practices. |
| OceanOPS | Former JCOMMOPS | Joint WMO-IOC International Centre of Excellence for Coordination and Monitoring of Meteo-Oceanographic Observing Systems part of GOOS; Centralization, archiving and open access to metadata, assist and coordinate instrument deployments, communication. |
| OceanSITES |  | Collect, deliver and promote the use of high-quality data from long-term, high-frequency observations at fixed locations in the open ocean. |
| OCG | Observations Coordination Group | Strengthens implementation of GOOS by reviewing, advising on and helping to coordinate 12 global observing networks |
| ODIS | Ocean Data and Information System | Provides an interoperability layer and supporting technology to allow existing and emerging ocean data and information systems, from any stakeholder, to interoperate with one another; enables and accelerates more effective development and dissemination of digital technology and sharing of ocean data, information, and knowledge |
| OOPC | Ocean Observations Physics and Climate Panel | Co-sponsored by GCOS, GOOS and WCRP; scientific expert advisory group charged with making recommendations for a sustained Global Ocean Observing System for climate in support of the goals of its sponsors |
| OSSE | Observing System Simulation Experiment |  |
| RMIC | Regional Marine Instrument Centre | Assist Member States of its region in calibrating their national meteorological standards and related oceanographic monitoring instruments, organize regional instrument intercomparisons, provide advice on instruments performance and maintenance |
| RRR | Rolling Review of Requirements | WMO process for gathering and documenting user requirements on observations in all relevant applications within WMO programmes, and comparison with current capabilities. |
| S&BP | Ocean Standards and Best Practices | Promote development of standards and best practices across the marine meteorological/ocean observing networks, under OCG |
| SC-ESMP | Standing Committee on Data Processing for Applied Earth System Modelling and Prediction, under INFCOM | Develop regulatory and guidance material for GDPFS, support and enhance capabilities of WMO Members to benefit from impact-based and probabilistic products, including training material. SC-ESMP has seven Expert teams and groups. |
| SC-IMT | Standing Committee on Information Management and Technology, under INFCOM | Normative work and technical systems required to improve and increase access to, exchange and management of current and past Earth system observation data and derived products through WIS. |
| SC-MINT | Standing Committee on Measurements, Instrumentation and Traceability, under INFCOM | Develop normative work and technical systems required to optimize the acquisition of Earth system observation data through WIGOS. SC-MINT has nine Expert Teams. |
| SC-MMO | Standing Committee on Marine Meteorological and Oceanographic Services, under SERCOM | Develop proposals for international standards for methods, procedures, techniques and practices in marine meteorology, oceanographic and coastal services. SC-MMO has five Expert Teams. |
| SC-ON | Standing Committee on Earth Observing Systems and Monitoring Networks, under INFCOM | Facilitation of worldwide cooperation in establishment and evolution of surface- and space-based observing networks for making available Earth System data to WMO Applications. Focus on normative work and technical systems including the development of guidance and tools required to achieve the development of WIGOS and its tools. |
| SCOR-OASIS | Observing Air-Sea Interactions Strategy, part of the Scientific Committee on Oceanic Research, under ISC. |  |
| SERCOM | Commission for Weather, Climate, Water and Related Environmental Services and Applications | Leading and coordinating promotion, development and implementation of globally consistent and user-focused hydrological, meteorological and climate services. |
| SOFF | Systematic Observations Financing Facility | New financing mechanism that aims to support and accelerate the sustained collection and international exchange of the most essential surface – based weather and climate observations in compliance with GBON. |
| SoG | Statement of Guidance | Comparison of user requirements with observing system capabilities for a given application in order to draw attention to the most important gaps in observing capabilities, based on RRR. |
| SOT | Ship Observations Team | Coordination of data collection programmes, involving voluntary observing ships and ships of opportunity. |
| SSS | Sea Surface Salinity | One of the Essential Ocean Variable |
| SST | Sea Surface Temperature |  |
| SG | INFCOM Study Group |  |
| TT-GBON | Task Team on GBON Implementation, under INFCOM | Develop technical guidelines, processes and procedures needed to ensure implementation of GBON, and to prepare for effective performance and compliance monitoring of GBON |
| UNEP | UN Environment Programme |  |
| WCRP | World Climate Research Programme | Coordinates and facilitates international climate research to develop, share, and apply the climate knowledge. |
| WDQMS | WIGOS Data Quality Monitoring System | Monitors the availability and quality of observational data based on monitoring information from Numerical Weather Prediction Centres |
| WIGOS | WMO Integrated Global Observing System | Global framework for the management and design tools to optimize Earth System observations and user-driven measurement capabilities. WIGOS components are GOS (Global Observing System, essentially World Weather Watch), GAW, WHOS (WMO Hydrological Observing System), GCW, GCOS and GOOS. |
| WIGOS metadata TT | Aka TT WIGOSMD, under INFCOM/SC-IMT | Develop and maintain WIGOS metadata code lists, review metadata model and representation, develop key performance indicators. |
| WIS | WMO Information System | Coordinated global infrastructure for telecommunications and data management functions, owned and operated by WMO Member; routine collection and automated dissemination of observed data and products, as well as data discovery, access, and retrieval services for Earth System, and related data produced by centres and Member countries in the framework of any WMO Programme |
| WRA | The 6 WMO Regional Associations, part of WMO Governance. | Responsible for the coordination of meteorological, hydrological and related activities within their respective Regions:  Region I (Africa)  Regional II (Asia)  Region III (South America)  Region IV (North America, Central America and the Caribbean)  Region V (South-West Pacific)  Region VI (Europe). |

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1. Main acronyms specified in [Annex 5](#_Annex_5:_Glossary). [↑](#footnote-ref-2)
2. Dependent on AG OCEAN being created (see Recommendation B7). [↑](#footnote-ref-3)
3. WMO-IOC centre with governance based on WMO, IOC and GOOS/OCG [↑](#footnote-ref-4)
4. Main acronyms specified in [Annex 5](#_Annex_5:_Glossary). [↑](#footnote-ref-5)
5. Manual on WIGOS (WMO-No. 1160, Appendix 2.1). Principle 7: Observing network design should use a tiered structure, through which information from reference observations of high quality can be transferred to other observations and used to improve their quality and utility. [↑](#footnote-ref-6)