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INFORMATION DOCUMENT

WMO–IOC JOINT COLLABORATIVE BOARD SESSION REPORT (MARCH 2022) AND WORKPLAN FOR 2022–2023

Second meeting, 1-2 March 2022

Summary

The Joint World Meteorological Organization (WMO) – Intergovernmental Oceanographic Commission of UNESCO (IOC) Collaborative Board (JCB) held its Second Session (JCB-2) online in March 2022. This session was led by the Co-Chairs Dr Albert Martis (WMO) and Dr Srinivasa Kumar Tummala (IOC). The meeting discussed a series of co-developed IOC/WMO presentations, looking at potential areas for collaboration across research, observations, data, modelling, services and capacity development. This gave the JCB a view of progress of over the past year and where joint action could add value. A joint collaborative workplan for 2022–2023 was agreed, further information on which can be found in Section 6 of this report.

Summary Report of the Second Session of

Joint WMO-IOC Collaborative Board (JCB-2)

1-2 March,2022

Executive Summary

The Joint World Meteorological Organization (WMO) - Intergovernmental Oceanographic Commission of UNESCO (IOC) Collaborative Board (JCB) held its Second Session (JCB-2) online through 2 × 3-hour meetings on 1-2 March 2022: see Annex 1 for the Agenda. The JCB Co-Chairs Dr. Albert Martis (WMO) and Dr. Srinivasa Kumar Tummala (IOC) chaired the Session.

Following the adoption of the Joint WMO-IOC Collaborative strategy (2022-2025) by both WMO 73rd Session of Executive Council (EC73) and IOC Assembly 31st Session in June 2021, the expected outcomes of JCB-2 were to:

- Understand the role of JCB in adding value to the joint activities and mutual interest between WMO and IOC.
- Identify gaps/possible areas of strengthened collaboration and to formulate recommendations to address these gaps, and
- Draft the outline of a workplan for 2022 – 2023.

The theme presentations across the full value chain provided the JCB progress of work over the past year and proposed short term priorities for action. The JCB was able to discuss gaps/opportunities, and how /where the JCB can add value. A joint collaborative workplan in 2022-2023 was agreed. Further information can be found in Section 6.

All material and the video recordings of JCB-2, are in the JCB file cloud folder.

1. Opening

The JCB Co-Chairs, Dr. Albert Martis (WMO) and Dr Srinivasa Kumar Tummala (IOC) chaired the Session, with Dr Martis leading on the first day, and Dr Kumar on the second. At the Opening, both welcomed the participants to the Session. Dr Kumar further reminded about the joint WMO-IOC Collaborative Strategy, approved in June 2021 by both WMO and IOC governing bodies, and that this Session is an opportunity to use the guidance of the Strategy to develop a workplan.

Senior Executive from both IOC and WMO Secretariats also gave opening remarks.

Dr. Vladimir Ryabinin, IOC Executive Secretary, highlighted:

- the important role of collaboration between the WMO and IOC,
- that the observing and forecasting systems are key to coupling different models, and
- that more ideas are needed especially with respect to the common work in the earth system approach.

Dr. Wenjian Zhang, WMO Assistant Secretary General highlighted the:

- WMO 18th Session of Congress Resolution 9 about the JCB and the transition from the former Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM),
- incorporation of JCOMM functions into the new WMO bodies, and the important role of JCB to keep the momentum of the WMO-IOC collaboration.
- JCOMM-5 Session (2017) adopted a JCOMM 10 Year Strategy, emphasizing the importance of marine coastal meteorological services, Disaster Risk Reduction (DRR), extreme weather and tsunamis,
- JCOMM legacy, of 20 years of collaboration between WMO and IOC, and
- need for WMO-IOC collaboration to be strengthened and continued.
- Areas of extreme weather, DRR and coastal are important areas of mutual collaboration between WMO and IOC.

The Agenda was approved by all JCB members.

2. Secretariat Report (WMO and IOC)

Dr. Anthony Rea, Director of Infrastructure Department (WMO) and Dr. Emma Heslop, Programme Specialist for Global Ocean Observing System (GOOS) Office (IOC), gave a joint WMO-IOC Secretariat Report. Highlighted by WMO was the concept that the JCB can look at work together in specific areas such as observations, modeling etc., and also in delivery or thematic areas such as extreme weather. The new WMO Data Policy was an example of good collaboration and also important for the future. IOC highlighted several areas of recent and potential future collaboration, including

programmes under the Ocean Decade, followed by a number of forward looking events such as COP 27, where joint presence and/or messaging could be powerful.

3. Introduction of all members

Dr. Martis introduced all the JCB members. He acknowledged the new composition and noted several new members joining since the last meeting in March 2021. Each participant gave a brief introduction. The Table of Participants is in Annex 2. The JCB membership since February 2022 is available here.

4. Theme Presentations

Theme leads were asked to present on 3 aspects:

- A report of joint WMO and IOC activities in the last year
- Proposals for 2-3 short term priorities, and
- Suggestions for how the JCB can add value to the theme work.

Presentations per theme area are available in the JCB filecloud. Each theme discussion is summarized below

Observing Systems (led by Sidney Thurston (WMO) and Toste Tanhua (IOC))

Discussion focused around the following areas as outlined in the presentation.

- Co-Design and co-create: defining what is needed for earth system forecasting, working together on co-design for key thematic areas (extreme weather, coastal issues, carbon) under the Ocean Observing Co-Design programme, link Rolling Review of Requirements (RRR) and Co-Design Exemplar projects, collaborate on articulating what is needed in observations and modelling. Identify and articulate priority co-implementation areas – carbon, air-sea fluxes
- Cooperation at regional/national scales: in addition to co-design of observations, co-support for infrastructure is necessary, there is untapped

potential for collaboration between national meteorological and ocean observing systems / institutions

- Communications/engagement through joint thematic seminars: providing information and supporting deeper cultural change. The data team also highlighted this need, and would like to collaborate/contribute to the proposed series of joint thematic online seminars.
- Potential links between WMO and IOC in Ocean Decade Programmes; there would be mutual benefit to be gained from WMO connection with all the GOOS Ocean Decade Programmes; Ocean Observing Co-Design, Observing Together, and CoastPredict
- Operational/sustainable base for observations: move from heavy reliance on short-term research funding, ocean observations need to become more operational, exchange between WMO and ocean communities to support ocean space becoming more operational.
- Ocean observations most needed by ocean-atmosphere prediction: sea-level pressure, SST, Argo, air-sea fluxes, marginal ice zones, etc.

Data-Processing & Management (led by Jeremy Tandy (WMO) and Sergey Belov (IOC))

An overview of WMO-IOC activities for 2021-2022 was provided. From the WMO point of view this was to:

1. Communicate and engage for mutual strategic reinforcement.

Engagement between INFCOM/Standing Committee on Information Management and Technology (SC-IMT) and IOC teams:

- common technical approaches to data sharing, discovery and access across WMO Information System (WIS)2 and the IOC Ocean InfoHub (OIH)/Ocean Data and Information System (ODIS)
- stakeholder engagement

2. Develop standards and best practices

WMO Unified Data Policy (Res.1)

WIS2 Tech Regs (for submission to INFCOM-2, Nov 2022) – aligned with ODIS

WIS2 demonstration projects:

- Open Global Telecommunication System (GTS)
- Exchange of CF-NetCDF data for marine observing platforms

Adoption of CF-NetCDF profiles for marine and radar data – experimental, Decision 21 (INFCOM-1)

3. Meet service needs and respond to change.

The WIS2 initiative seeks to improve data sharing for all WMO activity areas – including marine meteorology and oceanography; for real-time and "durable" datasets.

4. Support and leverage priority/complimentary initiatives.

Focus of SC-IMT covers current and future data sharing ecosystems:

- Current – approval of new data formats favoured in marine and oceanography community (CF-NetCDF)
- Future – development of WIS2 using approach that is harmonised with ODIS

An overview of IOC activities for 2021-2022 included:

IOC International Oceanographic Data and Information Exchange programme (IODE) continued to promote and expand on the work being done through GOOS, IODE, Ocean Best Practices System (OBPS), Ocean InfoHub (OIH) etc.

- More work has been done to improve awareness beyond government institutions and current stakeholders
- The IOC Ocean InfoHub (OIH) pilot project was started in 2020 as a startup activity of the IOC ODIS with pilot work focusing on three regions (Africa, Latin America, PSIDS) and developing a range of tools and training available for those who want to link their system to ODIS.
- IOC/IODE successfully registered proposed actions to the UN Decade of Ocean Science for Sustainable Development:
    - E-DNA expeditions in marine World Heritage sites

- Ocean Practices for the Decade
- OceanTeacher Global Academy: Building Capacity and Accelerated Technology Transfer for the Ocean Decade
- Pacific Islands Marine Bioinvasions Alert Network (PacMAN)
- An ODIS supporting the UN Decade of Ocean Science for Sustainable Development – OceanData2030

IOC Proposals submitted in cooperation with IODE:

- The World Ocean Database Programme (WODP): Openly discoverable, accessible, adaptable, and comprehensive digital global profile oceanographic data of known quality
- CoastPredict - Observing and Predicting the Global Coastal Ocean
- In progress: IODE Project Office as Decade Coordination Office for Ocean Data

Dr Belov provided an overview of coordinated WMO-IOC activities 2021-2022**:**

1. Communicate and engage for mutual strategic reinforcement.

Broader engagement between WMO and IOC activities such as GOOS, IODE, OBIS, Global Ocean Science Report, World Ocean Assessment, LME: LEARN, HAB, Ocean Literacy, etc.)

2. Develop standards and best practices.

- **share best practices and information** through outlets such as the OBPS and through publications and workshops and conferences
- **ensure involvement** of global networks and making use of the OBPS and ensuring that methods are reproducible and best practices are accessible and that key stakeholders are reached
- **support data providers** in setting up such services close to the acquisition
- **support open data policy** on core EOVs for Operational Oceanography

3. Meet service needs and respond to change.

- **need for a common understanding of FAIR and CARE** in practice for ocean data, including best practices and tools and the capacity and capability building to allow their use.
- cloud based solutions for hosting data and fast processing are seen as complementary service to basic data infrastructures and federated data portals
- Innovative data and information products rely on commonly agreed metadata standards, community-based quality control mechanisms

4. Support and leverage priority/complimentary initiatives.

- to facilitate multinational programmes
- Moving beyond a linear marine data value chain towards a digital ecosystem with feedback loops operationally connecting users with data providers and enhancing the speed and impact of marine data, for all e.g., a data system should not be a silo that just absorbs data, but a backbone that carries such information from users back to the observing system

5. Cooperate in capacity development where there is mutual benefit.

- The UN Ocean Decade has a vision to deliver transparent, accessible and inclusive ocean data and information, for all;
- Open data is not necessarily equitable data and training and capacity development is crucial so that individual nations have the capacity to manage their own data and can generate the knowledge needed for local needs
- Capacity for data stewardship should be developed as close as possible to the data collection / management as possible.

6. Take joint regional approaches

- sharing local programs regionally and internationally - set up and share best practices and toolkits and train the trainer workshops
- regional data services, and governance mechanisms of the UN Ocean Decade e.g. Strategy for Ocean Data and information stewardship and the UN Ocean

Decade Data Coordination Group, and activities including the UN Ocean Decade Collaborative Centres, programmes, actions and wider community

Dr Belov noted that the current marine data landscape is very complex and confusing to stakeholders and users: more efforts are needed to clear communication as to what the different platforms, data brokers/services provide, and for whom, the data flows and properties of the data and services, but also communicating about limitations, what is not provided.

Regarding the proposal for two priority focus areas within the data theme, separate views were provided from both WMO and IOC:

- *WMO perspective*
- Implementation of WMO Unified Data Policy (Resolution 1)
- WMO Information System 2.0 (WIS2)
    - Development of Technical Regulation for submission to INFCOM-2 (Nov 2022)
    - Development of WIS2 implementation plan, including transition from GTS/WIS1 to WIS2

- *IOC perspective:*
- Revision of IOC Oceanographic Data Exchange Policy (for adoption by IOC Assembly in June 2023)
- Promoting jointly developed «ocean data map»
- WMO and IODE to collaborate on the global data ecosystem under decade and using ODIS and WIS
- Fostering the development and wider use of multi-community best practices
- Coordinated capacity development activities on data management

In considering how the JCB can advise and strengthen activities, the WMO and IOC theme leads provided the following suggestions:

- *WMO perspective -- Cross-cutting:*
- Leveraging JCB members in developing and executing the WIS2 and ODIS implementation plans – user their networks to ensure that we're engaging the right people, providing the right support, hearing the challenges from marine and oceanography stakeholders
- Incorporate IOC stakeholders in development of WIS2 implementation plan
- Identify opportunities for joint WMO-IOC regional initiatives to support implementation of WIS2 and ODIS.
- *IOC Perspective -- Cross-cutting:*
- Co-design and co-development of the IOC ODIS
- Coordinate the data-related activities under the UN Decade of Ocean Science for Sustainable Development (2021-2030). Invite WMO INFCOM experts to join the IODE INTER-SESSIONAL WORKING GROUP TO PROPOSE A STRATEGY ON OCEAN DATA AND INFORMATION STEWARDSHIP FOR THE UN OCEAN DECADE (IWG-SODIS)
- Membership of GOOS and IODE experts in ET-IM, ET-AC and ET-W2WPE

After the WMO and IOC theme lead presentations, the discussion that followed raised several topic points including:

- The Digital Twin and its link to the JCB. It was noted that
    - it's still a "thing" that needs better definition, for example 'how is it different from data assimilation? where does it fit? maybe in research field?'.
    - Mr Tandy has not yet been able to identify digital twins in DM area.
    - Dr Belov indicated that these will form products for decision makers, which is important. These applications are only possible through advanced interoperability so Digital Twin is cross-cutting from

observation, through data management to products. Therefore, the ocean value chain should be involved.

- Regarding standardization in data assimilation, one of the things observed: identified syntactic standards have been identified. In WMO there are code tables but between modelling centres, but there is a need to better harmonize.
- Comments that data is essential: good data then good output.
- There is obvious need for WMO and IOC collaboration, so that data formats can be dealt with. On content side, WMO has manuals that list what forecast fields should be produced, for example, horizontal resolution. However, that leaves a lot still for interpretation. WMO still struggles with some standards, although experts and agencies have some experience to get all these into a few WMO projects.
- Theme leads Mr Tandy and Dr Belov both indicated that working better with all teams will be important, and this cooperation will be key especially given that this is the beginning of long path.

Forecasting Systems (led by David Richardson (WMO) and Fraser Davidson (IOC))

From IOC perspective, Mr Davidson reported recent JCB activities on the various aspects related to the prediction and from WMO perspective, Dr Richardson reported the progress of the development of the Seamless Global Data-processing and Forecasting System GDPFS (S/GDPFS) Roadmap toward Earth System Prediction. They also proposed potential activities to be addressed such as the improvement of ocean prediction of the GDPFS, full Earth system verification symposium and review of the user requirements. They summarize that the Decade could be impetus for solidifying and mutualizing the ocean component as part of S/GDPFS. The discussion focused around several areas:

- Development of an international ocean data processing and forecasting facility for the ocean, similar to ECMWF. Important focus areas for this for the future will be marine spatial planning, in line with the output from the High Level Panel, this will be important to modelling and Digital Twins.

- The concept of delivering unified services from GDFPS. Such system is important, the user does not want to gain information from 3 different sources.
- Copernicus was highlighted and discussed as an example of an integrated modelling structure. Its success is as an integrated modelling structure with a user interface, such a system on the ocean side would be valuable to deliver services. The point was made that Copernicus delivers unified data sources for 'services' in a WMO sense, Copernicus does not take responsibility for the services it supports.
- The need to look at how ocean and met modelling systems work together, the needs of and for coupled systems are growing exponentially, however society will not afford two such systems, it is important that the two communities (and JCB) consider carefully how we do this.
- Services need to be the driver of the development of S/GDPFS, but at the same time, GDPFS should be the driver of data/observation requirements.
    - The WMO Workshop on the Impact of Various Observing Systems on NWP that WMO develops every 4 years is an important area for collaboration, this is where the guidance for observing and modelling community is developed. It is important that this is a locus for collaboration for an earth system approach, collaboration across WMO and IOC, and across research and operational communities.
    - The need to always be cognizant of the value chain, the links from observations through data and modelling systems to delivery of services. Service delivery is the driver.

Services (led by John Parker (WMO) and Alexander Frolov (IOC))

The Services theme was jointly presented by the two leads, Mr Parker (WMO) and Dr Frolov(IOC). Several joint activities over the past year were highlighted including the IOC representation on the Standing Committee for Oceanographic and Marine Meteorological Services (SC-MMO) and likewise, the WMO representation on the IOC Tsunami and Other Hazards Working Group (TOWS-WG). There have also been several events during the year, led by WMO, where IOC have been invited as

participants to present on the ocean services work of mutual interest. As well, WMO Marine Services Division was able to visit the IOC Secretariat in Paris, and Ocean-OPS in Brest for discussions to strengthen the mutual activities.

With the guidance of the WMO-IOC Strategy, two short range joint proposals, which could be progressed using existing WMO and IOC mechanisms were presented:

- Strengthening the response and resilience to coastal flooding hazards for coastal communities; and
- Advancing ocean prediction and forecasting to the benefit of end-users.

Both proposals are cross-cutting between services, forecasting and observations. The value of developing products for both of these short range priorities will be mutually beneficial to both WMO and IOC Members/Member States. Additionally, keeping sight on the needs of the stakeholders is paramount.

The JCB Services representatives also suggested areas where the JCB could add value, which included that it is a mechanism for cross-cutting discussions – not just WMO Service to IOC Service (which is already underway in existing mechanisms) but the value of services link across all areas of the value chain. It was noted that the JCB would be a great strategic think tank from which potential proposals can be mooted, within reason of available resources (both human and financial). The JCB plays an important role to ensure that WMO and IOC can collaborate for the mutual benefit of Members/Member States, especially those that are the same for both, and/or for strengthening collaborations between national agencies within countries.

Research (led by Matthew Wheeler (WMO) and Lisa Alexander (IOC))

Drs Lisa Alexander and Matt Wheeler reported on the research theme coordinated by WMO and IOC in 2021. The presentation started with a brief description of the new activities of the World Climate Research Programme (WCRP - co-sponsored by WMO, IOC and International Sicence Council (ISC)) focusing on regional oceanic scale and its involvement in the Digital Twins of the Ocean as well as the joint WCRP-World Weather Research Programme (WWRP) S2S (Subseasonal to Seasonal) activity.

The relevant WMO Research Board's activities were also summarised, such as their work on six Concept Notes as well as coordination with ocean experts on Earth System Modelling and Observations. Contributions from WWRP and Global Atmosphere Watch (GAW) on ocean activities such as WWRP's CoastPredict proposal for the Ocean Decade, Tropical Cyclone Probabilistic Forecast Products workshop and GAW's role on measuring atmospheric composition over ocean.

It was pointed out that the S2S and PPP (Polar Prediction Programme) activities were ending in a few years following which WWRP will be focusing more on coupled predictions at NWP time scales and data assimilation.

The following priority focus areas for 2022-2023 were then summarized:

1. Enhancing science to predictions and services:

various ongoing work to enhance science to provide solutions for action were mentioned such as ultra-high-resolution and advanced Earth system modelling (ESMO, Digital Earth, CMIP, CORDEX, WGNE), observation-model-data prediction integration, prediction efforts at subseasonal to interdecadal time scales (WGSIP, S2S), attribution and assessments of hazards classes etc.

2. Ocean observing system design and ocean monitoring:

under this, improving observations for coupled data assimilation has been identified by the WMO Research Board concept note as one of the focus areas. Two other priorities were coordinating and standardizing CO2 observations over the ocean as identified by GAW and enhancing regional ocean observing system through collaborative programs (as identified by WCRP).

3. Bringing research communities together:

For this, the suggestion was to engage with the UN Ocean Decade, and to continue WMO-IOC collaboration through co-sponsored research activities. As well, it was emphasized that collaboration should be strengthened through participation in listed future scientific meetings and conferences of mutual interest.

Regional Cooperation and Capacity Development (CD)

Regional and capacity development are both cross-cutting themes that reach across the entire ocean value chain. Several presentations were given, including from Mr Omar Chafki (JCB member on the WMO Capacity Development Panel), Mr Peter Pissierssens (UNESCO/IOC Project Office for IODE and IOC Capacity Development Coordinator) and Mr Rodney Martinez Guingla (WMO Member Services, Costa Rica Office).

Mr Omar Chafki provided overview on the current review of the WMO Capacity Development Strategy, which was initially implemented in 2015. As per WMO EC's request, the review takes into account WMO community platform and how CD needs of NMHS can be better understood, as well as the involvement of WMO regional training centers and training partners. He presented the timeline of the review and highlighted the comments and suggestions received. The feedback received suggested keeping the document not too theoretical and focusing more on strategy and shortening its length in half. He also shared some of the challenges such as delay in receiving feedback and the need to balance high level and detailed information in the Strategy. As for the way forward, he mentioned recruitment of new NOAA personnel and short-term contractor to help in the completion of the writing. He ended his presentation by asking to send in additional comments and feedback related to the Strategy by March 2022 to John Ogren.

Mr. Peter Pissierssens presented an overview of the IOC CD Strategy 2015-2021. He noted 6 outputs including:

- Human resources developed
- Access to physical infrastructure established or improved
- Global, regional and sub-regional mechanisms strengthened

- Development of ocean research policies in support of sustainable development objectives promoted
- Visibility and awareness increased
- Sustained (long-term) resource mobilization reinforced

He shared that the 31st Session of the IOC Assembly decided to revise the IOC CD Strategy and a Working Group was established to work on a new draft, taking into account the following CD developments:

- Outcomes of the 2nd IOC Capacity Development Survey (September 2020 - January 2021);
- Capacity Development Chapter of the Implementation Plan of the UN Decade of Ocean Science for Sustainable Development (2021-2030);
- Consultations with IOC global and regional programmes related to Capacity Development;
- Consultations with UN specialized agencies, non-UN IGOs, Global and Regional organizations, programmes and projects, NGOs and private sector partners.

He emphasized that in addition to preparation of draft CD Strategy to be submitted to the IOC Assembly at its 32nd Session in June 2023, the Group of Experts is also tasked to prepare a proposal to promote visibility and reach of the revised IOC CD Strategy so that its target audience will read through and appreciate the document as a guide in implementing capacity development activities.

Mr Pissierssens then introduced the OceanTeacher Global Academy (OTGA) as a tool that IOC developed under IODE as its training platform. From one single training center, the OTGA has now evolved into a network of 17 Regional and Specialised Training Centres. In the framework of the UN Decade of Ocean Science for Sustainable Development, OTGA contributes to Decade challenge 9, by providing relevant and customised training on the different topics and these are delivered in various languages catering for local needs. The COVID19 pandemic triggered a fundamental change to ensure that education and training did not stop. Due to the pandemic, OTGA has become more and more an e-platform for self-learning with

blended learning formats. OTGA is ready to deliver the training needed to for the Ocean Decade and beyond.

Mr Rodney Martinez Guingla's presentation focused on ocean-related activities in RAIII and RAIV which allowed the audience to understand the point of view of these two regions and end users aligned to the JCB meeting. Noted that since 2020, oceanside events were included in the discussions of RAIII and RAIV where many professionals participated and discussed several recommendations.

For RAIII, focused on Eastern Pacific, indicated oceanographers and meteorologists from the region had a great response and discussed 3 important aspects: Ocean-climate nexus, Observations, and services. Also, the participants gave several recommendations and identified the needs regarding the creation of a roadmap and technical group, ocean observations promoting data change, promoting collaboration, and taking opportunities in the region.

After the ocean side event, WMO organized a technical online seminar where it was a massive response from the participants from the whole region and other regions. In this event, it was reviewed the advances in ocean observations and potential collaborations with other initiatives of the Tropical Pacific Observing System (TPOS) and other regional associations to identify research areas for improving ocean services, especially, services for Early Warming Systems in a highly vulnerable area. As well mentioned, the main challenges and opportunities in the region, since this is a region with strong knowledge and research community and historical data, but improvement of data exchange and cooperation is needed. In that sense, it is important to promote regional engagement and institutions and contribute to global systems.

In the case of RAIV Caribbean, he indicated that there is more development with the framework of the members, in the last members meeting they adopted a resolution to strengthen ocean services, also, they established the RAIV Expert Team on Marine Meteorology and Oceanography (ET-MMO). Many aspects were discussed on the ocean side events: 1) improved coastal marine services, 2) coastal hazards, and

multi-hazard early warning systems, 3) research and capacity development, 4) maritime safety and polar, 5) international and regional cooperation. Also, there were some key recommended actions that included: highlight the weather-climate linkage in Earth System Approach, fully coupled modeling, forecasts and services, and strengthen integrated ocean observations and open data exchange to meet the greater need for quality early warmings, forecasts, and services, for regional stakeholders.

Therefore, WMO organized a technical online seminar in the Caribbean area and meteorologists and oceanographers from 25 countries participated to analyze the gaps in the region. These included critical variables required to be observed in real time data, improving marine forecast and coastal, coordination and integration ocean observations efforts. As well, the challenges and opportunities to improve operational and ocean services in the Caribbean region and some ideas of fostering coordination on observations efforts with regional organizations (e.g., Caribbean Meteorological Organization and Caribbean Community-CARICOM); also, development a regional strategy to strengthen regional observations.

Finally, Mr Martinez shared the activities /next steps planned for RAIII and RAIV on operational and ocean services, which includes the mapping of institutions and projects on ocean issues ongoing in both regions: meetings with regional organizations (e.g., TPOS and the Permanent Commission for the South Pacific(CPPS)), establishment of RAIII Task Team on Marine Meteorology and Oceanography, participation in upcoming event OSC on Eastern Boundary Undercurrents System in Peru, implementation of activities of ET-MMO (2022-2023), execution of marine training course in RAIV, identification of funding opportunities in the region and increase cooperation between WMO and IOC to put together needs of services to close gaps in the region.

Following the 3 presentations, the JCB discussed various points of interest including:

- Leveraging synergies between WMO and IOC RTCs (Michel Jean – INFCOM President), and link to WMO Global Campus (Estelle De Coning, WMO Science). Peter Pissierssens noted that there were regular meetings with WMO before

the pandemic, and this needs to be picked up again to see how to mutually enforce collaboration with IOC. He suggested WMO to look at possible joint courses that can be organized on the OTGA platform as well as pooling experts between regions where WMO has more available expertise, for example bringing oceanographers and meteorologists together and supporting their respective capacity development. Yinka Adabayo (WMO Member Services) reiterated Peter Pissierssens' points and expressed interest in picking up again discussions with Peter 3 years ago. Peter Pissierssens suggested continuing the discussions and proposed visiting WMO to discuss potential collaboration.

- Ian Lisk (SERCOM President) added that in terms of bringing different disciplines together, atmospheric also needs to be brought in. One challenge for cross-discipline approaches is the need for coordination.
- Vladimir Ryabinin (IOC Exec Secretary) noted that while OTGA is very promising, it is developed as a project, and what WMO can bring in is more stability for OTGA as it may also help advance capacity development of WMO.
- Fraser Davidson (JCB) mentioned about the need for CD to use digital earth. He emphasized it is important and to start anticipating related CD needs instead of waiting for it to be well established.
- Michel Jean (INFCOM President) raised the need to involve decision makers and policy makers and providing training targeting them. Lisk (SERCOM President) added that various communities should work together and design CD training targeting policy and decision makers.
- Peter Pissierssens (IOC-IODE) referred to OTGA and OIH/ODIS as tools available to train middle level decision makers and higher as end-users. CD needs to focus more on training them and repackage to make it more attractive to policy makers.
- Yinka Adebayo (WMO Member Services) reiterated the importance of training provided by local and designated experts, delivered by institutions designated to deliver training and impact activities on the ground.
- JCB Co-Chair Dr Kumar shared experience in India where INCOIS hosts 2 centres and OTGA RTC. These mechanisms where both centers are in the same

ministry and exchanging information is very important. He suggested INCOIS experts to be trained at WMO centers and vice versa.

- Vladimir Ryabinin (IOC Exec Sec) mentioned that Ocean Literacy is oriented towards different targets such as schools, private sectors, and including decision makers, among others.
- Mr. Omar Chafki (JCB) added that related to service delivery, it is important to shift to a solution provider and give users what they need.

Suggestions for how the JCB can add value indicated:

- Better communication of regional focal points between WMO and IOC to address regional needs
- Improve existing WMO-IOC Regional collaborative mechanism to Deliver as one (e.g., IOC OTGA and WMO Regional Training Centres (RTCs), regional GOOS)
- Consolidate online training resources
- Synergy between IOC CD strategy and WMO CD Strategy and implementation at regional level
- Public-Private Engagement for project proposals
- Mutual CD collaboration for stability and advancement
- Engage met/ocean community with decision makers, budget, admin et al with CD activities
- Mobilize institutions at the regional level
- Organize meetings between IOC and WMO

5. Discussion – How can the JCB add value to all these themes/Identified Gaps and Potential to Address

Having seen all the theme presentations, Agenda Items 5 and 6 were combined into one discussion. This allowed the JCB time to consider the various ideas and suggestions for the way the JCB can add value to the benefit of the themes, and other proposed work of mutual interest the WMO and IOC; and respective

Members/Member States. As well, gaps were identified and ideas for actions to address these gaps. This is summarized below:

Observations

Gaps/Priorities/Opportunities	How can the JCB add value
• Observations in Areas under National Jurisdictions - MSR Consent process is incompatible with operational oceanography • **Ocean Decade**: Observing Co-design; Observing Together; CoastPredict - GOOS-Co-Deign will provide an opportunity to increase collaboration between IOC-WMO with mutual benefits. • **GBON** – cover basic ocean observations as part of atm observations. **GOOS Co-Design** of a fit-for-WMO ocean observing system – Eg. Hurricane, carbon accounting, etc. for sustainable observation. • **Strengthen regional and national agency collaborations between WMO and IOC on Ocean Obs** - Co-design, Co-create and Co-evaluate - Opportunity to increase cooperation between Met and Ocean agencies through increased visibility of WMO and IOC • Observational requirements - Balance between science and operational needs; coupled ocean atmospheric modelling 2 March 2022	• Synergy between RRR process and GOOS Co-Design • Ocean Carbon Observing • JCB Webinar Series – WMO & GOOS • Public Private Engagement • Enhance Coordination between all JCB themes • Establish strong links between JCB, GOOS-SC and TOWS-WG (e.g. Smart cables) • Promote collaboration with CEOS/CGMS and GOOS

JCB Obs (Sid Thurston): was pleased with IOC presentation on OTGA and suggests that he would like to work with OTGA for observations. educate regional players but also garner resources to fill the gaps. we can identify gaps through the training. he likes the regional approach.

JCB Services (Frolov): reference to smart cables and the value for tsunami early warning.

JCB Obs (Tanhua): acknowledge the pilot project on Smart Cable, and offer support from GOOS, while noting the bullets 2,3,4 especially GBON and GOOS Co-Design of the highest priority for collaboration between WMO and IOC. He highlighted the importance of the regional collaboration in designing the observation networks.

WMO Secretariat –Satellite (Kenneth Holmlund): reference to space-based observations and that there is dependence on space agencies. CEOS has many relevant programmes.

WMO Secretariat – Member Services (Rodney Martinez): notes that we cannot separate obs from services. need to co-organize meeting wmo-ioc TO REALLY REACTIVATE institutional cooperation. we need decisions at regional level where wmo and ioc can contribute. need dialogue.

JCB Data (Jeremy Tandy): asked how gaps/priorities/opportunities address long-term sustainability of observation systems which are often managed by research programmes.

JCB Obs (Thurston): GOOS has been effective for 3 decades. that is baseline. academic communities have been sustaining this. we want to weave GOOS into more sustainable approach. GBON could do this to drive long-term sustainability of the obs system.

JCB Obs (Tanhua): need to formulate what are requirements for "basis" obs system and take that to governments.

Data Processing and Management

Gaps/Priorities/Opportunities	How can the JCB add value
• Implementation of WMO Unified Data Policy and Revision of IOC International Oceanographic Data Exchange Policy • Promote jointly developed <ocean data map> • WMO & IODE to collaborate on the global data ecosystem under Decade through ODIS and WIS • Foster the development and wider use of multi-community best practices • Coordinate Capacity Development on data management	• Leverage JCB members in developing and executing WIS 2.0 and ODIS implementation plans • Incorporate IOC stakeholders in development of WIS2 implementation plan • Identify opportunities for WMO-IOC regional initiatives to support implementation of WIS2 and ODIS • Co-design and co-development of IOC ODIS • Coordinate data -related activities under UN Decade - Invite WMO INFCOM experts to join IODE IWG-SODIS • Membership of GOOS & IODE experts in ET-IM, ET-AC, ET-W2WPE

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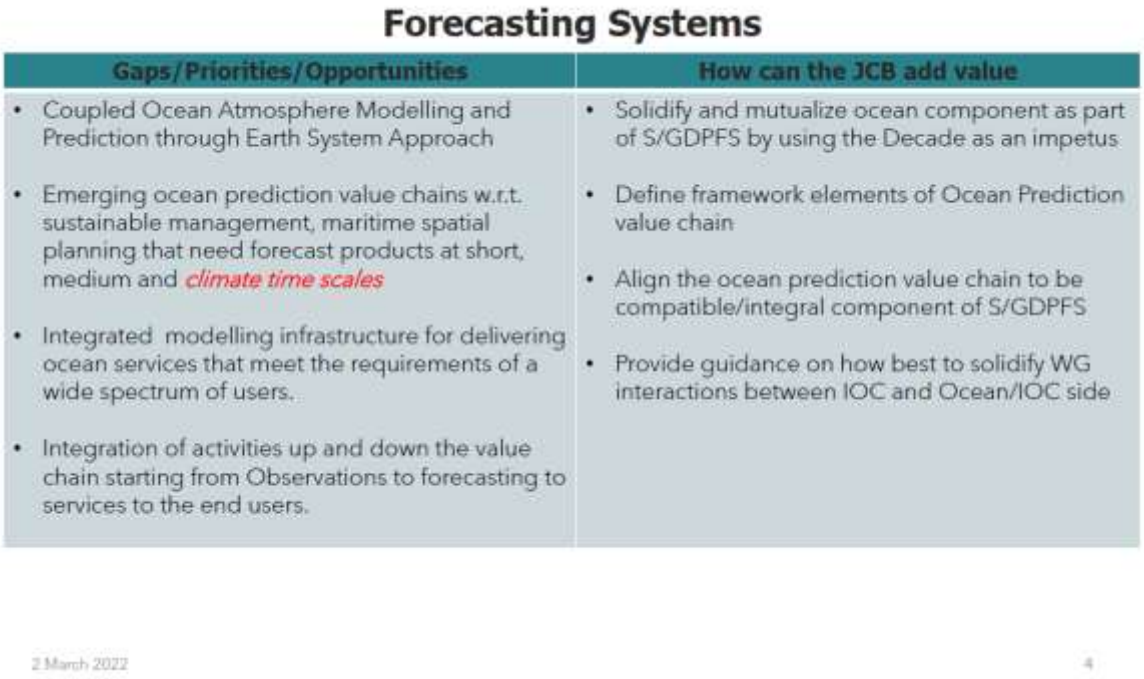
JCB Data rep (Belov): clarify it is IOC International Oceanographic Data Exchange Policy. Reference the JCOMM DMA requesting gap analysis. He asked for further revisions so critical priorities are included.



Forecasting Systems

Gaps/Priorities/Opportunities	How can the JCB add value
• Coupled Ocean Atmosphere Modelling and Prediction through Earth System Approach • Emerging ocean prediction value chains w.r.t. sustainable management, maritime spatial planning that need forecast products at short, medium and *climate time scales* • Integrated modelling infrastructure for delivering ocean services that meet the requirements of a wide spectrum of users. • Integration of activities up and down the value chain starting from Observations to forecasting to services to the end users.	• Solidify and mutualize ocean component as part of S/GDPFS by using the Decade as an impetus • Define framework elements of Ocean Prediction value chain • Align the ocean prediction value chain to be compatible/integral component of S/GDPFS • Provide guidance on how best to solidify WG interactions between IOC and Ocean/IOC side

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President SERCOM (Lisk): asked for explicit regarding the 'extended time scales' to consider the climate change

JCB Prediction rep (Fraser): agreed to change to 'climate time scales'

Services

Gaps/Priorities/Opportunities	How can the JCB add value
• Create a framework to globally address coastal inundation, marine env emergencies, and hazardous maritime and coastal weather events into a MHEWS • Strengthen the response & resilience to coastal flooding hazards for coastal communities *including tsunamis* (cross cutting b/w services, forecasting & obs)" - improve operational capabilities of existing global TWS; promote sharing of data (bathy, topo, satellite, sea level); improving coastal modelling & products in coastal zones. • *How to communicate and disseminate the coastal warnings better* • Mechanisms - TOWS-WG, ODTP-SC, SERCOM (SC-MMO, SC-DRR, SC-HYD), INFCOM (SC-DIM), GOOS ETOOFS, WCRP, *WWRP*, GLOSS • Advance ocean prediction & forecasting to benefit end-users (cross cutting b/w services, forecasting & obs) (Ocean-Atm coupling including Sub-seasonal to seasonal, coastal, sea ice predictions; improving products for end users eg. shipping, coastal communities, fisheries, env. emergency response; and implementing digital transformation of met-ocean service where appropriate) • Mechanisms - WMO SERCOM (SC_MMO) and INFCOM (SC-ESMP), GOOS ETOOFS, WCRP, GDPFS, *WWRP*	• Forum for Crosscutting discussions • Utilize existing mechanisms and subsidiary bodies to connect the collaboration between WMO and IOC on priority activities • Potential Proposals - within reason of available resources • Reduce duplication and confusion, especially for joint WMO and IOC Member / member States - strong collaborations between national agencies within Member States

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JCB Services (Frolov) : notes the two top priorities for collaboration as concrete steps, using existing systems eg. GTS and consider interoperability.

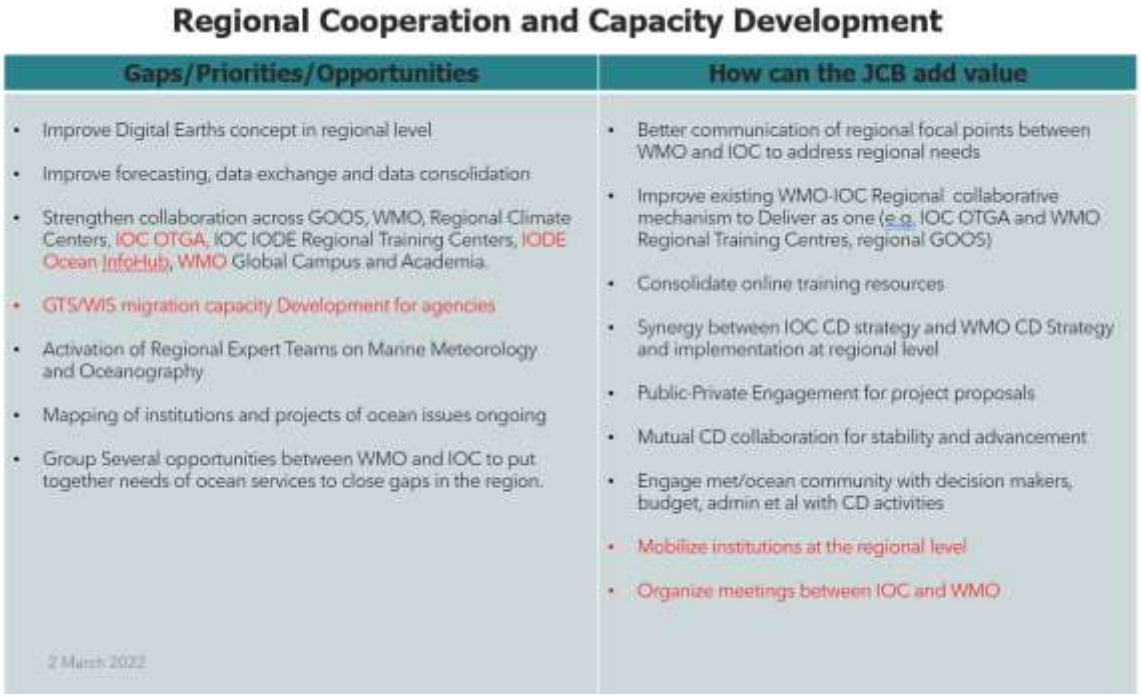
JCB Services (Parker) : notes the communication and dissemination of coastal warning services; need to make sure we represent the end user requirements for ocean predictions.

Research

Gaps/Priorities/Opportunities	How can the JCB add value
• Enhancing Science to predictions and services: Science to provide solutions for action; integration of observation model data prediction; ultra-high-resolution modelling; sub-seasonal to interdecadal prediction; advance earth system modelling; attribution and assessments of classes of hazards; Tipping elements, irreversibility and abrupt change • Ocean observing system design and ocean monitoring • Improving observations for coupled data assimilation; Coordination and standardization of CO2 observations over the ocean; Ocean observing system design • Bringing research communities together: Atmospheric and Oceanic researchers; engage with Ocean Decade, research capacity in developing countries; enhance links and integration beyond WMO and IOC; participate in meetings, conferences, workshops and summer schools 2 March 2022	• Facilitate integration across models and observations in the coupled atmosphere-ocean system. • Facilitate the co-design of services and products including a discussion of new products from research • Engage with the UN Ocean Decade. • Review if the ocean community has been surveyed on systematic errors • Improve collaboration with the ocean community on the lack of atmospheric composition observations over the ocean. • Building research capacity in developing countries by supporting regional panels • Jointly engage to improve Sea ice thickness monitoring and modelling • Better communication with *products uncertainties (risk and science) to support services*

JCB Prediction (Fraser): notes communication with products uncertainties, that probablistic products are part of it.

JCB Service (Parker): acknowledge the efforts to jointly engage to improve the sea ice thickness monitoring and modelling; notes the communication of risks and uncertainties could benefit services within JCB framework.



JCB Data (Tandy): notes the GTS/WIS migration in regional capacity development strategy.

WMO Secretariat – Member Services (Rodney Martinez): proposes to mobilize the institutions at the regional level, supported by both WMO and IOC and co-host meetings

6. Next Steps - Workplan 2022-2023

The following identified items comprise the JCB workplan for 2022-2023 and way forward, including:

- Establishment of JCB Webinar Series across the value chain
- Development of proposals for Satellites Ocean position white paper
- Enhanced synergy between GBON/RRR process and GOOS Co-Design to promote sustainability observation
- Increased focus on ocean carbon research and observing capacity and design
- Joint development of an ocean data map

- Collaboration on interoperability between IOC/IODE OIH/ODIS and WMO WIS: Enhanced involvement of all JCB members in developing WIS 2.0 and ODIS imp. Plan and regional initiatives
- Collaboration between IOC/IODE and WMO on ocean best practices (IOC OBPS)
- Harmonization WMO and IOC data policy, guidance and consultations
- Strengthened response & resilience to coastal flooding hazards for coastal communities including tsunamis
- Advancement of ocean prediction & forecasting S/GDPFS to benefit end-users and Members
- Increased venues for marine meteorology and oceanographer expert community to come together at regional/local level in addition to increasing the involvement of decision makers
- Co-hosting of big ocean events between WMO and IOC and co-lead in other big event/conferences (e.g. COP)
- Increased regional collaboration between WMO and IOC (e.g. Ocean Side Event)
- Intensified leveraging of existing strategic plans from WMO and IOC to achieve stronger contribution
- Generation of link and harmonization of CD activities/ programmes/ strategies of WMO and IOC :
    - Better communication of regional focal points between WMO and IOC to address regional needs
    - Improve existing WMO-IOC Regional collaborative mechanism to Deliver as one (e.g., IOC OTGA and WMO RTCs, regional GOOS)
    - Consolidate online training resources
    - Synergy between IOC CD strategy and WMO CD Strategy and implementation at regional level
    - Public-Private Engagement for project proposals
    - Mutual CD collaboration for stability and advancement
    - Engage met/ocean community with decision makers, budget, admin et al with CD activities
    - Mobilize institutions at the regional level

- Organize meetings between IOC and WMO

7. Closure of the meeting

The meeting was closed with statements from the two Co-Chairs, and the WMO and IOC Executives.

Both Co-Chairs thanked everyone for their contribution. Further, Dr. Martis (WMO Co-Chair) acknowledged:

- the importance of having a big picture with respect to the earth system approach and the need for alignment of each theme functions between WMO and IOC.
- is support for the proposed initiative of joint WMO-IOC ocean 'conference' (or big event like a Symposium) and proposed more focus on regional activities to benefit the Members.
- the priorities identified by the JCB.

The WMO and IOC Executives thanked and congratulated the Co-Chairs, and the thematic members and observers for their contributions, and coordinated approach for collaboration.

Furthermore, Prof. Petteri Taalas (WMO Secretary General)

- Proposed the JCB to concentrate on concrete actions in the face of major challenges of the GOOS, data availability and tsunami warning functions.
- Noted the global carbon budget and DRR/MHEWS are hotspots that could help Members to improve their competency.
- Acknowledged the success of the JCB's work so far, since inception, especially the progress made in the face of a global pandemic.
- Noted the WMO reform and concerted effort from infrastructures and services.
- Committed more resources for GOOS and SOFF to enhance the exchange of ocean data.

Dr. Zhang (WMO ASG) acknowledged:

- the continuous generation of successful outcomes between WMO and IOC since the JCB creation, and
- WMO's commitment to the priorities in the working plan.

Dr. Ryabinin (IOC Executive Secretary) stated:

- a desire to increase WMO and IOC synergy for global big events (e.g., COP27 and UN Ocean Conference) and closer alignment of organizational strategies and operational plans to meet the global objectives of climate/ocean, DRR that are in mutual interests.
- His advocacy for the functions of the JCB and strengthened partnership between JCB Members.

The meeting closed at 14:00 PM CET 2nd March 2022.

Annex 1: Agenda

Co-Chairs: WMO – Dr. Albert Martis (Curacao) and IOC – Dr. Srinivasa Kumar (India)

Day 1 (Online)
Tuesday March 1st, 2022
(11.00 AM to 14.00 PM CET)

1. **Opening (10 mins)**

- Welcome, Approve Agenda etc

2. **Secretariat Reports (WMO and IOC) (15mins)**

3. **Introduction of all Members (30 Mins)**

- Acknowledging the new composition with several new Members since the last meeting in March 2021.

4. **Theme presentations** (100 minutes - 20 mins per theme: 10 mins ppt and 10 mins discussion)):

- Observations
- Data

Break – 10 mins

- Forecasting
- Services

Wrap up of Day 1 (15 mins)

Day 2 (Online)
Wednesday 2nd March (11.00 AM to 14.00 PM CET)

5. **Continued discussion from Day 1 (60 minutes - 20 mins per theme: 10 mins ppt and 10 mins discussion)**

- Research
- Regional
- Capacity Development

6. **Discussion – how can the JCB add value to all these themes ?(30 mins)**

Break – 10 mins

7. **Discussion – Identified gaps and potential actions to address (30 mins)**
8. **Next Steps – Draft Workplan 2022-2023 (30 mins)**
9. **Wrap Up and Close (20 mins)**

Annex 2: Table of Participants

THEME	WMO Member	WMO Secretariat	IOC Member	IOC Secretariat
Co-Chair	Albert Martis (Curacao)	MAR	Srinivasa Kumar Tummala (India)	Albert Fischer/Emma Heslop
Observing System	Sidney Thurston (USA)	Anthnony Rea, Lars Peter Riishojgaard, Dominique Berod Rodica Nitu Kenneth Holmlund Belen M Miguez	Toste Tanhua (Germany)	Albert Fischer, Emma Heslop
Data-Processing & Management	Jeremy Tandy (UK)	Anthony Rea, Peiliang Shi, Enrico Fucille, Omar Baddour	Sergey Belov (Russian Federation)	Peter Pissierssens
Forecasting Systems	David Richardson (UK/ ECMWF)	Anthony Rea, Yuki Honda	Fraser Davidson (Canada)	Albert Fischer, Denis Seng Chang

Services	John Parker (Canada)	Johan Stander, Maxx Dilley, MAR Wilfran M. Okia, Cyrille Honore	Alexander Frolov (Russian Federation)	Bernardo Aliaga
Research	Matthew Wheeler (Australia)	Jurg Luterbacher, Michael Sparrow, Oksana Tarasova, Estelle de Coning	Lisa Alexander (Australia)	Henrik Enevoldsen
Member Regional Representatives	Mizuno Takanori (Alternate to Hasegawa Naoyuki) (Japan) Omar Chafki (Morocco)	Filipe Lucio Yinka R. Adebayo, Mustafa Adiguzel, Yoshiro Tanaka, Rodney M Guingla		

WMO and IOC Executive:

WMO Secretary General, Petteri Taalas

WMO Deputy Secretary General, Elena Manaenkova

WMO Assistant Secretary General, Wenjian Zhang

IOC Executive Secretary, Vladimir Ryabinin

MAR Secretariat: Misaeli Funaki, Zhichao Wang, Nayeon Kim, David Wyatt, Sheilla Baldeon

INCOIS Support to IOC Co-Chair: Francis Pavanathara, Nagaraja Kumar, Aneesh Lotliker

NOAA Support to US Members: Susan West

JMA Support to Japan Member: Kenji Oshio, Aki Shimpo, Jitsuko Hasegawa, Mayuko Kasai

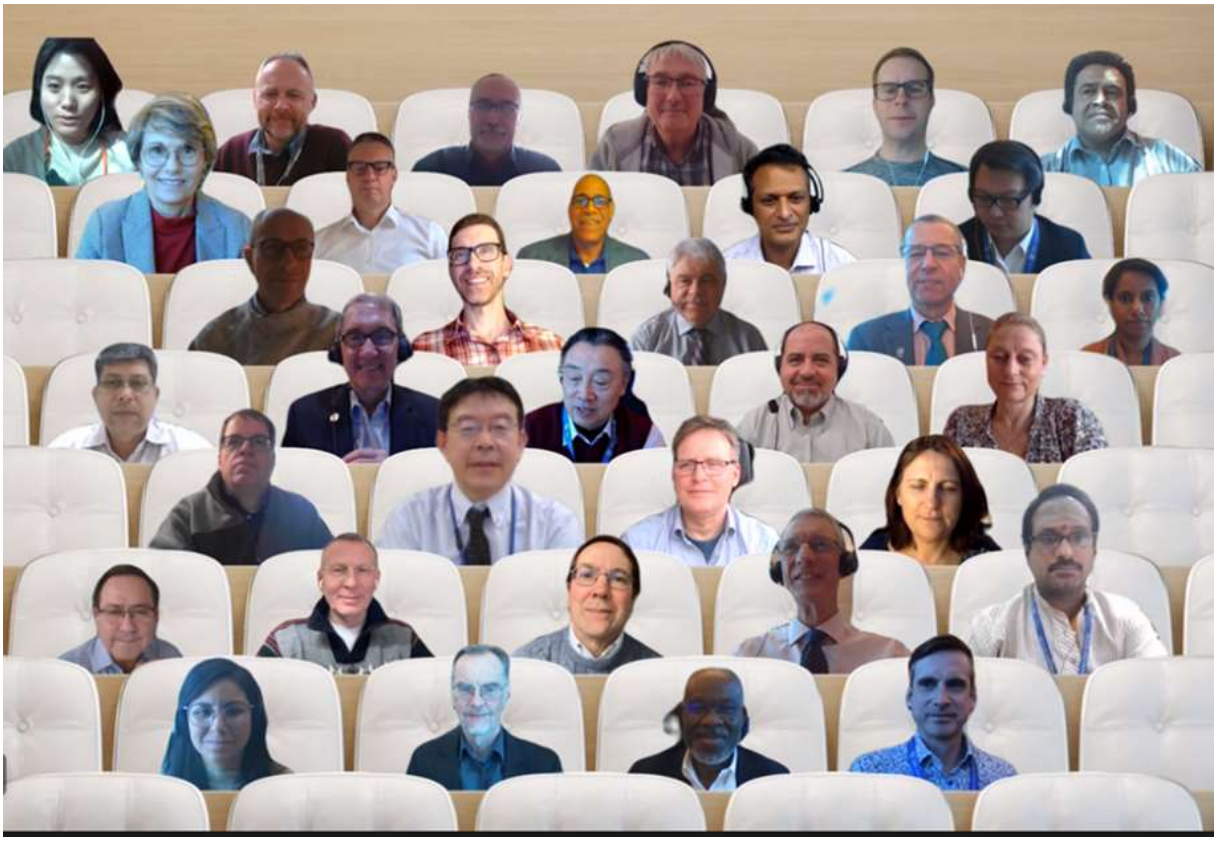
Observers:

Ian Lisk, President WMO SERCOM
Michel Jean, President WMO INFCOM

Apologies:

Hasegawa Nauyuki (Japan)
Alvaro Scardilli (Argentina)
Hamid Alizadeh Lahijani (Iran)
Ashley Johnson (South Africa)
Sarah Grimes (WMO)
Albert Fischer (IOC) on Day 1.

Annex 3: Group photo



Annex 4: List of Acronyms

CD	Capacity Development
CEOS	Committee on Earth Observation Satellites
Cg	Congress
CGMS	Coordination Group for meteorological Satellites
COP	UN Climate Change Conference
CPPS	Permanent Commission for the South Pacific
DRR	Disaster Risk Reduction
EC	Executive Council
EOV	Essential Ocean Variable
ET-AC	Expert Team on Audit and Certification/SC-IMT
ET-IM	Expert Team on Information Management/SC-IMT
ETOOFS	Expert Team on Operational Ocean Forecasting Systems/GOOS
ET-W2WPE	Expert Team on WIS2 WMO Programmes Engagement/SC-IMT
GBON	Global Basic Observing Network
GDPFS	Global Data-processing and Forecasting System
GLOSS	Global Sea Level Observing System
GOOS	Global Ocean Observing Systems
GTS	Global Telecommunication System
INFCOM	Commission for Observation, Infrastructure and Information Systems
IOC	Intergovernmental Oceanographic Commission of UNESCO
IODE	International Oceanographic Data and Information Exchange programme
IPCC	Intergovernmental Panel on Climate Change
ISC	International Sicence Council
IWG-SODIS	Inter-sessional working group to propose a strategy on ocean data and information stewardship for the UN Ocean Decade
JCB	Joint WMO-IOC Collaborative Board
JCOMM	Joint WMO-IOC Commission for Oceanography and Marine Meteorology
MHEWS	Multi-Hazard Early Warning System
OBPS	Ocean Best Practices System
OceanOPS	WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology in situ Ocean Observing System Monitoring and Coordination Centre
ODIS	Ocean Data and Information System
ODTP-SC	Ocean Decade Tsunami Programme Scientific Committee
OIH	Ocean InfoHub
OTGA	Ocean Teacher Global Academy
PPE	Public-Private Engagement
PSIDS	Pacific Small Island Developing States

RCC	Regional Climate Centres
RRR	Rolling Review of Requirements
RTC	Regional Training Centre
SC-DRR	Standing Committee on Services for Disaster Risk Reduction and Public Services
SC-ESMP	Standing Committee on Data Processing for Applied Earth System Modelling and Prediction
SC-HYD	Standing Committee on Hydrological Services
SC-IMT	Standing Committee on Information Management and Technology
SC-MMO	Standing Committee on Marine Meteorological and Oceanographic Services
SC-ON	Standing Committee on Earth Observing Systems and Monitoring Networks
SERCOM	Commission for Weather, Climate, Water and Related Environmental Services and Applications
SOFF	Systematic Observations Financing Facility
TOWS-WG	Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems
TPOS	Tropical Pacific Observing System
TWS	Tsunami Warning Service
WCRP	World Climate Research Programme
WG	Working Group
WIS	WMO Information System
WMO	World Meteorological Organization
WODP	World Ocean Database Programme
WWRP	World Weather Research Programme
GAW	Global Atmosphere Watch

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