

EXPERT MEETING REPORT



The Global Ocean
Observing System

Ocean Observations in Areas under National Jurisdiction (OONJ) Workshop

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1. Context

Over a number of years, the scientific community undertaking sustained ocean observations has raised the importance of taking measurements in maritime areas under national jurisdiction. It has also highlighted several challenges related to carrying out research in areas under national jurisdiction, including in disputed areas and relating to the granting of consent for marine scientific research (MSR)¹. In order to deliver the ocean information that society needs to face the challenges of climate change, safety at sea and at the coast, and sustaining healthy oceans, there is a need for an integrated and global ocean observing system, including observations in areas under national jurisdiction. The 1982 United Nations Convention on the Law of the Sea (UNCLOS) provides the legal basis for maritime areas such as territorial seas and exclusive economic zones (EEZs), which are areas under national jurisdiction with different rights and obligations for States and international organizations. Areas under national jurisdiction cover over one-third of the ocean and are therefore essential for an effective global ocean observing system. The concerns expressed by the scientific community raise important issues of legal clarity. Although UNCLOS provides the international legal framework for activities in the ocean, implementation raises challenges and requires States to facilitate MSR, including through providing clarity on how they regulate ocean observations and MSR activity in accordance with UNCLOS.

The Advisory Body of Experts on the Law of the Sea (ABE-LOS) of the Intergovernmental Oceanographic Commission (IOC) worked on these issues between 2003 and 2009 and laid the foundation for the development of the Argo notification scheme. This provides a practical solution, through the notifying of States when Argo floats drift into waters under their national jurisdiction, of enabling rapid clearance for the collection and sharing of such observations. However, many other ocean observing implementers, and the Argo Programme itself in terms of float deployment, still face important challenges when seeking consent to undertake ocean observations in waters under national jurisdiction.

Launched in 2019, the Global Ocean Observing System 2030 Strategy calls for a step change in the level and effectiveness of partnerships to deliver ‘a truly integrated ocean observing system that provides the essential information needed for our sustainable development, safety, wellbeing and prosperity’. For a truly global and integrated system, more States need to be involved in the observing system and all regions of the oceans need to be adequately

¹ Note the term consent is mainly used within this document and is the terminology consistent with UNCLOS, however this is also referred to as ‘clearance’ in the ocean observing community and so this term also appears in the document. They both refer to consent being given.

sampled, including waters under the jurisdiction of coastal States. This will be vital to meeting the challenge of the UN Decade of Ocean Science for Sustainable Development (launched in 2020), since observations are one of the foundational components underpinning sound ocean policy, management, and prediction.

In recent years, the Global Ocean Observing System (GOOS) and the Observation Coordination Group (OCG) have both received requests from the implementers of global ocean observing networks to consider the many challenges of ocean observations in EEZs. This was raised as an important issue at:

- The Eighth and Ninth OCG Meetings (OCG-8, 2018 and OCG-9, 2019)
- The Sixth and Seventh GOOS Steering Committee Meetings (GOOS SC06, 2017 and GOOS SC-7, 2018)
- The World Meteorological Organisation (WMO) Executive Council (2018) and 18th World Meteorological Congress (2019).

To address these concerns and support the integrated global ocean observing system, GOOS organised an Experts Workshop on Ocean Observations in Areas under National Jurisdiction to develop ideas for potential solutions, within the existing provisions of UNCLOS, in regard to the taking of sustained observations in waters under the jurisdiction of coastal States.

2. The Experts Workshop

The Experts Workshop on Ocean Observations in Areas under National Jurisdiction was held on February 12-13 2020 at UNESCO in Paris. The two-day workshop focused its discussions on the taking of *sustained* or long-term ocean observations in waters under national jurisdiction and did not consider the needs of short-term scientific projects.

The objectives for the Experts Workshop were to:

- hold discussions aiming at highlighting potential concerns and potential solution spaces to facilitate the taking of long-term ocean observations in waters under the jurisdiction of coastal States;
- identify approaches for legal and/or suggestions for practical framework(s) in the context of UNCLOS;
- suggest areas of work on defining or demonstrating the value/impact of the needed observations;
- suggest a process(es) of wider IOC consultation of all Member States that explores this space and comes to solutions.

The workshop discussed:

- the global ocean observing system and the value of observations to coastal States;
- the different issues, and possible causes of those issues, that the global ocean observing networks face in undertaking observations in areas under national jurisdiction, in particular the EEZ;
- potential concerns of coastal States regarding sustained ocean observations in areas under their national jurisdiction;
- potential solution spaces in relation to these issues and then in relation to the issues faced by the global networks.

The attendees convened in their personal capacity as experts. Attending were:

- representatives of many of the global ocean observing networks under the OCG;
- international law of the sea experts (academic and DOALOS);
- representatives from the IOC and the WMO.

See [Annex 1](#) for the Workshop agenda and the list of attendees.

3. Ocean observing and legal background

3.1 The Global Ocean Observing System (GOOS)

GOOS coordinates sustained ocean observing activities in order to support the delivery of harmonised data that is fit for use by those who need this information, for example for climate policy, hazard warnings and weather prediction, management of marine resources, marine and coastal operational decisions. GOOS has three key delivery areas: climate, weather and ocean prediction, and ocean health.

Since 1991, GOOS has been leading the development of a truly global ocean observing system that delivers the essential information needed for our sustainable development, safety, wellbeing and prosperity. It is led by the IOC of UNESCO, and co-sponsored by WMO, the United Nations Environment Programme (UNEP) and the International Science Council (ISC).

There are seven elements to the GOOS core team:

- **GOOS Steering Committee:** a multinational body that provides direction to the GOOS core team in implementing its strategic objectives and building outside partnerships.

- **Expert Panels:** The Physics and Climate, Biochemistry, and Biology and Ecosystems Panels are vital for identifying user needs and evaluating the system.
- **The Observations Coordination Group:** the OCG strengthens GOOS implementation by coordinating the system through twelve global observing networks and OceanOPS (formally known as JCOMMOPS).
- **The Expert Team on Operational Ocean Forecast Systems:** ETOOFS guides initiatives to improve capacity, quality and interoperability of ocean model forecast products.
- **GOOS Regional Alliances:** GRAs identify, enable and develop GOOS ocean monitoring and services to meet regional and national priorities.
- **Projects:** advancing innovation and expanding the observing system, services and product delivery by expanding into new areas and capabilities.
- **The GOOS Office:** The GOOS Office team works full time to enable the GOOS core to function and to enable connection across the observing enterprise.

Through these components GOOS supports a community encompassing all those playing a role in the observing system: international, regional, and national observing programs, governments, UN agencies, research organisations, and individual scientists. By working together on observing tools and technology, the free flow of data, information systems, forecasts, and scientific analysis, this global community can leverage the value of all these investments.

3.2 Global ocean observing networks

The **Data Buoy Cooperation Panel (DBCP)** comprises the Global Drifter Array and the National/Coastal Moored Buoy Networks.

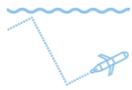


The DBCP **Drifting Buoys** is a network of surface lagrangian drifters equipped with a thermistor on the base of the buoy to measure sea surface temperature and a sensor above for air pressure; a drogue attached below the surface and centred at fifteen metres allows the drifters to follow the surface circulation. The drifters are the only source of global *in situ* air pressure data and the primary source of *in situ* sea surface temperature data for climate. A small number of drifters also report surface salinity, wind speed and wave data. The aim of the DBCP Global Drifters Array is to maintain a global 5x5 degree array of surface drifting buoys. In addition, drifters are also deployed at higher latitudes, often on seasonal ice, in the Arctic and Antarctic regions. The DBCP **Moored buoys** encompass moored buoys deployed, operated and maintained by a wide variety of organisations. They provide data in support of weather prediction, marine services, and research. Some of these networks have been in place for forty years, and so provide valuable time-series for marine climate studies, in particular for waves.





Core Argo is a network of quasi-lagrangian **profiling floats**, which are capable of adjusting their buoyancy to measure the upper 2,000 metres of the ocean. The array of almost 4,000 floats provides 140,000 temperature/salinity (T/S) profiles and current velocity measurements per year distributed over the global oceans at an average 3x3 degree spacing. Floats cycle to 2,000 metres depth every ten days. Additional types of Argo floats are now increasingly contributing to the Argo Programme with **Biogeochemical Argo** (BGC Argo) floats that sample an additional six variables and **Deep Argo** floats that sample to 6,000 metres. A primary focus of the Argo Programme is to document seasonal to decadal climate variability and to aid our understanding of its predictability. Argo provides a quantitative description of the changing state of the upper ocean and the patterns of ocean climate variability from months to decades, including ocean heat and freshwater storage. Argo data are routinely used in ocean and coupled ocean-atmosphere forecast models.



OceanGliders network is an international array of autonomous underwater gliders, which measure physical variables such as pressure, temperature, salinity, and current, as well as biological variables relevant to the abundance of phytoplankton, zooplankton, fish, and ecologically important chemical variables such as dissolved oxygen. Ocean gliders are able to monitor transects autonomously and continuously, to depths of 1,000 metres. The OceanGliders network includes long-term repeat sections in key areas over the global oceans, documenting the variability of the ocean boundary current circulation, sampling ahead of storms to improve impact forecasts, and addressing questions of how a future ocean will change in many respects and at many different scales.



The **Global Ocean Ship-Based Hydrographic Investigations Programme (GO-SHIP)** is an international network of global class research vessels engaging in **repeated transect hydrographic surveys**. GO-SHIP is the only comprehensive oceanographic program documenting, with high accuracy, ocean physical and biogeochemical changes throughout the water column, including for the deep ocean below 2,000 metres, including vital carbon observations. GO-SHIP observations are critical to understanding and documenting the large-scale ocean water property distributions, their changes, and the drivers of those changes. The data are used to address questions of how a future ocean will change in response to global warming, e.g. become more acidic and stratified, changes in circulation and ventilation processes, altered water cycle and sea-ice, and how this will interact with natural ocean variability. An emerging objective is to also determine ecological changes, systematically studying large scale decadal changes in the ocean. The GO-SHIP measurements are also critical to quality control a new generation of sensors on floats, gliders, and buoys.

The **OceanSITES** Open-Ocean Timeseries network collects physical, biogeochemical, and biology/ecosystem data worldwide through **interdisciplinary moorings** taking high-frequency observations at fixed locations in the open ocean, as well as the overlying atmosphere. OceanSITES has three types of sites: ocean transport moored arrays, air/sea flux reference sites, and multidisciplinary Global Ocean Watch sites, which operate in key regions of the global ocean. OceanSITES aim is to provide sustained, high frequency timeseries to the full-depth of the ocean, with a temporal resolution from minutes to decades, in order to detect, understand, and predict global physical, biogeochemical and ecosystem state and changes, including ocean warming, ocean carbon uptake/storage and acidification, also considering the role of and impact on ecosystem.

The **Ship Observations Team (SOT)** consists of three networks involving vessels of opportunity from the maritime industry (container ships, tankers, etc.) as well as research vessels, coast guard, and maritime patrol vessels.



The **Voluntary Observing Ship Scheme (VOS)** is one of the oldest observation networks with observations dating back 150 years. The ships supply marine meteorological observations, at appropriate quality and timeliness, for defined application areas in weather and marine services. There are currently approximately 2,500 active VOS ships, which submit nearly 2 million observations each year. It complements sources of synoptic surface marine meteorological observations in coastal areas and the high seas, and is also important for climate research. The **Ship of Opportunity Program (SOOP)** network consists of collecting temperature profiles down to 800 metres across ocean basins as well as surface CO₂ and surface temperature and salinity data. SOOP can be divided into four sub-programs, each focusing on different variables and addressing various phenomena, therefore having a unique contribution: SOOP - Expendable bathythermographs measuring temperature in the upper 700 metres of the ocean, SOOP-CO₂ for surface carbon, SOOP-BGC for other biogeochemical surface variables, and SOOP-Thermosalinographs measuring sea surface temperature and salinity. The **Automated Shipboard Aerological Programme (ASAP)** provides upper-air observations of appropriate quality and timeliness for weather services in the WMO defined application areas, such as forecasts and warnings to safeguard commerce and the protection of life and property at sea. The soundings are made using balloons (filled with helium gas) equipped with the required instruments and data telecommunication system. Around 5,000 upper air soundings are taken annually.





The **Global Sea Level Network (GLOSS)** is a network of tide gauges delivering to specifications (data, timeliness, accuracy) for characterising Global Sea Level Change. The main component of GLOSS is a 'Global Core Network' (GCN) of 290 sea level stations around the world providing long term climate change and oceanographic sea level monitoring. It is

designed to provide an approximately evenly-distributed sampling of global coastal sea level variation. The GLOSS altimeter calibration (ALT) set consists mostly of island stations, which provide an ongoing facility for mission intercalibrations. The data is also used in many local settings for applications such as port operations, the data are transmitted in real time, 'fast' for tsunami warnings, and in delayed mode.



The **Global HF Radar Network** uses coast-based high-frequency radar technology to measure surface currents, waves (height, direction, period) and wind. The network helps determine the movement of surface waters, providing critical information to support pollutant tracking, search and rescue operations, harmful algal bloom monitoring, vessel navigation, ecosystem-based management, and marine spatial planning. The Global HF Radar team works to connect the States operating HF Radar while supporting the transition of these systems to a sustained effort. Assimilation of HF radar data into many regional ocean models has significantly improved forecasting.



The **Animal Borne Ocean Sensors (AniBOS)** network monitors several essential ocean and biodiversity variables, providing inputs to estimate global ocean indicators, contributing to the quantification of the upper ocean variability and yielding data for a range of operational ocean and weather forecasting applications. Animal borne ocean sensors measure a variety of variables that are crucial to understanding both animal behaviour and their interaction with marine ecosystems, as well as providing data from many chronically under-sampled regions of the global ocean. These variables include temperature and salinity profiles, but also fluorescence, oxygen or surface wave and wind activity. In the last decade, about 500,000 temperature-salinity-depth profiles were obtained in high latitudes, coastal shelves and tropical areas, regions that are currently poorly covered by traditional observing platforms, greatly enhancing studies of climate variability and the delivery of information to inform climate prediction estimates at global and regional scales.

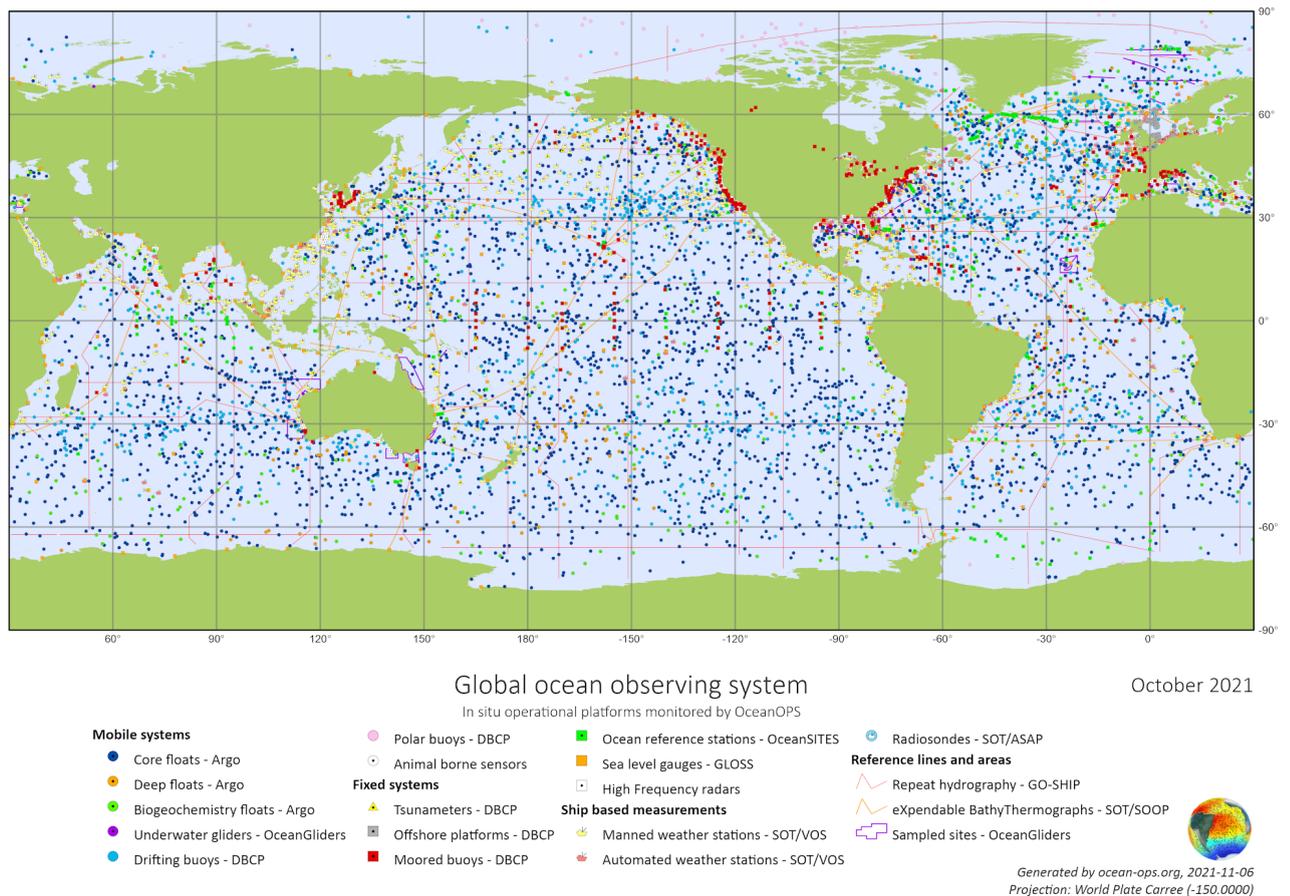


Figure 1: Map of the global ocean observing networks monitored by OceanOPS. Note: symbol size is not to scale, in order to make the observations visible the scale is exaggerated to an order of a hundred kilometers. Check <http://www.ocean-ops.org/reportcard> for further information on the status of the networks and the societal value of an integrated Global Ocean Observing System.

3.3 International Legal Context

3.3.1 UNCLOS

The UNCLOS promotes the efficient and equitable utilisation of the resources of the oceans and seas, the conservation of their resources, and the study, protection and preservation of the marine environment (preamble, fourth recital). Many Parts of the Convention, including Part XII on the protection and preservation of the marine environment and Part XIV on the development and transfer of marine technology as well as various other articles of UNCLOS contain provisions relevant to sustained ocean observations, complementing the legal regime for the conduct of MSR as established in Part XIII of UNCLOS, which is the focus of this section.

Of relevance to ocean observations under UNCLOS are its provisions on the delimitation of maritime zones. A coastal State has sovereignty (and thus exclusive jurisdiction over marine scientific research) in the three zones closest to its coast: the internal waters (landward of the coastal state's baseline - Artt. 5-11), the archipelagic waters (waters enclosed by archipelagic baselines - Artt. 47 & 49) and the territorial sea, which stretches seaward from the baseline up to a maximum of twelve nautical miles (Artt. 2, 3 & 245). On its continental shelf (Artt. 77 & 78) and in its EEZ (Artt. 55-57), a coastal State has specific jurisdiction over MSR (Artt. 246-253). In the high seas - the part of the ocean beyond the EEZ (Artt. 86 & 87), all States have the freedom to conduct MSR (Art. 257).

Part XIII lays out a comprehensive legal framework for the conduct of MSR and aims to achieve a balance between rights and interests of coastal States and that of other States. Yet the term 'MSR' is not defined in the Convention. Other related terms included in UNCLOS such as 'exploration', 'environmental assessments', 'monitoring', 'survey activities', or 'hydrographic surveys' are also not defined in the Convention, but nonetheless, pursuant to the Convention, those activities and uses are not subject to the specific regulatory regime for MSR provided in Part XIII.

Under its most salient provisions, Part XIII reaffirms the right of all States and competent international organisations to conduct MSR (Art 238) and a duty to promote and facilitate its conduct (Article 239). In particular, in furtherance of the duty to cooperate, which underpins UNCLOS provisions, States shall seek to promote, through competent international organisations, 'the establishment of general criteria and guidelines to assist States in ascertaining the nature and implications of marine scientific research' (Art. 251). In addition, they shall 'adopt reasonable rules, regulations and procedures' for the promotion and facilitation of MSR beyond their territorial sea and facilitate 'access to their harbours and promote assistance for marine scientific research vessels' (Art. 255).

Other rules in Part XIII provide that MSR should not unjustifiably interfere with other legitimate uses of the sea that are compatible with the UNCLOS and should also be duly respected in the course of such uses (Art. 240). States and international organisations have the obligation to promote international cooperation in MSR (Art. 242), to create favourable conditions for its conduct and to cooperate to integrate the efforts of scientists in studying the essence of phenomena and processes occurring in the marine environment and the interrelations between them (Art. 243). Moreover, they shall publish and disseminate knowledge resulting from MSR and promote the flow of scientific data and information and the transfer of knowledge resulting from them (Art. 244).

The jurisdiction over MSR on its continental shelf and in its EEZ means that a coastal State has the right to regulate, authorise and conduct MSR in these zones (Art. 246(1)). Part XIII establishes specific rules for the granting of consent for MSR to be undertaken in the EEZ or

on the continental shelf under the jurisdiction of a coastal State (Art.246 (2)). In this regard, consent shall, in normal circumstances, be granted for MSR carried out for peaceful purposes and to increase 'scientific knowledge of the marine environment for the benefit of all mankind' (Art. 246(3)). The consent might also be tacit or implied (Art. 252). There are also situations that allow the coastal State to suspend or require the cessation of the MSR activities in its EEZ or on its continental shelf (Art. 253). Also, when a MSR project is intended to be carried out by or under the auspices of an international organisation in the EEZ or on the continental shelf of a coastal State that is member of that International organisation, that State is deemed to have authorised the project if it approved the details of the project at the time the project was adopted by the organisation (Art. 247). However, in certain cases, coastal States may withhold consent (Art. 246(5)-(7) including if the research project is of direct significance for the exploration or exploitation of natural resources. The State that conducts MSR activities does have the duty to provide information on the research project to the coastal State (Art. 248) and to comply with certain conditions regarding cooperation and participation in the project, sharing of samples, data and research results, and the removal of scientific research installations and equipment (Art. 249). Other specific rules in Part XIII address among others, scientific research installations or equipment (Artt. 258-262), as well as responsibility and liability (Art. 263).

3.3.2 IOC

The IOC has a twenty-year history of work in developing a cooperative framework regarding the real-time sharing of ocean data collected in EEZs, and in particular has a successful track record in creating a Member State agreed framework and mechanism for the provision of data from the global Argo Programme from floats that drift into EEZs, in compliance with UNCLOS, through:

- IOC Resolution XX-6 (1999, "The Argo Project")
- IOC Resolution EC-XLI.4 (2008, "Guidelines for the Implementation of Resolution XX-6 of the IOC Assembly Regarding the Deployment of Profiling Floats in the High Seas within the Framework of the Argo Programme")
- Decision IOC/EC-LI/4.8 (2018, "Evolving Capabilities of the Argo Global Array of Profiling Floats")

The 2018 IOC decision supporting an extension of the Argo notification scheme to include six biogeochemical variables - oxygen, pH, nitrate, chlorophyll, backscatter and irradiance – has been a recent and important step forward in the recognition of the need for a wider range of sustained observations. It was also an endorsement of the value the Argo Programme brings to global ocean observing and of the trust developed in the IOC mediated solutions.

Under the Argo notification scheme, States appoint an Argo Focal Point and will have central (OceanOPS, formerly JCOMMOPS) or optionally bilateral (State-to-State) notification. The desire for bilateral notification is to be made centrally to the IOC, and OceanOPS maintains a list of these States. OceanOPS monitors the trajectories of the Argo floats globally and if an Argo Float owned and operated by State A drifts into the EEZ of State B, then State B is notified and has the option to request that data from this float is not shared while floating in its EEZ. If bilateral notification has been requested by State B, then State A is notified by OceanOPS regarding the location of its float and its imminent drift, and has the responsibility of notifying State B (OceanOPS also notifies the Argo Focal Point in State B). In practice, although on average some 175 floats per year, of the approximately 4,000 float array, can be subject to the notification protocol, only once has there been a request that the data not be shared.

3.3.3 WMO

These issues were also raised at the WMO 70th Executive Council in June 2018. In February 2019, WMO held a Technical Workshop on “Enhancing ocean observations and research, and the free exchange of data, to foster services for the safety of life and property”. The discussions considered the evolving requirements for ocean observation and research in support of WMO Application Areas with focus on marine meteorological services. The workshop resulted in two resolutions passed at the WMO Eighteenth Congress.

- Resolution 45 (Cg-18) "Ensuring adequate marine meteorological and oceanographic observations and data coverage for the safety of navigation and the protection of life and property in coastal and offshore areas"
- Resolution 46 (Cg-18) "Future collaboration between WMO and the Intergovernmental Oceanographic Commission on facilitating oceanographic observation in coastal regions in support of Earth system prediction and climate services"

The first resolution reaffirms the importance of marine meteorological observations, including those in EEZs, used operationally by WMO Members to provide services in support of safety of navigation and the protection of life and property in coastal and offshore areas, and clarifies the legal regime under which VOS and surface observing platforms operate in taking marine meteorological observations, as operating outside of UNCLOS Part XIII and therefore allowing unhindered operation in EEZs; while complying with UNCLOS general principles such as peaceful use of the sea, protection of human life at sea, and dissemination of information.

The second Resolution notes the twenty-year history of work by the IOC to develop a cooperative framework regarding the sharing of ocean data in EEZs (IOC Resolutions XX-6 and EC-XLI.4, and IOC Decision EC-LI.4.8 regarding the Argo notification scheme) recognises

that WMO's operational forecast models and services increasingly rely on sustained global data streams of subsurface observations; and decides to identify the requirements for subsurface ocean variables to improve the quality of these forecasts and services, work closely with IOC in order to explore mechanisms that make the highest-impact subsurface ocean data freely available, and build the capacity of all WMO Members to use the resulting forecast systems and services.

Both resolutions were noted at the IOC Assembly 30th Session under item 7.1.1.

4. Challenges faced by the global ocean observing networks

The issues the global ocean observing networks face in undertaking sustained ocean observing programmes are summarised below. This summary is based on their presentations and discussion at the workshop, which were also informed by the findings from a 2018 joint GOOS-OCG Survey of the global ocean observing networks.

4.1 MSR consent process

a) The process is incompatible with the *operational reality of sustained ocean observing*

There is no consistency in the practice among coastal States in response to applications for consent to conduct MSR in areas under national jurisdiction, in particular the EEZ. The information required by one State is not the same as another State, and the requirements for information can be excessive to the point of making applications prohibitive. In addition, the process is often governed by different government departments in different states, and often not flexible to change.

Examples of operational reality being incompatible with MSR consent process as implemented by States:

- Ship missions are regularly subject to unforeseen changes, such as vessels requiring repairs, changes in equipment or personnel, and national MSR consent procedures are frequently not sufficiently flexible to adapt to these changes.
- The MSR procedure is non-trivial and time consuming for a programme deploying hundreds of floats a year; as the opportunities often arise at short notice, many are missed. Often, the Argo Programme simply does not deploy in areas under national jurisdiction unless it is a part of that coastal State's Argo Programme and even then, some States still require clearance. There are gaps in the Argo coverage due to these issues.

- OceanGliders often occupy a transect year-round through monthly/bi-monthly retrieval and redeployment, thus retrieval and re-deployment of these autonomous instruments occurs on a regular basis throughout the year. Applying for MSR clearance for each deployment quickly becomes burdensome.
- In addition, it is reported that the consent to applications for ocean observing operations is sometimes given at the last moment, even up to the day before the mission is due to initiate. This is simply not compatible with the operational reality of major ocean observing operations where a vessel, its crew, scientific staff and scientific equipment are waiting for this last-minute clearance. There is anecdotal evidence that areas where this has occurred are now simply avoided, which compromises the global system and our ability to accurately track major ocean trends.
- It is also reported that even when MSR clearance has been given, it can be provided with demands that are costly and/or impossible to comply with. Such demands can arrive at the last minute and with no flexibility.
- For major research vessel operations, it is reported that funding windows do not coincide with the timeline for MSR clearance procedures. For many sustained programmes, funding is provided annually and there is a specific window in which this can be spent, and a six-month clearance procedure becomes incompatible with such regular funding timelines.

These issues of inconsistency, lack of flexibility, late notice and disproportionate demands are problematic for GOOS and the global ocean observing networks in several ways. First, sustained observing networks operate many missions per year, in many different locations. For example, Argo deploys around 800 floats a year, and numerous ship missions are undertaken by the GO-SHIP and SOOP networks. Thus, lengthy procedures, with large variances in implementation between States, and exacting requests for information are burdensome to administer and add a significant cost to an observing mission, such that at some point the mission is no longer cost effective and so is undertaken elsewhere or not at all. In other cases, procedural demands can be so prohibitive, such that missions are not initiated. Finally, the issue of last-minute clearance becomes a major risk factor to a mission and so areas where this is known to be an issue are avoided.

One suggestion raised through the discussion was to develop a more centralised management of the networks' MSR requests, with a timely response to the MSR request also specified.

As stands, these MSR process issues are incompatible with *sustained* ocean observing activities and limit the extent of the observing undertaken by the major networks in a number of important areas of the global ocean.

b) Advance notice is incompatible with operation of sustained ocean observing for some platforms

Apart from the question of the applicability of the UNCLOS MSR provisions for certain types of sustained observations, the application of these provisions is impracticable for a number of observing platforms and operations.

For some observing networks, it is impossible to know ahead of time where an observing platform will be taking the observations. For others, it is important to be able to take advantage of opportunistic vessel transects in remote areas. This is an issue for networks using 'ships of opportunity', those that deploy instruments that drift with ocean currents, and those that deploy instruments on marine animals.

For example:

- SOOP runs regular lines with the support of commercial ship operators. SOOP has some limited information on when the observations will be taken but this is subject to change depending on the commercial operations (beyond SOOP's control) and generally with not sufficient precision to comply with MSR procedures as implemented by many States that request specific location and timing information.
- AniBOS sensors are attached to marine animals, for example seals and turtles, and although a general region of regular operation of the animals can be identified, it is clearly not possible to govern when and where any single animal will be sampling.
- Opportunities to deploy Argo Programme floats are often identified at short notice and opportunistically, the vessel may already have clearance but not including Argo floats or may have not previously needed clearance. In addition, the situation can be further complicated by confusion over who should be applying for clearance, the State under whose flag the deploying vessel operates or the State which owns and operates the Argo float. This complexity is non-trivial, thus opportunities to deploy floats cannot always be acted upon.
- The DBCP Drifting Buoy network can determine ahead of time where a buoy will be released. However, where they subsequently travel is governed by ocean currents, as with Argo profiling floats. The Drifting Buoy network faces many of the same issues as Argo.
- Increasingly new observing technologies, such as gliders, are being used to operationally sample within storms and hurricanes in order to provide vital *in situ* profiles of the heat content of the water column. It is obviously not possible to state for such operations exactly where the observations will take place six months in advance, although a region of activity could likely be indicated. This information has been shown to significantly improve the prediction of the violent storm strength in several parts of the global ocean, which is becoming increasingly important where large areas of coastal population are threatened by violent storms on an annual basis.

- Voluntary Observing Ships (VOS) observe a range of sea surface measurements, primarily for the safety of life at sea, across from a large network of vessels, many of which are commercial. It is simply not possible to know, with any accuracy, 6 months in advance, where such ships will be or if they will be actually reporting observations. The issues for VOS, however, have in the past been confirmed, and recently reconfirmed by WMO Resolution 45 (Cg-18) "*Ensuring adequate marine meteorological and oceanographic observations and data coverage for the safety of navigation and the protection of life and property in coastal and offshore areas*", such that UNCLOS Part XIII is not applicable to VOS or DBCP operations.

4.2 MSR clearance is often impossible to obtain in zones where EEZs are disputed

In areas where there is ongoing tension or dispute between States over the boundaries of the EEZ, it may become impossible to obtain MSR clearance. Clearance from one State might mean that clearance cannot be gained from the other. These areas frequently remain unsampled as there is no clear method to obtain MSR clearance.

4.3 No national procedure for MSR clearance - new technology

In some States, the Ministry of Foreign Affairs or other relevant competent authority, do not have a procedure in place to apply for MSR clearance for some of the newer ocean observing technologies. In practice, this means that the operator of the scientific equipment does not have a mechanism under which to apply for MSR through their national system. This has been reported as an issue for new observing technologies such as ocean gliders.

Networks/Issue areas	1 a) MSR process incompatible operational reality of sustained observing	1 b) Advance notice incompatible with platform operation	2) Observing in EEZs disputed zones	3) No national procedure for clearance
Argo	* ²	* ³	*	
SOT SOOP	*	*		

² For Argo deployments

³ This is resolved under IOC Resolution XX-6 (1999, "The Argo Project"), IOC Resolution EC-XLI.4 (2008, "Guidelines for the Implementation of Resolution XX-6 of the IOC Assembly Regarding the Deployment of Profiling Floats in the High Seas within the Framework of the Argo Programme") and Decision IOC/EC-LI/4.8.

SOT VOS	*	*		
GO-SHIP	*		*	
GLOSS				
DBCP Moored Buoys	*			
DBCP Drifters	*	*		
OceanSITES	*			
OceanGliders	*		*	*4
HF Radar	N/A			
AniBOS	*	*		*

Table 1: Issue areas with ocean observing networks affected.

5. A tension between the taking of sustained ocean observations and the concerns of coastal States

There are a few areas of concern for coastal States in considering the taking of ocean observations within their EEZs. These concerns revolve mainly around their rights, resources, and security. An example of the lens through which a State can look at such a request for consent would be: could the observations collected or information produced by these observations be of significance for the interests of the coastal State in respect of the use of its natural resources, living and/or nonliving?

Part of the problem that coastal States articulated is that there is a lack of information or explanation of the benefit to the State of the observations that are requested to be undertaken within their EEZs. In addition, a shortfall in the ability of some States to take advantage of and/or benefit from the observations in their EEZ has been cited as an issue. The ability to benefit from the observations can be hampered through access and/or being able to use the data for national benefit. Thus a weighing up of perceived risk against benefit of the observations taken within their EEZ cannot necessarily be made.

In the discussions, this issue of the ability of States to access and to use the data to gain the benefit of the observations was raised several times, bringing in aspects of data delivery, capacity development, and service development, to connect the observations to users, and with this, questions of equity of access to information. One of the reasons cited for the success of the Argo notification scheme is that all data is freely available and accessible from open and publicised portals.

⁴ In some cases.

It was also noted that although having local scientists or PhD students involved in ocean observing missions enables some transfer of skills and knowledge, and has been very successful in some instances, this involvement does not replace having access to and use of the data.

Individual networks may not be able to resolve all of the issues noted above for each type of observation and each MSR consent process. However, there should be some pathway available for States to gain from the observations taken within their EEZs. Knowledge of such expectations within the networks will enhance their ability to be open to support availability in ways that are possible at a network level. There also should be some pathways for States to be supported in developing data use capability at global and regional levels. Highlighting this to GOOS and ocean data management bodies could be helpful.

Another discussion point was the multiple use of observations in EEZs, for example to support fisheries management, whilst at the same time the information could be used by commercial fishing enterprises to target the managed fish stocks. Although it is recognised that this possibility exists, the direction of a number of modern fisheries management systems is to work closely with commercial operators, sharing such information, so that the information and knowledge lessens waste, such as by-catch and fuel consumption. And the provision of ocean information to artisanal fishing communities supports efficiency, safety, and the survival of locally important livelihoods.

There was also some question as to how realistic these concerns are. In making data freely available, there will always be some risk since how that data is used cannot be controlled. There is a need to articulate the utility of the observations in EEZs, to outweigh this risk with the value that the observations can bring. There is also the threat of not taking the observations and being able to act upon this knowledge that needs to be considered, especially in relation to the multiple environmental stressors such as climate change and over-fishing.

Unmanned vehicles were brought up as a platform, as they are also used as an intelligence gathering, surveillance and reconnaissance instrument in other spheres, and therefore could conceivably have a dual use. This is a relatively remote but potential risk. The articulation of the benefit of observations and the recognition of belonging to the global ocean observing system, internationally coordinated by GOOS, is an important consideration. For example, the Argo Programme does not include floats deployed by navies as a part of Argo.

The consensus of the session was that the real concerns of coastal States need to be addressed, that in order to gain the benefits of the observations for local and global society, States will not have complete control over how the information is used. However, the reality is that the benefits generally should outweigh the risks and that more often data are not fully utilised. A part of next steps should be to clearly articulate the value of the observations, and also be willing to engage in discussions around the coastal State concerns. The focus should be on ocean observations by ocean observing networks, coordinated under GOOS, that bring specific benefits, and that can have multiple uses. Recent economic data shows that multiple use has economic benefits, i.e. the more the data is used,

the greater the economic benefit⁵. States may be willing to solve issues and find specific solutions for specific problems.

There was consensus that communication on the benefits of ocean observations in EEZs, with recognition that there are real concerns, is important. Likewise, data availability and data use are important to address.

6. Seven ‘solution spaces’

The issues and specific challenges faced by the global ocean observing networks were used as the basis for discussions and identification of potential solution spaces consistent with UNCLOS to facilitate the taking of systematic and sustained ocean observations in all waters under national jurisdiction. Since the workshop was convened to consider solution spaces in the context of the current UNCLOS provisions, long-term options involving the development of an implementing agreement under UNCLOS or proposing amendments to the Convention were not considered viable or practical to address the current needs of the observation networks.

In this context, the term ‘solution spaces’ is used to identify approaches that have the potential to ease the issues faced by the global networks in taking sustained observations in waters under national jurisdiction. Although the Workshop considered all waters under national jurisdiction, i.e. EEZs and territorial waters, the discussion focused on the issues and the solution spaces for the undertaking of sustained ocean observations in EEZs. Through these discussions seven potential ‘solution spaces’ were identified at the Workshop. They are different in nature and require action by different entities. No one solution solves all issues.

The seven identified solution spaces are summarised below, with a summary of the main discussion points around the benefits, challenges, potential to resolve the challenges identified, applicability to the networks and who or whom would need to act.

6.1 Argo notification scheme as a process (model)

This solution space is based on the process that enabled the Argo notification scheme to develop, which allows floats to drift into a State’s EEZ (from the high seas or from another State’s EEZ) and continue sampling, as per IOC Resolution EC-XLI4. This practical

⁵ OECD Science, Technology and Industry Working Papers - Value chains in public marine data: A UK case study. <https://www.oecd.org/unitedkingdom/value-chains-in-public-marine-data-d8bbdcfa-en.htm>

arrangement recognises that the path of a float is non-steerable. The Argo scheme is generally accepted as consistent with Part XIII of UNCLOS.

The idea is to invoke, through the IOC, the same consultative process that enabled the Argo notification scheme to develop and succeed in creating a new practical arrangement. Such a consultation process might consider platforms and variables, and the achievements that have enabled the Argo notification scheme to be such a success for science and society. If such a consultation process were to develop a similar scheme, there also now exists an infrastructure and framework at OceanOPS to facilitate such procedures.

The success of the procedure relies on transparency and good communication, and on the appetite of the IOC Member States to engage in a new process. Many issues are key, such as the access to usable data, the value of the data to national and global challenges, as well as good understanding of the procedure by the IOC Member States. In the discussions at the Workshop, participants considered if there was a possibility to use the same process and concepts for other observing platforms.

Benefits:

If a similar scheme were the outcome of the IOC consultation process, the infrastructure at OceanOPS is already in existence and trusted with notification procedures. In addition, IOC Member States are familiar with the process and scheme, and much was learnt in the development of the Argo notification scheme. Argo has been highly successful for the global science community. Many States contribute to the scheme and it was recently extended to include six biogeochemical variables as the urgent need and value of the observations was recognised by IOC Member States.

Challenges:

The discussion and subsequent development of the IOC resolution would require considerable effort over time.

Not all IOC Member States yet have designated a national Argo focal point, which can receive the notifications.

Although the Argo notification scheme can act as a model, it is by no means guaranteed that a similar process would be the outcome of the consultation.

One difficulty with the system of Argo floats is specificity: it will never be possible to know exactly where a platform is going to be and operate.

Potential:

The Argo process may usefully be developed for other networks such as the OceanGliders, the SOOP XBTs and DBCP drifting buoys. This would require well prepared groundwork, bearing in mind the importance of clearly articulating benefits for a successful outcome.

For such a process to be developed for other networks, there is a need to prepare well in advance, to have early consultations, and to keep in mind that preparation and a clear articulation of the benefits are key elements for success.

Representatives of a majority of the GOOS networks expressed the opinion that they see this solution as feasible.

Applicability:

For OceanGliders, advance notice could be given of missions and also should a glider potentially be swept by strong currents into an EEZ.

For DBCP, advance notice could be given of anticipated trajectories.

For SOOP, there are some fixed routes where the ships work and specific States in which EEZs the network works, which gives predictability (monthly more or less); predictability would be a strong value as it allows more transparency and provides room for more opportunistic observations and sending a notification on the day the measurements start and the day that they finish is a feasible approach.

A procedure with a continued update on the information as the network becomes aware of it was posited, e.g. to inform the State on when the platform will occupy this space during the year and give a continued update to the State (ships information, sensors used, precise dates, specific lines).

For AniBOS, it would be easy to follow the Argo notification procedure. All the platforms use the same variables, the animal network becomes complicated because it is not steerable, however general areas of likely occupation could be provided and visibility of observations in real-time.

One issue noted was that although unlikely, there is a remote possibility that animals could be trained to observe specific spaces, however, any such use would likely be obvious from the data.

Who, how & when:

In a preparation phase, this report and the ideas contained therein could be introduced through an IOC Assembly side event, enabling delegations to listen to experts, familiarise themselves with the terminology, proposed solutions, and to ask questions.

6.2 LOSC, Article 247 (IOC procedure)

The second solution discussed was the use of LOSC, Article 247 which states:

“A coastal State which is a member of or has a bilateral agreement with an international organization, and in whose exclusive economic zone or on whose continental shelf that organization wants to carry out a marine scientific research project, directly or under its auspices, shall be deemed to have authorized the project to be carried out in conformity with the agreed specifications if that State approved the detailed project when the decision was made by the organization for the undertaking of the project, or is willing to participate in it, and has not expressed any objection within four months of notification of the project by the organization to the coastal State”.

This provision was included in the UNCLOS to facilitate the conduct of MSR projects involving access to EEZs of a plurality of coastal States by introducing an authorisation procedure for projects adopted by or under the auspices of an intergovernmental body. However, Article 247 has yet to be implemented and its implementation could be complex and open to interpretation. In essence, it provides for Member States of an intergovernmental body (for example the IOC) to adopt an MSR project, which then may be carried out after giving notice of intent to conduct the project in a member or participating State's EEZ. If no objection is received within a limited time frame (four months), in theory, the work could go ahead.

Benefits:

The added value of using Article 247 as a solution space is that it would avoid applying individually to all potentially involved coastal States and would channel all communications through the intergovernmental body ensuring that all coastal States involved would be equally informed about the project, its execution and results.

Challenges:

If the Article 247 option is to be used, it must be done through an intergovernmental body that has a procedure in place for this purpose. The IOC is currently the only body that has a procedure in place for the implementation of this article. The IOC Procedure on Article 247 was adopted in 2005 but has not yet been used. Different views were expressed on the reason why, including that the procedure is regarded by some in the ocean observing community as cumbersome, as it would still involve providing detailed information long in advance, which may not always be possible, and leave approval status uncertain until late stages of the project since individual coastal States may still reject approval within four months after notification by the IOC.

The procedure to date (since its 2005 adoption by IOC) has never been used so there are currently no means for assessing its effectiveness. In addition, what might be termed an MSR project can be interpreted differently by different actors.

Potential:

Considering that the procedure was developed sixteen years ago and has not yet been used, it might be appropriate to look at it again. One way to do that could be to conduct an assessment of the current procedure by a competent organ of the IOC and consider suggesting the adoption of improvements to the procedure. However, it might also be an option to experiment with the current procedure by promoting the conduct of a pilot with one of the GOOS network projects.

Applicability:

Most networks could likely benefit in some way if this was accepted and efficiently operated. Not all participants agreed, for example, on the capacity of OceanOPS to automate the process or to operationalise the MSR request.

Who, how & when:

The use of the IOC Procedure implementing Article 247 should be discussed by the governing bodies of IOC: Executive Council and IOC Assembly. The suggestion to conduct a pilot project implementing the procedure could be further explored by inviting GOOS networks to propose potential projects.

6.3 Update the DOALOS Guide

The third solution is to update the Guide prepared by the Division for Ocean Affairs and the Law of the Sea (DOALOS) "*Marine Scientific Research: A revised guide to the Implementation of the Relevant Provisions of the United Nations Convention on the Law of the Sea*". This guide provides draft standard forms for States to use when they request an MSR project clearance and draft standard forms for the States in providing clearance. The idea is that updated guidance could reflect the issues raised in the workshop, providing a new 'best practice' for granting MSR clearance for sustained observing that would address the issues of MSR process and advanced notification (issues 1 and 2 above).

DOALOS would need to take the lead on this solution. There is a specific procedure to develop updates to the Guide that includes a mandate from Member States through the annual General Assembly resolution on oceans and the law of the sea. However, it was suggested that a 'lighter' approach could be in the form of issuing additional guidance to the existing Guide. The Division would need to look into the details to assess the feasibility of the

lighter process, including costs implications. The second edition of the *Guide to the Implementation of the Relevant Provisions of the United Nations Convention on the Law of the Sea*, that is currently in use, was finalised in 2009. There is some argument that it could be time to develop an update.

Benefits

The Guide is “vessel based” but some annexes provide guidelines that can still be useful for non vessel-based research.

The Guide could be updated to address some of the issues faced by the global observing networks, for example the time to gain clearance, the application and the process, flexibility in accepting an area and a time range rather than specifics location and days (perhaps with an update closer to date of operation), and the provision of specific requests with clearance.

Potential:

Several points were raised:

- the importance, when drafting national legislation, of taking into account that there are many different conventions (UNCLOS, CBD, IMO, etc.) that need to be viewed in an integrated manner for the purpose of interdisciplinary scientific research;
- a group of experts could be created to update the revised Guide, to include new technologies;
- an ‘update’ could be in the form of ongoing advice and outreach undertaken by DOALOS as part of its mandate to provide information, advice and assistance with a view to promoting better understanding, wider acceptance, uniform and consistent application and effective implementation of UNCLOS. It also assists Member States in their efforts to derive benefits from the international legal regime for the oceans with an emphasis in this regard on capacity building. If provided with a mandate by the United Nations General Assembly, and the necessary funding from Member States, DOALOS could lead the development of an update to the Guide on the implementation of relevant provisions of UNCLOS on MSR.

Challenges:

The Guide is not legally binding.

Applicability

Most networks could likely benefit in some way if this was accepted and efficiently operated.

Who, how & when:

This solution space has potential, however there are time and resource implications that need to be considered, particularly by DOALOS.

6.4 Raising awareness activities

The fourth solution is to help States realise the impacts and value of the observations, for example around issues that impact States such as climate change, sea level rise, extreme weather, and to raise awareness on the need to have a truly integrated GOOS, increasing transparency and enabling an evaluation of benefits versus risks, an enabling environment.

Problems to observe EEZs are (at least partially) linked to the fact that States do not realise the value and the benefit(s) of the GOOS and noting that communication and work on the value of the observations was also part of the Argo notification mechanism, the participants recognised therefore, the importance of such outreach (linked to the Solution space n°1).

There was a general agreement that States may not fully realise what the value of ocean observations is to the national, regional and local society or the issues faced by observers. Awareness raising activities is an immediately actionable solution that would benefit all networks.

Benefits:

The Argo Programme has focussed on transparency, articulating the core mission, data availability and education. For instance, there have been workshops for young scientists and programmes for high school students. Including state representatives in technical meetings was recognised as a good approach, in that sense States' participation would help increase legitimacy.

Challenges:

Raising awareness on the importance of the work of GOOS in waters under national jurisdiction was considered a potential source of apprehension for some networks, with the risk that some coastal States might raise red flags that would render their work even more difficult.

Potential:

The idea of communication was strongly supported by many experts and examples of situations where networks needed to ask for authorisations from coastal States' representatives which did not understand their work were shared. Also shared were many good ideas and examples relating to raising awareness.

For GLOSS, the tide gauge network, with issues around the availability of important data, this solution space on communicating the value of the data was strongly approved. The fact that national meteorological services were increasingly using the data was considered an indication of their value.

The question of tsunami monitoring was also examined and the need for states to share their data as a mandatory condition for the tsunami early warning system was suggested. In this same spirit, it was mentioned that if the data are not shared between States, the early warning system that they agreed to implement will not function in an optimal manner. This issue was considered as strongly linked to the need for communication on the value of the data.

Capacity building was also identified as a good way to raise awareness and enhance the network's legitimacy: namely by taking the observation in collaboration with the coastal State, to share the expertise (demonstration).

In this same order of idea, transferring the ownership of the observing instrument to the coastal State whose waters are being observed might be an option but a limited solution depending on whether the instrument used is expendable or not.

To have scientists onboard (on the vessel and/or implicated in the research) from the coastal State in which the observations are taken might help for the clearance process. However, examples were also given where this has been tried and does not make the procedure easier. In some States, national scientists also have to apply for MSR clearance in national waters.

Finally, a scheme where scientists are able to borrow a suite of instrumentation (for example IMOS allows scientists to borrow the receivers and they only need to buy the transmitters) might be a more regional solution. A pool of instruments that one could recycle on an annual basis.

Applicability:

Most networks could likely benefit in some way if there was greater, consistent and combined effort in this area. However, although raising awareness activities would likely be supportive, this would not solve all problems with MSR.

Who, how & when:

To use the momentum created by the UN Decade of Ocean Science for Sustainable Development as a possibility to advocate for the importance of the observations taken in EEZs might facilitate the establishment of an enabling environment. The UN works on finding innovative activities to give visibility to help 'sell' the UN Decade on Ocean Science at the international level. To have activities helping increase transparency concerning the

importance of the observations taken could help with this. The WMO was also considered as an important actor to help raise awareness.

Several key ideas that emerged were:

- networks engage with coastal States around capacity development;
- GOOS undertakes outreach on these topics;
- DOALOS undertakes outreach with regard to UNCLOS;
- outreach and training that WMO undertakes.

The message would be stronger if consistent.

On the raising of awareness, one might collect ideas from the networks on how to create an enabling environment. These ideas would then be put in one place and allow States to understand how they might engage in this way.

6.5 WMO Recommendations

Looking at additional resolutions related to variables/platforms that are important for WMO service delivery could be considered.

Benefits:

Coordinate GOOS/WMO action would again help raise awareness in the meteorological/oceanographic community and benefit WMO members for weather and climate services.

Challenges:

Passing a WMO resolution is considered a solution but the process is time-consuming and slow. The limited impact of recommendations - as they are not binding in the same way as WMO regulatory material - was also stressed, as well as the strong difference between the wordings ["shall" versus "urges the States to"].

Potential:

A debate followed on data availability and the capacity of the IOC data policy to help solve the issue of taking observations in exclusive economic zones and its link to this challenge, however compliance with the data policy is not tracked.

Applicability:

Potential to support the taking of observations by those platforms that significantly contribute to WMO safety of weather and climate mandates.

Who, when & how:

Meteorological agencies should be encouraged within the States to comply with the data policy that exists in order for the system they agreed to implement to function in an optimal manner.

Some opportunity to work on this has been presented recently with the revising of the WMO Data Policy (see later WMO Resolution 42).

6.6 Regional arrangements

Several examples exist of specific networks reaching agreement with a group of States in specific areas. There was agreement on the importance of regional governance and that working to develop a regional multi-State agreement to help facilitate observations in waters under national jurisdiction could be useful in some circumstances.

As a clarification on the European Union (EU) legislation on MSR, there is no EU competence on MSR and an EU Member State must go through its European neighbour's clearance procedure to work in its EEZ. Fisheries are regulated by the European Union and therefore have a different regulation. Stock abundance research for fisheries is not considered MSR but under the sovereign jurisdiction of the coastal State.

The participants examined if a solution space existed at the EU level, given that structures such as EuroGOOS and the European Ocean Observing System (EOOS) support coordination at a EU level. Although there is no EU marine space in general and the EU has no official competence on this issue, a project for a simplified procedure for the Member States of the EU was discussed in the past but never accepted.

Benefits:

Can be used now to develop accord in areas with close maritime links, and does not involve, for example, the agreement of all IOC Member States, just those with common regional interest(s).

Challenges:

This solution takes time and resources to develop, generally at a network level, sometimes an innovative offer needs to be developed, there is no 'blueprint' for success.

Potential:

On the possibility of working on a regional basis, the participants agreed on the importance of regional governance on ocean science matters and that it was useful to think about the networks that have an important regional presence.

Applicability:

This has potential to aid some networks' issues, in some areas, particularly where there are strong regional drivers, and an understanding of the importance of the observations to the coastal States (e.g. climate and/or human pressure induced changes in the marine environment).

For example, for GO-SHIP, a regional arrangement could be part of the solution as the network faces greater challenges in some regions, but it could only be a part of the solution. GO-SHIP would probably always need to go through full marine research procedures - all the more so as the lines are operated by more than one State.

For SOOP, the efficiency of this solution was unclear. The possibility of organising an arrangement with each State was mentioned as probably preferable. Again, the possibility to arrange for facilitating the measurements in some specific lines was put forward.

Who, when & how:

The EU Project EuroSea has a legal component and will develop a report that will air/address the potential for European agreement. However, the work generally lies at a network level and takes time and resources. It is not clear how this could be scaled or better supported. Highlighting the results of this report in regional fora could be one suggestion.

6.7 LOSC, Article 258

The UNCLOS contains one provision, Article 258, which explicitly refers to the deployment of scientific installations and equipment. That article reads as follows: *"The deployment and use of any type of scientific research installations or equipment in any area of the marine environment shall be subject to the same conditions as are prescribed in this Convention for the conduct of marine scientific research in any such area"*.

Some participants suggested the use of Article 258 as a means to clarify the status of new ocean observing platforms, e.g. ocean gliders, in light of difficulties experienced with some coastal States about clearance applications concerning their deployment. The provision could be used to clarify to national authorities that the national MSR clearance procedures should also incorporate the use of new technologies, other than vessels.

Some participants expressed the view that Article 258 should not be viewed as a 'solution space' as it confirms that the deployment of installations and equipment for MSR is subject to the same legal regime as vessels, and thus is an example of a provision considered to be complicating the practical implementation of the UNCLOS MSR regime.

Benefits:

Confirms that the deployment of new technology and equipment for MSR is subject to the same legal regime as vessels.

Challenges:

Any discussion of this solution space may encounter debate on its meaning. Participants disagreed on the pertinence of considering Article 258 as a solution space to help facilitate the work of the ocean observing community in EEZs. It was highlighted that even if Article 258 might help the deployment of new platforms, scientists would still rely on the member states granting MSR clearance. This does not resolve the issues associated with the MSR clearance process (issue 1), or advance notice (issue 2).

Potential:

To resolve issues associated with deploying new platforms not originally foreseen under the UNCLOS.

Applicability:

This suggests that within UNCLOS there is provision for new technology to be considered as subject to the same provisions as the ocean observing platforms that existed when UNCLOS was elaborated, which means that new technologies must apply for MSR clearance. This does not reduce any of the issues that networks face with the MSR procedure, it does however provide the pathway for operators of new technology/platforms to apply for MSR through their Ministry of Foreign Affairs.

Who, when & how:

This is for GOOS and the networks to advise the ocean observing community.

7. Analysis

In this section, the solution spaces developed through the two-day workshop have been assessed for their potential to resolve the multiple issues that the networks face. This gives some guidance as to which solution spaces could be most effective for specific networks and across the range of ocean observing networks.

Network / Solution Space		GO-SHIP	SOOP	VOS	DBCP Drifters	Argo	AniBOS	Ocean Gliders	Ocean SITES	GLOSS
1	Argo notification scheme process	No	Yes	Yes	Yes	Yes (deploy-ments)	Yes	Yes	No	No

2	Article 247	Yes	Potential	Potential	Potential	Yes (deployments)	Potential	Yes	Yes	No
3	Update the UNCLOS Guide	Yes partial	Potential	No	No	Potential	Potential	Potential	Potential	No
4	Raising awareness	Yes partial	Yes partial	Yes partial	Yes partial	Yes partial				
5	WMO resolutions	Partial	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes partial
6	Regional arrangements	Yes partial	Yes partial	No	Yes partial	Yes partial	Yes partial	Yes partial	Yes partial	Yes partial
7	Article 258	No	No	No	No	No	potential partial	potential partial	No	No

Table 2: This table provides an assessment of the effectiveness of the various solution spaces in resolving the challenges faced by the global ocean observing networks, as detailed in Section 4. Note that ‘Yes’ signifies that the solution could resolve the challenges faced, ‘Yes partial’ signifies that it could work but would only partially resolve the issues faced, ‘Potential’ signifies that it could potentially solve the challenges but there is some doubt as to how effective it could be and/or that it would depend on how successfully the solution is implemented, finally ‘No’ signifies that this solution would not solve the challenges faced by that network. Some of the network columns are banded by colour, as these networks face similar challenges due to the nature of the observing platform and operations, e.g. SOOP and VOS operate on commercial ships and therefore have no or limited ability to provide advance notice of the location of the ships taking observations; drifting buoys, profiling floats and animal borne sensors have no control on the platform location once deployed, although some short-term predictive capability is possible.

A summary is provided below of the relative timing and difficulty to implement the various solutions to provide some assessment of the feasibility and timescales of implementation for the potential solution spaces.

Solution Space	Level of difficulty to implement	Who	Timescale	Potential to assist networks
1 Argo notification scheme process	Non-trivial, however a pathway, if well prepared, well defined issues. IOC Member State appetite to form a team to work on this	IOC	3-5 years	Yes many
2 Article 247	Not used before, difficult to assess potential. Perhaps assess through a pilot project or a small group. To develop a global solution would be more work.	IOC	2+ years	Yes some, others partial
3 Update the UNCLOS Guide	There is a cost implication to DOALOS, need to work together on why needed can be done, need mandate from Member States	DOALOS	1-2 years	Potential for some

4	Raising awareness	High feasibility, many different options to pursue, needs planning, resources, could be a priority for action, together with other solutions	IOC, WMO, DOALOS	Implement now, but likely years to have impact	Yes partial all
5	WMO Resolutions	Feasible, some longer-term propositions (e.g. GBON), WMO appetite to work on this.	WMO	3-5 years – some opportunity for short-term awareness	Yes most
6	Regional agreements	Will only work in some regions, e.g., Mediterranean, Baltic, Europe, Pacific Islands. High cost to networks in time and resource, no guarantee or blueprint – is there some work that would support a best practice or framework	Networks	1-3 years	Yes partial many
7	Article 258	Assist with granting consent for deployment/use for new networks	Networks, individual coastal States	Immediate	Yes, partial for new technologies

Table 3: Summarises the solution spaces with some guidance as to the number of networks each could assist (as presented in Table 2), what organisations would implement the solution, the timescales for implementation, and a general assessment of the resource required and level of difficulty to implement.

Key synthesis points from the two tables:

- Raising awareness could be very effective. This would assist all networks, it would however likely take time for communications to have sufficient impact on the issues raised above, as it would need to reach the appropriate decision makers in many States. Also, it only works if this is being done on a consistent basis, since many government officials remain in their positions for limited periods. Raising awareness should be a target solution in combination with other actions.
- An Argo-like process has significant potential to aid a number of networks and should be considered seriously as a solution.
- Article 258 may aid by encouraging coastal States to adapt their national clearance procedures to accommodate platforms other than vessels, but it does not solve many of the other issues raised across the networks.
- WMO resolutions can be effective and would support service delivery. For the VOS network, marine meteorological measurements can be argued to be outside what falls under MSR and the WMO Resolution 45 (Cg-18) "Ensuring adequate marine meteorological and oceanographic observations and data coverage for the safety of navigation and the protection of life and property in coastal and offshore areas" from WMO Eighteenth Congress has been passed in this regard. There is therefore no need to find additional solutions for the VOS network, and for ocean observations that fall under the WMO mandate this is an effective pathway. See next section for recent work on the new WMO Data Policy.
- Regional agreements have potential to resolve the issues faced in some circumstances. However, this comes with some uncertainty and at some cost, in

terms of time and resources, to the organisation undertaking the work to develop a regional agreement.

- Article 247 has potential as a solution, however it should be tested. The IOC has a process in place, but it has not yet been implemented. One suggestion would be to test the process and use of article 247 through a pilot in an area with known issues. This would come with a cost to IOC and other organisations involved, and so some informal consultation with Member States, perhaps through IOC Assembly or Executive council forums, to gauge interest in undertaking such a pilot, is recommended. It would also be possible to undertake a review of the current procedure with a view to identifying potential improvements.

8. Post-Workshop developments

Since the 2020 Workshop developments in the three areas below are noted as supportive of the issues outlined above, and will be taken into consideration in the conclusions.

Firstly, work by the WMO in assessing gaps in its Global Basic Observing Network (GBON) have highlighted that small States with large EEZ areas will struggle to be able to fulfill their 'global' role in ocean observing, the GDP to EEZ ratio is very high. In such cases (high EEZ to GDP ratio), the coastal State will need some assistance in fulfilling local and global needs. This could be through support from global ocean observing networks and potentially in the future through new funding mechanisms such as the WMO's Systematic Observations Financing Facility (SOFF)⁶. In addition, recent work on the WMO Unified Data Policy for the International Exchange of Earth System Data (Resolution 1 (Cg 18.5)) is supportive in clearly articulating the responsibility of States to exchange ocean data in a free and unrestricted manner. This policy provides a single 'unified' data policy across multiple domains: Weather, Climate, Hydrology, Atmospheric Composition, Cryosphere, Oceans and Space Weather that aims to broaden and enhance the free and unrestricted international exchange of Earth system data. For oceans it covers *in situ* and remotely sensed observational data, in and above the ocean, and at the sea-surface, from the open ocean to the coast, in order to provide the necessary input to monitoring and prediction systems for a variety of Earth system applications. It acknowledges the right of governments, based on their national laws and policies, to choose the manner by, and the extent to which, they make data available domestically or for international exchange, thus does not override national data policies, it does however note the observations that shall be and should be exchanged. See table 4 below. This has been approved by WMO at WMO Congress 18.5 in October 2021 - Resolution 1 (Cg 18.5).

⁶ <https://public.wmo.int/en/our-mandate/how-we-do-it/development-partnerships/Innovating-finance>

Secondly, the UN Decade of Ocean Science for Sustainable Development has the goal of making sustainable oceans a reality. This will require sufficient observations in EEZs, where many of the resources that need to be sustainably managed are located. GOOS has put forward three transformational Programmes under the Ocean Decade that could support resolution of some of the issues raised. The Programmes *CoastPredict: Revolutionising Global Coastal Ocean observing and forecasting, co-designing the needed infrastructure and offering open and free access to coastal information*, and *Observing Together*, which will transform ocean data access and availability by connecting ocean observers and the communities they serve through enhanced support to both new and existing community-scale projects, will both have a key focus on making the observations work for users. The success of a Global Coastal Ocean Observing System, and all the benefits this would bring to States, will in part depend on taking more observations in EEZs.

Finally, the recent IPCC AR6 Report (Climate Change 2021: The Physical Science Basis⁷) addresses the most up-to-date physical understanding of the climate system and climate change, and brings together the latest advances in climate science, and combines multiple lines of evidence from paleoclimate, observations, process understanding, and global and regional climate simulations. This lays out the challenges that States face in stark terms, and some of the most impactful effects of climate change are now front and centre in international dialogue as we begin to experience such events with greater frequency. The ocean plays a fundamental role in many aspects of climate change for which adaptation and mitigation action will be necessary. Issues related to sea level rise, marine species migration, marine food security, ocean acidification and warming, extreme weather events, the global carbon budget, to name a few, are steadily increasing. We cannot manage what we cannot measure and so the climate crisis is fast raising awareness of the need for ocean observations.

Core data (shall be exchanged on a free and unrestricted basis)	Recommended data (should be exchanged)
<p>Core observational data:</p> <p>(a) Marine meteorological and oceanographic observations, as defined in the Manual on the WMO Integrated Global Observing System (WMO-No. 1160);</p> <p>(b) All other physical Global Ocean Observing System (GOOS) Essential Ocean Variables (EOVs) and physical ocean domain GCOS ECVs, some of which are included in section 2, Climate, above made as part of a GOOS observational network, programme or project, consistent with the Intergovernmental Oceanographic Commission (IOC) Oceanographic</p>	<p>Recommended data:</p> <p>(a) Physical GCOS ECV and GOOS EOVS observations that have been collected outside of designated GOOS activities;</p> <p>(b) All other observed biogeochemical and biological/ecosystems GCOS ECVs and GOOS EOVS;</p> <p>(c) Observations of pH, chlorophyll-A, suspended particles and downwelling irradiance which are fundamental to address significant scientific and societal ocean/climate-related issues.</p>

⁷ The Working Group I contribution to the Sixth Assessment Report - <https://www.ipcc.ch/report/ar6/wg1/>

Data Exchange Policy (IOC Resolution XXII-6)	
<p>Other core data:</p> <p>(a) Ocean analysis and prediction fields provided by global NWP systems operating under the auspices of the GDPFS, as defined in the Manual on the Global Data-processing and Forecasting System (WMO-No. 485);</p> <p>(b) All ocean reanalysis fields provided by the Global Processing Centres of the GDPFS;</p> <p>(c) All watches, warnings, advisories and alerts for public safety (protection of life and property) issued by Members' designated warning and alerting authorities according to WMO Technical Regulations.</p>	

Table 4: From WMO Unified Policy for the International Exchange of Earth System Data - Resolution 1 (Cg 18.5) - <https://public.wmo.int/en/our-mandate/what-we-do/observations/Unified-WMO-Data-Policy-Resolution>

9. Conclusions, Recommendations and Next Steps

The need for action at an international level has been recognised by for example the G7 Science and Technology Ministers' Tsukuba Communiqué⁸ which notes *'93% of the global ocean is >200 m deep and spans many different jurisdictional boundaries and is governed by established international law; ocean observing is "big science". Proper, sustained, comprehensive and globally coordinated observation of the ocean and seafloor is necessary so that we have the tools to provide the data and understanding required to inform, with evidence, policy decisions about use of the ocean, especially against the background of human-induced change and natural variability. A comprehensive ocean observing programme would need to operate under a sound international framework in order to coordinate the deployment of global ocean observing assets to optimize their usage'*.

Requests for MSR clearance can be subject to geopolitical issues that go far beyond the realm of ocean science, and therefore requires action beyond the level of organisations such as GOOS, the OCG and the global networks. It requires higher level action by intergovernmental bodies such as IOC/UNESCO, WMO, DOALOS, and the United Nations General Assembly which has declared its competence to review developments in ocean and law of the sea matters.

The OONJ Workshop team makes the following recommendations under the premise that these recommendations should enable agreed and equitable access to ocean observations in areas under national jurisdiction. It also makes them in light of advances in sustained ocean observing and the pressing global and national needs for these observations, to face challenges associated with climate change and adaptation, sustainable development, and to ensure safety of life and property at sea and in coastal areas.

1. IOC to consider initiating a process equivalent to the Argo notification scheme applicable to other platforms/variables. The initiative for commencing such a process should be brought to the IOC Assembly as a proposal by any Member State of the Commission, by the Executive Council, by the Executive Secretary, by the Head of any organization of the UN system, or by other organizations invited to participate in the work of the Commission. Initiating the discussion at the level of the Executive Council requires following a similar path, and should include an explanation why the decision of the Executive Council is required.

⁸ https://www8.cao.go.jp/cstp/english/others/communique_en.html

2. IOC, with DOALOS and WMO support, set up an informal meeting, perhaps in conjunction with the IOC Assembly or Executive Council, to discuss and share different practices in the implementation of MSR clearance procedures by States. National examples could be provided, leading to an expression of an 'IOC Best Practice' for national implementation of MSR clearance procedures for sustained ocean observations.
3. IOC/GOOS, WMO and DOALOS consider a joint work plan or initiative to raise awareness of the issues and the value gained from ocean observations, nationally and globally, especially in the context of the aims of the UN Decade of Ocean Science for Sustainable Development. A coordinated awareness building effort would be more powerful than a single action. Perhaps initially through socialising the report and findings, particularly with IOC and WMO Member States and Members, the OCG and BioEco Panel networks.
4. GOOS should use the information from the findings, recommendations and outcomes of the OONJ Workshop to support networks, the GOOS National Focal Points, and the ocean observing community in working with the MSR clearance procedures and with States around the MSR clearance procedures. Ensuring that networks are aware of the potential of regional agreements, and for those for which it is relevant of the use of Article 258, and also of raising awareness. GOOS could also develop a focal point for the collection and documenting of ongoing issues and dissemination of any raising awareness materials.
5. WMO to consider how resolutions could be supportive in highlighting the need for sustained ocean observations from EEZs and the critical role the national MSR clearance process plays in enabling this. GOOS to provide as and when required to support such regulatory tools.
6. DOALOS to assess if there is appetite to pursue gaining a mandate from Member States to develop an update to the *Guide to the Implementation of the Relevant Provisions of the United Nations Convention on the Law of the Sea*.
7. IOC to consider initiating a pilot, using the IOC Article 247 process to undertake ocean observations after adoption of the project by the IOC and notifying Member States of the intent to undertake the activities in their EEZs.

The IOC, WMO and DOALOS are encouraged to consider the recommendations above, and the action that they can take separately and in unison to support the taking of sustained ocean observations in coastal States EEZs.

Annex 1: OONJ Workshop participants, agenda and background

Please find a table of participants below. For more detailed contact information and to consult the Expert Meeting agenda and background please visit the [meeting website](#).

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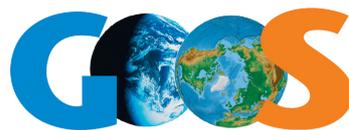
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Annex 2: Glossary of acronyms

ABE-LOS	ADVISORY BODY ON THE LAW OF THE SEA
ANIBOS	ANIMAL BOURNE OCEAN SENSORS
ASAP	AUTOMATED SHIPBOARD AEROLOGICAL PROGRAMME
BGC	BIOGEOCHEMICAL
DOALOS	DIVISION FOR OFFICE AFFAIRS AND LAW OF THE SEA
DBCP	DATA BUOY COOPERATION PANEL
EEZ	EXCLUSIVE ECONOMIC ZONE
ETOOFS	EXPERT TEAM ON OPERATIONAL OCEAN FORECAST SYSTEMS
GBON	GLOBAL BASIC OBSERVING NETWORK
GBC	GLOBAL CORE NETWORK
GLOSS	GLOBAL SEA LEVEL NETWORK
GOOS	GLOBAL OCEAN OBSERVING SYSTEM
GO-SHIP	GLOBAL OCEAN SHIP-BASED HYDROGRAPHIC INVESTIGATIONS PROGRAMME
GRA	GOOS REGIONAL ALLIANCE
IOC	INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
ISC	INTERNATIONAL SCIENCE COUNCIL
OceanOPS	WMO-IOC JOINT CENTRE FOR OCEANOGRAPHY AND MARINE METEOROLOGY IN SITU OBSERVATIONS PROGRAMME SUPPORT
OCG	OBSERVATION COORDINATION GROUP
MSR	MARINE SCIENTIFIC RESEARCH
SOFF	SYSTEMATIC OBSERVATIONS FINANCING FACILITY
SOOP	SHIP OF OPPORTUNITY PROGRAMME

SOT	SHIP OBSERVATION TEAM
UNCLOS	UNITED NATION CONVENTION ON THE LAW OF THE SEA
UNEP	UNITED NATIONS ENVIRONMENT PROGRAMME
VOS	VOLUNTARY OBSERVING SHIPS
WMO	WORLD METEOROLOGICAL ORGANIZATION

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