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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)

First Meeting of the Global Ocean Observing System Steering Committee (GOOS SC-1)

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Final Report

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Executive Summary

The GOOS Steering Committee (SC), formed by IOC Resolution XXVI-8 'Strengthening and Streamlining GOOS' (2011), held its first meeting at UNESCO 20-22 June 2012. In accordance with its terms of reference, the Committee selected John Gunn (Australia) and Eric Lindstrom (USA) as its co-chairs.

The Committee held structured discussions around three themes: 1. sustaining present observations; 2. expanding to new variables and serving new requirements; and 3. identifying regional priorities, capacity, and addressing gaps.

The Committee highlighted the strength of treating sustained research and operational observations together, and agreed on the utility of the Framework for Ocean Observing and its focus on Essential Ocean Variables in articulating the multiple 'missions' addressed by a single observing system. It emphasized the importance of reaching out to users, and in particular to modeling users, in helping to evaluate observing system performance and identify requirements. The Committee decided to negotiate with GCOS and WCRP on the role of the present Ocean Observations Panel for Climate, formally re-establishing GOOS sponsorship for addressing physical Essential Ocean Variables, including GOOS requirements for real-time services and in the coastal ocean.

The Committee affirmed the importance of expanding GOOS into new variables. It decided to work with IOCCP as the nucleus of a panel for carbon and geochemical variables, recognizing that any expansion in mandate would require additional funding and personnel support. It also decided that it would seek to develop a biology/ecosystems panel in cooperation with SCOR, GEOBON and other activities.

The Committee recognized the importance of the GOOS Regional Alliance (GRA) concept, as a way of engaging national action at a regional level that was often seen as most appropriate to the issues faced by Member States. It identified a large heterogeneity in the arrangements for and capacity of the present GRAs. The Committee reemphasized the utility of a link with the GODAE OceanView Coastal and Shelf Seas Task Team, and the potential to generate projects that would develop useful information at a local level. The Committee recognized the need to develop capacity as a key element for global participation in GOOS, and in particular the need to identify and develop approaches to potential funders.

The Committee agreed to an initial work plan of long-term and initial actions:

1. Articulating 10-year goals for GOOS, to inform a two-year work plan;
2. Engaging with key conventions and assessments on their needs for ocean information,
3. Improving outreach for GOOS,
4. Engaging IOC Member States, with a focus on raising awareness and information exchange,
5. Identification and developing engagement with potential donors for GOOS,
6. Broadening the variables examined by GOOS and establishing three disciplinary panels for Physics, Carbon/Geochemistry, and Biology/Ecosystems,
7. Improving GOOS Regional Alliance (or like) implementation, starting with a focus on collecting information on priorities and capacity from each GRA,
8. Capacity Development, beginning by developing a statement of needs for GOOS, and
9. Analyzing the challenge of data interoperability.

Background

IOC Resolution XXVI-8 'Strengthening and Streamlining GOOS' decided to recommit the IOC to a Global Ocean Observing System (GOOS) that is a holistic system of global, regional and coastal observations and products, aligned with a Framework for Ocean Observing[1] oriented to an Essential Ocean Variable approach, promoting GOOS's role in informing key societal issues as expressed in UN conventions, and reinforcing global participation through capacity development. It reformed the governance structure of GOOS by confirming that the IOC governing bodies are directly responsible for the governance of GOOS. It dissolved the Intergovernmental Committee for GOOS (I-GOOS), the GOOS Scientific Steering Committee (GSSC), and its subsidiary panels. In addition, the Assembly in its report "asserted the importance of GOOS as a priority for the IOC; noted that geographically-balanced representation on the GOOS SC should be assured; and emphasized the desirability of representation in the GOOS SC of other IOC programmes as well as of, inter alia, POGO, SCOR, GEOSS, JCOMM and IODE."

The resolution created the GOOS Steering Committee (GOOS SC) and defined its terms of reference, which in summary are to:

- identify the essential ocean variables to observe, and develop and update the scientific, technical and implementation plans and targets for GOOS,
- monitor and promote the development of GOOS based on these agreed plans,
- assess the performance of GOOS in providing users with fit-for-purpose data and information,
- encourage research and operational programmes to enhance and improve GOOS, and
- advise on developing the capacity of all Member States to participate in and benefit from GOOS.

The GOOS SC will develop a work plan, and have the authority to create and dissolve time-limited panels to focus on particular terms of reference.

Formation of the GOOS SC and initial discussions

The IOC Executive Secretary invited Member States and sponsors to submit nominations for the GOOS Steering Committee through IOC CL-2397 (31 August 2011). Five GOOS SC members were appointed by IOC regions, and an additional ten experts were appointed in January 2012 by the Executive Secretary in consultation with the sponsors WMO, UNEP, and ICSU. The list of members and meeting participants can be found in Annex 2 (p. 26).

The GOOS SC held a virtual meeting[2] by e-mail between March and May 2012, and the report of this meeting is available at the link above.

Introduction to this report

This report of the First Meeting of the GOOS Steering Committee (GOOS SC-1) roughly follows the agenda found in Annex 1 (p. 22). Decisions and recommendations are highlighted in bold. The key actions arising from the Committee discussions are summarized in the table in Section 9 (p. 18).

[1] IOC/INF-1284, http://www.oceanobs09.net/foo/

[2] http://ioc-goos.org/vigsc

1. Opening

Mitrasen Bhikajee, Deputy Executive Secretary of the Intergovernmental Oceanographic Commission (IOC), welcomed the GOOS Steering Committee members and guests to UNESCO, IOC and Paris. The IOC as a Commission of Member States has four High Level Objectives related to marine hazards, climate, ecosystem health, and environmental management. Ocean observations and therefore GOOS have a role in achieving all four of these objectives. Bhikajee recalled that the IOC Member States in their reform of GOOS and creation of the Steering Committee had recommitted to GOOS as a priority. He called upon the Committee to accept the large responsibilities they had been given, and to bring its expertise to the IOC for further development of the ocean observing systems.

The secretariat invited the participants to introduce themselves. Summary introductions from the participants were also gathered during the March 2012 virtual meeting of the GOOS SC, and can be found as a background document on the meeting website.

In accordance with its terms of reference, the Committee **confirmed** by acclamation John Gunn and Eric Lindstrom as its co-chairs.

The provisional agenda was adopted as found in Annex 1 (p. 22).

2. Background

background documents:

- *IOC resolution 'Strengthening and Streamlining GOOS'*[3]
- *GOOS Status report*[4]
- *Framework for Ocean Observing*[5]

Several presentations addressed the background leading to this first meeting of the GOOS SC, including the reform of GOOS governance, the status of the GOOS observing system and the GOOS programme, and the Framework for Ocean Observing developed after the OceanObs'09 conference.

The GOOS Project Office Director, Albert Fischer, reiterated in a presentation[6] the mandate of GOOS and the charge to the GOOS Steering Committee, as defined by the IOC Member States in IOC Assembly Resolution XXVI-8. He recalled that the Committee was agreed with sponsors to be 'interim' until their governing bodies could agree formally to the reform. The resolution, in addition to elevating the role and responsibility of the IOC Assembly in GOOS governance and execution, empowers the new SC to lead GOOS based on the ideas expressed in the Framework for Ocean Observing. The Committee's terms of reference instruct it to:

- *identify the Essential Ocean Variables (EOVs)* to observe, and develop necessary *plans and targets* for GOOS
- monitor, promote, and provide *guidance on development and operation* of GOOS
- *assess the performance* of GOOS in providing users with fit-for-purpose data and information
- *identify* and encourage research and operational *programmes* to enhance and improve GOOS

[3] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=8600&lang=en
[4] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=8666&lang=en
[5] http://www.oceanobs09.net/foo/
[6] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9203&lang=en

- *advise on developing capacity* to participate in and benefit from GOOS

Fischer gave a second presentation[7] on the status of GOOS as a collaborative system of sustained observations, and as a programme made up of its Steering Committee and secretariat. GOOS, as a collaborative system of observation programmes supported through national and operational research funding, has grown significantly over the past ten years, but specific growth goals set for the in-situ climate networks have not been met in the past five years. National contributions to the implementation of GOOS vary by network - a very large proportion of nations implement coastal networks defined in GOOS, and a smaller number of nations implement open ocean observations. Implementation of coastal GOOS is largely driven from national and local concerns and funding, with some coordination taking place through the GOOS Regional Alliances (GRAs). GOOS, as a coordinating programme, supported largely through UNESCO/IOC regular budget funds, has been deeply affected by the financial situation at UNESCO this biennium (2012-2013). GOOS regular budget to support meetings and coordination activities has been cut by 80% from planned levels due to withholding of the US assessed and voluntary contributions to IOC/UNESCO and less flexible staff costs. Extrabudgetary funding from the Republic of Korea, China, and project-based contributions from the European Commission and Global Environment Facility (GEF) would be able to partially compensate for this loss of funds and allow the secretariat in support of GOOS and JCOMM to function.

Lindstrom presented[8] the Framework for Ocean Observing, as co-chair of the post-OceanObs'09 Task Team that developed it. This Framework responds to the Call for Action of the OO'09 conference for *"…governments and organizations to embrace a framework for planning and moving forward with an enhanced global sustained ocean observing system over the next decade, integrating new physical, biogeochemical, biological observations while sustaining present observations. Recommendations on this Framework, considering how to best take advantage of existing structures, will be developed by a post-Conference working group of limited duration."*[9] The Framework for Ocean Observing (FOO) inspired the reform of GOOS governance. The FOO is based on systems thinking, organizing the observing system on: 1. requirements based on societal issues, driving 2. processes (observations) which output 3. data and products that then feed back to scientific or societal benefit, the source of the requirements. The fitness for purpose of the system is judged by the success of observing system outputs which satisfy requirements. Presently GOOS global requirements are expressed in the ocean chapters of GCOS implementation plans focused around Essential Climate Variables. The success of the ECV under GCOS concept has been adopted and generalized as Essential Ocean Variables, which the GOOS SC has the mandate of evaluating through the work of its panels. The evolved GOOS will be driven by requirements, negotiated with feasibility or readiness levels of observations systems for those EOVs. The sustainability, expansion, and integration of GOOS will be based on meeting an expanding set of societal issues in additional fields, including biodiversity, regional seas needs, regional and global fisheries, marine management needs and global marine assessments.

The Committee **noted** that the GRAs coordinate a wealth of activity in coastal and regional seas observation programmes. While a small number of GRAs are underperforming, many are extremely active and successful, each in their own manner. The wide variation of priorities and institutional arrangements has made a collective evaluation of the role of GRAs in the GOOS a challenge. The majority of the GRAs are noted for the richness of activities,

[7] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9202&lang=en
[8] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9187&lang=en
[9] doi:10.5270/OceanObs09.Statement

often with emphasis on physical monitoring and data management and products tailored to specific regional needs, such as oil spill response and coastal inundation.

The OOPC/JCOMM overview graphic of GOOS status is due for updating, including satellite contributions, and perhaps be steered away from measures based only on platform deployments to show measures of implementation for variables. Variable-based completion statistics could also be created, which would include percentage of completion of sampling rates and spatial coverage with appropriate resolution and accuracy goals.

Incorporation of coastal observations into the overview of GOOS would require definition of goals, which vary regionally. The Panel for Integrated Coastal Observations (PICO) plan identifies the variables and observing systems required to respond to particular Phenomena of Interest (PoI) or societal benefit areas (see p. 12). Under each PoI, the plan identifies pressures and drivers of ocean ecosystems, and identifies the requirements for observations and information-generation necessary for process understanding and to respond to the societal issues posed by each PoI.

In discussing the status of GOOS, some members of the Committee expressed a strong desire to identify system targets and metrics for coastal observations as well as open ocean and satellite observations. The Framework for Ocean Observing which was inspired in many respects from the work of GCOS and application of its systems thinking to the GOOS climate / open ocean component could also serve to focus regional or national coordination of observing systems, implemented to address regional and national priorities. This local use of the Framework could empower the agents for implementation within IOC Member States to identify their own priorities for investment in ocean observations, and help them identify and articulate arguments to sustain and grow this investment.

The Committee **accepted** the primary tenet of FOO that we cannot measure everything, nor do we need to. The GOOS SC must evaluate the EOVs and prioritize needs to match societal drivers. On a global level conventions and assessments, like UNFCCC, CBD, IPCC, and the emerging UN World Ocean Assessment (Regular process) provide the highest-level opportunities for expression of requirements focused on particular issues. They were also a possibility to engage decision-makers at a high level.

Gunn introduced in a presentation[10] the need to develop an operating model for GOOS and the GOOS SC. This emphasized the governance aspects of the GOOS SC which set it apart from the methodologies of the I-GOOS. The emphasis of the GOOS SC will be to provide recommendations which will become decisions for the IOC Member States to take at IOC Assemblies and Executive Councils. The GOOS SC must monitor, promote and provide guidance on development and operation of GOOS. This will require regular assessments of how fit for purpose the GOOS systems are. Biennial workplans based on decadal workplans will be essential for communicating to the member states the status and goals of the GOOS. The goals of the GOOS as expressed by the GOOS SC work plans will depend upon the GOOS panels for implementation and implementation planning. The Panel work load should be designed to integrate with panel member's professional responsibilities, most of whom will be selected for their knowledge and direct experience in implementation of observation strategies for ocean variables.

The Committee **decided** that it should develop a decadal GOOS plan at a strategic level, as a vision for the larger community and to help the development of more specific work plans for GOOS and for its individual panels (see item 1 in the table on p. 18). It emphasized that the SC was not a technical advisory group and that it would rely on its panels and associated partners to develop detailed implementation plans.

[10] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9188&lang=en

Theme I: Sustaining present observations

3. Elements of the present system: where are we now

WMO: expectations for GOOS

Wenjian Zhang (WMO) highlighted GOOS as an essential Observing system to IOC and WMO in his presentation[11]. WMO Global Observing Systems cover: Global Observing Systems (WWW/GOS), WMO Space Programme, Global Atmospheric Watch (GAW), World Hydrological Cycle Observing System (WHYCOS), and WMO Co-sponsored Observing Systems (i.e. GCOS, GOOS, GTOS and GEOSS). Global Framework for Climate Services (GFCS) and WIGOS/WIS were recognized key priorities for 2012 – 2015. In its WIGOS Implementation Plan, two activity areas are relevant to GOOS,

- Collaboration with WMO and co-sponsored observing systems
- Integrated Observing System operation and maintenance

WMO Rolling Review of Requirements (RRR) is under responsibility of CBS with Expert Team on the Evolution of Global Observing Systems (ET-EGOS). RRR has a profound implication and application in Ocean Application through the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) in ocean-based observations and JCOMMOPS development strategy and in Climate Monitoring (GCOS) as well. GFCS requires enhanced ocean observations, making it both a challenge and an opportunity for IOC and WMO.

Efficient coordination and effective mechanisms were discussed to ensure enhanced synergy among the Global Observation Systems. As an official body of WMO and IOC, the Data Buoy Cooperation Panel (DBCP) is an excellent example of collaboration and partnership of both organizations. DBCP responds critically to JCOMM Observations Programme Area, and is expected to address climate monitoring requirements in Ocean Applications to a large extent. It is noted that WIGOS and GOOS are compatible systems. Follow-up meetings may be proposed after GOOS SC-1, and short term and long term goals should be identified accordingly, and representatives to each other's sessions may be considered.

Climate requirements and assessment of fitness-for-purpose: OOPC and the Framework

Lindstrom, chair OOPC, explained in a presentation[12] that the Ocean Observation Panel for Climate is co-sponsored, in addition to GOOS and IOC, by WCRP, GCOS and JCOMM, with support from US NOAA and NASA. While technically dissolved by the GOOS S&S resolution, the GOOS SC agreed that OOPC would be reaffirmed as the climate and open ocean observations panel for GOOS. OOPC monitors the state of observing systems, including mission coverage for satellite observations and in-situ observation systems for climate, such as Argo, ship hydrography and buoy systems.

The OOPC mandate has been to provide societally-relevant descriptions of the state of the ocean, primarily through the support and provision of ocean climate indices. In support of these products the state of the observing systems which provide the underpinning observations are monitored and reviewed. OOPC provides important liaison with the ocean/climate community and with other programs to advocate for sustaining and enhancing the observing system, including reviewing components of the system as necessary.

Examples of Ocean State Indices and societally-relevant products were described:

[11] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9192&lang=en

[12] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9191&lang=en

- Ocean Surface Salinity for Aquarius satellite mission
- Transition of the 2009-10 El Niño to the 2010-11 La Niña and the Niño3.4 SST index
    - an A$30 billion reduction to Australian GDP due to flooding was attributed to La Niña.
- Sea Level drop observed to be due to La Niña flooding. During the 2010-11 La Niña three global ocean observing systems operating simultaneously demonstrate the nature of the global sea level drop: these observing systems are satellite altimeters, GRACE, and in-situ Argo floats.
- Global sea level trends are now monitored with spatial resolution. The 1993-2011 trends resemble structure of Pacific Decadal Oscillation, indicating significant advances in scientific understanding are still wanting of better, long-term data.
- Arctic Sea Ice observations continue to indicate that Arctic sea ice coverage is significantly decreased over the past several decades.

While the OOPC did not meet during the past year, the group remained actively represented at meetings of the WCRP, CEOS, OI'12 and JCOMM. Eric Lindstrom will step down as chair of OOPC. The future of OOPC is dependent upon recruitment of a motivated replacement and new infusions of energy for the panel.

Lindstrom also presented[13] an effort to develop a Deep Ocean Observing Strategy led by the OOPC that was an experiment in Framework for Ocean Observing systems thinking, combining physical, chemical, and biological experts and variables. The effort was still underway, but had helped to influence a donation by Sea-Bird Electronics of a pool of CTDs to be used for deep measurements on OceanSITES time series stations.

GCOS and the Framework

Adrian Simmons, chair of the Global Climate Observing System (GCOS), explained in his presentation[14] that GCOS is comprised of the climate components of its contributing systems, including GOOS, GTOS and WMO's several observing systems and climate services such as WIGOS, GOS, GAW, and WHYCOS. In turn GCOS has been designated as the climate observing system for GEOSS. GCOS attempts to operate at the Member State level by emphasizing national contributions and specific roles within GCOS. Its cycle of reporting of adequacy, developing implementation plans, and reporting on progress identifies specific agents for implementation, and is organized around definition and requirements related to Essential Climate Variables. GCOS is mandated by the UNFCCC and aids the work of IPCC, UNFCCC, WCRP, IGBP and GFCS. This breadth allows GCOS to speak succinctly, with a single voice on observation needs to the UNFCCC through its SBSTA's recurring agenda item on sustained observation needs of the Convention. GCOS is planning future increased emphasis on observational needs for climate adaptation, which for GOOS would likely imply more emphasis on coastal observations and issues.

Services requirements and observations coordination: JCOMM and the Framework

Candyce Clark, U.S.-NOAA Climate Program Office and JCOMM Observations Coordinator described in her presentation[15] the role JCOMM will play in the FOO. JCOMM will contribute to the technical coordination, instrument requirements, model enhancements and other implementation issues. The JCOMM has been network based, not Essential Ocean Variable

[13] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9200&lang=en
[14] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9196&lang=en
[15] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9189&lang=en

based, as evidenced by the iconic in-situ implementation status graphic, or the program members of the Observations Coordination Group: DBCP, SOT, GLOSS, Argo, OceanSITES, and IOCCP. The Observations PA Coordination Group will adapt to FOO and evaluate the different programmes in support of the EOVs across platforms, using existing mechanisms where possible. JCOMM avoids setting requirements for new EOVs, relying on OOPC through GCOS for requirements for product uses. JCOMM recognizes the need for better interaction with IODE to facilitate more open data access.

Ocean carbon observations coordination and data management: IOCCP and the Framework

Maciej Telszewski, coordinator of IOCCP, described in his presentation[16] how the IOCCP, co-sponsored by IOC and SCOR, promotes development of a global network of ocean carbon observations for research through technical coordination and communication services, international agreements on standards and methods, and advocacy and links to the global observing systems. Due to financial turmoil in UNESCO, IOCCP was forced to leave Paris, but has found a new home at the Institute of Oceanology of the Polish Academy of Sciences (IOPAS, or IO-PAN), Sopot, Poland. In the past eight years since its establishment, IOCCP held 23 workshops and published 22 reports, guides, and strategy documents. Working closely with SOLAS IMBER carbon working group (SIC), IOCCP carries out three major research activities of Surface Ocean, Ocean Interior, and Ocean Interior Data Synthesis. A most comprehensive sea surface CO2 data set was released in September 2011. An EU project, CarboOcean is under way.

The FOO report suggested IOCCP initiate a biogeochemical panel with partners. Although there have been 12 countries involved, some major partnerships are missing in Asia, like China and Korea. Considering current situations and future plans, more secretariat support is required for IOCCP, especially for GO-SHIP.

Data management: IODE and the Framework

Ariel Troisi (IODE co-chair) summarized in his presentation[17] IODE operations mandate and data policy: to provide timely, free and unrestricted exchange of data. Data management and accessibility is a fundamental cross-cutting issue, and may fall outside of the EOV framework for observation system design. Ocean data standards, QA/QC best practices, metadata development, and most importantly building community acceptance are the key needs for IODE. The GOOS SC noted that key to acceptance will be data identifier methods to prove providence of data and perhaps tag data as part of the GOOS. Some GOOS SC members expressed the view that an ocean data portal is, perhaps, too general for usefulness. The metadata and QA/QC standards are created at the EOV community level and not at the level of IODE. IODE should strive to provide GOOS services to attain the needed community acceptance needed.

4. Discussion on sustaining present observations

The Committee **brainstormed** the strengths, weaknesses, opportunities and threats (SWOT) related to sustaining present observations under GOOS. The output of this discussion is found in Annex 3 (p. 29), and also underpinned the later discussion on the GOOS SC work plan (see Section 9 p. 18). The major elements of the proposed GOOS SC work plan addressing sustaining present observations include engaging with key conventions and assessments on their need for ocean information, improving outreach for GOOS, more directly engaging the IOC Member States, identifying and developing

[16] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9190&lang=en

[17] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9206&lang=en

engagement opportunities with potential donors, and improving GRA implementation and communications.

The reform of GOOS governance formally cut GOOS ties with the Ocean Observations Panel for Climate (OOPC) which continued to be co-sponsored by GCOS and WCRP. The Committee **decided** to engage GCOS and WCRP in re-establishing GOOS sponsorship of a panel based on the present OOPC that for GOOS would have responsibility for physical ECVs, for GCOS would be the focal point for the oceanic domain, drawing as needed on the expertise in geochemical and biological variables for climate from the other GOOS panels (see section 6, p. 13), and for WCRP would liaise with the necessary project and programme-wide contact points to capture research needs for sustained ocean observations.

Theme II: Expanding to new variables and serving new requirements

5. Elements of an expanded system

UNEP: expectations for GOOS

Ashbindu Singh, Chief, Early Warning Branch Division of Early Warning & Assessment, summarized in a presentation[18] UNEP activities leading to the Regular Process "To keep under review the world environmental situation." The UNEP Medium Term Strategy is to be expanded for 2014-16 to add the sub-programme "Environment under Review", designed to focus on issues of the international community which will be aided by environmental assessments. Thematic assessments have included Assessments of Impacts and Adaptation to Climate Change: sea level rise". A publication series of regional "Global Environmental Outlook (GEO) Assessments" has included Pacific, Caribbean, Atlantic and Indian Ocean Environment Outlooks. The assessments include progress on achieving internationally agreed goals and objectives, which has led to the UNEP Global Environmental Alert Service and other outreach systems, such as UNEP Live web service. UNEP Live could help GOOS distribute priority environmental data and indicators. The UNEP has a need for quantitative indicators for monitoring the environment. In turn, GOOS needs UNEP, as a user of data, to push hard for data requirements of assessments and indicators. The opportunity for stronger partnership between UNEP and GOOS should be based in demanding and meeting requirements for marine assessments. Together we should push the line assertively, that because we need policy action, we need the data that is required.

ICSU: expectations for GOOS

Howard Moore gave the ICSU presentation[19]. Envisioning research for global sustainability, ICSU aims through Future Earth (formally launched in Rio+20 June 2012) to provide the knowledge required for societies in the world to face risks posed by global environmental challenges, in collaboration with UNSCO, ISSC, UNEP, UNU, and Belmont Forum. ICSU has co-sponsored four global environmental change programmes. Belmont Forum was recognized as major funder for the environmental programmes. Amongst ICSU's five grand challenges, those of forecasting and observing are directly relevant to GOOS. Earth observation systems will take an important role in Future Earth and its components, which requests further partnership between GOOS and ICSU.

[18] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9207&lang=en

[19] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9214&lang=en

The ICSU World Data System (WDS) has a similar data policy to GEOSS. IODE is a network member of the WDS. Considering the legacy of International Polar Year (IPY), follow up data management is needed. ICSU will review its role in earth observation system and cooperate with GEOSS (strategy plan 2012-2017).

SCOR: engaging emerging scientific requirements for sustained observations and the Framework

Wolfgang Fennel, SCOR president, discussed in his presentation[20] the question "How can SCOR and GOOS interact?" International scientific coordination requires both intergovernmental and non-governmental activities. The IOC and SCOR have provided these two parallel tracks for ocean sciences since 1960. Both aid the international science communities by identifying and addressing important science issues. SCOR provides a "Project Incubator" and a mechanism for the ocean science community to develop international research projects. SCOR Working Groups, of strictly limited duration, are set up to advise and further international research projects. The criteria for creating a WG are strictly quality of science and identified deliverable product. A WG cannot be based only on furthering GOOS goals by planning for potential impact on GOOS activities.

Coastal observations: Requirements for Global Implementation of the Strategic Plan for Coastal GOOS

background document: GOOS-191

Jose Muelbert's presentation[21] on the "Requirements for Global Implementation of the Strategic Plan for Coastal GOOS (GOOS-191) emphasized the building blocks of a system of coastal observation systems. The design and evaluation mechanism for the PICO plan emphasizes the Drivers/Pressures/States/Impacts/Responses/Drivers model. In addition to developing the Phenomena of Interest (PoI) end to end plans, there is a clear requirement for investing in DMAC to improve access to existing data at all levels and scales. Implications of the PoI are identification of gaps in the coastal observation network. The GEO Coastal Zone Community of Practice is developing a gap analysis for the global coastal network.

The GOOS SC noted that in addition to the Coastal Implementation Plan's list of PoI's, several others can be added: Coastal shipping communities have great need for navigation and safety numerical modeling; Blue carbon and carbon related questions. The "operational oceanography" community has developed many of the models required for open ocean and coast services. These models strengthen and add products to the end-to-end approach.

Biodiversity requirements, observations, and data management: GEOBON and the Framework

Carlo Heip, co-chair of the GEO Biodiversity Observation Network (GEOBON) Marine ecosystem change Working Group, presented[22] the goals of GEOBON and how they related to the Framework for Ocean Observing. A goal of GEO is to establish by 2015 a comprehensive worldwide biodiversity observation network to underpin science and to enable decision-making in resource conservation and management. Biodiversity and ecosystem services were closely linked. The priorities of the Marine working group are to define marine realms and associated ecosystems, define Essential Biodiversity Variables (EBVs) linked to EOVs and classification, develop standards and protocols for sampling, and

[20] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9212&lang=en
[21] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9211&lang=en
[22] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9208&lang=en

to build on existing monitoring, observation, data and e-science initiatives. Marine food webs are regulated through complex interactions that may come from the top (predators) or bottom (primary production). A biodiversity observing network should be strategic to build understanding of these controls. A GEOBON all-hands meeting in December 2012 will develop future plans, including how to develop relationships with the Convention for Biodiversity, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

6. Discussion on expanding to new variables and serving new requirements

Gunn led a Committee **discussion and brainstorming** session on developing a vision for GOOS in 2019, in terms of what new requirements, users and stakeholders might be engaged in GOOS; what new components might be implemented; and what impact these new capabilities might have. The Committee reflected on which areas of the observing system needed some *evolution* to improve and which areas needed a *revolution* in thinking or action to improve. The output of this brainstorming is found in Annex 4 (p. 31). They provide some raw material to support further action by the Committee in its work plan (see Section 9, p. 18) in terms of the target stakeholders to help develop requirements and to engage with the outputs of GOOS.

The Committee **agreed** that the distinction between 'research' and 'operational' observations is neither clear or helpful, and that ocean observation practitioners and funders that strongly identify on one side or other of this divide should be encouraged in GOOS to work closely together. The goal of GOOS was *sustained* observations that responded to expressed high-level requirements. The Framework concept of 'readiness levels' provided a way to organize observations and encourage greater readiness in terms of the technological and human capacity to make sustained observations of value to the stakeholders of GOOS.

In discussing the panel structure that would best support expanding GOOS technical work in defining requirements, coordinating observations, and assessing data and information fitness for purpose, the Committee asked where the line would most logically be drawn between chemical and biological variables to divide primary responsibilities. The Committee **decided** that a logical place to define this division was between non-living and living variables, but emphasizing that there would be need for each side to consider variables on the boundary (see Table 1 on the next page), perhaps with a member common across each panel.

The Committee **emphasized** that a central concern of GOOS would be for globally-measured, as near to real-time as practical, standardized and referenced sustained observations. It also **noted** that GOOS would need to go through a stepwise evolution in incorporating new variables, drawing on the concept of *readiness*. Through these analyses the Committee **stressed** that the new panels of GOOS would have to work to build observing community consensus around the few new key priority actions that should be promoted. The Committee **identified** the issue of ocean acidification and its impact on marine ecosystems as an area where definition of the key variables and observing networks was required, and in particular for biological variables. This work had started to be addressed in the PICO plan.

The Committee **recognized** that in the coastal zone the disciplines often needed to be considered together, and that human impact on the environment (such as erosion and habitat destruction) was also a major issue that needed monitoring. Land-based monitoring of certain variables of impact in the coastal ocean (i.e. pesticide runoff) was also important even if not central to GOOS, and would have to be negotiated with partners.

Table 1. Variables and the GOOS dividing line between a panel that would consider geochemical and biological variables. Those variables in the grey zone were considered by the Committee to be more logical to group with the biological variables

geochemistry	carbon pCO2 pH alkalinity DO2 (oxygen) nutrients
	chlorophyll phytoplankton microbes
biology	zooplankton | increasing trophic levels functional groups | biodiversity fish ecosystems human impact

The Committee **decided** to work further on establishing the boundaries and scope of work for the panel for geochemistry filled by the IOCCP and a new panel for biology/ecosystems it would like to establish with partners (see also Section 9). It recognized that the IOCCP would need additional resources in order to take on new tasks for GOOS beyond its immediate goals for the ocean carbon community in IOCCP. Dealing with biogeochemical variables beyond those directly relevant for ocean carbon will require cooperation with other bodies such as IOCCG, SGONS, myOcean, ChloroGIN and others. The Committee **asked** IOCCP to help develop a costed 'growth phase' work plan outlining needed human and financial resources to support new activities on top of the present approximately $150k/year base budget of IOCCP (see also item 6 in Table 2 on p. 19). The IOCCP had already taken steps such as the inclusion of a sensors expert, and plans to add nutrients and oxygen experts to the panel.

In the Framework, the panels' job was both:

- outwards looking from the observing system: identifying requirements for EOVs that addressed the issues being asked of the observing system and engaging with scientific users to assess if the outputs of the observing system were fit-for-purpose; and
- inwards looking: assessing readiness of observing systems and variables, balancing feasibility and impact of sustained observations in its recommendations, and coordinating observation elements and data management, and promoting standards and best practices.

The OOPC and JCOMM split these two functions for physical variables, while the IOCCP did both jobs with a thus-far very sharp focus on ocean carbon variables.

The Committee discussed the ideal composition of the panels in order to accomplish their tasks, and **agreed** that a key principle was that the GOOS panels should not try to replicate work that was already organized in the community. One model was to have a small

executive-style panel that would entrain expertise for particular workshops or activities that required it.

The Committee also held a focused discussion on coastal observations and their future place in GOOS. It **noted** that the GOOS panels separated by discipline would face a large task in addressing coastal to open ocean observations. Muelbert recalled the history of coastal observations in GOOS which led PICO to focus on ecosystems observations and issues. He noted that many coastal observations were being taken in 'GOOS structures' especially in the developing world, but that these were not easy to find.

The Committee **agreed** that GOOS could play a significant role in advising on coastal observations, by providing expertise on a *framework* for developing integrated observation systems to address specific issues, promoting *standards and best practice* for measurements to make them intercomparable, sharing experiences and comparing designs, and *promoting data sharing, integration and interoperability*. GOOS could also provide an umbrella for the development of regional pilot projects. But GOOS centrally could not plan in detail coastal observations in all regions, which need to be based on regional and national priorities. It should focus energy on promoting the intercomparability and availability of coastal observations, and could build on the inventory of GRA contributions to GOOS.

The Committee **noted** that ocean forecasting would within a decade become more seamless between the coastal and open ocean, and these systems would require both coastal and open ocean data (see also the suggestion regarding GODAE Ocean View and coastal forecasting in Section 8, p. 18). It **encouraged** JCOMM to consider standards, best practices, and data exchange for coastal as well as open ocean data where appropriate.

The Committee also **stressed** that having coastal data globally available would enable new science and the development of new knowledge, as well as global assessments to inform policy related to the ocean. It noted that EOV concept provided a framework for the inventorying and promotion of data sharing to achieve this goal.

Theme III: Identifying regional priorities, capacity, and addressing gaps

7. Building blocks

GOOS Regional Alliances: report from the GOOS Regional Forum V (October 2011, Sopot, Poland)

Tom Gross, GOOS Project Office, reviewed in a presentation[23] the seventeen year history of the GRAs, since the idea of a GOOS Regional pilot programme for NE Asia in 1994 to the most recent Fifth GOOS Regional Forum (GRF-V), held in October 2011 in Sopot, Poland. Following the establishment of EuroGOOS in 1994 and NEAR-GOOS in 1996 an additional nine GRAs were formed, and met together in the first GRA forum (GRF-I) in Athens 2002. The development of GRAs has been uneven, as each GRA sets its own governance structure and priorities. There is no consensus of opinion or historical record to suggest what type of organization might work best for a particular region. Purposely, very few constraints have been placed on how regions organize themselves to participate in GOOS. Nevertheless some basic principles were developed, and are found in the document on "Regional Policy for GOOS" endorsed by the fifth session of the IOC-WMO-UNEP committee for GOOS in June 2001.

[23] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9209&lang=en

The GRF-V was proposed by the GOOS Regional Council chairs, Hans Dahlin and Kostas Nittis, to help the growth of the collaboration between GRAs and hopefully to continue the growth of the GRA Regional Council which was not fully formed during the GRF-IV in Guayaquil. The GRF-V was well attended and, as usual, the wealth of accomplishments presented by the GRAs was impressive.

A discussion session was held between the GRA chairs, which reviewed the current GOOS thinking about coastal implementation and the Framework for Ocean Observing. The drive of the PICO plan to develop global coastal networks was accepted, but tentatively, as it was unclear how GRA-level regional actions would be knit together to form a global network. Communication and sharing of best practices may be the most practical expression of global coastal ocean observation coordination. There was uncertainty of the completeness of existing systems. Some expressed the need for a business plan which could convince governments to support GRAs. The need for products addressing national benefit, which would underpin national support was reiterated.

GRF-V reviewed the FOO and GOOS restructuring with appreciation. The GRAs felt that the organizing structures of GOOS should create a platform for collaboration, global participation and capacity development. In the new GOOS structure the role of the GRAs was envisioned to reinforce the national drivers which will be primary driving force of GOOS. GOOS at a regional level must drive local services, early warning and assessments, responding to different national needs, arrangements and capacity.

GRAs and the Framework

Zdenka Willis, chair GOOS Regional Council, reported in a presentation[24] on progress toward creating an assessment of the capabilities of the GRAs and coastal GOOS. Following recommendations of the GRF-V, the chair submitted questionnaire templates to the GRAs to obtain detailed information concerning GRA membership, primary objectives, active observations systems, capabilities and products. The lack of responses and heterogeneity of the GRAs made this exercise difficult. Planning for further refinement in this assessment process was aided by implementing the templates for all of the GRAs, based upon information from previous GRF presentations and web site descriptions. Application of either the PICO plan Phenomena of Interest's or the FOO's EOV's and readiness levels proved to be difficult across multiple GRAs.

The GOOS SC noted the difficulty of this assessment exercise, but approved of the effort and encouraged its continuation. Strengthening communication between GOOS SC and GRAs and between GRAs is a great priority. A unified presentation of GOOS structure, goals and methods should be made available for presentation at GRA meetings, to communicate the GOOS global level ambitions for the GRAs and coastal GOOS.

Regional implementation of a pilot project in a priority "super site" domain to demonstrate the value added of an end-to-end system of systems for coastal GOOS

Jose Muelbert summarized in a presentation[25] the PICO Coastal Implementation Plan proposal for a pilot project demonstration of the principles of the plan. Recognizing that some complete end-to-end systems exist, such as IMOS or IOOS concepts, the PICO recommends a pilot project to demonstrate the value added of an end-to-end system of coastal systems, or a "super site" demonstration project. Most operational observation systems are not part of an integrated system of systems. By identifying several separate systems and demonstrating the value added by integrating them, the pilot project should

[24] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9221&lang=en

[25] http://ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=9210&lang=en

elucidate the steps needed to accelerate the build out the full Coastal GOOS. PICO suggested the Indonesian Archipelago-South China Sea Region, as it has: greatest number of pressures; great habitat & species diversity; demonstrates many phenomena of interest; and has many regional networks already in place. Some GOOS SC members warned that the region expresses great political sensitivity to observations within EEZs, and cooperation is difficult on a broad scale.

Views from the regionally-appointed Committee members

Margarita Gregg, representing Region I (W. Europe and N. America), emphasized the importance of the GOOS SC developing metrics for success, to measure how GOOS was performing. These should be expanded beyond the metrics for the open ocean physical observations to those identified at the regional level. She also emphasized the need for data management and links to data products to be strong in GOOS and in its panels as an integrated activity.

Mthuthuzeli Gulekana, on behalf of Ashley Johnson representing Region V (African and Arab states), noted that the new IOC Sub-Commission for Africa was launched in May 2012, and would be conducting a comprehensive survey of ocean science facilities including both human capital and infrastructure in Africa. This would form a basis to ensure that Africa has an ocean observing system addressing its needs, including issues such as tsunamis, HABs, storm surges, and sea level rise. GOOS-Africa and ODIN-Africa had helped in the implementation of tide gauge and data management infrastructure, and would continue under the umbrella of the new Sub-Commission. He noted that South Africa had made a big investment in both meteorological and oceanographic observations, in cooperation with the South African weather service, and was active in the Southern Ocean Observing System.

Shaohua Lin, representing Region IV (Asia Pacific) and former chair of I-GOOS, stated her pleasure at the establishment of the GOOS SC after several years of discussions. She recalled that her region was involved in NEAR-GOOS, SEAGOOS, and IOGOOS activities, was active through the WESTPAC IOC Sub-Commission, and had several Large Marine Ecosystem (LME) projects involving ocean observations. She encouraged the GOOS SC to give guidance to IOC Member States on how to better engage GOOS.

Frederico Nogueira, representing Region III (Latin America and Caribbean) emphasized encouraging Member States to create national GOOS programmes, the importance of coastal observations to many states, and the need to identify sustained funding sources for open ocean observations. He identified the GOOS Regional Alliances as key implementers of ocean observations. In his vision GOOS rested on three legs: serving research, ocean services, and requiring capacity building.

Alexander Postnov, representing Region II (Eastern Europe), recalled the importance of GOOS as an end-to-end system that encompassed models and produces information of direct application and use. The group was particularly concerned with the Black Sea, eastern Baltic, and Mediterranean. He also emphasized the utility of linking with Regional Seas conventions and action plans (such as in the Black Sea) to provide information related to pollution.

In the subsequent discussion, the Committee **emphasized** the importance of capacity development, of developing an inventory of regional contributions to GOOS through the GRAs and similar bodies, and the need to engage Member States to improve their support for ocean observations and the GOOS programme. Nadia Pinardi raised the issue of also working with met services, particularly in data management and the generation of routine information from ocean observations.

8. Discussion on identifying regional priorities, capacity, and addressing gaps

The Committee discussed the rationale for GOOS Regional Alliances, and **agreed** that they are a good organizing principle, since partnerships and coordination cannot always be developed globally - GRAs provide a reasonable geographic size and limited number of Member States for coordination. They often have resources, and can be more focused on the large number of coastal users of ocean observations. The Committee **noted** that the implementation and governance was heterogeneous, and that GRAs did not all uniformly engage the key stakeholders in a region. However some GRAs provide a useful framework and fora to negotiate regional government support to ocean observations, and to negotiate data exchange for transboundary ocean issues. Another function GRAs can play is to support technical coordination of Regional Ocean Observing Systems (ROOSs), although some are more focused on open ocean observations. The Committee **noted** the importance of highlighting success stories, and **suggested** developing a deeper partnership with the GODAE Ocean View coastal forecasting efforts, perhaps through demonstration projects for coastal forecasting and reanalysis services. The CLIVAR Basin Panels were also a resource being used by some GRAs.

The Committee **agreed** that over the next 12 months it would work on the following items related to GOOS Regional Alliances:

1. A draft 'GRA Master Plan' drawing from GRA best practices and providing suggestions for strengthening GRAs. This would address success stories, metrics, coverage, goals, organization, and outreach.
2. A mapping of GRA governance structures (*led by T. Gross IOC secretariat*) to inform the GOOS SC.
3. An inventory of GRA contributions to GOOS, their observing networks and the Essential Ocean Variables, as a complement to the JCOMM/OOPC picture of the open ocean GOOS (*led by Willis and Pinardi with help from all SC members*).
4. An evaluation of the sustainability of GRAs, for GOOS SC strategic planning.

The Committee discussed capacity development and successful models. Many Committee members **emphasized** capacity development through the GRAs, although the global networks also required capacity development. Many GOOS partners such as POGO were involved in capacity development activities, as were a number of the JCOMM teams. The Committee **suggested** that an inventory would help inform further action by GOOS. Some Committee members also suggested that capacity development should focus on techniques rather than on developing general marine science capability, while others felt differently. The Committee **agreed** that a central consideration in developing capacity development activities was responding to local needs and promoting local ownership. The Committee also **agreed** that 'capacity development' at higher levels (policy and government levels) was needed to develop the understanding for the need for ocean observations, and to promote the use of environmental decisions in policy-making, improving the science-policy interface.

Theme IV: An operating model for GOOS and the GOOS SC

9. Immediate work plan and mode of operation

The Committee discussions summarized in Section 4 (p. 10), Section 6 (p. 13), and Section 8 (p. 18) led to the collective development of the immediate work plan summarized in Table 2 below.

The Committee **agreed** that each task should advance through teleconferencing with those task team members agreeing to contribute.

The Committee further **agreed** that as a general principle a 75% quorum (in person, on the telephone, or by e-mail) would be needed for making key decisions. Committee members were expected to respond within 10 days with comments on draft documents or decisions, and an absence of a response would be assumed to mean no objection was raised.

Table 2. Immediate work plan for the GOOS SC with priorities and timelines, as well as responsible SC members who would form a task team for the work plan task.

Work plan task	*Priority and timeline*	*Task team: responsible SC members (* lead)*
1. Articulate 10-year goals for GOOS allowing development of a 2013-2015 work plan • first draft for comment to be prepared by Secretariat, drawing from OceanObs'09 and other documents • review by co-chairs • discussion by SC	Highest priority, ASAP	All SC members
2. Engaging with key conventions and assessments on their needs for ocean information	Immediate priority	
• starting with the Convention on Biological Diversity (CBD), which has called on IOC-UNESCO to help provide information for the definition of ecologically or biologically significant areas (EBSAs) and on understanding of the impacts of ocean acidification, and	October 2012 CBD meetings	Gunn, Lindstrom
• UN World Ocean Assessment (Regular process) and other relevant assessment processes	ongoing	Gunn, Lindstrom, Muelbert
3. Improving outreach for GOOS • publicizing the creation of the new GOOS SC and its use of the Framework for Ocean Observing as a basis of engaging with partners, the ocean observing community, and users of ocean information (communicating outwards and inwards),	High priority	Gunn*, Gregg, Knapp (link with POGO), all SC

Work plan task	*Priority and timeline*	*Task team: responsible SC members (* lead)*
3 (continued) • developing a communication plan in collaboration with key partners (e.g. POGO and the GOOS sponsors) • engaging modeling users of ocean data, in particular GODAE OceanView and its coastal and shelf seas task team, • identifying the GOOS role in developing climate services, and • promoting the linking of coastal and open ocean areas in GOOS		[Knap (POGO)] Santoleri, Wijffels, Lindstrom [?] [Santoleri]
4. Engaging IOC Member States, with a focus on raising awareness and information exchange, including development of a strategy that is appropriate with the various areas/regions/Member States	High priority	Gregg*, Johnson, Postnov, Lin, Nogueira
5. Identification and developing engagement with potential donors for GOOS	High priority	Lindstrom, Gunn, Knap
6. Broadening the variables examined by GOOS and establishing three disciplinary panels for Physics, Carbon/Geochemistry, and Biology/Ecosystems, • based on the OOPC for physics, • based on IOCCP for carbon/geochemistry, • and using the expertise of the former PICO and in cooperation with SCOR and GEOBON for biology/ecosystems; Developing scope and revised ToRs if needed Identifying priorities for each panel	Immediate priority 6 months before asking members to join	 Lindstrom, Wijffels Telszewski, Tanhua*, Knap, Santoleri Muelbert*, Sun, Gunn
7. Improving GOOS Regional Alliance (or like) **implementation**, • starting with a focus on collecting information on priorities and capacity from each GRA • development of a full work plan based on the discussion in Section 8 (p. 18)	 Immediate priority within 12-24 months	Willis*, Muelbert, Nogueira, Snoussi, Lin, Santoleri

Work plan task	*Priority and timeline*	*Task team: responsible SC members (* lead)*
8. Capacity Development, • by contributing to the IOC capacity development survey, and • developing a statement of needs for GOOS as a precursor to • developing a strategy for action Scoping/development of a survey for the African Region	Immediate need but needs raising of funds and time of SC	Nogueira, Mafimbo, Johnson, Gunn
9. Analyzing the challenge of data interoperability, including why this has failed to produce results, cooperating with IODE, individual network panels, and the immediate user community; as a first step towards developing actions. • paper reviewing needs/requirements and options for action, for discussion at next GOOS SC	Long-term priority	Troisi*, Wijffels, Willis

10. Closing

The co-chairs thanked the participants for their active participation and encouraged them to continue their active participation in the intersession. They proposed a tentative second meeting of the GOOS SC in February 2013, to be confirmed by correspondence.

Annex 1: Agenda

Wednesday
20 June

9:00 **1. Opening**

a. Welcome to IOC and UNESCO *(Bhikajee, 5 min)*

b. Round of introductions from participants: including what you hope to achieve by participating in the GSC and what you are able to personally commit *(30 min)*

c. Confirmation of the co-chairs of the GOOS Steering Committee *(5 min)*

Declared interest from John Gunn and Eric Lindstrom to co-chair. Confirmation (or selection if other candidates come forward) by appointed and ex officio members of the GSC.

d. Adoption of the agenda *(5 min)*

e. Logistics announcements *(5 min)*

2. Background

a. Reminder of the process of reform of GOOS governance and IOC Resolution XXVI-8 *(Fischer, 10 min with questions)*

background document: IOC resolution 'Strengthening and Streamlining GOOS'

b. Status of GOOS including global and regional efforts *(Fischer, 15 min with questions)*

background document: GOOS Status report

c. Framework for Ocean Observing *(Lindstrom, 20 min with questions)*

background document: Framework for Ocean Observing

d. Introduction to Theme IV: An operating model for GOOS and the GSC *(Gunn, 20 min with questions)*

10:30-11:00 Coffee break

Theme I: Sustaining present observations

11:00 **3. Elements of the present system: where are we now**

a. WMO: expectations for GOOS *(Zhang, 15 min with questions)*

b. Climate requirements and assessment of fitness-for-purpose: OOPC and the Framework *(Lindstrom, 15 min with questions)*

c. GCOS and the Framework *(Simmons, 15 min with questions)*

d. Services requirements and observations coordination: JCOMM and the Framework *(Pinardi / Clark, 15 min with questions)*

e. Ocean carbon observations coordination and data management: IOCCP and the Framework *(Telszewski, 15 min with questions)*

f. Data management: IODE and the Framework *(Troisi, 15 min with questions)*

12:30-13:30 Lunch

13:30-15:00 **4. Discussion on sustaining present observations**

Identifying issues

- *Collect data once use many times*
- *Delivering information from present observations*
- *Outreach and sharing success stories: communicating the need for present observations*
- *Fragility of research funding sources*
- *Addressing multiple societal issues / scientific requirements (climate, met and ocean forecasting systems, ocean-related hazards,*
- *Global, regional and national requirements, open ocean, shelf and coastal observations*

Assessing if structures and processes are in place to address these issues

Strategy for engaging funding agencies

15:00-15:30 coffee break

15:30-17:30 continuation of **4. Discussion**

Theme II: Expanding to new variables and serving new requirements

Thursday *21 June* *9:00*

5. Elements of an expanded system

a. UNEP: expectations for GOOS *(Singh, 15 min with questions)*

b. ICSU: expectations for GOOS *(??, 15 min with questions)*

c. SCOR: engaging emerging scientific requirements for sustained observations and the Framework *(Fennel, 15 min with questions)*

d. Coastal observations: Requirements for Global Implementation of the Strategic Plan for Coastal GOOS *(Muelbert, 20 min with questions)*

background document: GOOS-193

e. Biodiversity requirements, observations, and data management: GEOBON and the Framework *(Heip, 15 min with questions)*

10:30-11:00 coffee break

11:00-12:30 **6. Discussion on expanding to new variables and serving new requirements**

Identifying issues

- *What are biological and ecological Essential Ocean Variables? Can what observing requirements for ecosystems be expressed as 'variables'?*
- *How do groups, regional or global, become a part of GOOS?*
- *Coordinating many already-independent coordination groups: i.e., IOCCG, GACS, OTN, IOCCG, GEOBON*

Assessing if structures and processes are in place to address these issues

Promoting common communication and language

12:30-13:30 lunch

Theme III: Identifying regional priorities, capacity, and addressing gaps

13:30-15:00 **7. Building blocks**

a. GOOS Regional Alliances: report from the GOOS Regional Forum (October 2011, Sopot, Poland) *(Gross, 15 min with questions)*

b. GRAs and the Framework *(Willis, 15 min with questions)*

c. Regional implementation of a pilot project in a priority “super site” domain to demonstrate the value added of an end-to-end system of systems for coastal GOOS *(Muelbert, 15 min with questions)*

background document: GOOS-193

d. Views from the regionally-appointed Committee members *(Gregg, Johnson, Lin, Nogueira, Postnov, 25 min)*

15:00-15:30 coffee break

15:30-17:30 **8. Discussion on identifying regional priorities, capacity, and addressing gaps**

Identifying issues

- *regional heterogeneity*

- *matching donor interest and national priority*
- *ocean observing systems as a small part of decision-support systems*

Assessing if structures are in place to address these issues

20:00 Self-funded group dinner at *Restaurant Marie-Edith*, 34 rue du Laos

Friday
22 June

9:00 continuation of **8. Discussion**

10:30-11:00 coffee break

Theme IV: An operating model for GOOS and the GSC

11:00-12:30 **9. Discussion of the operating model**

Organization of the work and allocation of responsibilities, the process for ensuring all the components are effectively integrated into a unified voluntary collaborative system, processes for operating and evolving the system

- structure of GOOS
- role of the GSC, role of the co-chairs
- specific roles of GSC members and the organizations they represent
- advice for / role of the GOOS Project Office
- working arrangement for the intersessional period (teleconferences, actions)
- advice to IOC and other sponsors

12:30-13:30 Lunch

13:30-15:00 continuation of **9. Discussion**

15:00-15:30 coffee break

15:30-17:30 **10. Review of decisions, recommendations, and actions**

including immediate next steps and next meeting, issues to be raised with governing bodies

Annex 2: List of participants

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Annex 3: SWOT analysis

The results of the brainstorming of strengths, weaknesses, opportunities, and threats of GOOS by the Committee.

Strengths
REAL Delivery
Research intellectual support
Delivering improved forecasts
GRA Concept
Multi-purpose
Components (Numerous)
International Cooperation
EOV Integration
Free data sharing
JCOMMOPS
IOC
Passion
GOOS SC
GODAE OceanView

Weaknesses
High Seas/Commons/Public Good
From improved forecasting – a number of stories have not yet been compiled into a strong argument of the benefits of ocean obs to forecasting. Link between ocean obs and forecasting is weak.
No universal involvement
Lack of Research support (financial).
Lack of Funding Sources
Outreach
Lack of integration between coastal and open ocean components
GOOS Value Proposition
No legally binding data convention (EEZs)
Language
Too Comprehensive (encompasses EVERYTHING)
Lack of End-user feedback and integration
Lack of Integrated ocean management
Connection to Conventions
IOC Delegations

Opportunities
Regular process
Science Assessments
Pilot projects
Cost Benefits Economics
Demonstrate solutions
Inter-operability
Standards and Protocols
Outreach
GRA Implementation

Climate Services
Energy source
Ocean ecosystems
Data rescue
Technology
Capacity Building
Emerging economies
Philanthropic funding (foundations and private sector)
IOC Member States

Threats
World Economy
Ship Days
Piracy
Vandalism
Competition with other ocean obs programmes (eg other GEOSS)
GOOS as an environmental threat
Complexity
IOC Budget
Lack of operational oceanography agencies
Varying priorities
Political issues
How to sustain projects?

Other
Criteria for prioritization
Increasing requirement/demands
Mission creep
Harsh environments
Opacity
Corrosion
Batteries/energy

Annex 4: GOOS 2019 requirements/users/stakeholders, components, and impact

Requirements / users / stakeholders

Industry (shellfish as example, resources oil/gas, ocean users, deep sea mining, ocean energy, desalination)
Marine technology sector (showing value in broader economy)
European Commission (research, legal framework demanding obs)
Governments
Research funding agencies
New international organizations
Information producers - State of ocean reports - TV etc.
Operational oceanography forecasting networks
Services (met offices and "ocean offices")
Met forecasting (met/ocean forecasting)
Greater number of assessments IPCC, IPBES
IUCN - conservation NGOs
Marine conservation
Fisheries and fisheries managers
Insurance, risk management
Research community
Coastal managers
channels to contribute to WIS/WIGOS

Components

Deep ocean
seasonal ice zone
western boundary currents and key circulation elements
biogeochemical component
polar seas obs. (incl sea ice)
coastal observations
Data and information management
Integrated Synthesis products from satellite and in situ (in a variable-based approach)
Real-time State of the ocean / Digital ocean
biogeochemistry + biology/ecosystems

Impact - who will notice?

Users of seasonal forecasts (land users)
Agriculture (particularly in tropics)
Decision-makers
Renewable resource industry - aquaculture industry. HABs, water quality.
Recreational users: tourists, surfers, beach bums - beach reports as analogy to weather reports
Marine transportation industry
Media services
Carbon market, climate management
Disaster managers
Adaptation managers

Evolution?
Data sharing
[need continuity for climate]
clear partner strategy

Revolution?
Transcending research community - research-> operational funding
Linking Research+operations (could be an evolution— and the observer and funder can come from different sides of this fence)
ocean data sharing convention - legal framework
Wet Office as analogy to Met Office
Real-time State of the Ocean online