



INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)

GOOS Cross-Panel Workshop

IOC Project Office for IODE
Oostende, Belgium
16-17 September 2016

Decisions and Actions summary

GOOS Report No. 219

UNESCO

Background

Chairs and secretariat of the three GOOS Panels, for Physics and Climate (OOPC), Biogeochemistry (led by IOCCP), and Biology and Ecosystems, met with the goal of:

- harmonizing and fixing the definitions used in EOVS Specification Sheets across the panels
- ensuring consistent use of phenomena in the connection from EOVS to applications
- to agree on the process and timeline of publishing the GOOS requirements expressed in EOVS and the Strategic Mapping
- harmonizing and fixing the definitions around observing elements or networks, and the network specification sheets

As an interactive workshop, the outcomes are here captured as a summary of the decisions and actions.

1. Definitions for the EOVS specification sheets and GOOS Strategic Mapping

A **GOOS Essential Ocean Variable** is a sustained measurement or group of measurements necessary to assess ocean state and change of a global nature, universally applicable to inform societal benefits from the ocean at local, regional, and global scales.

The attribute '**Essential**' is evaluated based on a measured variable's impact in answering societally-relevant scientific questions, and feasibility for sustained observation from identification of readiness. EOVS are concise and easy to communicate, and limited in number.

Different local or national realities, capacities, and priorities may require sustained observations of additional variables beyond the GOOS EOVS.

[Note that this longer and more detailed definition was inspired by the UN decision for SDGs from "The Future We Want" Rio+20 Outcome Document (para 247): "We also underscore that sustainable development goals should be action-oriented, concise and easy to communicate, limited in number, aspirational, global in nature and universally applicable to all countries while taking into account different national realities, capacities and levels of development and respecting national policies and priorities. We also recognize that the goals should address and be focused on priority areas for the achievement of sustainable development, being guided by the present outcome document. Governments should drive implementation with the active involvement of all relevant stakeholders, as appropriate.]

[evaluating impact can include the responsiveness, specificity, and sensitivity of the sub-variable in capturing the phenomena needed to answer the scientific questions]

Sub-variables are components of the EOVS that may be measured, derived or inferred from other elements of the observing system and used to estimate the desired EOVS.

Supporting variables are other EOVS or other measurements from the observing system that may be needed to deliver the sub-variables of the EOVS.

[An unresolved question remains: where do the 'complementary variables' that help deliver products/information from this observation fit? - these can be pressure variables, etc.]

[The BioEco Panel was asked to advise if the above definitions are sufficient, or if some kind of contextual/pressure variable definition is needed]

Derived products are calculated from the EOVS and other relevant information, in response to user needs.

A **phenomenon** is an observable process, event, or property, measured or derived from one or a combination of EOVS, having characteristic spatial and time scale(s), that addresses at least one GOOS Scientific Question.

[phenomenon helps you identify why you must measure this variable]

[say something about linking questions above the EOVS and also linking observing techniques and networks]

The wording of **observing platform** is not generic enough as it implies a particular type of observing technology combination of sensor and support, and might be broadened to **observing approach** (for example to also encompass visual surveys and counting as an observing approach to measuring an EOVS).

An **observing network** has a leadership group or team that is coordinating globally [or regionally?] on common approaches for standards and best practice for observing and data systems, and promotes data sharing with the ideal of following the GOOS Principle of free and open exchange of data. It may span the spectrum from taking a common global approach to how an observing approach is used and promoting data sharing; to having a common global design, goals, and implementation plans and mechanisms.

[This definition above should be revisited after the BioEco meeting]

2. Framework for Ocean Observing Readiness levels

The panels agreed to use the nine-level FOO readiness scale in its evaluations of readiness of requirements, observations, and data systems, as far as possible.

To improve the scale and to avoid sensitivities in many agencies about the word "operational" and its relation to sustained research observations, the panels agreed to change the name of the "Pilot" "Level 6" to "**proven capability**". This reflects that a pilot requirement, observation technique, or data system is demonstrated as functional, and is repeatable or scalable.

Action (for Michael, in cooperation with Andrea who has source files), to revise the FOO report table with this wording, and re-publish the revision of the FOO with UNESCO, and on the OceanObs'09 and GOOS websites (by October 2016).

3. Publishing the EOVS specification sheets and the GOOS Strategic Mapping

Review in 2 stages for EOVS spec sheets

- **Expert review by discipline**
 - phys+bcg to panel experts, contributors, observing networks
 - bioeco to a small group per EOVS, larger than panel
 - Timing: end November 2016
- **GOOS community review**
 - out to GOOS mailing list
 - also as a communications measure
 - include cross-panel review
 - Timing: aim to finish by mid January 2017, so that Feb Miami workshop has input

The panels agreed that it should be a collective priority to **publish** a complete set of EOVS specification sheets and the GOOS Strategic Mapping, along with explanation, as a part of the **peer-reviewed** article on "Implementation of [using the?] the GOOS Framework for Ocean Observing" in order to engage and communicate with the scientific community. Possible targets are *Progress in Oceanography*, or *Nature Data Reports* (treating the EOVS specification sheets as a dataset that might be updated in the future). The journal article must be open-access.

Action (for a writing team including all panels and led by Bernadette and Maciej) to produce a first draft by the February 2017 Miami meeting.

Action (for Nic), to inquire with *Nature Data Reports* if they might welcome such a paper.

4. Metrics of success for the observing system

The panels agreed that metrics for success of the observing system by phenomena are desirable, in order to help sell the capabilities of the observing system, and identify the particular contributions of different observing networks. Care is needed in designing the metric in order to help the development of observing networks and GOOS as a whole when communicating upwards - it should show gaps and help justify the sustaining and growth of networks, with some realignment if needed.

The development of phenomenon-based metrics needs to continue after this meeting, and use the capabilities of JCOMMOPS and OSMC (and EuroGOOS in the AtlantOS context), but requires the intellectual leadership of the panels in close communication with the observing networks.

Metrics subgroup (initial): Maciej, Artur, Johannes, Bernadette, Michael, Sam. (Albert as available)

Action (for Michael) to organize the first call of this group.

Eventually linking cost to benefit should be examined.

5. Science Questions and Phenomena

See following pages for the science questions in broad GOOS categories and a working list of phenomena with some notes.

The science questions work across the themes of GOOS (climate, operational ocean services, ocean health).

6. Ocean colour/light/radiance spectra as an EOVS or technique/platform/network

Ocean colour exists as an Essential

Action: Artur to propose two options, first for discussion within the BCG panel and then wider discussion with the other panels.

- an EOVS for colour/light, in which some of the existing EOVSs become subvariables
- colour/light as a subvariable that contributes to multiple existing EOVSs
 - o bio to then include PFDs and chlorophyll as subvariables somewhere
 - o physics should include light as a subvariable somewhere

GOOS broad scientific questions	Physics	BeeGees	Biology
Current state of oceans	Regular assessment of the current ocean state and its evolution	1. Ocean carbon content 2. How large are the ocean's dead zones 3. Ocean biomass	1. Phytoplankton 2. Zooplankton 3. Fish 4. Apex predators 5. Coral extent 6. Seagrass extent 7. Mangrove extent 8. Macroalgae extent
Predictions of future conditions	Operational ocean services (daily, <i>sub-seasonal</i> , <i>inter-annual</i> ,)	Predictions of eutrophication and pollution impact ocean productivity and water condition 1. Dead zones 2. Biomass	
Projection of trends	Projection of ocean state and its variability on society (decadal and longer term)	3. How is ocean carbon content changing 4. How fast are ocean dead zones growing 5. Change in ocean biomass	Etc. [timescale between prediction and projection will vary by variable] [incl. biodiversity: perhaps more aggregate]
[science understanding] Human impact on oceans	Society's impact on the oceans	How do eutrophication and pollution impact ocean productivity and water condition	TBD - related to drivers and pressures [where are the major areas where current human pressures are affecting ocean health?]
Impact of changing oceans on societal benefit	Ocean knowledge for climate forecast and projection	What are the rates and impacts of ocean acidification	TBD [ecosystem services, incl. food security]
Interactions with other components of global observing system	Physics links to Biogeochemistry and Ecosystems	How does ocean influence cycles of non-CO2 greenhouse gasses	TBD

prediction: operational system starting from a known initial state [statistical estimate with uncertainty]

projection: long-term trend of the current state [no true uncertainty, different scenarios]

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BCG

air-sea fluxes*
 storage of O₂
 Deoxygenation
 Net community production +
 Export production

Reservoir of organic carbon

*Variations and secular trends in organic
 carbon reservoir*

Interior storage of carbon

Anthropogenic carbon storage

Anthropogenic CO₂ uptake

*[consensus was that these should be
 reduced]*

Eutrophication +
 Pollution +
 Interior ocean circulation* +
 Ocean acidification
 Transport of organic matter
 Upwelling
 Transport Times
 Ventilation/ transit time distribution

[+Nutrient transport?]

[Nitrogen cycle

Carbon cycle

Phosphorus cycle or Nutrient cycle]

Physics

Circulation
 Fronts and eddies
 Tides
 Coastal processes
 Air-sea fluxes
 Surface waves
 Near inertial oscillations
 Freshwater cycle
 Sea level
 Upwelling
 Riverine [input: salinity, nutrients, carbon]
 Heat storage
 Stratification
 Mixed layer
 Watermass
 Sea ice extent
 Extreme events

*[approach for identifying the phenomena:
 to answer scientific questions with EOVS,
 which phenomena need to be captured]*

BioEco:

Phyto:

Biomass, productivity
 Anomalies in biomass and productivity
 Role in transport/cycling of elements
 Occurrence of HABs
 Impacts of HABs (toxicity, mortality events)

Zooplankton:

Change in phenology
 Change in biogeography
 Change in functions/traits
 Change in abundance
 Change in species richness

Fish:

Sustainability
 Recruitment
 Diversity
 Distribution shifts
 Ecosystem role

Coral reefs:

Change in coral community state
 Coral community decline, chronic
 processes
 Severe events (bleaching, cyclones)
 Coral community recovery due to
 interventions

Seagrass:

Seagrass cover
 Above ground biomass
 Shoot density
 Algal abundance
 Seagrass disease

Macroalgal:

Seasonal cycle in cover or maximum
 extent
 Recruitment

Regime shift

[phenomena for biology and ecosystems:
some will be driven by space/time scales
of physical/biogeochemical processes]
[DPSIR approach: biological phenomena
may not help in definition of requirements]
[phenomenon could be a range of linked
habitats?]

Examples

EOV: fish

Phenomena:
fisheries production
primary production
diversity (fishery trophic level)

EOV: Phytoplankton

Phenomena to incl:
primary production

Annex 1: Participants

Sam Simmons – GOOS BioEco
Nic Bax – GOOS BioEco
Patricia Miloslavich – GOOS BioEco
Ward Appeltans – GOOS BioEco
Peter Provoost – IODE Project Office, Oostende
Katy Hill – GOOS Physics
Bernadette Sloyan – GOOS Physics
Johannes Karstensen – GOOS Physics
Albert Fischer – GOOS
Michael Ott - GOOS/AtlantOS
Maciej Telszewski – GOOS BGC
Artur Palacz – GOOS BGC

Annex 2: Agenda

Friday, 16 September 2016

*[The **goal** for today is to: (i) harmonize and explain EOV-related terms and definitions used in the Panel Spec Sheets (tables 1&2) by physically drafting relevant definitions to be included in the Spec Sheet glossary; to (ii) arrive at a consistent and to the extent possible “trans-disciplinary” list of ALL EOV-related phenomena used across ALL sheets, and to (iii) agree on process/milestones to release a public version of the 'upstream' part of the Strategic Mapping (linking societal benefits, applications/scientific questions, EOVs).]*

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|---------------|--|
| 09:00 – 09:10 | Welcome & Local logistics Info (Ward) |
| 09:10 – 09:20 | Workshop Goals & Plan for the Day, any adjustments to agenda (Albert) |
| 09:20 – 09:50 | Update on Panels' EOV work since GOOS-SC-5 (10 min each) <ul style="list-style-type: none"> - Focus on changes/additions in EOV list, any fundamental revisions in the spread-sheet structure. - Overview of outstanding issues (spec sheet completeness, phenomena, questions to be formulated etc., coherence of nomenclature, units, updated list of experts). - Expected timeline for (draft?) public release. |
| 09:50 – 10:30 | A Block on 'GOOS Strategic Mapping' <ul style="list-style-type: none"> - Reminder on utility and audiences (Albert, 5 min) - Presentation by Michael on the proposed list of societal benefits, applications/scientific questions, phenomena, EOVs as based on the most recent panel EOV specification sheets (10 min)
including background document (based on extracts from AtlantOS deliverable) - Presentation by Ward and Peter on the database to capture all elements of the Strategic Mapping (7 min) - Discussion of common approach, any barriers based on Panel approaches; decision on milestones and timeline for public release by GOOS |
| 10:30 – 11:00 | Coffee Break |
| 11:00 – 11:30 | A Block on 'GOOS Strategic Mapping' - continued |

From here onwards each discussion point should finish with a written definition/description for that section/table/figure/field with any potential Panel-related variations clearly noted.

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|---------------|--|
| 11:30 – 12:30 | EOV Spec Sheet “Background and Justification” + Table 1 (EOV information) – terms & definitions <ul style="list-style-type: none"> - What is an EOV? Sub-variable? Supporting variable? Derived product? Etc. keeping in mind that the FOO should be the common denominator. - What belongs to the ‘Background & Justification’ section? Max length? |
|---------------|--|

12:30 – 13:30 Lunch Break

- 13:30 – 15:00 EOVS Spec Sheet Table 1 cont. + Table 2 (drivers, science questions, **TRL**)
- List of science questions from all Panels. Do they complement each other in addressing the high-level societal requirements?
 - **Technical Readiness Level (TRL): 3 vs 9 step scale. Need to adhere to the clear FOO guidelines. Can all the Panels do that?**

15:00 – 15:30 Coffee Break

- 15:30 – 17:00 EOVS Spec Sheet Table 2: definitions of phenomena & their scales
- What is a phenomenon? What is the corresponding concept used in the Bio&Eco context?
 - Phenomena need to be described in terms of spatio-temporal scales – a hint towards what is and what is not a phenomenon.
 - Where and how to distinguish between open-ocean and coastal, surface vs subsurface etc.? Focus on solutions where needed.
 - How can we construct a metric of adequacy of the observing system based on phenomena (or EOVS)?
- 17:00 – 18:00 Consensus list of all EOVS Phenomena
- Can we harmonize the list of phenomena whenever we are in fact talking about the same or very similar thing?
 - How to approach regional distinctions in phenomena?
 - Expected outcome: list of agreed phenomena to be posted online, shared and referred to in Strategic Mapping and across all EOVS spec sheets.

Saturday, 17 September 2016

*[The **goal** for today is to: (i) harmonize the terms and definitions surrounding EOVS observing platforms and networks; and to (ii) discuss the format of a network specification sheet.]*

- 09:00 – 10:30 EOVS Spec Sheet Tables 3 & 4 - Observing Networks terms and definitions
- What is an observing network/element vs. observing platform? E.g. “GO-SHIP” vs “ship-based”
 - How to treat (refer to) communities of practice?
 - Spatio-temporal sampling coverage and frequency in spec sheets: for a network vs a single platform.

10:30 – 11:00 Coffee Break

- 11:00 – 12:00 EOVS Spec Sheet Tables 3 & 4 cont.
- 12:00 – 12:30 EOVS Spec Sheet Tables 5 & 6 - Data Management and References definitions
- Common understanding of data streams, repositories, near-real time etc.

- Need for precise data management TRL estimate.

12:30 – 13:30 Lunch Break

13:30 – 14:00 EOVS Spec Sheet Tables 5 & 6 - Data Management and References definitions - continued

14:00 – 15:00 Network Specification Sheets

- Example presentation by OOPC (**max. 15 minutes**).
- How should a multidisciplinary Network Spec Sheet look like? Use the example of GO-SHIP to analyse this across all disciplines.
- Clear connection to Strategic Mapping.
- What level of overlap between EOVS and Network Spec Sheets is desirable?

15:00 – 15:30 Coffee Break

15:30 – 16:30 Network Specification Sheets cont.

16:30 – 17:00 Planning for future work

- Outstanding issues? What remains to be tackled in a cross-panel manner?
- Propose to nominate one member from each panel to review the draft EOVS Spec Sheets from other panels in order to ensure that they are comprehensible beyond the native expert panel.