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Evolving and Sustaining Ocean Best Practices Workshop II

04-06 December 2019

Intergovernmental Oceanographic Commission, Paris, France

Proceedings

Editors

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March 2019





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Suggested Citation:

Simpson, P., Pearlman, F. and Pearlman J. (eds) (2019) *Evolving and Sustaining Ocean Best Practices Workshop II, 04– 06 December 2018, Intergovernmental Oceanographic Commission, Paris, France: Proceedings*. AtlantOS/ODIP/OORCN Ocean Best Practices Working Group, 35pp. DOI: <http://dx.doi.org/10.25607/OBP-436>

Acknowledgements

We gratefully acknowledge the following organizations for providing organizational, and/or logistical co-sponsorship and in-kind support for the workshop:

- IEEE
- IOC/GOOS
- IOC/IODE
- JCOMM OCG
- AWI
- BERGEN UNIVERSITY
- CCMi
- GEOMAR
- IOOS
- NRF/SAEON
- SOCIB - through JERICO Next
- USF
- WHOI

This project has received funding from the European Union’s Horizon 2020 research and innovation program under grant agreement No 633211 (AtlantOS) and under grant agreement No: 654310 (ODIP). Funding has also been received from the NSF Ocean Research Coordination Network under NSF grant 1143683. In addition, in-kind support by the following organizations or projects is gratefully acknowledged: support by the European Research Council Advanced Investigator grant ABYSS 294757 to Antje Boetius and the HGF Infrastructure Program FRAM of the Alfred Wegener Institute; JERICO Next; INTAROS and NOAA.

Any opinions, findings, and conclusions or recommendations expressed in these proceedings are those of the contributors only.

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1. Executive Summary

It is important to appreciate that ocean observing is more than just taking observations at sea. Only by considering a need for observing and by making sure that information (including observations) can be merged into a product/outcome is the ocean observing complete and meaningful. The new paradigms of the information age - onboard processors, large memories, artificial intelligence, access to the internet and ubiquitous cloud resources opened significant opportunities to access and use best practices. There have been many documents on the positive impacts of best practices. The discussion and report here will focus on what is being done and what should be done in the future.

The first Ocean Best Practice Workshop (OBP Workshop I), held at IOC Paris, November 2017, brought together a community of experts from International Agencies, Programs, Projects and other Organizations who participated in presentations and panel discussions and contributed significant recommendations for the implementation of a new Ocean Best Practice System (OBPS). At the Second Ocean Best Practices Workshop (OBP Workshop II), also held at IOC Paris, December 2018 participants gathered to review the Ocean Best Practices System (OBPS) implementation which, after a year of intense development, now comprises: repository archive; sophisticated but user-friendly web interface; advanced technology including text mining and semantic tagging; peer-reviewed journal linked to the repository; a training component supported by the OceanTeacher Global Academy and a community forum.

Ocean Best Practices Workshop II agenda included presentations, breakout sessions and panel discussions each with a main objective of reviewing and, providing recommendations for further near-term and long-term development of the OBPS. Community experts discussed the importance of ocean observing and provided (based on Best Practice examples from observing networks, regional observing systems and other groups) an overview of approaches that have been used, or are under design, to ensure a mature Best Practices framework for ocean observing activities.

The two Breakout sessions, “Framing the next generation of OBPS”, addressed two aspects: community development around best practices; and technical implementation. These provided key guidance to the next steps.

A summary of each presentation, panel discussion, and breakout session is provided in the workshop proceedings. Section 16 provides a full list of Workshop recommendations. A snapshot of some of the community recommendations include:

- ◆ OBPS is finishing a development phase, but has more user-defined functionality to implement: community review platform; GOOS endorsement process; dashboards to support gap analysis; metrics visualization; integration of datasets; use of schema.org mapping to link to Google Data Search and much more.
- ◆ The OBPS needs to focus on the vision and planning for the next UN Decade of Ocean Science by articulating a clearly defined short-term goal such as a one-stop-shop for each EOVS and sensor and deployment mode. Use OceanObs’19 to create a vision for the UN Decade of Ocean Science.
- ◆ Sustainability to support the vision requires a trusted provenance (e.g. IOC-IODE-GOOS) and should include involving experts, and organizations.
- ◆ Heighten the visibility of Ocean Best Practices System through, for example, building a strong communication and outreach campaign team targeting ocean observing regional groups
- ◆ Expanding capacity building including e-courses and Summer Schools should be a priority.
- ◆ Success will need to be defined through metrics. Some metrics suggested include: research papers with best practices identified; number of citations; number of community likes (user feedback mechanism (number of stars); attach BP to data sets and then monitor uptake.

Table of Contents

| | |
|---|-----------|
| Acknowledgements | 1 |
| 1. Executive Summary | 2 |
| 2. Introduction and Objectives | 4 |
| 3. Workshop Agenda | 5 |
| 4. Participants | 7 |
| 5. Best Practices Project: Overview and Objectives - Jay Pearlman | 8 |
| 6. Vision for the next decade - Martin Visbeck | 8 |
| 7. OBPS : current status and demo - Pier Luigi Buttigieg and Pauline Simpson | 10 |
| 8. Community Experiences and Challenges in Best Practices (Presentations) | 11 |
| 9. OBPS evolution – community needs for the future (Open Discussion) | 16 |
| 10. Looking forward to Day 2 - Peter Pissierssens | 19 |
| 11. Summary of Day 1 and challenges for the the next generation - Cristian Munoz Mas | 20 |
| 12. Breakout Sessions: | |
| 1. Framing the next generation of OBPS: community development around best practices | 20 |
| 2. Framing the next generation of OBPS: technical implementation | 21 |
| 13. Framing the next generation: Sustainability, Governance and Harmonization | 23 |
| 14. Governance, Sustainability, Community Building and Training (Continuation: Panel with Open Discussion) | 26 |
| 15. Ocean Best Practices Workshop II: Implementation - Jay Pearlman | 28 |
| 16. Workshop Recommendations | 29 |
| 17. Appendices | 32 |
| Appendix 1 - Acronyms | |
| Appendix 2 - List of Figures | |
| Appendix 3 - Suggested references | |

2. Introduction and Objectives

There is an ever-present need for the dissemination and uptake of best practices in the multidisciplinary field of ocean observation. However, the complexity and fragmentation of this domain and the diversity of its stakeholders make discovery, accessing and adoption of ocean best practices a considerable challenge. The new paradigms of the information age - onboard processors, large memories, artificial intelligence, access to the internet and ubiquitous cloud resources offer significant opportunities to access and use best practices. The Ocean Best Practice Working Group, a group of experts in a broad set of disciplines and diverse interests was established, with the support of the ODIP II and the AtlantOS European projects (AtlantOS - (<https://www.atlantos-h2020.eu/project-information/best-practices>)), as well as the NSF funded Research Coordination Network (RCN: (<http://sites.ieee.org/oceanrcn/>), to plan and prototype the Ocean Best Practices System (OBPS). This was for the whole system: repository, peer review and training

The **first Ocean Best Practice Workshop (OBP Workshop I)** was held in November 2017 at the UNESCO-IOC in Paris, and brought together a community of experts from International agencies, Programs, Projects and other Organizations. These experts contributed significant recommendations for the implementation of the OBPS.

A summary of the Workshop I findings is provided in [Simpson et al \(2018\)](#). The resulting OBPS, and associated benefits are shown in Figure 1.

| OBP Creator Benefits | OBP User Benefits |
|--|---|
| Content Indexing by all major search engines | Consolidated access to best practices hosted in a living, sustained system (oceanbestpractices.org) |
| Content tagging using approved vocabularies for improved discovery and use | Easily discoverable and comparable content, powered by ocean-focused search and indexing technology |
| Digital Object Identifier issued for improved citations | Notification services to keep track of updates |
| Associated peer reviewed papers (Frontiers Research Topic- BP) | Peer review and community forums provide insight and commentary |
| Simple submission process supported by templates | Access to best practices relevant to Sustainable Development Goals and Essential Ocean Variables |
| User metrics | Feedback on use/metrics |

Figure 1: Ocean Best Practices Creator and User benefits

The **Ocean Best Practices Workshop II (OBP Workshop II)** was held at the UNESCO- IOC in Paris, December 2018. It was organized by the Ocean Best Practices Working Group with the objective of better understanding the future needs of the ocean observing community and gaps in best practices in addition to reaffirming technology advances implemented. Over the 2.5 days, 29 international ocean experts from International agencies, Programs, Projects and Organizations participated in presentations and panel discussions. Presentations were provided and are live linked in the proceedings below.

3. Workshop Agenda

The workshop was organized to focus on themes relating to the growth in the availability and in the use of best practices and how the OBPS can further this across the ocean observing value chain (see Figures 3-6). From this perspective, the desired outcomes were: (1) recommendations for best practice creation and uptake, (2) recommendations for further system development/implementation and (3) options for governance and sustainability.

| Tue 04 Dec | Session | Session lead and participants |
|-----------------------|--|--|
| 09:00 | Ocean Best Practice - Overview and Objectives | Jay Pearlman |
| 09:25 | Vision for the next Decade | Martin Visbeck |
| 10:05 | OBPS: Current Status (including demo) | Pier Luigi Buttigieg and Pauline Simpson |
| 11:05 | Break | |
| 11:20 | <p>Community Experiences and Challenges in Best Practices (Presentations)</p> <p>This session provides (based on Best Practice examples from observing networks, regional observing systems and other groups) an overview of approaches that have been used, or are under design, to ensure a mature Best Practices framework for ocean observing activities.</p> | <p>Moderator: Johannes Karstensen; Rapporteur: Nick Roden;</p> <p>Mark Bushnell (IOOS), Truls Johannessen (INTAROS & ICOS), Frank Muller-Karger (MBON), Rachel Przeslawski (NESP/IMOS), Pierre Testor (OceanGlider), Juanjo Danobeita (EMSO) R. Venkatesan (NIOT / DBCP) Jiang Fan (NCOSM)</p> |
| 11:50 | Lunch | |
| 13:15 | Community Experiences and Challenges in Best Practices (Presentations & Panel) - continued | Presentations and Panel Session continue |
| 15:45 | Break | |
| 16:15 | <p>OBPS evolution – community needs for the future (Open Discussion)</p> <p>This session provides an opportunity to comment on the present status of the Ocean Best Practices System (OBPS) and to propose and discuss requirements for future capabilities.</p> | <p>Moderator: Frank Muller-Karger; Rapporteur: Cristian Munoz Mas</p> |
| 17:45 | Looking forward to Day 2 | Peter Pissierssens |
| 18:00 | Adjourn | |
| 20:00 | Dinner (No Host) | 20 Eiffel Restaurant |

| Wed 05 Dec | Session | |
|-----------------------|---|--|
| 09:00 | Summary of Day 1 and Challenges for the next generation; charge to breakouts | Cristian Muñoz Mas |
| 09:20 | Breakout 1: Framing the next generation of OBPS: community development around best practices (open discussion) Breakout 2: Framing the next generation of OBPS: technical implementation (open discussion) | Moderator: Cyndy Chandler; Rapporteur: Rachel Przeslawski Moderator: Mark Bushnell Rapporteur: Pauline Simpson |
| 11:15 | Break | |
| 11:30 | Framing the next generation of OBPS: Breakout Session Reports | |
| 12:00 | Lunch | |
| 13:15 | Framing the next generation of OBPS: community and technical implementation (open discussion) | Moderator: Cyndy Chandler; Rapporteur: Mark Bushnell |
| 14:00 | Framing the next generation: Sustainability, Governance and Harmonization (Panel) | Moderator: Cyndy Chandler; Rapporteur: Mark Bushnell Panel: Gabrielle Canonico, Juliet Hermes, Emma Heslop, Bob Houtman, Jay Pearlman, Nadia Pinaridi, Peter Pissierssens |
| 15:30 | Break | |
| 16:00 | Governance, Sustainability, Community Building and Training (Panel with Open Discussion) | Panel continued - with open discussion among participants |
| 17:30 | Adjourn | |

| Thu 06 Dec | Session | |
|-----------------------|---|---------------------|
| 09:00 | Implementation Plan Proposal - Workshop Review and Recommendations (for IOC, etc.) | Jay Pearlman |
| 11:00 | Open discussion | |
| 12:30 | Close | |

4. Participants



Figure 2: Ocean Best Practices Workshop II, Paris, Dec 2018 participants (Nadia Pinardi missing)

Over the 2.5 days, 29 international ocean experts from International agencies, Programs, Projects and Organizations participated in presentations and panel discussions.

| | |
|----------------------|---|
| John ALLEN | SOCIB, Spain |
| Mark BUSHNELL | IOOS, United States of America |
| Pier Luigi BUTTIGIEG | AWI, Germany |
| Gabrielle CANONICO | MBON, United States of America |
| Cynthia CHANDLER | WHOI, United States of America |
| Juan DANOBEITIA | EMSO, Italy |
| Jiang FAN | NCOSM China |
| Vicente FERNANDEZ | European Commission |
| Champika GALLAGE | WMO, Switzerland |
| Juliet HERMES | SAEON, South Africa |
| Emma HESLOP | IOC- GOOS France |
| Bob HOUTMAN | NSF, United States of America |
| Truls JOHANNESSEN | University of Bergen, Norway |
| Johannes KARSTENSEN | GEOMAR, Germany |
| Arno LAMBERT | IOC- IODE Belgium |
| Frank MULLER-KARGER | University of S Florida, United States of America |
| Cristian MUÑOZ MAS | SOCIB, Spain |
| Francoise PEARLMAN | IEEE, France |
| Jay PEARLMAN | IEEE, France |
| Nadia PINARDI | University of Bologna, Italy |
| Peter PISSIERSENS | IOC-IODE Belgium |
| Rachel PRZESLAWSKI | NESP, Australia |
| Nicholas RODEN | University of Bergen, Norway |

| | |
|-------------------|---------------------------|
| Pauline SIMPSON | IODE/CCMI, Cayman Islands |
| Maciej TELSZEWSKI | IOCCP, Poland |
| Pierre TESTOR | Ocean GLIDERS, France |
| R. VENKATESAN | NIOT, India |
| Martin VISBECK | GEOMAR, Germany |
| Ling YUAN | NCOSM, China |

Day 1: Tuesday 04 December 2018

5. Best Practices (BP) : Overview and Objectives - Jay Pearlman



Jay Pearlman opened the workshop with the definition of a community Best Practice, which was a consensus outcome of the Best Practices Workshop I, as “*a methodology that has repeatedly produced superior results relative to other methodologies with the same objective*”. In addition, a best practice is a promising method that will have been adopted and employed by multiple organizations. Jay introduced the Ocean Best Practice Working Group (OBPWG) (the “Working Group”) and its members, who guide the development of the OBPS and interact with the ocean observing community to facilitate the creation, documentation, and use of ocean best practices. Jay then talked about best practice challenges, indicating that the quality of documentation varies widely: data and metadata formats are inconsistent, machine readability is limited (if at all), sustainability is often not guaranteed; work creating OBPs is not often acknowledged or key BP recognized. Practices are scattered and hard to find. In answer to those challenges, the OBPS has extended the IOC/IODE repository with a new user interface, advanced semantic indexing and search, a peer-reviewed *Best Practices in Ocean Observing* Research Topic in the journal *Frontiers in Marine Science*, and a community of ocean best practice developers and users. Jay mentioned that further system capabilities need to be considered and this is part of the workshop agenda. These may include coordinating with programs defining and demonstrating emerging technologies; linking with additional ontologies; linking across the value chain of best practices; recognizing GOOS community ‘endorsed’ best practices; addressing the feasibility (technical and social) of implementing best practices in developing countries; offering capacity building and training; and finally investigating areas for intercomparison across disciplines. Jay recognized that governance and sustainability are major factors in the willingness of our community to engage – and invest the time and energy to actively participate with OBPS. In conclusion, Jay emphasized that the workshop is a forum for discussion and building consensus, leading to recommendations for future planning.

6. Vision for the next decade - Martin Visbeck



Martin Visbeck introduced the AtlantOS Project (<https://www.atlantis-h2020.eu/>) whose vision is to improve ocean observations using the OceanObs 09 Framework for Ocean Observing (FOO), to obtain an international, more sustainable, more efficient, more integrated, and fit-for-purpose system. The AtlantOS initiative aims to be a long-lasting and sustainable contribution to realizing societal, economic and scientific benefits arising from this integrated approach, with implementation extending beyond the project’s lifetime. He highlighted the AtlantOS’ benefits and outcomes and ambition to foster international collaboration resulting in free and open access to data and information as supported by the GEO Blue Planet and Galway and Belem Statements. Martin noted that best practices are implicit in most of AtlantOS objectives, but still need to become explicit. He went on to ask the question: *why do we need to observe the ocean?* Here are some of the reasons: an increasing demand for deep sea observations; linkage between ocean and climate (global loss of

dissolved oxygen; global sea level rise; acidification (increase of heat content); life in the ocean (toward genomics); marine services including the Copernicus satellites and Mercator services; sustainable ocean development – “the ocean we need for the future we want” - and the introduction of the Blue/Green economy.

Where are we heading with the OceanObs19 framework? The 2009 framework led to prioritization of Ocean observation requirements as Essential Ocean Variables (EOV). OceanObs19 calls for an enhanced, global, and sustainable Ocean Observing System over the next decade, integrating new physical, biogeochemical, and biological observations while sustaining current observations. Martin introduced the concept of the Value chain, elements of which are shown in figures 3, 4 and 5.

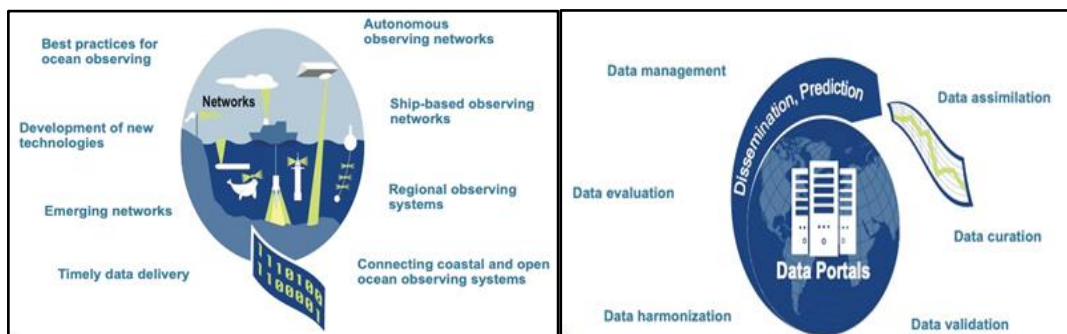


Figure 3 Observation and Data Gathering

Figure 4 Data flow and integration

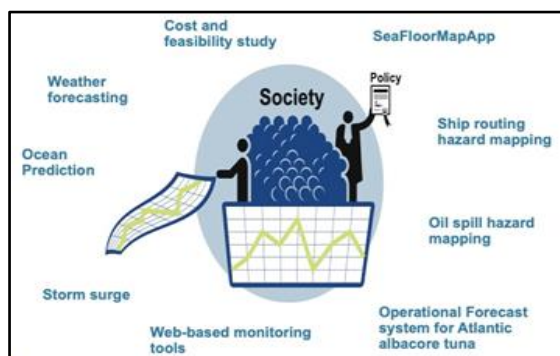


Figure 5 Information and products

What value does the establishment of good/best practices bring to ocean observation, ocean data integration, ocean information products; and the same question for the quality of ocean observation products?

He compared the old and the new way of approaching best practices. An example of the old way are the deliberations of the SCOR Working Groups, which have often advanced best practices. A number of examples of SCOR outputs were listed by Martin.

He then focused on the new way, the OBPS initiative, addressing scope, list of themes – some are new (human health, blue economy), and key program objectives/outcomes. These include information, innovation, integration, and governance. We have opportunities to show what we do and articulate what we could do. We can open-up communication channels, outline plans, call for a few things we would like changed.

Martin looked forward to OceanObs19 (a bottom-up, community-driven effort). He stressed the need to develop a best practice for observation of plastics in the ocean. He recommended that the Working Group consider what we wish as an outcome of OceanObs19. He reviewed the launch of the [UN Decade of Ocean Science for Sustainable Development](#) starting 2021 which the Intergovernmental Oceanographic Commission (IOC) has the charge of organizing. Ironically, he noted that we are presently in the Decade of Biodiversity and no one is aware of it! He again suggested we seize this opportunity to further our efforts. The UN Decade [Executive Planning Group](#) has just been formed, but had not yet met (Martin is a member).

Questions and Comments

Martin Visbeck: I am also thinking about capacity building; best practices are an opportunity to narrow the gap between developed and developing countries.

Frank Muller-Karger: How can we focus the concern about plastics in the ocean onto the impact on global life (measuring the variable vs. affect). He suggested using Keynote speakers at OceanObs19 to call on Ocean Observations and best practices.

Martin Visbeck: Regarding plastics, I would like to see in 2 years a study/assessment; this could also be used as an engagement opportunity

Juanjo Danobeitia: Elements for small island states and development should be included in the Decade of Ocean Science for Sustainable Development

Martin Visbeck: This points to the needs to be affordable “low” technologies that are still contributing to ocean sciences

7. OBPS: current status and demonstration - Pier Luigi Buttigieg and Pauline Simpson

Technologies for a FAIRer Use of Ocean Best Practices



Most potential best practices are scattered, have varying degrees of accessibility, and varying digital lifetimes. Pier-Luigi Buttigieg introduced the OBPS technical developments to achieve FAIRness (**F**indable, **A**ccessible, **I**nteroperable and **R**-Usable) and confirmed that F, A and R are achievable, but the challenge is to be Interoperable and discussed the need for interoperability with other repositories. To be interoperable, (meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation. Data (metadata) uses vocabularies that support FAIR principles. And finally, (meta)data include qualified references to other (meta)data.

Pier Luigi provided a live demonstration of the OBPS Repository new User Interface advanced search options across the metadata and full text content and semantic tagging of each document. He demonstrated how the use of ontologies has greatly increased the semantic indexing and discoverability down to the sentence level in a document.



Pauline Simpson, complementing Pier Luigi’s demonstration, gave a presentation on key attributes of the repository. She emphasized that without repository content submitted in a standardized machine-readable format, many of the technology advances introduced to OBPS and the benefits for the community could not be fully realized. She highlighted the additional metadata fields added to the document (meta)Data sheets e.g. EOVS, SDG, Maturity Level, next Review Date and best practice originator contact details etc which had been requested at the Nov 2017 workshop. Pauline prioritized the need for all BP creators to include the metadata

sheet in their best practices. She reminded participants of the advantages of templates to evolve toward uniform best practice documentation and cited the three BP templates already available on the OBPS interface (sensors, ocean applications and data management). She highlighted the future expectation of being able to create the machine-readable best practices on the OBPS interface followed by immediate automated ingestion. Pauline then clicked through the live OBPS indicating the new metadata fields recommended by the Ocean Best Practices Workshop I, which were now provided on the submission interface.

OBPS Technical Developments Proposed

At the end of the session Pauline and Pier Luigi briefly outlined new functionality that could be considered for implementation as part of the recommendations that would come from this 2018 Workshop.

- Knowledge and technology transfer (training) – scope how OBPS can support training and capacity building
- Web Editor on the UI for creation of a draft best practice - a la Wikipedia - generate structured documents that are more easily parsed
- Automated ingest of best practice – Document Data Sheets and templates - machine readability
- Automated alert email when next review of a best practice is desired
- EOVS/SDG/Spatial coverage – a web service access that can offer a direct select and populate
- Maturity level/Technology Readiness Level –new different scale
- GOOS endorsement process – build the endorsement functionality for EOVS (and later for SDGs)
- Additional metadata fields: EOVS Supporting Variables; Sensors (BODC Sensor Vocabulary used for semantic tagging); Network; Component of the observation lifecycle; GOOS Endorsed best practice and specify who endorsed it (e.g. IOCCP)
- Community Review –voting and commenting capabilities - already requested by ODS/SEADATANET and SCORWG/GO-SHIP Manual Nutrients Chapter
- Version control - system generated - ability to sum statistics across versions
- Export of records (metadata and full text options) from UI in different formats eg. BibTex, EndNote, Mendeley etc
- Enhanced metrics - UI display of individual record download metrics etc
- Linked data
- Import more terminologies and permit sub-selection in search
- Web crawling - evaluate the results of the testing phase re relevance and curation
- Schema.org compliance - Google Datasearch current efforts proposing earth science extensions to schema.org

Questions and Comments

Maciej Telszewski: How long does it take to deposit an item into OBPS?

Pauline Simpson: It depends on a number of things: regularity/experience of depositing into OBPS; having all the metadata and file in front of you to copy and paste. Having all of those then, she expects that it would take 15 minutes to deposit. New depositors have found it can take 30 minutes. This is one of the drivers to pursuing templates and automated ingest of metadata and content.

There followed a discussion on versioning by Emma Heslop, Martin Visbeck, and Jay Pearlman and a brief discussion on interoperability and the associated ability to inter-compare practices and outcomes.

8. Community Experiences and Challenges in Best Practices

- **Moderator: Johannes Karstensen**

- **Rapporteur: Nick Roden**



Johannes Karstensen (GEOMAR) presented concepts where BPs exist or could be useful. He suggested using the value chain as a structuring guide. (see Figure 6) Starting from societal requirements, the value chain elements include scientific approach, data acquisition, data management services, products and services, and conclude with societal benefits. Where are the BPs in the value chain?

There are many different flavors of value chains: Network organizational structure; Infrastructure and sensor; Data flow, data structure and data dissemination; Observing design and BP are used to structure output e.g. to respond to expectations from external bodies. Gabrielle Canonico highlighted some IOOS efforts to generate best practices.

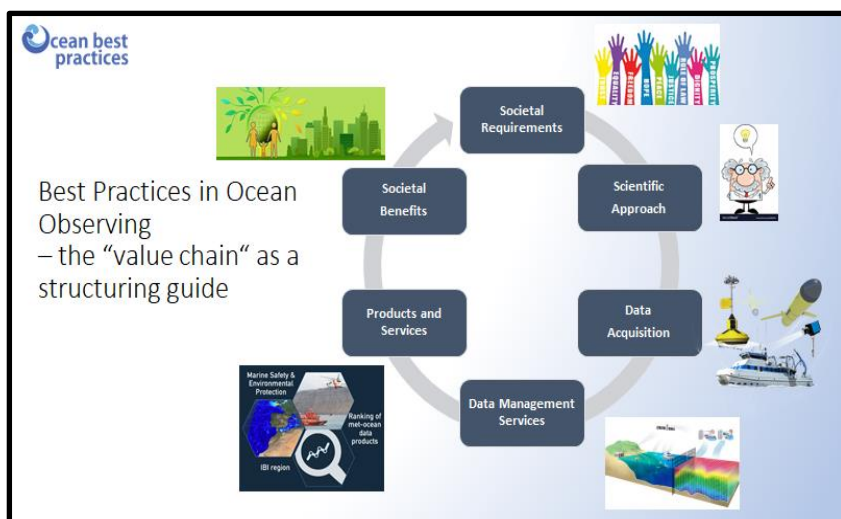


Figure 6:
Karstensen - BP in ocean observing chain as a structuring guide

Presentations:

Mark Bushnell - US Integrated Ocean Observing System (IOOS)



Mark Bushnell struggles with the term ‘best’ and suggested that we should think of “best practices” as the practices in play today. The IOOS office does not generate best practices, it is up to the regional associations to do that. There are exceptions such as the quality assurance manuals (QARTOD)¹. He noted the use of repository version control for QARTOD manuals, and urged participants to think of existing practices as well as good or best practices for repository submissions, as this will prove useful for legacy information.

Questions and Comments

Maciej Telszewski: We do not want multiple documents describing oxygen methods, as there is only one method for Winkler titrations.

Another workshop participant: We need to have a selection and then a process that selects the best document for a given network.

Emma Heslop: It is useful to have the choice from multiple best practices, then we can have some sort of community functionality to bring groups together to decide which is best.

Johannes Karstensen: One needs to first have a location where all of this information/best practices can be collected and then it is community driven step to address comparisons of methods. It may be necessary to have regional solutions and thus a single global best practice may not be desirable. In any case, the documentation is essential.

Truls Johannessen - [INTAROS & ICOS](#)



Truls Johannessen first reviewed the creation of **ICOS: Integrated Carbon Observation System** (<https://www.icos-ri.eu/>). ICOS is an organization of twelve member countries and over 130 greenhouse gases measuring stations aimed at quantifying and understanding the greenhouse gas balance of Europe and neighboring regions. ICOS data is openly available at the Carbon Portal, a one-stop shop for all ICOS data products. ICOS builds on long-term collaboration. Its structure has four main parts 1) ecosystem, 2) terrestrial 3) analytical, and 4) ocean

¹ <https://ioos.noaa.gov/project/qartod/>

thematic. The data flow in ICOS is highly structured. It works for global integration (SOCAT, Global Atmosphere Watch...) and uses QuinCe, data reduction and quality control software. In terms of best practices, the carbon group is well organized with established best practices within the community.

Truls then went on to describe **INTAROS (Integrated Arctic Observation System)**, which has 50 partners. It is a multidisciplinary observation program for the Arctic. Best practices in the INTAROS activity are a very important component. The program consists of multiple work packages, which will result ultimately in a road map for future research activities. There are challenges in building Arctic observation systems including organization, technology data generation, dissemination, and management, engagement and funding.

Questions and Comments

Johannes Karstensen: ICOS is based on one specific observing objective (carbon). It is good example of approaches to organizing observing and sets a different frame for organizing best practices.

Truls Johannessen: There is still a lot of work that needs to be done to build up best practices for the influx of new sensors that are now available.

Maciej Telszewski: The Oceans of Tomorrow H2020 projects have developed some of the approaches discussed above.

Frank Muller-Karger - [Marine Biodiversity Observation Network \(MBON\)](#)



Frank Muller-Karger presented MBON and also discussed biodiversity. He discussed relationships between GEOBON, GOOS (EBVs) and closed with a comprehensive list of BP challenges.

He acknowledged that, today we still do not know the distribution of organisms in the World's oceans; how they change with latitude and depth, and how they themselves are changing. He stressed the importance of biodiversity, because it is the foundation of much of today's economy, human health etc. Biogeographic information is being collected, but it is clustered around the coast and ocean surface. MBON is a "coalition of the willing" who agree to share knowledge and know-how to evaluate changes of biodiversity in the ocean, including data, products, protocols and methods, data systems and software. He suggested EOVS and EBV should not be considered separate from one another but each of them may have 15-20 different ways to measure them. This raises the question of how do you document the best practices? Best Practices vary widely across the ocean research and operations community. They come in different formats with different information. They are hard to compare and many times only a small part of the best practices is of interest - it could be a single paragraph in a 100 page document. Many times when programs end that created a BP, the BP disappears into someone's desk drawer or worse.

Questions and Comments

Martin Visbeck: A challenge in the community is about naming. He suggested establishing best practices about how to label things. GEOBON is a network that looks at a challenge (biodiversity of an ecosystem). His suggestion was to come up with a better syntax/ontology with what we call things (systems/networks).

Jay Pearlman: This seems essential, not just a 'nice thing' and should be addressed under the Framework of Ocean Observing.

Johannes Karstensen: Perhaps the EOVS specification sheets are a possibility to focus the initial effort in this area?

Rachel Przelawski - [Ocean Best Practice: Marine Sampling of Australia's Waters](#)



Rachel Przelawski of **National Environment Science Program (NESP)** and **Geoscience Australia (GA)** started by outlining the work to develop a suite of standard operating procedures in Australian waters which involved over 70 collaborators and 30 agencies. Australia has a large area of marine protected areas with multiple stakeholders, so the challenges in establishing sampling manuals were: 1) reaching consensus – the solution in Australia was to establish scope (and objective) early on and offer recommendations rather than mandates; 2) Data discoverability and accessibility – this requires working with the variety of collaborators through workshops and make recommendations that can be discussed and then (hopefully) followed; 3) Ensuring uptake – promotion is the approach and includes pamphlets, posters, conferences, social media and whatever else will help convey messages; 4) Promoting international relevance – a good approach is to relate the solutions in Australia to international frameworks such as EOVs and EBVs. She identified future directions as including: feedback questionnaire; implementation of surveys; oversight group; scoping of new field manuals; release of Version 2 of the field manuals. The manuals are effectively best practices.

Questions and Comments

Johannes Karstensen: It's a question of when detail really starts.

Jay Pearlman: Version control is the biggest problem with web-based best practices.

Pierre Testor - [OceanGliders Best Practices](#)



Pierre Testor discussed Ocean Glider Best Practices. These include a broad range of infrastructure such as shore-side facilities, glider platforms, sensors, deploy/recover support, and data management. Gliders are suited to process studies because they are reusable. After a decade of operations now need a practice program. The glider community is composed of many teams around the world. As a result, there are many processes that need to be standardized. They need best practices for infrastructure, vehicle configurations, glider platforms in the laboratory, vessels and deployment. Data management Best practices are moving towards a single Ocean Gliders exchange format. Much has already been done for real time data flow, but the delayed mode data processes need to be improved. There is a need for best practices for observation and design. A good example is glider missions planning and definition. This includes subjects such as type of vessel to be used, the glider performance, level of expertise and training required (important), distance between deployment points, environmental constraints, integration with other platforms, adapt and design considerations. This is not a single best practice, but more likely a series of standard operating procedures or manuals.

Questions and Comments

Truls Johannessen: How do the gliders perform in ice?

Pierre Testor: They are not too reliable.

Mark Bushnell: How can OBPS team work with the planned joint UG2 / 8th EGO glider workshop at Rutgers in May?

Pierre Testor: Best practices are certainly on that agenda already.

Juanjo Dañobeitia - [EMSO ERIC Progressing in Deep sea and water column Best Practices for Fixed point Observatories](#)



Juanjo Danobeitia introduced the distributed research infrastructure of **EMSO (European Multidisciplinary Seafloor and water-column Observatory) - ERIC (European Research Infrastructure Consortium)**. EMSO is a consortium of partners sharing in a common strategic framework of scientific facilities (data, instruments, computing and storage capacity). Formally the European Research Infrastructure Consortium (ERIC), it is a legal framework created for pan-European large-scale research infrastructures. He mentioned the need for standards and interoperability, throughout his 30+ years seagoing career.

Questions and Comments

Johannes Karstensen: Is there a coordinator for best practice information within the network?

Juanjo Danobeita: The network is collaborating with other organization (i.e. ICOS) for best practices.

R. Venkatesan - [Indian Moored Buoy Programme: OBPS-R: Evolving and Sustaining Ocean Best Practices Workshop, II – Paris 04-06 December 2018](#)



R. Venkatesan highlighted that there were three ways to characterize best practices: 1) sensor 2) platform and 3) sampling and analysis. He discussed the challenges of sensor best practices availability, there are several factors that create issues. For example, there are a limited number of sensor manufacturers. The quality of the products varies and there are errors in manuals. Finally, servicing is not consistent. He asked questions ‘how do you make manufacturers follow best practices’ ‘do we need skilled technicians to operate instruments’?, He also noted the need for best practices about calibration.

Venkat then presented best practices work applicable to buoy data. In this, he looked to the Indian moored buoy program and sensors, which is coordinated with the JCOMM Data Buoy Cooperation Pane; the need for training is one of the priorities. Venkat mentioned his team’s work hosting regional workshops with ~110 participants including 30 industries as well as writing published papers on data telemetry and modeling.

Jiang Fan - [Brief Report of Ocean Standards ,Metrology & Best Practices in China](#)



Jiang Fan highlighted that the National Center of Ocean Standards and Metrology is responsible for marine standards in China. He outlined the China Marine Standard System (consistent with ISO) that produced 119 marine national standards. It includes calibration facilities for CTD and wave sensors in collaboration with CSIRO and JCOMM. He suggested sharing these Chinese standards with the OBPS and for NCOSM to join the peer group. RMIC/AP and OTGA.

Questions and Comments

Cindy Chandler: Great that there are inter-comparison programs

Cristian Munoz: We should encourage China to contribute to the OBP repository

Pauline Simpson: I am excited by the prospect of 119 best practices from China deposited into OBPS repository

Frank Muller-Karger: How is China preparing for biological and biodiversity observations? (No answer was captured).

Jay Pearlman: How do you transfer your BPs to other countries/regions?

Jiang Fan expressed again his interest in collaboration.

Additional discussion on Community Experiences and Challenges regarding the impact of the OBPS.

Martin Visbeck: One of the challenges in observations is that one of the major stakeholders in national programs is the military. As a result, some instruments are not available to other countries. Do we encourage open access, or only use technology that is open to the world?

Truls Johannessen: As an example, LiCOR is not available for purchase in Europe.

Pier Luigi Buttigieg: As there are BPs that apply to a particular region, this could apply specifically to technology that is only available in certain areas. Also, multilingual support is possible within the repository.

Jay Pearlman: How do we engage the manufacturers? They need to be approached by us as a unified community if we are to carry the influence to be heard.

Truls Johannessen: ICOS has tried this; one needs to go as a group.

Martin Visbeck: An organized group some decades ago was interested in specifications and best practices for CTDs. They approached the various companies at the time for interest in responding. While there were multiple responses, the unified approach created a market environment so there is now only one company left, not a great result for the consumer. There are organizations (for example, the Alliance for Coastal Technologies in the USA) that compare instruments for observers, but do not make recommendations. Should there be a coordinated approach to observation systems (much like early climate models formed CMIP)?

Truls Johannessen: There are possibilities to get international attention. We could use SDGs as a tool. There are international organizations that we can work with.

9. OBPS evolution – community needs for the future (Open Discussion)

Moderator: Frank Muller-Karger

Rapporteur: Cristian Munoz Mas



This session focused on the current OBPS capabilities and provided a forum for comment on the present status of the Ocean Best Practices System (OBPS) and to propose and discuss requirements for future capabilities. Frank Muller-Karger kicked off the discussion by reviewing the suggested topics: There are a number of areas that the Working Group was looking for expert input

from the workshop. These included:

- Practical and functional aspects of the OBPS
- Test-driving the OBPS: Uploading, maintaining, downloading BPs
- Exercising case studies with high priority such as best practices for EOVs; this includes curating the EOVS specification sheets and the associated best practices with GOOS
- Linkages to external Best Practice and Communities of Practice (GEO BON - BON in a Box, other)
- Expectations from external bodies (e.g. JCOMM)
- Promotion of use of OBPS

Comments

Bob Houtman: as a funding agency the question is where do we go from here?

Important areas were discussed with both positive and negative aspects. A positive direction would include identification of a gold standard best practice but that's probably unrealistic. More likely the OBPS will support the collection of existing best practices, which can be used to establish a hierarchy of best practices for reference. In an ideal environment, the community agrees about best practices for particular platforms and sensors. These support, for example, particular EOVS.

This is the target but this seems very hard to get to in a short period. The question is what does the group see as a realistic value in terms of best practices? Standard Operating Procedures (SOPs) are

being implemented by various regional observing systems, but in the international scene, there are many SOPs for the same instrument/methodology. Is the real value of OBPS in collecting the same SOPs? If there is an umbrella like GOOS; can assessors (experts in the subject) of those best practices be under the umbrella?

Can we establish a hierarchy to organize best practices depending on the context that is used? Designing observatories that collect standard observations is a long process, which includes collection of community-based requirements, development process, next steps and assessment of sensors, and then new recommendations to change sensors. This can be valuable but needs a structure on how to get to that point. (a best practice for designing systems).

Nadia Pinardi: The first thing that OBPS needs to achieve is to become the platform for BPs, with or without consensus, and this is what JCOMM expects from OBPS. No equivalent group exists. We need better connections with requirements and standards of WMO to the OBPS. OBPS should have WMO community BPs. JCOMM OCG would be the body to interact with OBPS because it has good connections with WIGOS and WMO instrument practices.

Champika Gallage: Contributed further details on the acronyms used in this interaction for those not familiar with these groups.

Martin Visbeck: The OBPS, with its Web User Interface (UI), is trying to reach 500 best practices (Editor note now has 661). This group needs to figure a way to get consensus from different areas through EOVs etc. What are we going to learn from this unification of a variety of best practices? EOVs are discussed and promoted through JCOMM; other areas like OBIS, etc should be considered. Focusing on EOVs may not be the best way to simplify the problem, however. UN framework through policies and SDGs is another option. Ocean indicators need to make need associated best practices in order to work. These indicators are reported through statistics department of each country. These departments and their operating procedures are a long way from our values.

Pier Luigi Buttigieg: There is work on the creation of SDG Interface Ontology to help with discussions between these various entities, creating a window for interaction.

Frank Muller-Karger: What other ways are there to find value?

Nadia Pinardi: WMO want us to take responsibility and best practices can structure our community.

Pier Luigi Buttigieg: Communities have interfaces ready for action. Ontologies represent that, helping to relate EOVs and SDGs, etc. To highlight this value, the question is how to expose the efforts to non-specialists. OBPS is a window to expose those linkages. The UN semantic framework provides a link to the SDGs.

Cyndy Chandler: Looking at an example, OBPS maps best practices to EOVs and SDGs indicators. Introduce national statistic offices to the documents as to how indicators will be monitored. What are scientists going to use to measure EOVs that are related to the specific indicators. It should not be a big effort but we have clear examples right now. OBPS is mapping EOVs to best practices as well as the work of Juliet Hermes and Maciej Telszewski in creating a matrix of such mappings.

Juliet Hermes: The work in creating the matrix is continuing.

Emma Heslop: An activity is on-going within JCOMM/OCG to develop by GOOS a system within OBPS for endorsing best practices, based on the linkage with EOVs.

Cyndy Chandler : There are very important requests for validation worldwide. Utilizing best practices related to EOVs is essential for getting project funding.

Emma Heslop: Associating best practices to the metadata of the actual data is important for data lineage. Best practices are proxy of where the data is (and how it was created – Editors note).

Jay Pearlman: Indicators can reflect complex processes, but once you have it, gathering statistical info can be a best practice.

Martin Visbeck: Propose new indicators that have best practices associated with them and assure that the best practices are findable. Agencies may be interested (like 5 indicators for ocean health). Martin requested a page and a half with the opportunities and engagement of the OBPS concept. This is a good starting point to pass from OceanObs19 to the new UN Decade of Ocean Science.

Cyndy Chandler: We need to write it, I agree.

Frank Muller-Karger: How should we structure the WG/Breakout Sessions in OceanObs19, maybe one for BPs?

Maciej Telszewski: Last year we discussed the structure that is now in OBPS development. We need to give clear guidance on best practices to be used to measure EOVs. We are not there yet in OBPS, and still need to focus on developing EOVs.

Frank Muller-Karger: My EOV spec sheet is incomplete, but this is voluntary work; I have no time to go through the process and populate best practices in the system; how can that be done?

Maciej Telszewski: Lots of agencies have spent money in developing EOVs during the last years. This work needs to be done. Every sheet has a creator and a task team. We can fund workshops to develop this capacity and submit the BPs.

Johannes Karstensen: There are misunderstandings on the degree of complexity. There are different platforms; soon we may need a best practice for each platform and EOV; this is too much. At the present, every EOV specification sheet links to different best practices.

John Allen: BPs for platforms, EOVs, indicators? What are we going to do or to address?

Maciej Telszewski: We can use a 'T Matrix method' where all can be linked.

Pier Luigi Buttigieg: The system cultivates best practices for potentially anything. Using EOVs for scoping the problem is very valuable. We can have extra dashboard with TRLs for best practices and people can do gap analysis to assess what is missing. The endorsement process is also valuable; it comes from GOOS and can then be exported to UN or whomever else.

Nadia Pinardi: Best practices for platforms, EOVs that can be related, GOOS endorsement, but also we can have best practices for problems, which are much less scientific but areas that OceanObs19 is going to address. UN indicators are an example but there are other problems like ocean operation forecasting or climate and ocean health indicators. We need to think 10 years ahead to give solutions with data, models etc but also with best practices

Frank Muller-Karger: How do we prioritize? We cannot do everything together in the next year.

Nadia Pinardi: I suggest the following priorities: Test-driving the OBPS: Uploading, maintaining, downloading BPs; Exercising case studies with high priority EOVs; curating the EOV specification sheets with GOOS; Linkages to external best practices and Communities of Practice (GEOBON - BON in a Box, others); Expectations from external bodies (e.g. JCOMM); Promotion of the use of OBPS.

Frank Muller-Karger: Rachel gave us an example of reports. Can we use her experience for OBPS? How can we engage users?

Rachel Przeslawski: We need to reach out broadly for certain issues. We need somebody leading this. First identify the need, select a group (networks, etc). This can be difficult..

Johannes Karstensen: There are 3 GOOS expert panels that should enter at least into consideration.

Truls Johannessen: IOCCP

Gabrielle Canonico: We need to demonstrate relevance of observations to the users.

Nadia Pinardi: JCOMM will soon be restructured and enter into GOOS more than it was before. The new "JCOM" and GOOS will be together to face the best practices issues. JCOMM was dedicated to operational systems. Real Time data need to implement best practices. EOVs, platforms and problems are three foci to contribute from OBPs perspective.

Jay Pearlman: EOVs are essential to understand oceans. Which of these should be addressed first? How do we cover the value chain?

Emma Heslop: Technology can be used. Support of development of EOVs through, for example, workshops to create the community space to afford BPs in a technical way.

Francoise Pearlman: EOVs is an approach, the other is to address clearly identified user needs, i.e., solving problems. We need to have a combination as we move forward.

Mark Bushnell: QARTOD process may come in handy. I like Martin's suggestion to engage the UN Decade. However, we should be realistic as it is difficult to forecast ten years' time. We need to maintain the flexibility to "just go with what emerges".

Nadia Pinardi: We will get better ocean and weather forecast with ocean observations. We predict because we have knowledge from the past.

Cyndy Chandler: EOVs are critical for weather forecasting. Completion of the EOV specification sheets is a priority. We have plenty of best practices already in the repository; we need to connect these with the EOVs.

Emma Heslop: We need to find the right methodology to do it.

Cyndy Chandler: Juliet, Ana Lara and Maciej are working with similar things, so most of the work is done.

10. Looking forward to Day 2 - Peter Pissierssens



Peter Pissierssens referred to the keynote presentation by Martin Visbeck which showed us opportunities on how to make the OBPS relevant to more than just our own audiences and communities.

If we look at what OBPS wants to be - a curated, secure and permanent repository of ocean related methodologies, means for community engagement and consensus building, and practices that *“have been generally accepted as superior to any alternatives because they produce results that are superior to those achieved by other means or because they have become a standard way of doing things”* – it is a definition of BP that you will easily find in the community and one that the OBPS has also been using.

The OBPS must become the first source that scientists will go to when they are looking for best practices, SOPs, etc. Similarly, we hope that those who lecture on ocean observation, data and product development will refer to the OBPS repository in their course materials. This then relates also to how the OBPS will contribute to Capacity Development and Transfer of Marine Technology; OBPS needs to be a key reference and authority tool.

Today, we saw a demonstration of where we are with the OBPS and I believe it can be said that we now have a working prototype that can easily be operationalized after it has been “adopted” by IOC through a partnership of IODE and GOOS, which should ensure long-term core funding. We will be talking about this tomorrow in the discussion on sustainability.

We heard from several organizations and projects in the last sessions and all of them have developed SOPs and best practices that are being used within their communities. The challenge for us now will be to convince these organizations and projects to share their SOPs and best practices with the OBPS. But we may then also need to think how we can best serve these various specialized communities to easily and quickly discover best practices that are relevant to them without the need for complex queries. Some sort of packaged query (dashboards) using high-level keywords springs to mind. Of course, simply looking at what best practices are included in the collections for each of the partners is an alternative method.

Looking forward to the second day of the workshop, we will be discussing the core system and the sort of business model that needs to be developed to attract additional resources to further develop and customize for changing needs.

For OBPS to continue being relevant it must serve the needs of its customers and we need to think about who our customers are. Today, we talked about the UN Decade, where countries but also several UN Agencies will try to work together. These cover different aspects of ocean research and use, and this offers us opportunities to link the OBPS repository to others so that we can address multi-sectoral needs such as coastal zone management. A problem we need to solve is the territorial behavior of all agencies who want to build their own system (referred to by Martin Visbeck). This is of course not unique for the UN. We see it also at the national level between different government departments. We will need to work hard to make the OBPS a service for all.

Day 2: Wednesday 05 Dec 2018

11. Summary of Day 1 & next generation challenges - Cristian Munoz Mas



Cristian Munoz Mas opened the session by reminding the audience of the OBPS vision and mission. He then discussed challenges identified during yesterday's session:

- OBPS as a multi-stakeholder bottom-up process; Capacity building for developing countries; Legacy and usability of best practices; Types of users; Stakeholders coordination and collaboration; Funding; Organizations and projects to share their best practices with the OBPS; Global Integration of Systems and Disciplines.

He then highlighted needs raised yesterday, such as:

Easy and quick discovery of best practices; OBPS support to the next UN Decade..; OBPS focus across EOVs, Platforms and “specific problems” ensuring EOVs specification sheet content in OBPS; Dashboards to show availability of BPs for each EOV and associated variables and BP endorsed by GOOS Panels ; GOOS expert panels leading to promotion of best practices in OBPS; Incorporate community feedback mechanisms to help refine methods; Editor Note: These and additional user needs which were raised during yesterday's sessions have been included in Section 16 Workshop Recommendations.

Cristian then introduced the theme for Day 2 - ‘Framing the next generation’. This would include breakout sessions on community development and technical implementation, to be followed by a discussion on sustainability, governance, and harmonization.

12. Breakout Session 1: Framing the next generation of OBPS: community development around best practices



- **Moderator: Cyndy Chandler**
- **Rapporteur: Rachel Przeslawski**

Attendees: John Allen, Gabrielle Canonico, Cyndy Chandler, Vicente Fernandez, Juliet Hermes, Emma Heslop, Bob Houtman, Fan Jiang, Truls Johannessen, Johannes Karstensen, Frank Muller-Karger, Jay Pearlman, Rachel Przeslawski, Nick Roden, Maciej Telszewski, Ling Yuan,

TOPICS for OPEN DISCUSSION:

- Interfaces with the community,
- Coordination and collaboration across networks and observation systems,
- Building a broader participation for creating and using best practices

Breakout Session 1 Report:

1. Interfaces with the community

The group discussed how we define the community. This is essential to understand how to engage and support ocean observing. We also need to define how products are used. Ideas during the discussion reflected the diverse interests of the group, with ‘community’ defined to include both OBP providers and users (researchers, resource managers, policy makers, and various industry sectors). Importantly, the suitable standards and best practices can vary according to users, and there is thus an opportunity to learn more about different best practices across various communities by attending fora not normally

considered by the Working Group (e.g. petroleum industry). The user is at the end of the value chain, and there are excellent opportunities for the Working Group to engage with new communities as they are forming (e.g. –omics communities).

Although the Working Group has representatives from each community, there is some concern about how much information is getting relayed back to each community. It was recommended that we communicate more broadly and directly to these networks about the OBPS (e.g. collaboration with other newsletters), not just as individuals.

2. Coordination and collaboration across networks and observation systems

For efficacy, we need to find the most influential people in each community (e.g. regulatory bodies for petroleum industry) and engage consistently and regularly with them. This is particularly relevant now with the OBPS coming into fruition. However, there are two considerations inhibiting use of the OBPS: 1) resistance to new platforms and insistence on using familiar processes, 2) concern about transferring IP/ownership to an external source. Editor Note: The latter is addressed by the OBPS policy that a best practice creator retains full ownership of any content deposited into OBPS.

- Before the repository is fully used by a community, other collaborators need to be identified.
- Milestones and deliverables remain undefined, making it challenging to promote the OBPS to potential users. We suggest a short-term focus on EOVs, with a long-term vision for multi-disciplinary ocean observing systems, differentiating between tactical and strategic outputs.
- We should identify gaps in BPs and approach the GOOS panels. We are not leveraging the panels enough.

There was a lot of discussion about linking EOVs to best practices. GOOS is undertaking strategic mapping between network and EOV specification sheets. The best practices in the repository can then be linked to EOV specification sheets and endorsed by GOOS. Automation and links are key to this process to facilitate regular updates. There was some concern that GOOS Regional Alliances (GRA) are not always well-connected to GOOS.

3. Building a broader participation for creating and using best practices

The group discussed how we best go forward from here, with the following key points raised:

- We need to focus on forward decadal planning and associated metrics of impact and success.
- We must continue to ensure the OBPS remains fit-for-purpose, including a continued note (e.g. ocean acidification) to ensure international government support and potential funding.
- Evidence of current success is critical to increase our engagement with potential users. We need to identify the low-hanging fruit (e.g. cases where indicators and best practices have 1:1 mapping).
- Knowledge transfer (i.e. capacity building) should be included as a crucial element of the system.
- It is essential to identify needed but underdeveloped best practices and the process to do this.

RECOMMENDATIONS are included in Section 16

Breakout Session 2. Framing the next generation of OBPS: technical implementation



- **Moderator: Mark Bushnell**
- **Rapporteur: Pauline Simpson**

Attendees: Mark Bushnell, Pier Luigi Buttigieg, Juanjo Dañobeitia, Champika Gallage, Arno Lambert, Cristian Munoz Mas, Françoise Pearlman, Peter Pissierssens, Pauline Simpson, R. Venkatesan

TOPICS for OPEN DISCUSSION:

- Techniques and resources presently available that can be employed for the OBPS
- OBPS enhancements that may require capability development
- Who/when the development might be expected to originate
- Reward/effort ratio for the proposed activities to help in prioritizing them
- Challenges - constraining the scope of the OBPS while staying agile

Breakout Session 2 Report:**Techniques and resources presently available**

- Most technology components in the OBPS are modular and, where possible, existing software and tools have been used. This has meant the technology is easy to extend and even replace. The contractors have thoroughly documented the processes, making it easy for others to pick up. Where bespoke code has been utilized, it is open source and has been kept to a minimum. These design principles will be maintained in the future.
- BP document structure (driven by templates) reflects our movement towards standardized formats that are needed for future technology. We will move toward a unified document format and metadata standards although we appreciate that this is difficult to achieve. Through the OBPS, we offer some stability for the community linked to the functionality of the system. OBPS intends to disseminate and make more visible our templates, stating that these allow the full functionality of the system to be realized. It will be essential to work with other organizations that have metadata and document formats and specifications to align as far as possible

OBPS enhancements and capability development

- Issue of DOI (Digital Object Identifiers) to BP records has been welcomed by the community, but we need to create DOIs for all archived documents that don't have them yet. We need to also accept DOIs from organizations that have already assigned DOI to their best practices.
- Reduce noise in search and browse needs additional metadata and search filters
- Assure version control is robust and consistent
- Implement community feedback option on the interface for each document both formal and informal.
- Interface with teaching programs like OceanTeacher Global Academy and Instrument Manufacturers
- Multimedia support via hosting raw files in different resolutions and web hosting videos for training in the use of OBPS
- Use dashboards for gap/congestion analysis and visualization of metrics
- Extend Endorsement process to communities in addition to GOOS
- Increase visibility of OBPS
- The reward/effort ratio for the proposed activities to help in prioritizing them.

Challenges and constraints

There were some areas discussed, but led to no recommendations:

- Translations of documents (summary: technically feasible, but requires extension of resource base: translator/curator time)
- Hosting multiple versions (different languages) of the method under the same record (provided by the system function but initial OBPS policy was to upload only English versions)
- Would need to add alternative labels (multi-language) to ontology/thesauri terms.

RECOMMENDATIONS are included in Section 16

13. Framing the next generation: Sustainability, Governance and Harmonization



- Moderator: Cyndy Chandler
- Rapporteur: Mark Bushnell

Panel:



Bob Houtman
Nadia Pinardi
Gabrielle Canonico



Juliet Hermes



Jay Pearlman (left) and Peter Pissierssens (right)



Emma Heslop

The session commenced with an [introductory presentation](#) by Emma Heslop on the IODE/GOOS OBPS highlighting how OBPS is transitioning from development to operational status. With this evolution comes the need to define future governance and structure (including core and technical innovation) and importantly, funding to meet the needs of the next development phase.

Emma Heslop led the start of the Panel Discussion by identifying the funding needs over two timescales: near term (1-2 years) sustaining the existing OBPS, and longer term (~10 years). She noted the existing enhancement funding from AtlantOS is coming to an end, and a proposal to IODE and GOOS Management Groups has been developed describing formal governance and a reporting structure. The proposal is expected to be reviewed by IODE and GOOS and then offered to IOC Assembly. It will be hopefully accepted by early summer of 2019. The existing OBPS would continue with IOC project funding focused on operations. It is not expected that IOC will provide funds for further technology development. Funding for advanced technology would be sought elsewhere, and these would be determined through community interest. An OBPS Steering Group (SG-OBPS) will be established which would report to IODE/GOOS. Emma presented the proposed draft structure and terms of the SG-OBPS (see Emma's presentation) whose Terms of Reference would be to guide OBPS vision and strategy, monitor progress, establish task teams where needed and report to IOC/IODE/GOOS. Particularly, the SG-OBPS will identify and address opportunities for additional funding proposals as well as spearhead advocacy opportunities. Timeline: IODE Committee meeting Feb 2019, GOOS Steering Committee May 2019, IOC Assembly July 2019.

Panel and Participants Discussion

Nadia Pinardi: Noted the reorganization of JCOMM to JCOM is happening now, and will not be completed until next year so representation on SG-OBPS challenging, but relevant points for future JCOM should be included; suggested a WMO representative on the SG

Bob Houtman: Stated the need for a clear description of a pilot effort and suggested removing the use of the word pilot which was readily agreed.

Peter Pissierssens: Raised the issue of budget cycles and timing of needs.

Peter Pissierssens: Discussed the two types of IODE projects, those that are short term and those that are long term. OBPS would be a long-term project.

Bob Houtman: Again repeated the need for an overarching clearly defined short term goal: one-stop-shop for each EOVS and sensor and deployment mode (e.g. ship, mooring) for ease and completeness of access. This will also need to address the end to end value chain of sensor to applications and users.

John Allen: Noted the plethora of projects focused on best practices

Emma Heslop: Suggested we might incorporate them into our effort as modules for collaboration and possibly to be funded.

Jay Pearlman: Pointed out there's not enough resources in IOC, so consolidation is wise.

R, Venkatesan: Liked the one-stop-shop vision.

Cyndy Chandler: Stated that outreach has been conducted to various entities where we might expect encouragement (but not funding).

Frank Muller-Karger: asked (in the US at least) if there could be some directive included in RFPs, PPG < OCE Data Policy etc. that directed researchers to OBPS Repository to follow community best practices when collecting ocean measurements and observations

Bob Houtman: Conceivably, when the system has sufficient content, he could envision this being accomplished under the IOOC (with David Legler/NOAA & Eric Lingstrom/NASA). IOOC (<http://www.iooc.us/>; US inter-agency group under Consortium for Ocean Leadership)

Emma Heslop: Noted that operational observing systems should also be encouraged to submit BPs to the OBPS Repository, and said she thought South Africa would agree.

Peter Pissierssens: Said the idea could proceed through the IOC, and he expanded the idea of requesting engagement from Member States that would include developing nation participation.

John Allen: BODC has done a good job of requiring operators to document their processes and said it could serve as a role model for the OBPS. We should recommend to ocean data repositories/archives to point their data collectors to OBPS

Cyndy Chandler: Followed John's comment by noting CCHDO and others point many to GO-SHIP for a role model and could instead point to OBPS.

Nadia Pinardi: Asked what happens after the two-year period

Peter Pissierssens: Said it might then become a permanent IOC project.

Juliet Hermes: It would be important to be able to define success, perhaps through metrics.

Rachel Przeslawski: Thought NESP might be a good channel to bring the news of OBPS to the public.

Bob Houtman: Agreed for the need for metrics and levels of accomplishments.

Jay Pearlman: Metrics exist now – number of docs in repository, downloads per BP; review through Frontiers count, and user interface to discover BPs – and we are now into the realm of sustaining / maintaining the system.

Peter Pissierssens: Suggested another metric – research papers with BPs identified. The group identified other metrics: number of citations; number of community likes; attach BP to data sets and then monitor uptake; user feedback mechanism (number of stars);

Pier Luigi Buttigieg: Download metrics, system is not sure who actually uses the best practice.

Johannes Karstensen: Said even better were datasets linked to BPs.

Peter Pissierssens: Reminded the group of the Breakout group's interest in developing a dashboard to help with metrics, which also include some method of ranking BPs.

Frank Muller-Karger: Suggested care with the speed at which we proceed with these efforts, noting research is often ahead of BPs.

Maciej Telszewski: Highlighted we're talking about operational systems, that not everything is a certified reference standard, that multiple BPs often exist, and that through our efforts we might decrease the number of BPs.

Nadia Pinardi: Suggested using the SCOR working groups as well.

Pier Luigi Buttigieg: Said the system exists to support the development of BPs, noting the scope limits.

Jay Pearlman: There's no metric for reduction / standardization of BPs

Maciej Telszewski: Responded by saying the Dickson ‘bible’ has 27 SOPs for carbon observations. Question of whether we can narrow down to a single practice. This may not be realistic.

Pier Luigi Buttigieg: We have download metrics, but they don’t identify implementation, and that linkages from data sets & publications do so.

Emma Heslop: In addition to metrics, a milestone might be linked to satisfaction of BPs for EOVs.

Emma Heslop: Suggested the use of simple and transparent metrics

Cyndy Chandler: Said doing so through social media is common.

Pauline Simpson: Highlighted Altmetrics for metrics obtained through social media

Emma Heslop: Noted that tools such as the templates are already in place, and she thought some form of metrics is possible.

Jay Pearlman: Noted the need for marketing of metrics, and that they must be prioritized so what are the rules for doing so?

A discussion followed regarding DOIs to be cited, either the original publication and/or a document within the OBPS

Jay Pearlman: Reviewed the benefits of having BPs archived with both the originator and the OBPS DOI.

Mark Bushnell: Noted the inability of copyrighted BPs to reside in the OBPS, which can be a challenge for requiring operators to cite OBPS.

A discussion followed regarding a preprint which is a full draft of a research paper that is shared publicly before it has been peer reviewed.

Pauline Simpson: Explained the terms Preprint, Postprint and Publisher version within copyright vocabulary

Pier Luigi Buttigieg: Discussed possibilities of linkages between documents and proper attributions.

Johannes Karstensen: Wondered about ways to develop BPs and how can the OBPS best do so.

Rachel Przeslawski: Said their group was working on it and she’d have something to report next year.

Nadia Pinardi: Suggested we discuss sustainability and she gave a presentation:

Ocean Best Practices: from observations to end-user products - Nadia Pinardi

Nadia Pinardi made the following points:

1. She highlighted ocean best practices is an essential component of any earth observing system. We should identify users: scientific community, educational community, industry & private sector, public services community, policy makers, and perhaps the general public. The OBPS should serve them all.
2. She reviewed the value chain of observations to societal benefit (input data systems, generic information, customized products & services, and societal benefits), noting BPs throughout.
3. Steps towards sustainability – involve experts, connect with JCOMMOPS best practices, connect with practices for satellite data, connect with institutions (GOOS, GODAE, WMO/JCOM), select best practices for 1-2 downstream services (storm surge, for example), IODE Pilot Project (2019), JCOM Pilot Project harmonized between GOOS & WMO (2020).

Cyndy Chandler: Suggested the content from Nadia’s brief presentation be made available for incorporation in the workshop report. (Editor Note: all presentations are live linked in these proceedings)

Frank Muller-Karger: Wondered how to clarify the inclusion of satellite/remote sensing, noting it could be a large challenge.

Nadia Pinardi: Agreed

Cyndy Chandler: Suggested starting with the EOVs that may include some satellite observations.

Emma Heslop: Said satellite SOPs exist, and it’s a matter of interaction between communities.

R. Venkatesan: Noted the calibration/validation interaction between satellite observations and EOVs.

Jay Pearlman: Discussed “testing the waters” of the satellite community before jumping in, further highlighting the potential for vastly increasing the OBPS workload

Nadia Pinardi: Suggested interaction with the GEO community

Cyndy Chandler: Noted our lack of interaction to date.

Frank Muller-Karger: Explained he had already sent an email - *Hello Artur-I wanted to mention that we have a success story within the IOC Ocean Best Practices Working Group that is relevant to the Ocean Colour EOY – we should update the spec sheet accordingly. The series of IOCCG tech reports is now tagged with DOI’s and resides within the OBPS at IOC. We made a link between IOCCG, as they were looking to assign DOIs to the tech reports, and the Ocean Best Practices System accepted and assigned the DOIs. Perhaps Venetia and Pauline can add details if needed, such as how best to refer to the OBPS and the reports in the system.*

Gabrielle Canonico: Emphasized the distinction between users and society, which must both be served – folks managing MPAs, fisheries managers, etc. must all see value in the OBPS. She agreed that interaction with GEO is a natural connection. She saw OBPS value in supporting research to operations transitions, and innovation in other ways as well.

Juliet Hermes: Suggested interacting with Blue Planet and emphasized the need to specifically support both scientific and technical users.

Gabrielle Canonico: Thought we could strengthen connections with the regional alliances.

Juliet Hermes: Mentioned the interaction with IMOS, IOOS, and the South African region at the 2017 OBPS workshop.

A discussion followed about the distinction between the GOOS (office), IOC, GOOS (the whole thing), and other GOOS named groups.

Pier-Luigi Buttigieg: Noted the satellite community is welcomed, ontology exists, and content exists. He also showed how a search can bring related societal topics to OBPS users.

14. Governance, Sustainability, Community Building and Training (Continuation: Panel with Open Discussion)

- ❖ If sustainability is linked to utility, need and relevance – what will make the OBPS vital to the community?
- ❖ What is the impact we can have for societal issues?
- ❖ To achieve our vision, we will need to move beyond a 2-year project and achieve some level of sustained funding:

- **What would be the milestones that should attract that funding?**

Pauline Simpson: Reminded that milestones had been defined in the project strategy plan, one hard target being repository critical mass (of at least 500 documents)

Peter Pissierssens: Discussed the various ways an employee can be retained (with varying levels of permanence), the various funding possibilities., and the various positions (including volunteers).

Mark Bushnell: Noted the example of the Satellite Telemetry Interagency Working Group (STIWG) which rotates volunteer positions annually among participating agencies.

Johannes Karstensen: Noted organizations that contribute to a trust fund, but the question of un-earmarked fund contributions and legal issues are challenges.

Juliet Hermes: Mentioned the Belmont Forum but few were familiar with and it requires submission of a proposal.

A discussion of alternative proposal paths followed, such as embedding contributions within other project proposals.

Cyndy Chandler: Mentioned the EXPORTS program (primarily a US NASA program).

Jay Pearlman: Mentioned G7.

Juanjo Danobeita: Suggested organizing a special event

Truls Johannessen: Thought it might be a workable idea to have a special event.

Jay Pearlman: Followed with the idea of “bite-sized” tasks.

We discussed the unsuccessful SCOR WG proposal

Cyndy Chandler: Thought it might be worthwhile trying again.

Frank Muller-Karger: Said that’s just asking an organization (Ed Urban) to search for funds for us, rather than identifying a true funding source.

Johannes Karstensen: Mentioned the European program COST.

Truls Johannessen and Nadia Pinardia: Nodded yes, but again a proposal is required.

Peter Pissierssens: Suggested a mosaic approach to look for contributions from Member States, which he sees as the way forward *for the next 4-6 years*. Market to other IOC Programmes

R. Venkatesan: Suggested targeting industry, which may find benefits.

- **What should be the model given that submission and distribution remain free and this is a global service?**
- **Where would you like us to be in 10 years’ time...**

Rachael Przeslawski: It would be nice to see movement from simply being a repository to an organization which more fully supports users and emerging techniques (plastics, eDNA).

R. Venkatesan: Seconded the idea.

John Allen: Our centralized BP location is our primary authoritative function, and it’s relevant at several levels (sensors, platforms, SDGs).

Peter Pissierssens: Wondered if there was community interest in evaluation of sensor performance in different regions.

Pier Luigi Buttigieg: Reviewed the methods within the OBPS that may be able to support the question.

Mark Bushnell: Noted that the NOAA Alliance for Coastal Technologies does precisely what Peter sought – regionally specific sensor testing – and that ACT director Mario Tamburri has agreed to allow these reports to be submitted to OBPS. [Editor Note: ACT now included in OBPS]

John Allen: Presented his procedure for reading a paper which involved viewing figures early,

Pier Luigi Buttigieg: Noted that figures are very difficult to manage on a machine-machine basis.

We then discussed various hurdles encountered when receiving community feedback/comments –

Peter Pissierssens: Suggested going through OceanExpert

Cyndy Chandler: Mentioned ORCID so as to weed out “Mickey Mouse” feedback. [Editor Note: not everyone has an ORCID]

Pier Luigi Buttigieg: Said it’s important that we target engineers, and technicians

John Allen: DOIs do a great job of making grey literature look very white.

Emma Heslop: Wondered about retention of negative comments and responses, noting the need for management of such a feature.

R. Venkatesan: Relayed an experience with a sensor deployment that involved a simple solution to a problem and said we need to be sure to include such documents

Emma Heslop: Referred to them as “hot tips”.

Pier Luigi Buttigieg: There may be other ways to include such things within our effort.

Cyndy Chandler and Jay Pearlman thanked everyone for their active participation during the session and throughout the day.

RECOMMENDATIONS are included in Section 16.

Day 3: Thursday 06 December 2018

15. Ocean Best Practices Workshop II: Implementation - Jay Pearlman



Jay Pearlman opened by summarizing the community challenges:

- Global Integration of Systems and Disciplines
- Organizations and projects to share SOP /BPs with the OBPS
- Stakeholders coordination and collaboration
- Legacy and usability of BPs for each type of users
- Funding
- Capacity building for developing countries.

He then talked about the strategy toward sustainability describing the steps for the 3 relevant elements of the value chain (input data systems; generic information services; customized products and services). Experts from the observing, generic and downstream services will be involved. The orderly approach consists of organizing the ontology in a way to recognize the three steps of the ocean value chain above; connecting with OBP for satellite data (start with WMO CEOS and GEO community); and connecting in an institutional way with GOOS, WMO/JCOM community and GODAE.

The OBPS is identified as a joint IODE/GOOS Project, aligned with IODE, GOOS, JCOMM strategy elements. This provides stability, formal governance and reporting structure. Note: the project proposal is subject to approval by the IODE Committee (IODE-XXV) – Feb 2019; the GOOS Steering Committee Meeting – May 2019; and IOC Assembly – July 2019.

The near-term strategy is expressed for the initial 2 years:

- Make sure the outcomes of the two years are clear. Performance indicators are needed.
- One-stop-shop for each EOVS, sensor and deployment mode (e.g. ship, mooring) for ease and completeness of access. This will also need to address the end-to-end value chain of sensor to applications and users.
- Go beyond this as a facilitator and become a catalyst for new OBP.

Two to three generic service best practice examples (such as, WMO guide to storm surge, Assembly centers & NODCs) and 1-2 downstream services will be selected; a new JCOMM Pilot Project will start in 2020 for best practices harmonized between GOOS and WMO. It is noted that best practices are an essential component of any earth observing system that supports the SDGs.

The following reflects activities /implementation to be conducted in OBPS in conjunction with the 2-year strategy.

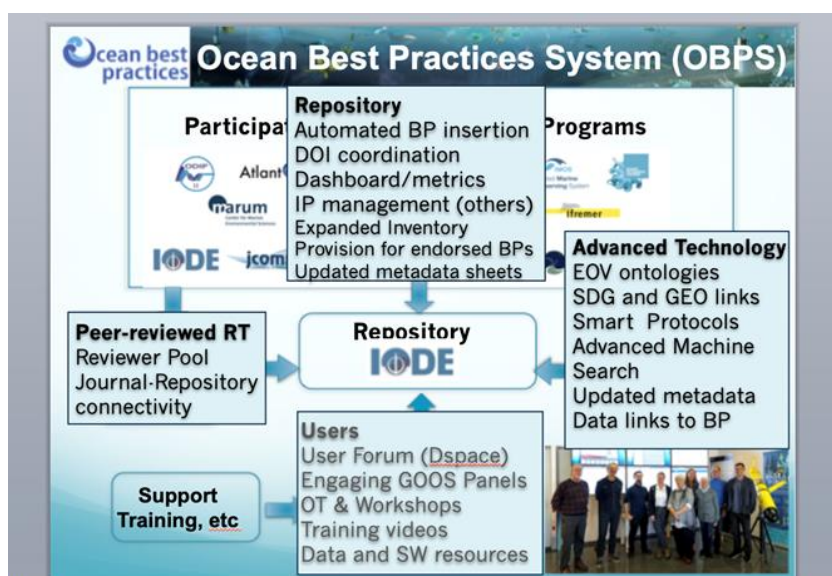


Figure 7: Summary of near-term actions for OBPS evolution

The **very near-term** activities are identified as:

- OO19 decision on panels and speakers
- Write a paper for the UN Decade of Ocean Science
- Address societal issues- picking themes
- Identify a small number of EOVs from each panel to be piloted.

The **near-term** activities are:

- Operations Project approval
- Critical mass of practices (more documents)
- Metrics
- Deliverables
- Initial focus during the next year on EOVs to include applications e.g. HABs on phytoplankton
- Update metadata sheets
- Linking table 6 of EOVs to OBPS?
- Dashboard of repository EOV status

One more level of detail for repository requirements:

- Community review – already requested by ODS/Seadatanet and SCOR WG/GO-SHIP manual nutrients chapter
- Version control – system generated – ability to sum stats across versions
- Export records from User Interface (UI) in different formats – bibtex, endnote, mendeley etc
- Enhanced metrics - User Interface download metric displayed against individual record
- Linked data
- Import more terminologies and permit sub-selection in search
- Web crawling – evaluate the results of the testing phase re relevance and curation
- Schema.org compliance - google datasearch – current efforts proposing earth science

Moving to operations metrics:

Existing metrics

- Number of documents in OBP repository
- Number of downloads/views per BP
- Academic credit, Frontiers Journal

Now that we are transitioning to an operational system, what metrics are required:

- Number of citations
- Number of community likes
- Attach BP to data sets and then monitor uptake.
- User feedback mechanism (number of stars)

16. Workshop Recommendations

(1) Recommendations for best practice creation and uptake

| Recommendation | Workshop Source |
|---|------------------------------|
| <i>Support BP creation and uptake</i> by 1) capturing user needs; 2) developing products relevant to and beyond scientific research; 3) gathering feedback on socialization strategies for target areas (e.g. SDGs); 4) prioritizing completion of table on | Breakout 1; Section 13/14 |

| | |
|--|--|
| EOVs and sub-variables by GOOS and finding ways to make these tables dynamic for regular updates; and 5) encourage operational observing systems to adopt BPs and provide them to the OBPS | |
| <i>Increase OBPS visibility</i> by: 1) Producing a page and a half with the opportunities and engagement of the OBPS; 2) engaging with regional groups to request submission to and also promotion of OBPS Repository; 3) planning an OceanObs '19 engagement/event with strong content; 4) use of search engine optimization; 5)collecting success stories; and 6) provide text (code snippet) that data repositories/centers and add to their sites\ | Section 9 - OBPS Evolution; Breakout 2 |
| <i>Build capacity</i> by 1) developing template/videos/tutorials or BP e-courses to document the process behind BP generation; 2) looking at the means to broadly distribute BP; providing methods for best practices education and uptake; 3) including Summer schools focused on EOVS and platforms to socialize OPBS | Breakout 1 |

(2) Recommendations for further system development/implementation

| Recommendation | Workshop Source |
|---|------------------------|
| <i>DOIs</i> : 1) Issue DOIs to earlier OBPS records, which were in the repository prior to allocation of DOIs; 2) Ensure DOIs reference stable versions on BPs and are interlinked across versions (and visually clear to users) | Breakout 2 |
| <i>Metadata</i> : 1) Create new metadata fields (and UI search parameter) for 'theme' (Region, Discipline) searches, and for network searches; 2) Extend mandatory fields and ensure more key fields are controlled with terminology | Breakout 2 |
| <i>Advanced Search</i> : Introduce Advanced Search allowing more syntax; Search Engine Optimization and keywords should be used to heighten visibility in search engines; Filter out non-relevant ontology content (table as furniture, R in CHEBI); Constrain Community search accounting that some communities are networks and others are projects | Breakout 2 |
| <i>Version control</i> : implement and test robustness of Version Control system | Breakout 2 |
| <i>Expand use of links</i> : 1) Expand links to GitHub, and access for Jupyter notebooks, as well as example data sets should be provided 2) Encourage community home webpage link-back to OBPS for web page-rank increase; 3) chema.org mapping to link to Google DataSearch; 4) integrate datasets into the record | Breakout 2 |

| | |
|---|------------|
| <i>Implement feedback mechanisms:</i> 1) Forward feedback to BP contact/author; 2) provide simple thumbs up/down linked to accounts (note: this is distinct from formal review therefore more easily implementable) | Breakout 2 |
| <i>Design dashboards</i> for gap and congestion analysis; metrics visualization; Link metrics to UI/UX | Breakout 2 |
| <i>Extend endorsement function</i> to other communities (including UN Decade), use as filtering system for expert, non-expert, and potentially dubious documents | Breakout 2 |
| Better define and communicate content review policies (FAQ) | Breakout 2 |
| Expectations from user groups/ external groups (e.g. JCOMM's guidelines on networks and platforms; i.e. defining semantics to stabilize building systems) | Breakout 1 |
| Host multimedia resources for training | Breakout 2 |

(3) Options for governance and sustainability.

| Recommendation | Workshop Source |
|---|------------------------|
| <i>OBPS transition to an IODE project</i> (the first 2 years); there is a need for an overarching clearly defined short-term goal: one stop shop for each EOV and sensor and deployment mode (e.g. ship, mooring) for ease and completeness of access. This will also need to address the end to end value chain of sensor to applications and users - start at the end of the chain and include users and products | Section 13/14 |
| <i>Long term governance:</i> OBPS as a permanent IOC project: within the framework of IODE, after the first 2 years, | Section 13/14 |
| <i>Steps towards sustainability:</i> involve experts, connect with JCOMM OPS best practices, inclusion of satellite/remote sensing; connect with institutions (GOOS, GODAE, WMO/JCOM), select best practices for 1-2 downstream services (storm surge, for example), IODE Pilot Project (2019), JCOM Pilot Project harmonized between GOOS & WMO (2020); connect with GEO, connect with blue planet; this includes outreach to those institutions shown above and user engagement | Section 13/14 |

| | |
|---|-------------------------------|
| <i>Define success through metrics:</i> metrics exist now – number of docs in repository, review through Frontiers count, and user interface to discover BPs; we now need metrics in the realm of sustaining / maintaining the system; other suggestions for metric: – research papers with BPs identified, and even better where datasets are linked to BPs.; metrics must be prioritized | Section 13/14 |
| <i>Milestone:</i> publishing EOY-best practice summary | Section 13/14 |
| Focus on the vision and planning for the next decade. | Breakout 1 / Section 13/14 |

17. Appendices

Appendix 1 – Acronyms

| | |
|----------|--|
| ATLANTOS | Optimising and Enhancing the Integrated Atlantic Ocean Observing Systems |
| AWI | Alfred-Wegener-Institute |
| BP | Best Practices |
| BPWG | Best Practices Working Group see OBPWG |
| CCDHO | CLIVAR and Carbon Hydrographic Data Office |
| CRM | Certified Reference Material |
| CSIRO | Commonwealth Scientific and Industrial Research Organization |
| CTD | Conductivity Temperature Density |
| DOI | Digital Object Identifier |
| EBV | Essential Biological Variables |
| ECV | Essential Climate Variables |
| eDNA | Environmental Deoxyribonucleic Acid |
| EMOS | European Marine Observing System |
| EOVs | Essential Ocean Variables |
| ERIC | European Research Infrastructure Consortium |
| EuroGOOS | European Global Ocean Observing System |
| FAIR | Findable; Accessible; Interoperable; Re-usable [data principles] |
| FIX03 | Fixed point Open Ocean Observatory network |

| | |
|-----------|---|
| FOO | Framework for Ocean Observation |
| FRAM | Frontiers in Arctic Marine Monitoring |
| G7 | Group of 7: Canada, France, Germany, Italy, Japan and United Kingdom and the United States are the 7 largest advanced economies in the World. |
| GEOBON | Group on Earth Observations Biodiversity Network |
| GEOMAR | GEOMAR Helmholtz Centre for Ocean Research |
| GEOS | Global Earth Observation System |
| GODAE | Global Ocean Data Assimilation Experiment |
| GOOS | Global Ocean Observing System |
| GO-SHIP | Global Ocean Ship-based Hydrographic Investigations |
| GRA | GOOS Regional Alliances |
| GROOM | Gliders for Research Ocean Observation and Management |
| ICES | International Council for the Exploration of the Sea |
| ICOS | Integrated Carbon Observation System |
| IEEE | Institute of Electrical and Electronics Engineers |
| IMOS | Integrated Marine Observing System (Australia) |
| INTAROS | Integrated Arctic Observation System |
| IO PAS | Institute of Oceanology, Polish Academy of Sciences |
| IOC | Intergovernmental Oceanographic Commission of UNESCO |
| IOCCP | International Ocean Carbon Coordination Project |
| IODE | International Oceanographic Data and Information Exchange of IOC |
| IOOS | U.S. Integrated Ocean Observing System |
| ISO | International Standards Organization |
| JCOMM | Joint Committee on Oceanography and Marine Meteorology |
| JCOMM OCG | JCOMM Observations Communications Group |
| JERICO | Joint European Research Infrastructure Network for Coastal Observatories |
| MBON | Marine Biodiversity Observation Network |
| NESP | National Environmental Science Programme (Australia) |
| NOAA | National Oceanic and Atmospheric Administration |

| | |
|----------|---|
| NODC | National Oceanographic Data Centre |
| NSF | National Science Foundation |
| OBPWG | Ocean Best Practices Working Group |
| OBPS | Ocean Best Practices System |
| OBPS-R | OceanBestPractices (Repository) |
| OCEANOBS | Ocean Observation [conference] |
| ODIP | Ocean Data Interoperability Platform |
| OGC | Open Geospatial Consortium |
| OORCN | Ocean Observing Research Coordination Network |
| ORCID | Organization in the Research Community [individual researcher id] |
| QARTOD | Quality Assurance / Quality Control of Real Time Oceanographic Data |
| RCN | Ocean Observation Research Coordination Network |
| SAEON | South African Environmental Observation Network |
| SCOR | Scientific Committee on Oceanic Research |
| SG-OBPS | Steering Group of the Ocean Best Practices System |
| SOCIB | Sistema d'observació i predicció costaner de les Illes Balears |
| SOP | Standard Operating Procedures |
| TRL | Technology Readiness Level |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| URI | Universal Resource Identifier |
| WHOI | Woods Hole Oceanographic Institution |
| WIGOS | WMO Integrated Global Observing System |
| WMO | World Meteorological Organization |
| WOD | World Ocean Database |

Appendix 2: List of Figures

- Figure 1: Ocean Best Practices Providers and user benefits
- Figure 2: Ocean Best Practices Workshop II, Paris, Dec 2018 participants (Nadia Pinardi missing)
- Figure 3: Visbeck Value Chain - Observation and Data Gathering
- Figure 4: Visbeck Value Chain - Data flow and integration
- Figure 5: Visbeck Value Chain - Information and products
- Figure 6: Karstensen - BP in ocean observing- value chain as a structuring guide
- Figure 7: OBPS Components

Suggested References

Pearlman, J., Buttigieg, P.L., Simpson, P., Muñoz, C., Hesop, E. and Hermes J. (2017) Accessing Existing and Emerging Best Practices for Ocean Observation, a new approach for end-to-end management of best practices. In: Oceans'17, Anchorage: Conference Proceedings, MTS/IEEE, 1-7. <https://ieeexplore.ieee.org/document/8232105>

Simpson, P., Pearlman, F. and Pearlman J. (eds) (2018) Evolving and Sustaining Ocean Best Practices Workshop, 15 – 17 November 2017, Intergovernmental Oceanographic Commission, Paris, France: Proceedings. AtlantOS/ODIP/OORCN Ocean Best Practices Working Group, 74pp. [DOI:10.25607/OBP-3](https://doi.org/10.25607/OBP-3)

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