

Observing Needs in the Deep Ocean
Sept. 19, 2019 11:30-12:30 Room 317B Convention Center

Moderators: *Lisa Levin* (Scripps Institution of Oceanography)
Alan Leonardi (NOAA Office of Exploration and Research)

Panelists:

Felix Janssen, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Germany:

Deep Observing and Essential Ocean Variables

Lynne Talley, Scripps Institution of Oceanography, USA:

Global cross-disciplinary observations in the deep

Henry Ruhl, MBARI, USA:

Expanding deep stakeholders and scaling up

Patricia Fryer University of Hawaii:

Deep exploration opportunities

Karen Stocks, Scripps Institution of Oceanography, USA:

Deep data: Advances, challenges and gaps

Background:

The deep ocean (below 200 m) covers over half of the planet and is increasingly recognized as critical in global heat, carbon sequestration and climate dynamics, a receptacle for contaminants and debris, as well as replete with living and non-living resources for society. Due to high pressure and its remoteness, as well as jurisdictional and governance challenges, observing in the deep ocean entails its own unique requirements. As such the deep ocean transcends the many Ocean Obs 19 themes: climate change, ecosystem health, food and energy, pollution, blue economy, observing technology innovation, data innovation, modeling challenges, and a need for community building and system integration.

Goals: This session discussed emergence of key observing needs in the deep ocean with a goal of fostering discussion among the very broad group of stakeholders with deep-ocean interests. We explore how to integrate observing programs, data, and models, to address societal needs of the 21st century. Key questions are:

- (1) How can we innovate and facilitate the integrated collection and analysis of physics, geology, biogeochemistry and biology observations?
- (2) How can we bring together the communities of industry, technology, science and conservation to fill deep-ocean data gaps?
- (3) How can we address the diverse coordination, management and capacity development needs of the highly distributed observing community?
- (4) How can technologies to conduct deep sea observations locally be scaled up to global-scale, multidisciplinary observing networks?
- (5) What is required to improve rapid data sharing and access across disciplines and countries?

After a brief introduction to the session, panelists addressed these questions in 5 min. flash talks, making specific deep observing recommendations. These presentations were followed by a half hour of audience questions as well as sli.do feedback and contributions. We generated a series of recommendations for the Obs'19 task team and these helped to formulate the DOOS contribution to

the Decade for Ocean Science. In addition audience comments were captured in the Slido app and provided to the panelists for review. (See Appendix A.)

Panelist Recommendations:

Janssen: Make benthic ecosystem observation a standard component of deep ocean observing programs

Talley: (1) Expand BGC Argo to global scale. **(2)** Incorporate routine biological measurements addressing multiple trophic levels, their diversity and function into GO-SHIP . **(3)** Expand Deep Argo to global scale over the next decade

Ruhl: (1) -Build communitie(s) of practice and networking, finding common perspectives. **(2)** Adopt/adapt GOOS forms of regional coordination, engagement and delivery by DOOS , e.g. from GOOS Regional Alliances. **(3)** Communicate a vision and the building blocks from EOVs and other tools, to tractable data streams and products towards integrated assessments.

Fryer: (1) Optimize the sensing and sampling capabilities of assets used on a given venture into the deep by advancing instrumentation that permits **real-time decision-making** about priorities of tasks. **(2)** Advance partnership between academic institutions, and with private, and industry entities to facilitate exploration of the deep ocean; facilitate access to samples by improving knowledge of what is available and a standardization of acquisition.

Stocks: (1) Leverage existing cyberinfrastructure when feasible, and develop a coordinated communication effort to address missing deep requirements. **(2)** Recommendation: Promote collaborative efforts to identify and create synthetic products that can bridge the gap in existing interoperability approaches.

Final Recommendations submitted to Ocean Obs '19 Organizers:

- 1.Extend deep-ocean observing capacities to the global scale as part of the UN Decade – addressing all deep-ocean-relevant EOVs and building on existing assets and networks.
- 2.Improve standardization of and access to deep ocean observing data, samples, and derived products
- 3.Facilitate partnerships, collaboration, integration and capacity building across deep-ocean observing communities, including deep-ocean exploration, seafloor mapping and private sectors, through the Deep Ocean Observing Strategy.

Appendix A: Summary of Slido Break out session ‘Observing Needs in the Deep Ocean’

The numbers in brackets refer to the original comments found in the commented sli.do excerpt (‘Observing Needs in the Deep Ocean+FJanssen.xlsx’). In that file, comments have been associated with break out session questions and recommendations.

General comments

We received the suggestion to submit needs and a path forward for the required deep ocean observation to the UN Decade (27). The other comments reflect the results of poll 2 asking about the alignment of the three recommendations with interests and needs of people attending the break out session: most of the comments addressed recommendation 1 (promotion of the deep ocean observing system implementation) while much less input was provided regarding recommendation 2 (improve standardization and data access), and 3 (promote partnerships and collaboration).

Comments on recommendation 1: ‘Promote the application of existing ocean observing technologies to include the full suite of deep ocean EOVs of all disciplines and bring them to global scale’¹

Several comments suggested to be more specific regarding which deep-ocean observations DOOS wants to extend and to which areas. It was suggested to identify a method to prioritize focus areas of deep ocean observing infrastructure (6). A better connection to modelers was suggested in order to shape the observing system (28). Also, a compilation of the different goals of deep ocean observing activities and the needs of users (e.g., mining industries / ISA; 21) has been suggested as a way to make sure that observations address the right scales (12). With reference to biodiversity assessments it was suggested to assess the significance of deep ocean observations (9).

We got a few suggestions of priority areas to consider for the development of the global observing system’s deep-ocean component. A lot of the comments pointed to the need for physical oceanography observations on the global scale (2) but also addressing specific transport phenomena or areas, including Deep Western Boundary Currents (7), the lower limb of the MOC, the AMOC, and the Drake Passage (14). It was suggested to focus on areas that are particularly hard to address and not in the focus of industry, e.g., the Beaufort Sea (8). Some comments addressed missing capacities to perform observations of deep ocean currents – even after Deep Argo will be implemented (17, 22).

Several comments suggested that DOOS should champion seafloor / subseafloor / solid earth observations (13, 15, 19, 23, 25, 29, 30), which may be more important than extending upper ocean variables to depth (13) and would also raise awareness for the deep ocean (30). Specific seafloor variables mentioned included bathymetry (referring to Seabed 2030; 30), bottom pressure and deep ocean gravimetry (19, 25), solid earth / geological processes (13, 29), and the contribution of the sub-seafloor to biogeochemical cycling (15). One comment specifically highlighted biology observations in the mesopelagic (3).

¹ The revised recommendation 1 as presented to the OceanObs19 plenary reads: ‘Extend deep-ocean observing capacities to the global scale as part of the UN Decade – addressing all deep-ocean-relevant EOVs and building on existing assets and networks’

Some suggestions were provided about existing and emerging technologies and observation networks that DOOS should consider: A BGC-glider network should be developed alongside of BGC Argo (1). SMART cables should be promoted (30) but accuracy and drift of bottom pressure sensors is still considered an issue (25).

Several comments highlighted opportunities to extend observing system capabilities by adding sensors to existing platforms, e.g., by installing biogeochemical sensors at physical-oceanography-centered moorings (4), equipping Argo with hydrophones to facilitate a multipurpose ocean tracking network (26), and adding more instruments, including optical and acoustic sensors, to ROVs / underwater vehicles (5, 24).

Further we were advised to not only focus on existing methods but also include new technologies (20) and the need for new and better observing technologies was mentioned several times (1, 2, 6, 15, 17, 22, 25, 30). The development and implementation of new technologies is addressed in the revised version of recommendation 1¹.

Comments on recommendation 2: ‘Improve standardization of and access to deep ocean observing data, samples, and derived products’²

Several comments were focusing on improving the access to deep-ocean observations. It was suggested to consider a visual platform for data access with appropriate search / filter functionality (depth, region, data type...) in terms of its usefulness and the efforts connected to its implementation (10). It was acknowledged, that improved access to deep-sea observations may require the provision of specific metadata that inform on, e.g., the deep-sea ecosystem being observed (11) or the specific sub-seafloor observations that have been carried out (16). It was further mentioned that the modeling community should be involved in shaping appropriate handling of deep-ocean data (28). Regarding standardization of observations, it was mentioned that ROV service providers could improve regarding Consistency and documentation of data collection and sampling (5).

Comments on recommendation 3: ‘Promote partnerships, collaboration and capacity building across the deep ocean observing community’³

Only few comments addressed specific partnerships to be promoted. While it was noted that the deep sea mining community is potentially an important user of deep-ocean observations and a strong driver of anthropogenic change in the deep sea (21) a strong need for improvement in terms of data transparency, and openness was identified for both mining industry and ISA (18). Without specific advice on how to promote partnerships, other relevant communities and networks have been mentioned, including Argo (26), Deep Argo (17), BGC Argo (1), fixed-point observatories (4), ROV service providers (5), remote sensing / GRACE (19, 25), Seafloor mapping / Seabed 2030 (23), the exploration community (24), and the SMART cable network (30).

² Recommendation 2 has not been revised before presentation to the OceanObs19 plenary

³ The revised recommendation 3 as presented to the OceanObs19 plenary reads: ‘Facilitate partnerships, collaboration, integration and capacity building across deep-ocean observing communities, including deep-ocean exploration and the private sectors, through the Deep Ocean Observing Strategy’