INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)

Fourteenth Observation Coordination Group (OCG-14)

Cape Town, South Africa
Hybrid Meeting - Website
June 6 - June 8, 2023

Final Report

UNESCO

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Group Photo

Executive Summary

The Fourteenth Observing Coordination Group Meeting was held from June 6 - June 8, 2023, with both virtual and in person attendees. The GOOS Observation Coordination Group (OCG) is charged to review, advise on, and coordinate across the global ocean observing networks to strengthen the effective implementation of a global ocean observing system (GOOS) and global marine observing system[1]. OCG works with 13 global *in-situ* networks and emerging 'global' networks, and has 8 key foci for its cross-network activity:

1. Improving the fit-for-purpose of the observing system against numerous requirements and the needs of OCGs sponsors and stakeholders;
2. Encouraging technical development of existing observing networks and engaging emerging networks and communities of practice that are the key to addressing new requirements and needs;
3. Developing metrics and targets to assess and report observing system performance and progress over time, towards meeting user needs;
4. Advancing exchange of international data and metadata and system-wide monitoring capabilities through OceanOPS;
5. Encouraging system-wide integration and quality standards through development of community best practices and standards;
6. Improving integration of data and information through data management standards and integration pilot projects;
7. Working towards increasing the ability of states with less developed observing capability to both take and use the needed observations;

[1] Terms of Reference

8. Encouraging environmental stewardship

The OCG-14 meeting covered advances across all the OCG foci areas, and had a particular focus on public private partnerships, the OCG data implementation strategy, improved connections with WMO on the Rolling Review of Requirements, discussed advances of impact studies, development of metrics of success and connections with UN Decade programmes. The key takeaways and discussions identified actions in a number of areas:

- Reviewing network progress and addressing network challenges;
- New emerging networks;
- Need to form a task team to fully develop our maturity model and its intended uses;
- Private sector interests and identified a few key areas around which to have follow up discussions with MTS-GOOS Dialogues;
- Approved the OCG Cross-Network Data Implementation Strategy (with some recommended changes) and will soon discuss implementation. We also noted the growing importance and criticality of metadata, and better defining the overall architecture of metadata flow and for what purposes;
- Recognized the importance, and pathways, of contributing towards observing impact studies;
- Reviewed progress by OceanOPS, approved its work plan, and noted the importance of addressing the "metadata gap" (eg potentially through harvesting);
- Recognized and applauded our Capacity Development (CD) activities, encouraged them to leverage other IOC and WMO CD programs to expand our reach, and asked for follow-up assessments of the impacts of CD workshops;
- Identified numerous UN Decade intersections with OCG Networks and agreed to identify suitable pilot projects that could advance these interests;
- Noted the importance of moving beyond network organizational paradigm, and organize a workshop in 2024 to determine how best to synthesize requirements to motivate observing action.

During the OCG-14 meeting two virtual workshops were held addressing various cross-network topics and an outreach event.

- **Low cost technology Workshop:** Hybrid workshop to showcase low-cost technologies that are available to observe coastal waters and evaluate ERDDAP services as a tool to enhance data accessibility to ensure the data is publicly available [June 2, 2023].
- **Boundary Currents Workshop:** Begin the discussions in-country of using the Agulhas Current as a pilot for the GOOS Co-Design Boundary Current Exemplar Project [June 5, 2023]
- **Outreach event:** Outreach event around Oceans Day to showcase observing platforms that the OCG uses to observe the ocean and address the importance of the ocean to society and link this to a tour on the SA Agulhas II research vessel. This expanded and organizers local in Cape Town expanded this planned 1 day event to a 4 day event [June 8-11, 2023].

Report

Note that this is an interactive document with links to recordings, presentations, and background and working documents. Click the blue underlined hyperlinks to reach those resources. The Report covers the discussions and follows the OCG-14 Meeting Agenda (here), the actions arising from these discussions are noted in the text and compiled in the Actions Table.
The meeting was held daily (6th of June - 8th of June, 2023) in Cape Town, South Africa at the Breakwater Lodge hotel with a virtual option for participation. Each substantive agenda item below captures a short summary, the main points of discussion and action items of each session. The opening session included orientation to the zoom tool and tips on meeting etiquette in the online format.

Please refer to the action table for the compiled list and additional information on the actions, including teams, identified priorities, and responsibilities.

Upcoming Meetings to note:

- DBCP-39, 24-27 October, Bali, Indonesia
- Tidal analysis workshop will be in Liverpool late summer or early fall. Date not yet set. The next biennial meeting is due in the Fall of 2024. Date and place not yet set.
- 7th Port Meteorological Officers (PMO-7) workshop 31 October -02 November, Nadi Fiji

1. Welcoming

Dr. Ashley Johnson, Director of the Department of Forestry, Fisheries and Environment in South Africa opened and welcomed the OCG team to the OCG-14 meeting on Tuesday June 6th. He welcomed the OCG team and highlighted the importance of this meeting and collaboration with IOC UNESCO and GOOS and its programmes. Climate impacts are crucial and impactful and South Africa is already engaged in much of the network work and has a high interest in ocean observations in the oceans around the continent.

2. Opening

David Legler, OCG Chairperson, opened the OCG-14 meeting and gave a presentation setting aims of the meeting and reflection on intersessional work and highlights and achievements, future plans and opportunities and potential next steps and actions with updates. (*Presentation link*).

3. GOOS Updates

Updates from the GOOS office on the recent activities and developments including an overview of the WMO rolling review of requirements (RRR) process, the establishment of Decade Coordination Office (DCO), Intergovernmental Oceanographic Commission (IOC) survey to capture examples of issues related to undertaking observations in states exclusive economic zones (EEZs) by networks and by IOC member states (*Presentation link*).

The discussion addressed the EEZ survey outcomes with 64 responses from the networks and 15 responses from member states. The action proposed to IOC 32 Assembly is to form an ad-hoc working group to explore the issue and report back to the next Executive Council with recommendations. Specific issues to be addressed include:

- Can a champion member state be identified to take the lead?
- How could MSR requests be approved quicker?
- Development of best practices?
- Conduct outreach with countries with increased needs, e.g., in Africa
- A change in the request and approval approach. Is increased knowledge of benefits by countries going to result in an easier process?
- Is there a possibility to frame the 'operational obs' as different from 'research obs'. The operational obs are made freely available in real-time and underpin products/predictions, which is different from a research obs where data may be held by PIs for years etc. Is this difference understood?

The National Focal points (NFP) discussion focussed on the future of the NFPs and successful implementation of such representatives. Some recommendations during the discussion included:

- Set up of a committee / nodes of NFPs
- Meeting of European NFPs upcoming that representatives should engage in
- NFPs should be engaged within the GRAs - coordination, messages to national level
- Challenge for NFPs to determine and establish a common level of engagement

Other materials:

- Report of Ocean Observations in Areas under National Jurisdiction Workshop: https://oceanexpert.org/document/26607
- For some networks, there are also NFPs, such as DBCP, GLOSS and SOT, https://unesdoc.unesco.org/ark:/48223/pf0000385404

Resulting action

GOOS Updates

- Adopt best practices and for GOOS to track measurements in the EEZ
- Present on OCG work at NFP meeting
- Additional 2 days focussed on cross network responses to requirements at OCG-15
- Connect with smaller IOC nations and IOC sub-commissions to be active in the EEZ discussions

4. European observation networks assessment in the EuroSea Project

Lessons learned about maturing networks within the EuroSea project and looking at data, governance and best practices. WP3 focussed on improving the integration of nations observations for optimal use in EuroGOOS contributing to GOOS initiatives. Coordination groups included observational networks, data flow and integration, OMICS observations, and European vision of ocean observing integration (*Presentation link*).

The discussion addressed the application of the Framework of Ocean Observing (FOO) within the EuroSea project, best practice development, metadata and OceanOPS, and potential OCG and EuroGOOS collaborations.

Resulting action

EuroSea

- More granularity on the OCG attributes
  - Request EuroSea KPI's for coordination metrics for consideration within OCG
- Consider GLOSS tide gauges access points, best practices and specification sheets including how to get engaged published on the websites
- Invite Gary Mitchum to an OCG exec meeting to discuss and define GLOSS issues

GCOS Implementation Plan

A brief update on GCOS implementation plan (IP) on ECVs (Essential Climate Variables) was presented by Sabrina Speich. To address the GCOS implementation plan the networks and panels need to be engaged and implement the recommendations where applicable. Various themes that address different parts of the value chain have been developed by GCOS. The plan showcases issues, benefits, implementation and recommendations on how to address the gaps.
The discussion covered various topics including:

- AOPC takes responsibility for measurements in the atmosphere over the ocean - and collaborates with the OOPC for example in areas around air-sea interaction and global energy and water cycles.
- The potential overlap between GBON requirements, in particular sea surface pressure, and the networks that provide the requirements was highlighted. How will this be remedied?
- In Germany the GCOS national focal point is collecting the planned actions for the GCOS implementation from the observers - likely not comprehensive but a start. Is that the same for other countries? The flow of information in this case would be via the GCOS national focal point and not OCG. Is this the mechanism to be continued and are these connected to the panels?
- Very few GCOS national structures with currently only Switzerland, Australia, Germany having these structures but no other countries.
- There is a need to move beyond platform counts and move towards a global view; however, it is unclear how GOOS, GCOS and others will develop and agree on metrics and how will user needs be taken into account (e.g., SST coverage through satellites, fisherman need sensors and observations at depth 20-50 meters).
- RCCCM network a potential entry point for ocean observation https://rcccm.dwd.de/DWD-RCCCM/EN/home/home_node.html?

Materials:

- GCOS Implementation Plan
- ECVs Requirements

Resulting action

GCOS

- Network response to the GCOS IP recommendations, WMO RRR etc.
    - Have this discussion as part of the additional 2 day discussion at OCG-15

5. Networks Reports Part 1

This session covered updates from across the networks providing highlights from the previous year, challenges, and looking forward to the goals, opportunities, report out against the network attributes. Additional asks to report on networks' next plans for multi disciplinary expansion, highlight UN Decade activities, self-evaluation on real-time data, delayed data access, best practices, and identifying networks main users and products.

The discussion addressed specific suggestions and asks from OCG networks and how OCG can assist in providing guidance. Highlights of achievements for each network are listed below.

DBCP (*Presentation link*)

- **Achievements:** New Executive Board; New data quality control tool developed at MeteoFrance; Lagrangian Drifter Laboratory, Data Acquisition Centre of WMO marine climate data system; Coriolis/France willingness to host GDAC for moored buoys; Region-free WMO ID allocation made available through OceanOPS; WIS 2.0 pilot: SIO/LDL for drifting buoys; Capacity Building, diversity and inclusivity.
- **Concerns:**
    - Decrease in number of operational drifters (Indian Ocean, Southern Ocean) and drop in deployments of tropical moored buoys (Indian Ocean)
    - Metadata accuracy needs to be addressed between operators and OceanOPS; Expand OceanOPS collected metadata in support of both operators and user requirements
    - Not all data are in agreed binary universal form (BUFR) and shared to GTS; some shared and discoverable online in other formats (Copernicus, EMODnet, etc.)
    - Cost increase and delay of instruments and equipment, shipping costs, ship-time costs, telemetry, etc. due to inflation (20-50%), adversely impacting maintenance, (re)deployments, and leading to decommissions. Costs are affecting Moorings and Drifters alike
    - Vandalism is a persistent concern
    - Multiple websites that need to be combined with some showing broken links
    - Audience of OceanOPS metadata and the roles and responsibilities of OCG networks with regards to OceanOPS unclear

OceanGliders (*Presentation link*)

- **Achievements:** In person meeting, 320 deployments, BUFR format for gliders was approved by WMO and released, best practices in development, improved data flows
- **Concerns:**

- BGC data is not making it into servers due to its delayed mode nature
- Unified data format can help and pose challenge
- Cross network collaboration is needed to share best practices

GLOSS (*Presentation link*)

- **Achievements:** in person meetings of data center representatives and Group of Experts, Data access and metadata plans, IAPSO proposal to hold a workshop on tidal analysis best practices, modernized governance structure for GLOSS
- **Concerns:**
  - Lack of centralized resources
  - Uneven support for data centers [all funded by national funding streams]
  - Note that it is unclear why OCG status update slide are requested

AniBos (*Presentation link*)

- **Achievements:** AniBos endorsed UN Decade project; Mostly data collection in the polar oceans, metadata integrated in OceanOPS; MEOP-CTD database and standardized data framework published; data available through ERDDAP; >100 deployment.
- **Concerns:**
  - Spatial coverage has decreased during COVID
  - Sustained funding is needed for longevity of the network
  - Improved procedures for oxygen and chlorophyll data is needed
  - Lack of personnel on biological data

HF Radar (*Presentation link*)

- **Achievements:** Website development; New system planed to be installed; Good agreement between the HFR and model simulation; new technology development; QC is an important topic
- **Concerns:**
  - OCG endorsement needed for more spectral bandwidth at an upcoming World Radiocommunication Conference
  - As HFR operators move onto dedicated bands for oceanographic radars, can OCG play a role in helping synchronize systems across countries to avoid radio interference
  - Facilitate discussions with the ocean modeling community on the value of HFR surface current and wave data for assimilation into and validation of operational forecast models
  - When radial measurements cross country borders, can OCG help foster the generation of total vector products.

The following topics were **discussed**:

- Indian ocean observing needs: Not a sufficient number of platforms to observe the area; an informal team is coordinating deployments for Argo floats [Call for members from the networks]
- Network activity in South Africa: HFR interest into SA; Europe has released a best practice in Frontiers, US has developed one as well about 10 years old

- Data: Implementation of the OCG data strategy and opportunities including increased access to any of the data in an operational center, and potential opportunities utilizing WIS2.0
- Metadata: GTS is entry point for end users/operational centers that should be connected to OCG activities and OceanOPS metadata; OCG should utilize and compare metadata across networks and assess whether the metadata is of quality and getting to end locations; the national practice of SA on marine management system which requires the data and metadata (machine to machine data harvesting); there is an increased need for more metadata which Argo is addressing through the manufacturer directly; need for standardized metadata reporting; need for defined responsibilities of tracking metadata; need for minimum requirements and how to grow the requirements; the need for an uniform way across the network to get the metadata

Resulting action

Networks Report Part 1

- Explore opportunities for a WIS2.0 pilot for HFR data
- Explore and define opportunities for more machine to machine metadata harvesting, including where it is working across networks, where are possibilities for replication, linking to sensor manufacturers, uniform way for metadata harvesting
- Refer to Data discussion: *Roundtable on metadata and data issues and requirements including near real time and delayed mode data*
- Highlight the key data centers in the data mapping

Networks Reports Part 2

OceanSITES (*Presentation link*)

- **Achievements:** 367 sites; New member countries include Italy, Spain, China; Visualization tool of flux data; applying AI to gap filling and extrapolation; CB activity
- **Concerns:**
  - OCG Plans for multi platform approaches
  - Wild card platform sites
  - Dialogue with modeling and reanalysis centers about utilizing in-situ platforms to assess and improve model/reanalysis performance
  - OCG/GOOS certification program for reference stations/networks

GO-SHIP (*Presentation link*)

- **Achievements:** Data management team established; 2 US cruises; Euro-GO-SHIP project
- **Concerns:**
  - Advocacy for key measurements transient tracers and CRMs for carbon and key data centres
  - OCG oversight on emerging biological observations – cross network cooperation and expansion of BIO GO-SHIP

- Continued assistance from OCG with integration with ERDDAP services and improving machine-2-machine metadata flows with OceanOPS
- Carbon certified reference materials

SOT (*Presentation link*)

- **Achievements:** SOT Strategy; GOSUD steering committee; ISO standards review for specifications for shipboard meteorological instruments; official transition from WMO Pub47 metadata format to the new SOT WIGOS metadata hosted by OceanOPS

SOOP - Achievements: Data management team established; 2 US cruises; Euro-GO-SHIP project; new technology development

ASAP - Achievements: ASAP independent panel within SOT; 4531 successful data submission to GTS; 17 active European ASAP fleet

VOS - Achievements: 3.96 million real-time observations sent to GTS in 2022; 25 national VOS programs; 2885 active vessels; delayed-mode data to VOS GDACs

- **Concerns:**
  - During COVID activities decreased and slowly recovered
  - Turbowin updates - need to modernize
  - Transition to BUFR format
  - Only 13 programs provide delayed mode data to the GDACs.
  - Increase in 3rd party data

Argo (*Presentation link*)

- **Achievements:** Sensor development: CTD, pH sensor, radiometer sensor, latency of real-time data delivery; formed a community of practice; Argo regional basin deployment planning meetings
- **Concerns:**
  - Significant holes in the Indian Ocean and Southern Ocean
  - Western Boundary Currents enhancement
  - Replace binary result for OCG Network Attributes to move towards a WMO RRR requirements form for global EOVs
  - Cross network collaboration on sensor development and deployment planning

IRSO (*Presentation link*)

- **Achievements:** Worked on IRSO SOT connections to OceanOPS; 50 organisations from 32 countries; New research vessel being built - under construction in Spain with delivery early 2024

The **discussion** covered the following topics:

- Decrease in atmosphere observations within VOS potentially due to the transition to BUFR format
- Global Basic Observing Network: GBON plans to expand to other variables; current GBON requirements are focussed on NWP; more advocacy and clarity is needed on GBON expansion; for marine data GBON is focussed on SST and pressure and for

other applications more variables are needed than currently specified. Better KPIs are needed to tease out the need and outcome
- Atlantic Observations: Atlantic and South Atlantic highlighted a need for increased observations and reference stations
- Collaboration: Ocean community to choose some key areas to collaborate on with the weather community
- Sensor: pH Sensor issues particularly for BGC are becoming increasingly problematic. Companies question the market need. Stronger partnerships with the private sector and R&D collaboration and coinvest required to advance sensors

Materials
- DBCP Environmental Stewardship survey still open for inputs from other networks: https://forms.office.com/e/vvA1vRpGrM

Resulting action

Networks Report Part 1 and Part 2
- SOOP representative, or technical coordinator from OceanOPS at IRSO meetings
- KPI development - is that needed to be done by OCG
- Discussion on other third party data streams outside of OCG - is this fully or partially a responsibility and willingness within OCG?
- Explore the definitions and requirements for reference networks incl. WMO INFCOM-2/Doc. 6.1(7), 2022
- Clarification on OCG attributes [general use, scoring or reporting related]
- Transition emerging networks to advance in maturity

6. OCG Network Readiness - from emerging to mature OCG network

This was an interactive brainstorming session to introduce the 3-tiered OCG metrics developed to track progress of OCG networks. The proposed metrics are based on the OCG Attributes, the Framework for Ocean Observing (FOO)[2] document for maturity of system/networks/elements and the implementation status table of the Report Card. It will serve as a reference to demonstrating the key factors and steps that are needed for an emerging OCG network to move towards a mature, fully-operating network (*Presentation link*).

The discussion addressed:
- Critically important to have metrics to communicate the value of networks
- Drafting and applying this process with the emerging networks is key
- Caveat to call the network sustained as no network is sustained and will constantly require more resources. To create a definition of “sustained” would be helpful.
- There is a need to express the benefits of the observing system and establish quantitative assessments of the ocean observing system cutting across societal benefit areas. A consideration could be to keeping the “sustained funding” an aspirational metric and use “persistent operations” as the short term achievable goal

[2] http://www.oceanobs09.net/foo/FOO_Report.pdf

- There is a need to assess what sustained means (e.g., 10 yrs, 20 yrs) and when and under what circumstances a network is considered sustained. In the case of sustainability the question arises where funding is coming from.
- Sustainability if linked to value. Potential top down approach to raise value and buy in and capacity from the government. Funding is associated with the social/societal impact of the network. Collecting stories (e.g. from the annual/technical reports of the network/system) is a good idea.
- Try to find out how the networks justify their funding for their programmes in the current operation. Mostly they are driven by scientific needs.
- Several assessment studies exist that are based on ocean/climate prediction systems. The problem is that the models (especially coupled models) still have too large systematic errors to judge the general importance of the observations
- Emerging needs for adaptation and mitigation of climate change. There is a GCOS task team (GATT) that is gathering stories around case studies - one was on marine heat waves. This kind of information needs to be fed into the assessment of impact - it would be valuable in both directions: for justifying the continued observations and for establishing new requirements.

Other materials:

- The Keeling curve:: https://history.aip.org/climate/Kfunds.htm
- IOC Ocean State Report

Resulting action

OCG Network Readiness - from emerging to mature OCG network

- Establish a Task Team with OCG Exec and network volunteers to develop a set of metrics
  - Add another column in readiness table regarding value/persistence/sustainability
  - Identify the intent and users of the metrics
  - Develop a definition of what it means to be sustained including revisiting the original GOOS ideas and definitions (OOSDP 1995[3]; Nowlin et al. 1996[4], 2001[5], Dunstone 2014[6], Weller 2019[7])
  - Also see Buch et al. (2019) linked in the European Marine Board Study - this is where the comparison between met and ocean observation systems is offered https://www.marineboard.eu/sustainable-funding-ocean-observations
  - Report at OCG-15
- OCG to discuss the methodology to collate and articulate the impact of network work [including GRAs, CLIVAR etc.]
  - Including consideration of technical reports that contain societal impacts for impact assessments and reach of network work
  - CD webinar series

7. Potential New Emerging Networks

This session explored new emerging networks, connections to OCG and existing OCG networks and network readiness in terms of OCG Network Requirements. The session showcased presentations from 5 new networks that are currently being adopted as new emerging networks (w/ exception of IMDOS).

Fishing Vessel Ocean Observing Network (*Presentation link*)

- Automatic profiling that fishing ships are doing during fishing operations, Society relevant areas and areas low of observations as a focus, Global network, Fishing vessels can host various sensors and most on core physical parameters but trying to advance to BGC, Measurements are close to CTD profiles, A lot of best practices application and development due to the variety of participants, Data management

[3] OOSDP (Ocean Observing System Development Panel). 1995. Scientific Design for the common module of the Global Ocean Observing System and the Global Climate Observing System: an Ocean Observing System for Climate. Department of Oceanography, Texas A&M University, College Station, Texas. 265 pp.

[4] Nowlin, Jr., W.D., Neville Smith, George Needler, Peter Taylor, Robert Weller, Ray Schmitt, Liliane Merlivat, Alain Vezina, Arthur Alexiou, Michael McPhaden, and Massaaki Wakatsuchi. 1996. An ocean observing system for climate. Bull. Amer. Meteor. Soc., 77 (10): 2243-2273.

[5] Nowlin, Worth D., et al. “Evolution of a Sustained Ocean Observing System.” Bulletin of the American Meteorological Society, vol. 82, no. 7, 2001, pp. 1369–76. JSTOR, http://www.jstor.org/stable/26215577.

[6] Dunstone NJ. 2014 A perspective on sustained marine observations for climate modelling and prediction. Phil. Trans. R. Soc. A 372: 20130340. http://dx.doi.org/10.1098/rsta.2013.0340

[7] Weller RA, Baker DJ, Glackin MM, Roberts SJ, Schmitt RW, Twigg ES and Vimont DJ (2019) The Challenge of Sustaining Ocean Observations. Front. Mar. Sci. 6:105. doi: 10.3389/fmars.2019.00105

includes standardizing the QC at the moment, ERDDAP accessibility, GTS access being established

USV OASIS (*Presentation link*)

- Endorsed UN Decade projects under OASIS; Development of community of practice, Network Publications being published; monthly webinar series; Challenges include business to USV business model differences and scalability w/ limited number of skilled professionals
- Specific asks from OCG: Help with coordination, data and project management, assistance with EEZ efforts and attribute maturity

Smart Cables (*Presentation link*)

- Shared cable infrastructure - telecom and science; Sensor capabilities include temperature, pressure, seismic acceleration; SMART repeaters are being deployed in key areas; Joint ITU/WMO/IOC task force created; Endorsed project under the UN Decade

Ship based Ecological Time Series (*Presentation link*)

- Many biological and BGC variables that are being collected; Development of FAIR data practices and building of data analysis capabilities; EuroSea funded project collaboration on BGC data products (SPOTS); April 2023 METS RCN Hackfest – Bio Use Case Development and 2024 workshop on FAIR data practices

Integrated Marine Debris Observing System (IMDOS) (*Presentation link*)

- Joint initiative of GOOS, GEO Blue Planet and UNEP; International Steering Committee established; Strategy and implementation plan being developed; Community review of EOV on plastics; Endorsed GOOS project; International marine debris data harmonization workshop (29-31 August 2023, Japan)

Discussion:

- Potential overlaps of core mission with other networks and the potential inclusion of the new emerging networks under the umbrella of the already existing ones
- Further assistance for OceanOPS will be needed to support growing demand by expanding and new networks
- WMO is making a campaign on EUVs

Other materials:

- Olsen, N. A., Bahr, F., Bethoney, N. D., Mercer, A. M., Gawarkiewicz, G. (2023). Integrating fishers' knowledge with oceanographic observations to understand changing ocean conditions in the Northeast United States. Frontiers in Marine Science https://doi.org/10.3389/fmars.2023.1144178

Resulting action

Potential New Emerging Networks

- Meeting in July 2023, to bring together the potential emerging networks to discuss potential overlaps with other networks and decision on whether they will be independent or sit under other networks
    - Include OceanOPS and data to discuss linkages/potential opportunities

8. Industry Dialogues

The presentation explored the intersection and integration of ocean observing activities and the private sector and a detailed report from the GOOS MTS Dialogues (*Presentation link*).

The discussion raised the following points:

- NOC (Southampton) and the HMRI (Halifax Marine Research Institute) have an innovation center that can be an example for private sector/small company enablement
- South Africa actively collaborated with Seabird and a small company to develop a flow meter
- Room for OCG to help industry to achieve the accuracy the ocean community needs (aggregating the demand) and dialogue between system marketplace (consulting companies working with the manufactures)
- OCG to be a forum for a wider community that utilizes the same sensors to have discussions and provide information on standards and types of sensors and the data that can be provided with such sensors to Governments
- OPBS experience is that the industry often wants “certification” (their customers need). This is easier and more realistic on a network level. This was supported by WMO representation and highlighted that certification and traceability are important and also interoperability
- GO-SHIP has been a hugely important test bed for new sensors. This has been done many times and they hope this can be continued
- Suggestion for OCG to advocate for private data donation to the public being eligible for a tax credit scheme

Resulting action

Industry Dialogues

- Roundtable discussion to work on demand articulation to industry in collaboration with networks and take forward with a discussion with industry
- Suggest to Dialogues with Industry to start conversations with sister industry sectors on demands/needs?
    - Targeted discussions to clarify procurement and procurement processes [e.g., Dialogues w/ industry, NOAA, WMO, HMEI]
    - Collecting good examples of successful collaboration with industry and the private sector and oceans community.
- Assess if OCG can facilitate and ask networks on a potential common practice and communicate the opportunity to industry on collaboration on field access.
- OCG and dialogues with industry to explore potential certification processes and/or standards.

9. Cross-Network Data Implementation Strategy

The OCG Cross-Network Data Implementation Strategy was presented and the discussion focused on how to move forward with the recommendations from the strategy. The

connections and developments at IODE, Open Access GTS update, WIS 2 projects were also discussed (*Presentation link*).

Discussion:

- The Data strategy was approved with edits to be made based on the discussion in the room. These include:
    - OCG should define that they expect that published/defined vocabularies are used. Maybe also do a survey which vocabularies are used?
    - Need to be more specific about the types of metadata we are referring to in the implementation strategy requirements (i.e. the platform operators have much richer metadata than the science users need).
    - Update Strategy to clearly indicated that better integration across OCG networks is one of the goals
    - Express in more detail what is expected of the active data teams from each network
    - Add text to encourage harmonization of QC/QC flagging across networks where possible
- Suggestion to form a task team across the OCG networks to provide ToRs and discuss implementation
    - Need to clearly define specific tasks for this group to work on
- Include the delayed mode data centers (like Tim Boyer (WOD)) to help test the federated system being developed and ensure the data aggregation centers are updated more regularly with delayed mode, QC'd data

Resulting action

Data Strategy

- Adopted the OCG Cross-Network Data Implementation Strategy subject to updating it to reflect the comments made during discussions.
- OSCAR Team, OCG Data team, and OceanOPS to discuss solution on how to update/change submitted metadata in the OSCAR system.
- OCG to develop the draft ToR and goals/deliverables of the proposed OCG data Task Team for OCG review and distribute to the networks in the next months.
    - OCG Data TT can address the following topics: data federation service for networks, cross network data and metadata quality flags, uniform data format to submit metadata to OceanOPS.
- OCG to discuss and define an OCG minimum metadata standard to use by the platform operators and data users when developing the network metadata format.
    - Network consensus was that there should be a single metadata "requirement" which ensure all key metadata (including WIGOS-required) goes through OceanOPS

10. Impact Studies

This session showcased two impact studies and explored the understanding of the experiences and best practices of OCG networks in conducting impact studies and explored ways to coordinate the community's asks to the modeling community.

Synobs/OS-Eval Team (*Presentation link*)

- Synergistic Observing Network for Ocean Prediction (SynObs)
- SynObs aims to identify the optimal combination of the different ocean observation platforms through observing system design and evaluation, and to develop assimilation methods which can enable drawing synergistic effects from these combinations.
- OSE/OSSE simulations planned to be run at the end of 2023
- Recommendations include: Standards and best practices on the way to perform OSEs; Observing network design options to test and define metrics for observing system evaluation taking into account user & application needs; Improve their robustness by moderating system-dependency with multi-system evaluation and regular re-assessment of the observation impact to follow the system evolutions; Efficient and sustainable way for routine observation impact assessment and to inform on observation impact status

North Sea Glider Data study (*Presentation link*).

The Met Office/NOC glider (MOGli) project aimed to provide a proof of concept of the potential operational use of gliders in the UK shelf seas. The gliders are deployed and operated by NOC, who deliver the data to the Met Office as a service. The gliders are targeted in an area near the JONSIS line where the waters of the Atlantic mix with the waters of the North Sea. The first gliders were launched in September 2022, funding allowed two gliders to be deployed in the spring and autumn and one during winter and summer. The gliders were set up to deliver data four times a day, with an additional transmission shortly before midnight just before the close of the 1.5 km resolution Atlantic Margin Model (AMM15) data processing window. The high resolution UK NWP model takes time-varying sea surface temperature fields from AMM15, that assimilates the temperature and salinity profiles, so improved AMM15 performance should benefit UK weather forecasts.

The impact of the glider data was evaluated by running two AMM15 suites in parallel from 1st Sept 2022 to 25th January 2023 - one assimilating the North Sea glider data, the other without it. All other data were assimilated into both suites, so differences in the results were due to the North Sea glider data. Preliminary results show the largest impacts in the region of the gliders but with time extending over a wider area, but not into the southern part of the North Sea. Although the Met Office has assimilated glider data for many years, this was the first time an impact assessment has been made. Future work planned is a multi-platform (gliders, rapid profiling floats etc.) impact assessment in the AMM15 model.

Discussion:

- Clarification on SynObs plans were discussed and the plan to have some impact studies ready to present at the WMO impact workshop 2024.
- SynObs will have a large amount of experimental data available for analysing the impacts and asking for anyone to get involved.
- Uncertainty was discussed on the ability to evaluate the impact on improving weather forecasts.
- Some uncertainty about assimilation altimetry. If assimilated both altimetry and Argo its difficulty to determine where the impact is coming form.

- Networks should be engaged with Synobs and OSSEs to get their relevant network impact studies included.
- Showcased impact on:
    - Surface current observations from HFR helped the Coastgard to increase the search area by three times.
    - Sub seasonal and seasonal forecast impact.
    - Co-design exemplars are currently working on impact studies.
    - Regional Bariac island where the data was used.
    - IMOS evaluation study on the economic impact of 1:12 return.

Other materials:

- Fujii et al. (2019). Review of Observing System Evaluation studies in Ocean Predict centers. https://doi.org/10.3389/fmars.2019.00417 (OceanObs'19 Community White Paper)
- Oke et al. (2015a,b). J. of Oper. Oceanogr. (In the GODAE OceanView Special Issue.)
- Ocean Predict OSEval Task Team: https://oceanpredict.org/science/task-team-activities/observing-system-evaluation/#section-introduction

Resulting action

Impact Studies

- GOOS to create a communications piece with Synobs to raise visibility of the Synobs OSE/OSSE data set and encourage participation at the WMO Impacts workshop (May 2024).
- OCG, OOPC, and GRAs (and other interested parties) to have more regular communication with OceanPredict.
- Suggest GRAs to invite Yosuke to the GRA meeting to broaden the reach of the work.

11. Best Practice

A status update on recent developments and activities on OBPS, assessment of OBPS purpose for networks, and elevate importance of OBPS to the ocean observing community and beyond. To discuss potential funding constraints and how OCG can help. Reminder of process and success stories (*Presentation link*).

- **Achievements** include: Represent GOOS OCG on OBPS, part of a TT focused on BP for under resourced countries, part of the OASIS SCOR WG supporting BP; Ocean Practices for the Ocean Decade, endorsed program; 'Endorsed' search field on OBPS now live; Editor on Frontiers research topic best practices
- **Next steps**: Work with BioEco panel further; Explore BP/standards with industry; Look at regional best practices in a global context
- **Asks**: Continue to drive this within your networks, through dedicated people and working groups; Is the OBPS being used; Inform constituents of your BP; Identify potential opportunities to raise awareness of OBPS; Determining obstacles to

creating/converging your best practices?; Share photos of best practices in action or any best practices stories

Resulting action

Best Practice

- Provide pictures of Best Practices in action to the BP team.
- Develop a GOOS story around the top best practices and people involved.

12. OceanOPS

Presented the OceanOPS WorkPlan and discussed and guided the work in the frame of the OceanOPS 5 year strategy. The OceanOPS budget was reviewed and priority areas for networks discussed to be pushed forward (*Presentation link*).

- **Achievements**: 82% of 8000 operational platforms qualify to WMO/OSCAR and synchronized; 20% for the historical database; Two main contributors to the OSCAR metadata submission is OceanOPS and World Weather Watch Issuer ID 20000 = world weather watch; Stabilizing metadata scoring system;
- **Risks**: Lack of IT resources; Miss operators prioritization; share responsibility for operations; Not much resources for expansion; Flat budget; Lack of metadata
- **Asks**: Priority - responsiveness and engagement; Communicate the benefits; Engage more with GLOSS

The **discussion** focused around the following:

- The need for a follow up with OSCAR database on correctness of the number of active platforms.
- The point was made that having an European OceanOPS might be useful and such initiatives can bring this forward and be connected.
- Some issues of providing metadata to OceanOPS were discussed and the need to solve these issues. People lack time to fill in the information for metadata and need automated services to make this process easier. In addition, after sending the metadata there needs to be an option to update the metadata afterwards. Harvesting the metadata from the ERDDAP services, the flexibility from OceanOPS might be creating more issues and need to be resolved.
- The general budget for OceanOPS was approved by all networks.
    - Argo approves. Disappointment was raised in the lack to view the system coverage by variable is still so far off due to limitations of IT resources. Metrics are needed to continuously underscore how far networks still have to go for some of the big gaps - polar, deep, BGC, etc . The report card gives the view that the ocean is crowded with platforms while huge gaps remain and in some cases we are going backwards. There is tension due to the funding model. The networks that pay into OceanOPS do so because they get a service to help operate their system. If OceanOPS is asked to do other ‘unfunded’ work, then they will have to reduce services to their subscribers. More funding to support these additional activities is needed.
    - Ocean Gliders approves.

- GO-SHIP approves. GO-SHIP does not have e.g., sensor details, which would be required in a harmonized approach across all networks.
- SOT approves.
- DBCP approves.
- OceanSITES approves.

Resulting action

OceanOPS

- Promote and outreach activities to various audiences on OceanOPS activities and work including through GOOS.
- OCG recommends OceanOPS to explore machine to machine harvesting of metadata with specific networks [e.g., HFR] into OceanOPS.
- OCG encourages new emerging networks to contribute financiallyto OceanOPS.
- OCG to ask the networks why the metadata is not appearing in OceanOPS [resources, harvesting not easy].
- OCG approves OceanOPS work plan and financial plan.
- Prepare and review the next OceanOPS Strategy
    - OCG to assist OceanOPS in lifting it and developing a funding strategy.
- WMO and OCG to explore potential funding strategies for EOV tracking/assessment/tools.
    - Initial step - write down what this looks like then next steps

13. Capacity Building and Workshop Readouts

Capacity development activities were shared highlighting recent activities and plans for 2024. Addressed working towards increasing the ability of states with less developed observing capabilities to both take and use the needed observations. Report outs and recommendations from pre-OCG-14 Workshops were shared as well (*Presentation link*).

OCG 2022 activities and 2023 plans

- **Achievements**: Successful webinar series; Ocean observing side event during the 18th WMO Regional Association I session; In person outreach event during the OCG-14 meeting; Instrument donations
- **Next steps**: Identifying needs; Focussed training sessions; Adopt an instrument; Cross network training opportunities; Introduction to tools and datasets
- **Asks**: Share upcoming CD activities or CD calendar; Reach out to OCG CD team for focused training opportunities

DBCP CB Readout (*Presentation link*)

- **Achievements**: 2 decades of dedicated in-region capacity building activities from 2003; 5 Western Indian Ocean, 5 Pacific Islands, 5 NPOMS, 1 Mediterranean, 500+ trainees, great appreciation from Members/Member States; Wave drifter pilot deployment for Solomon Islands.
- **Challenges**: Wide and diversified expectations, limited resources, difficult to sustain; Technical challenges in different regions; Follow up and monitoring mechanism
- **Asks**: Strategic guidance on CD; Funding and resources support

Low cost technology

- **Achievements**: Hybrid workshop to showcasing low-cost technologies that are available to observe coastal waters and evaluate ERDDAP services as a tool to enhance data accessibility to ensure the data is publicly available;
- **Recommendations**: Defining terminology - Low cost vs. Cost effective; Consideration as an Ocean Decade project; Continue to raise visibility & maximize community involvement; Develop a platform that connects the “low cost tech” community and people seeking these; Crosswalk of potential Networks collaboration; Develop handbooks and guides for ERDAAP services and a seminar series w/ hands-on component

Boundary Currents

- **Achievements**: Begin the discussions in-country of using the Agulhas Current as a pilot for the GOOS Co-Design Boundary Current Exemplar Project
- **Challenges**:
- **Actions & Next steps**: Review Paper focussed on the societal and weather impacts of the Agulhas Current, observational capabilities and key questions; Call for Steering Committee; Stakeholder identification and engagement to set priorities; Create best practices/recommendations on the observing system design; Explore top down approach to get more government buy in and create stronger workforce; Post Doc solicitation to archive historical data

Discussion:

- Capacity assessment conducted by the Ocean Discovery League is focused on the deep ocean - https://deepseacapacity.oceandiscoveryleague.org/
- Kyushu University in Japan produced low cost CTDs and distributed them to fishery people, and assimilated the observation data from the fishery people. Please see Hirose et al., 2021, DOI: 10.1175/JTECH-D-20-0156.1
- IOC launched Ocean CD-Hub in February as a global search platform to discover capacity development opportunities around the world in ocean science and management. The platform helps connect CD providers and beneficiaries by promoting existing efforts and identifying synergies and mutualizing resources. The current database features active calls for 2023-2024 opportunities.
- Increased stakeholder outreach and identifying their needs so they can influence our prioritization.
- Questions about quantitative study of the skill, or lack thereof, of some of the existing high resolution ocean prediction/reanalysis systems.
- Real-time data are limited, and it is necessary to increase the effort for inclusion of all kind of data that measures at very different frequencies and resolve processes not included in real-time data
- The low-tech group should define what low cost technologies are.
- For the mid-way conference it was suggested to consider three major hubs to be inclusive [South America, South Africa, other]
- Conduct a survey on DBCP capacity development activities to date to assess the impact of the workshops.

Other materials:

- https://oceancd.org

Resulting action

Capacity Development

- OCG CD Group to reach out to networks and explore potential overlaps and synergies. Consider utilizing other CD platforms [Ocean teacher academy, WMO etc.]
- Encourage Low tech groups to focus priority actions developed in the workshop and determine the implementation of them.

14. OceanObs'24 Midway Conference

Tammy Morris introduced the general updates and plans of the OceanObs'24 Midway Conference. (*Presentation merged into the OCG CB*)

Motivation: Proposition to host a mid-way conference in 2025 in South Africa to

- Better engage the LDCs, SIDS and other ocean observing communities to achieve a truly global ocean observing system
- Strengthen and coordinate activities from OceanObs'19
- Drive open and honest dialogue
- Engage with underrepresented countries in the ocean observing networks
- Build onto existing ocean observing systems,
- Support emerging and low-cost technologies
- Promote open access to FAIR and CARE data principles

Next Steps: Identify the location and timing

15. GOOS Communication

Laura updated the group on recent website updates for GOOS and OCG as well as recent communication focussed stories from within the system and components of GOOS. Future stories were discussed and opportunities for increased visibility of the work (*Presentation link*).

The discussion focused around the Report Card and the various strategies presented on increasing engagement and considerations for future stories.

- Many use the network specification sheets on the methods of how the ocean is observed. Requests not to remove them from the website. It is difficult to find this information in books etc. However, there is a potential need for them to be updated.
- Specification sheets, among other things, are hard to find in the network description on the GOOS site. The new OCG website could have improved that; however, it should be ensured that the specification sheets and other information is findable.
- Explore potential for a tracker for the web page.

Resulting action

GOOS Communication

- OCG to update the OCG Slide deck and request for annual updates from Networks to go out in February of every year [to be included]
- Adopt the wording on the GOOS website to better reflect the contribution of other agencies (e.g., WMO)
- OCG to encourage the networks to work with Laura on Network stories
- Develop recommendations to update Network specification sheets and reach out to Networks
    - Investigate metrics for downloads.
- CD webinar on application on specification sheets.
- CD webinar on Ocean Acoustics

16. UN Decade programmes - engagement opportunities

This session focused on coordination across networks on Ocean Decade and other activities and discussed what the Decade and other Actions need from global networks and how can and does OCG support these initiatives. Goal is to create an understanding of activities and connections and identify how OCG can help.

Co-design (*Presentation link*).
Sabrina Speich introduced the program work. Recent work included the Co-Design Workshop in 2022 bringing together programmes and people around the globe to document lessons learned and advance the exemplar projects (see presentation). A follow up workshop is planned for September 2023

- Ask: Networks to engage

CoastPredict (*Presentation link*).
Nadia Pinardi introduced the progress of DCC Coastal resilience strategy and workshop, projects under CoastPredict FLAME and Strategic objectives board across stakeholder engagement, education, science information, as well as the 10 endorsed projects to implement ideas in various coastal areas. She informed the session that the Global Coastal Experiment was to be launched soon.

- Ask: Fill out Global coastal experiment survey
- Discussion: The boundary current workshop before the OCG-14, people from CoastPredict and Observing together got involved in. Suggest to better synergize the experiment/test sites between the two programmes.

Observing Together (*Presentation link*).
Alvaro Scardilli reported on programme progress: 5 projects endorsed by the Ocean Decade, last actions in the programme, the programme resource assessment, and establishing interaction with GRAs. He also introduced the priority task of 2023.

- Ask: Move forward with interaction between Projects and respective GRA
- Comments: WMO is planning to better align the synergies between the RRR and the Co-design, probably starting in June and to have some results in December.

OASIS (*Presentation link*)
Meghan Cronin delivered the presentation as the Co-Chair of the OASIS. The programme is a joint effort of the SCOR working group and OASIS community. It focussed on air-sea interactions that fall into three 'Grand Ideas'. She introduced the 5 theme teams, in particular the theme team for Network Design & Model Improvements.

- Ask: For people to join OASIS Theme Teams at: https://airseaobs.org/get-involved
- Response: Monthly USV Webinar series: https://airseaobs.org/resources/webinars

ODRP-MAE (*Presentation link*).
Heather Spence introduced the acoustic work around the global, led by the US including the outreach efforts. Underwater acoustics is interdisciplinary, and can provide complimentary/additional information. Acoustics can help in monitoring and addressing climate change e.g., through monitoring Sea ice melt. Ocean Shots can be accessed from a wide variety of recordings.

- Ask: Proposals to become a project under the programmes. Encourage interactions with the programme.

OBON
Margaret Leinen briefly introduced the objectives of the OBON (Ocean Biomolecular Observing Network) Programme and its 14 endorsed projects. Based on eDNA that lasts up to ~2 weeks in the water deposited through mucus, skin cells etc. Interested in adding open ocean sites primarily cruises rather than long term sites. Interested in developing technologies and planning a workshop on fostering new technologies.

- Ask: Interested in potential partnerships and whether it is possible to develop and transfer capacity.
- Response: BIO GO-SHIP measures omics may be relevant to OBON - there is a US pilot and also activity in Australia and Japan.

MarineLife 2030 (*Presentation link*).
Frank Muller-Karger informed the session that MarineLife 2030 aims to address Challenge 2 of the Ocean Decade: Protect and restore ecosystems and biodiversity. Needs to partner with GOOS, OBIS and other Decade programmes to work together towards systematic coordination of observing marine life.

- Ask: Integration of biological observations into GOOS GRA and local programs and networks; advance the adoption of data collection standards and foercasting in a co-design framework; identify users and EOV requirements.

One Deep Ocean (*Presentation link*).
Nan-Chin CHU introduced the background and initial partners of the programme, updates and recent developments. She and Helen briefed the session with the first cruise in May 2023 and mooring site in New Caledonia, the successful international collaboration between Japan and France, as well as the development of Resident AUV and Moored profiler.

- Ask: (enforcing) links with EMSO-ERIC (EMSO France) OceanSite, Cabled network (MAMOR https://www.marmor-project.org/) SMARTCable, AUV project OceanGliders& OASIS, Research ship sharing IRSO

DOOS (*Presentation link*).

Leslie Smith introduced the goals of DOOS and its work through different working groups to address the deep sea challenges (below 2000m). She highlighted recent activities, including the two virtual annual meetings, an upcoming in-person event, 4 peer reviewed publications, etc. The programme also has successful collaboration with GOOS networks, such as Argo, GO-SHIP, smart cable, etc.

- Ask: engagement on EOVs to provide a deep ocean perspective; improving coordination to close the gaps in understanding of climate change; cheap(er) & deep(er) technologies for capacity development
- Response: DOOS would love to collaborate with Seabed 2030 more!

Seabed 2030 (*Presentation link*).
Belen Jimenez introduced the progress of Seabed 2030, currently 24.9%, with 2/3 of the ocean still to be mapped. There are multiple ways to get involved, contributing data, crowdsourced bathymetry, collecting data in transit, etc.

- Comments: SA (South Africa Naval Hydrographic Office) currently does not have the capacity/knowledge to process historical echo-sound data (single beam) into a proper product. How can OCG help to assist to contribute data to the project database? Bathymetry data are crucial to the SIDS to get the model forecast and an understanding on the surface current.
- Response: Welcome to contribute to the Programme, stories/statements from the users are really important, contact email (belen.jimenezbaron@niwa.co.nz) provided.

The discussion focused around how to measure parameters of multi-disciplinary interest together to meet the needs of users, to tackle the scientific problems, and to foster the communication and collaboration between Decade Programmes/Projects and existing OCG networks. Specific point discussed were.

- Questions on heat fluxes require various parameters to be measured.
    - Margaret: Some OCG ocean observing networks are at sea all the time, e.g. to service moorings. Taking samples is likely possible on many of those cruises. What's not assured is the processing/analysis.
    - Many platforms contributing to GOOS networks measure the variables needed for air-sea heat and momentum fluxes - often co-located: these include OceanSITES, research vessels and some VOS.
- Just want to note there is a similar situation for adding acoustics to existing efforts
- The importance of data formatting and data sharing using common standards.
- OCG/GOOS to drive/foster the culture that we can measure things together, physics, biology, chemistry, etc. Bring the social economic elements into this. Co-located multidisciplinary measurements and the message coming from the top
- Challenge is funding.
- The pathway to connect to the existing decade programmes/projects, to look for the opportunities and avoid overlapping.
- OCG to step out with the data strategy to discuss overlaps and applications.
- OCG to identify some practice that could act as pilot and learn from

Resulting action

UN Decade Programmes

- Identify and develop pilot projects to connect the programmes.
    - OCG to reach out to the networks and collect interactions with UN Decade programs and potential overlaps in variable collection.
    - Are there projects of interest that are already being conducted with network involvement?
    - OCG to step out with the data strategy to discuss overlaps and applications.
- OCG to share contact information for all the UN Decade programs leads.
- Meetings with Exec, OceanOPS, SOT - how to prioritize and approach vessel sectors and companies for deployment and observations.

17. Summarized Actions

Finalize action items, decisions and recommendations, set priorities for actions and potential roundtable calls. Quick review with 1 week provided post OCG-14 to provide comment before finalization and decision on OCG Goals (*Presentation link*).

David Legler gave closing remarks and summarized the actions resulting from the OCG-15 meeting. It was highlighted that many strategic discussions happened in this OCG meeting resulting in actions that will lead to change. The data strategy was approved with modifications, impact studies and impact workshops are being planned with the caveat that OSSEs are not the only way to assess the impact of ocean observations, OceanOPS recent activities and year ahead, capacity development, and OCG connection with WMO activities including the Rolling Review of Requirements. The dates of OCG-15 dates will be released as soon as possible including locations.

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