The Global Ocean Observing System
STEERING COMMITTEE

GOOS SC-12

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Halifax, Canada

Reports from GOOS components

GOOS Regional Alliances (GRAs)

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unesco Intergovernmental Oceanographic Commission
WORLD METEOROLOGICAL ORGANIZATION
UN environment United Nations Environment Programme
International Science Council

1. Achievements and Highlights

Below are summaries of achievements and highlights from the GRAs since the April 2022 GOOS Steering Committee meeting.

EUROGOOS:

i) A 2nd Tide Gauge Workshop was held on 4-5 May 2023 as a hybrid event hosted by Puertos del Estado, Spain. It brought the global tide gauge community to share experiences, exchange information on recent activities, and discuss ways to overcome the challenges across different geographical regions, while ensuring an effective coordination and communication with the Global Sea Level Observing System (GLOSS). Led by the EuroGOOS Tide Gauge Task Team an online live, managed tide gauge metadata catalogue for all permanent tide gauges along European and adjacent coastlines is now published. This Tide Gauge Metadata Inventory is designed to address inconsistencies and omissions in metadata across European tide gauge data portals, enabling tide gauge operators to populate a single centralised tide gauge inventory with comprehensive metadata, which can then be accessed by data portals and data aggregators to standardise their own metadata records.

ii) Launch of European Ocean observing System Strategy 2023-2027 (2 March 2023). With the new EOOS Strategy 2023-2027, and its accompanying Roadmap for Implementation, the development of EOOS will be advanced in line with its Mission to coordinate and integrate European communities and organisations operating, supporting and maintaining ocean observing infrastructures and activities, fostering collaboration and innovation.

iii) During the Arctic Science Summit Week (ASSW) 2023 in Vienna, EuroGOOS and Arctic ROOS, together with international partners, held a roundtable meeting to discuss the prospect of developing a GOOS Regional Alliance (GRA) for the Arctic. A GOOS task formation is proposed at the current meeting to develop a process towards realisation of an Arctic GRA.

iv) 11th FerryBox Workshop, Geesthacht, Germany (28-29 September, 2022). The workshop highlighted the progress within the FerryBox community during the 20 years since the EU FerryBox project started (November 2002) and discussing of the newest developments within the community, including the initiatives towards expanding the research network, the newest technological developments, and data and communication tools.

v) EuroGOOS and Mercator Ocean International sign a Memorandum of Understanding on 8 September 2022 to enhance cooperation in the promotion of ocean observations and the development of the European Ocean Observing System (EOOS) Framework.

This will include collaboration on in situ data assembly and processing in the framework of the Copernicus Marine In Situ Thematic Assembly Center (INSTAC) and the European Marine Observations and Data Network (EMODnet), on ocean monitoring and forecasting and, and strengthening links with national operational oceanographic services.

vi) The second edition of the EOOS Technology Forum was held from 22 to 24 March 2022 as a virtual event. It was endorsed as an activity of the UN Decade of Ocean Science for Sustainable Development 2021-2030 (Ocean Decade). The event brought together over 120 international participants, including instrument manufacturers, technicians, technologists, scientists, and policymakers. The three-day Forum comprised several keynote addresses, panel discussions, Show-and-Tell presentations, and interactions with the audience.

GRASP:

- The GOOS Regional Alliance for the Southeast Pacific (GRASP) is working to improve the visualization of sea level in the region of the member countries of the Permanent Commission for the South Pacific CPPS, through digital tools.

- On the GRASP website, the CPPS countries host information on the main variables that are monitored http://cpps-int.org/index.php/grasp-inicio.

- GRASP has a strategic plan that seeks to generate institutional communication among the countries and strengthen the technical capacities of the region.

IMOS:

IMOS had significant highlights in the use of observations to better understand our global climate and national environment. For example:

- The 2022 IPCC report included 64 publications using data from IMOS infrastructure and these papers were cited 90 times in the report. This outlines the uptake and applicability of IMOS observations at a global scale.
- The 2021 Global Carbon Budget was launched last year at COP26. Australia is a major contributor to determining the ocean's role in the Budget, through the observations collected by IMOS via Ships of Opportunity and Acidification Moorings. One third of the data used to constrain the Southern Ocean (and Southern Hemisphere) CO_2 uptake has been provided to the Surface Ocean Carbon Atlas through IMOS, making Australia the largest data provider for these regions over the last decade.
- The 2021 Australian State of the Environment Report included 99 publications using data from IMOS infrastructure and these papers were cited over 170 times. Citations were predominantly in the Marine and Antarctica chapters, but also in the Coasts, Overview, Climate and Extreme Events chapters.

IMOS has also had some major achievements in sustained observing including a decade of Southern Ocean observing. Recovering the 10th IMOS Southern Ocean Flux Station earlier this year was a huge engineering achievement as well as an exciting scientific milestone. The station is the only long-term air-sea flux and biogeochemistry mooring in the Southern Ocean.

In more recent additions to the program, IMOS is now collecting time series data on microplastics around the country. IMOS has now compiled the first temporal assessment of plastic pollution at the Yongala National Reference Station mooring on the Great Barrier Reef, highlighting the pervasiveness of plastics and microplastics even in pristine marine environments. IMOS is building on the work at this site to establish a database of microplastics contamination in coastal and shelf waters around Australia.

IOCARIBE-GOOS:

- **April 28-29, 2020 - Western Tropical Atlantic Regional Workshop hosted by IOCARIBE** - The workshop focused on identifying science priorities for each of the societal outcomes of the UN Decade including a Healthy and Resilient Ocean and a Transparent and Accessible Ocean. Discussions highlighted the need for a Tropical Americas and Caribbean (TAC) ocean observing system in the region to help share best practices on observing needs and capacities and improve data collection and management.

MONGOOS:

- Working closely with OceanOPS and GROOM, MonGOOS is now able to extrapolate and integrate glider data so that Member's activity is visible on the website (https://mongoos.eurogoos.eu/). MonGOOS has also updated the information on tide gauge stations, including information from the North African Mediterranean countries. A first community paper was published (Pérez Gómez et al., 2022) mapping of existing coastal sea level monitoring infrastructures, basic metadata information and the respective data availability in existing data aggregators.

NEAR-GOOS:

- **NEAR-GOOS - Gateway website and Interactive overview of metadata of observing tools:** NEAR-GOOS has developed its first gateway website, aiming to improve the services and increase the visibility of NEAR-GOOS by providing unified introduction, news and events.

- **Quick Bulletin of Ocean Conditions:** Bulletin with near-real time data on the ocean current (Kuroshio etc.) and sea surface temperature around Japan https://www1.kaiho.mlit.go.jp/KANKYO/KAIYO/qboc/index_E.html. Published by the Hydrographic and Oceanographic Department, Japan Coast Guard.

PI-GOOS:

- **Celebrating 30 Years Of Secretariat of the Regional Pacific Environment Programme (SPREP):** This year, SPREP is celebrating the 30th anniversary of the signing of the SPREP Treaty, which brought about the establishment of the organisation as a separate, autonomous body, tasked with the protection and conservation of the Pacific environment. The organisation has seen countless experts and passionate environmentalists over the past 30 years, from the Pacific region and around the world, who have contributed their knowledge and expertise to the building of a resilient Pacific environment.

- **Pacific Science and Traditional Knowledge Highlighted at UN Ocean Conference Side Event:** In June 2022, The Secretariat of the Pacific Community (SPC) and the Secretariat of the Pacific Regional Environment Programme (SPREP) organised a side event to highlight how the Pacific islands region is applying the best available science and traditional knowledge to forge and strengthen partnerships to achieve Sustainable Development Goal 14.

U.S. IOOS:

- **IOOS-supported High-Frequency Radars licensed to use new radio frequency bands:**

Photo: Newly FCC-licensed HF radar station, located at Fort Michilimackinac State Park, Straits of Mackinac at the confluence of Lakes Michigan and Huron with Mackinac Bridge in the background. Its FCC licensing required international coordination with Innovation, Science and Economic Development Canada. Credit: Michigan Technological University.

The U.S. Integrated Ocean Observing System Surface Currents Program worked with other NOAA offices, the IOOS Regional Associations, and the Federal Communications Commission to license all of the high-frequency radars in the IOOS national network to use eight new radio frequency bands allocated specifically for oceanographic radars. This allows the network to continue growing and providing high-quality, near real-time surface current velocity and wave measurements without interfering with other businesses and government users of this radio frequency spectrum. The IOOS HF-radar network consists of approximately 160 radars in nearly every oceanic coastal state, the Great Lakes, and Puerto Rico, providing data to support search-and-rescue operations, response to oil spills, marine shipping navigation, tracking harmful algal blooms, and coastal water quality monitoring.

- **2nd U.S. IOOS Code Sprint a success!**

  In April 2022, some 40 coders, programmers, researchers, and developers gathered in person and virtually to tackle emerging themes in ocean observing data management. The second U.S. Integrated Ocean Observing System Code Sprint, hosted by the Great Lakes Observing System, drew participants from all over the globe and developed new processes and tools that support our ability to produce, integrate, and communicate high quality ocean, coastal and Great Lakes information. During the sprint, the contingent split into smaller groups to tackle topics like compliance checkers, user documentation for setting up ERDDAP servers, and open source biodiversity data. In person collaboration augmented by Zoom, GitHub, and Slack created a dynamic environment for development, and this year's sprint not only resulted in several ready-to-go tools and products, but also spurred continued virtual collaboration in the GitHub and Slack spaces. A full list of outcomes can be found here.

- **SanctSound launches!**

  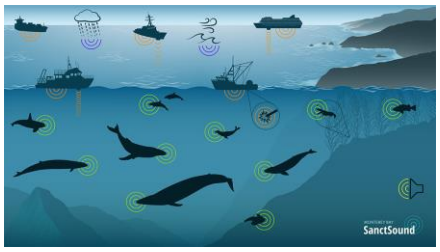

  Photo: In the web portal, sounds recorded in each sanctuary's soundscape can be explored through interactive underwater scenes that allow users to hear sounds and understand when and where they were present. Credit: Aline Design for NOAA

  The U.S. Integrated Ocean Observing System supported a cross-NOAA initiative, led by the Office of National Marine Sanctuaries, in partnership with the U.S. Navy and others to launch a new Sanctuary Soundscape Monitoring Project web portal. This portal allows the public to learn about the importance of sound in the marine environment. Visitors can listen to natural marine sounds as well as sounds from other marine activity. In addition, it shows how underwater sound monitoring is helping resource managers better understand the special places in the National Marine Sanctuary System.
  SanctSound generated 300 terabytes of data, all of which are accessible to download from the NOAA National Centers for Environmental Information Passive Acoustic Archive, and standard measurements from these recordings are also archived at NCEI and made accessible through the web portal hosted by U.S. IOOS.

- **2022 Google Summer of Code:**
  For the second year, U.S. IOOS served as a mentoring organization for Google's Summer of Code. A global, sponsored program funded by Google, the Summer of Code selects mentoring organizations from a pool of applicants. The program then invites post-secondary students to approach their preferred mentors with projects of their own design that contribute to active development of open source software packages. Once selected for funding, the students work closely with their mentors for 10 weeks in the summer, delivering final results in early fall.

- **New Marine Life projects support conservation, healthy ecosystems:**

Photo: Marine Life.jpg; Credit: Jeff Hester / Ocean Image Bank

On behalf of the National Oceanographic Partnership Program (NOPP), NOAA and partner agencies, including the National Aeronautics and Space Administration (NASA), the Bureau of Ocean Energy Management (BOEM), and the Office of Naval Research have awarded 5-year cooperative agreements to new projects that: (1) build upon the foundation established by the U.S. Marine Biodiversity Observation Network, the U.S. Animal Telemetry Network, and the U.S. IOOS Regional Associations to work across sectors and disciplines towards an integrated, sustained marine life observing capability for the U.S. ocean, coasts and Great Lakes; (2) advance technologies for efficient and/or automated collection of species and associated habitat observations; (3) enable open access to biodiversity data and information; and (4) utilize these observations, technologies, and data to address place-based management, conservation and restoration needs. A full list of the projects can be found here.

- **New National Harmful Algal Bloom Observing Network pilot projects support HAB monitoring and forecasting:**
  The U.S. Integrated Ocean Observing System allocated $2.5 million for ten pilot projects and a harmful algal bloom technology testbed across all 11 IOOS Regional Associations in FY 2022. This funding is a part of Congress' support for the nascent National Harmful Algal Bloom Observing Network. The network's aim is to enhance the nation's capacity for monitoring and detection of these blooms. The pilot projects focus on observation, data integration, and information services about the extent, toxicity, and length of blooms will inform decisions of coastal managers, seafood harvesters and aquaculture growers, drinking water utilities, animal stranding networks and others. The pilots build on HAB initiatives in all the IOOS RAs and include development and support for regional HAB bulletins as well as support for HAB forecasts, regional HAB networks, HAB monitoring infrastructure, HAB models, alert systems, and community science efforts. A full list of these projects can be found here.

CIOOS:

- CIOOS has focused on the continued expansion of data sets as well as the integration of new data sets, such as ocean glider data.

- CIOOS has worked with partner Bedford Institute of Oceanography (Fisheries and Oceans Canada) to integrate and make available data from major observing programs in the Atlantic region which are of interest to multiple stakeholders and rightsholders. Including the Atlantic Zone Monitoring Program, these 10 datasets contain observations collected from as early as 1969 to as recently as 2022, and together constitute more than 20 million lines of data.

- CIOOS has been focusing on expanding regional collaborations and developments (e.g. developing partnerships between CIOOS Regional Associations and US IOOS Regional Associations, including AOOS, NANOOS, GLOS, and NERACOOS).

2. Opportunities

- U.S. IOOS continues to develop the Benefits of Ocean Observing Catalog (BOOC) and advance work packages for the project. A prototype has been developed and a contract has been placed to transition the prototype to an operational system. The group is working with an initial collection of use-cases and will seek additional input on use cases for the catalog. This is an opportunity for GRAs and other GOOS components to provide input to aid in the development of the catalog. The operational system is being built as a cloud-based application and a Digital Commons based use-case review process is being designed and tested. Next steps include testing the operational system, testing of the use-case review process, drafting user documentation, and outreach to the wiser community for use-cases.

- EuroGOOS intends to build stronger synergies between the operational and ocean monitoring communities, help to enhance and coordinate ocean biology and biogeochemistry observations, support the transfer of the ocean data collected for operational services to the quality-controlled archived data repositories (EOOS OC, EuroGOOS ROOS, TT, WG). We continue to engage with the European GOOS National Focal Points via EOOS Framework to support ocean observing coordination in each member state, to increase observing capacity, efficiency, and visibility of the impact of ocean observations in vital services (through EOOS Operations Committee). We work towards the “European OceanOPS” that can provide information on the status of operating observing platforms and networks around Europe, including coastal assets, is ongoing. A Horizon EU proposal was submitted to support its further development (a funding decision is made in August 2023). We regularly exchange with the GOOS BioEco Panel, and the GEO BON MBON to map current biological ocean observing networks and capabilities in Europe.

- Australia’s National Research Infrastructure Roadmap indicated the need for a step-change in Environment and Climate infrastructure. This created the opportunity for IMOS to bid for additional funds to support expansion of the program. If successful, this

additional funding will support a range of initiatives including national-scale deployment of ocean gliders, addition of Deep Argo and eDNA to IMOS, enhancement of data delivery, and translation of data to information to increase uptake by non-experts and decision-makers.

- The 2023 and 2024 funding rounds also create potential for a national scale coastal infrastructure program to be launched in Australia. IMOS will lead this initiative with a range of other research infrastructure partners and agencies such as Geoscience Australia. If successful, this program will have strong links to GOOS initiatives such as CoastPredict and CoDesign.

- IOCARIBE GOOS is currently going through a 're-invigoration' process, where we are re-organising the Working Group of Experts and leadership following the 2018 GOOS Steering Committee, the 2019 IX GOOS Regional Forum in Japan, and IOCARIBE recommendations. This is being done while accounting for the recently endorsed Decade actions in the TAC region and the 2030 GOOS Strategy. As the group undergoes this process, the focus will be on organization, awareness, and needs assessments of the Member States in the region.

3. Issues or barriers

The GRAs have identified various challenges and barriers:

- Uncertainty in long-term sustained funding of ocean observations, and competitive funding often hamper the collaboration.

- Timeliness in sharing data.

- Dealing with the complexities of operating in the coastal zone based on the large number of existing programs, stakeholders and competing priorities. Some GRAs and national systems will need to work to carefully define a niche for operating and contributing at a national scale.

In Australia, IMOS has noted that there is a great amount of work to be done to more fully engage Australian First Nations People in ocean observing and ensuring they are aware of the information and understanding gained through IMOS observations for their use. There is a strong need for information sharing and co-design across a large number of communities.

In the GRASP GRA, the lack of a budget limits the development of activities and technical capabilities. GRASP countries (Colombia, Peru, Chile, and Ecuador) do not have a budget for

the maintenance and development of technological applications to maintain information systems.

The global COVID-19 pandemic has impacted the ability for various GRAs to hold regular meetings or meet in person and also had an impact on operations. For IOCARIBE GOOS, the pandemic greatly reduced the capacity to hold regular meetings and maintain an ocean observing infrastructure critical for weather forecasting and building climate resilience in the region.

Additionally, the original organizational structure of the group was to have an IOCARIBE GOOS Steering Committee made up of all IOCARIBE representatives. Unfortunately, due to the lack of capacity of the Member States in the region, and expertise, this was not accomplished. IOCARIBE GOOS is at a critical point in its history where it has an opportunity to develop a sustainable governance and management structure that represents both Member States and expert knowledge, while being connected to the broader GOOS community and GRAs.

4. Future

Main next steps/key areas of focus for the GRAs:

- Further explore how to **support the implementation** of the GOOS UN Decade programmes at the regional level through case studies
- To better define **practical ambitions** for GOOS & GRAs
- **To better articulate GOOS priorities** (EOVs, and others) and evidence for those priorities in support of regional and national scale advocacy to generate funding
- **Enhance connections and multilateral cooperation** of GRAs with global stakeholders (WMO, IMO, OECD, IHO, African Union etc. through broader meetings)
- GOOS office can be a **clearinghouse or matchmaker** to connect people with specific needs
- Provide a **collaboration framework** for common research, not necessarily in operational oceanography
- **Coordinate and support funding** bids/proposals and the identification of common regional interest

Ongoing Actions (from 10th GRA Forum):

- Policy
    - Contribute to new GOOS Regional Policy (GRA entry and Exit)
        - **Status update:**
            - During the 10th GRA Forum, the GRAs discussed regional approaches, vision, and policy for a thriving regional coordination ecosystem. From this workshop a report is being prepared to support the establishment of the new GOOS Regional Alliance Policy.
            - In addition, discussions have started on the constitution of a sub-task team which will include members of the Governance Task Team, GOOS Steering Committee, GRA leadership and regional projects. A series of workshops will be organized to discuss with the sub-task team members to be constituted about the revised policy. An outline of the revised policy will be prepared and members can be assigned responsibilities to lead the revision.
- Tools, Products, Communication
    - GRAs contribution to the development of BOOC by testing the prototype and contributing with use cases.
    - GRAs to provide list of products for the updating of the GRA website
    - Communicate /promote GRAs- Create short videos on GRA success stories according to GOOS strategic objectives
- Assessments
    - An international badge of quality that is respected internationally
    - Improved mapping of existing GRA capabilities and what is associated with them
    - Compile regional needs to scale up to inform global priorities

GRA Revitalization: PI-GOOS, IOCARIBE-GOOS and GOOS-AFRICA:

- **PI-GOOS**

  PI-GOOS consists of 21 Pacific islands and territories. It has been hosted by SPREP, but since the resignation of the responsible officer in 2019, PI-GOOS has not provided any reports. For this matter, the GOOS office issued a call for expressions of interest to host the PI –GOOS Secretariat, through an IOC Circular Letter (CL2922).

  The objective is to have a PI-GOOS institutional mandate with strong capabilities in ocean observations and be able to coordinate programmes, initiatives, projects, e.g. GOOS 2030

Strategy and GOOS Ocean Decade Programmes with Pacific Island States. The timeline to announce the new host of the PI-GOOS Secretariat is mid-2023.

- **IOCARIBE-GOOS**

  It was reported by stakeholders in the region that the CARIBE-GOOS has not seen any notable progress since 2021, noting the retirement of Cesar Toro as the Head of the IOCARIBE office in 2021. A new Head of the IOCARIBE office was appointed in January 2023, Ms Lorna Inniss. GOOS Office is conducting meetings with Ms Inniss concerning future plans, interest and activities.

- **GOOS-AFRICA**

  GOOS-AFRICA has recently drafted a new action plan in line with the GOOS 2030 Strategy. It has established a partnership with the Global Monitoring for Environment and Security in Africa (GMES & AFRICA). GOOS AFRICA is fully involved in the African Decade of Oceans and Seas and the African Blue Economy Strategy in the broader context of the African Vision' 2063. There has been increased focus from the Norwegian Agency for Development Cooperation (Norad) to support coordination and bring together the many dispersed centres of excellence in Africa. He noted that a new head of IOC Sub Commission for Africa and the Adjacent Island States will be appointed in 2023.

Upcoming priorities and events within GRAs:

- EUROGOOS:
  - Intends to facilitate the integration and collaboration between European marine-related Research Infrastructures (both ERICs and projects/AISBLs). Promote the establishment of pan-European EOV networks (focusing on biology and pollution) and facilitate further standardisation of data and meta-data.

- GRASP:
  - GRASP is seeking international cooperation resources (technical and economic) to develop regional initiatives to strengthen the region's technical capacities.

- IMOS:
  - Work to expand IMOS to observe from estuaries to the open ocean in a seamless program.
  - Work to engage marine industries to share data and increase national and international benefits of ocean observing.
  - Work to ensure data is model-ready and support products or tools to translate data into information that can be used by industry and government for decision-making and policy.
  - Work to more fully engage First Nations People.
  - Working toward linking IMOS with other GRAs, especially PI-GOOS as it is reestablished.

- IOCARIBE-GOOS:
    - May 8, 2023 - International Marine Science Conference on IOCARIBE GOOS
        - LOCATION: Bogotá, Colombia
        - FORMAT: hybrid concept with simultaneous english and spanish translation
        - ATTENDEES: the GOOS SC and GRAs are all invited to attend and contribute to the dialogue
        - GOAL: To develop a regional commitment and strategy to establish an Ocean Observing and Forecasting System for the IOCARIBE and TAC region ahead of the 17th Session of IOCARIBE. Determine a path forward while aligning with the GOOS 2030 Strategy, the GOOS Steering Committee, the work done in other GOOS Regional Alliances (GRAs), and the recently endorsed Decade Actions in the (TAC) Region.

- U.S. IOOS:
    - Implementation of IOOS and new funding initiatives in support of infrastructure development and inflation reduction.

- CIOOS:
    - GRA application forthcoming.

5. Questions for the Steering Committee

- How can the GRAs work together to further the GOOS mission of serving marine data and information needs for the efficient, safe, rational and responsible use and protection of the marine environment, while helping to advance the UN Decade?
- What does the GOOS Steering Committee see as the required responsibilities of the GRAs?
- How can the GRAs better support the implementation of the GOOS 2030 Strategy and the Implementation Roadmap?
- Does GOOS have funding or international cooperation programs for the GRA countries? Are there any initiatives that would assist in funding technological applications?
- What training programs or capacity building programs are available to GRAs?

Note: EUROGOOS, GRASP, IMOS, IOCARIBE-GOOS, U.S. IOOS, and CIOOS provided direct input for this report. Items pertaining to other GRAs were compiled from GRA websites and intersessional calls.

ANNEXES