



Scoping Paper: June 2021

## **An Observing system evaluation framework: identifying priority gaps and requirements and supporting the establishment of the GOOS Observing Co-Design (ObsCoDe) project.**

**Summary:** Strengthening the sustained ocean observing system is central to the goals of the G7 Future of the Seas and Oceans Initiative (FSOI). This activity reflects the need to provide a targeted set of priorities to guide coordinated investment by tabling a report on priority observing system gaps and requirements for discussion with the G7 members.

### **1. Background Information**

Strengthening the sustained observing system through agreed priorities for investment is central to the goals of the FSOI through Action Area 1. In response to this action, a draft work plan was tabled at the FSOI Working Group (WG) in 2017, listing detailed actions for investment by the observing network. The G7 FSOI agreed Biogeochemical Argo (BGC-Argo) was a priority and new commitments were made to the BGC Argo array, citing the G7 agreement. Feedback from National Focal Points suggested they were looking for a more targeted set of priorities where coordinated investment would have the most impact.

In recent years aspects of the global observing system, including the [Tropical Pacific Observing System 2020 project](#) (TPOS 2020), the Tropical Atlantic Observing System and the Indian Ocean Observing System have been reviewed. Objectives have included strengthening integration (satellite, in situ, with models), entraining new technologies and energising new partners to meet user requirements.

Reviews have engaged modelling groups such as [OceanPredict](#), the World Climate Research Programme's modelling groups and European Projects such as [AtlantOS](#) which are involved in dedicated Observing System (Simulation) Experiments (OSE/OSSEs). Reviews with stakeholders have been organised on an ad hoc basis, generally due to 'managing risk' so can be triggered by a number of factors, for example:

- A major change in observation technology (e.g. the introduction of Argo or a new satellite capability such as swath altimetry).
- A major threat to the observing system sustainability (e.g. reduced data returns from the Tropical Moored Array in the Pacific).
- A major change in observing system requirements/emerging use/user (e.g. fully coupled numerical weather prediction will challenge our upper ocean observing system in new ways).

The GOOS Physics and Climate Panel now has thematic evaluation activities focused on Air Sea Fluxes (now a Decade programme: [Observing Air-Sea Interactions Strategy](#) OASIS), Ocean Heat and Freshwater Storage and Boundary Systems.

#### **1.1. Identifying priority gaps and evaluating priorities for coordinated investment**

In 2017 the G7 highlighted Boundary Systems and polar regions as strategic gaps in the observing system and called for glider observations in these regions. However, moving to a more targeted, multi-platform approach would need agreement of the observation priorities

that could address the thematic (e.g. Boundary Currents), variable (e.g. Surface Ocean Carbon Observation) and regional gaps (e.g. Polar regions).

Given guidance developed from reviews and task teams to date, and feedback provided by operational prediction centres, it is timely to assess where there are obvious gaps and uncertainties that need addressing, and whether we are confident in approaches to address these gaps; and where more analysis is needed. Guidance from operational centres on priority use cases and user groups will also be useful to developing more outcome-oriented evaluations (e.g. for predicting extreme events).

## **1.2. Lessons learnt from observing system review and evaluation activities**

A range of approaches have been used to conduct observation reviews by groups often outside GOOS. Whilst superficially these reviews may appear independent, because of geographic or regime distinctions, in reality they are interconnected components of the global observing system. Additionally, there is significant overlap in the reviews, leading to potential confusion and lack of efficiency. As such, it would be valuable to establish a set of guidelines and best practices which would provide a foundation for developing more systematic approaches to requirements-driven integrated observing system co-design and co-development.

## **1.3. Supporting the development of a framework for the Co-design of observing and prediction systems: ObsCoDe**

The UN Decade of Ocean Science for Sustainable Development (UN Ocean Decade) is an opportunity to transform sustained observations to ensure we have an integrated, resilient and responsive ocean observing system that meets users' needs. Ocean observation and prediction systems are increasingly seen as integrated components of an ocean information system, and the co-design of observation and prediction systems that we develop and perform is central to the goals of the UN Ocean Decade for a 'transparent', 'accessible' and 'predicted' ocean.

GOOS has developed an ambitious UN Ocean Decade programme focused around integration, with three limbs of activity: Integrated Observing System Codesign (ObsCoDe), Coastal integration (CoastsPredict), and integration with local stakeholder communities (Observing Together). ObsCoDe aims to build the process, infrastructure and tools for co-design, creating an international capacity to evolve a truly integrated ocean observing system, matching agile observing and modelling capability with requirements. The high-level objectives of ObsCoDe include:

- Integrate observing and modelling to support a sustainable ocean and society in ways that are measurably better.
- Make ocean observing and information appreciably more impactful through transformative co-design with the modelling community and key user stakeholders.
- Establish the international capacity and modular infrastructure to co-design and regularly evaluate the observing system.
- Entrain new observing and information technology across all elements of the programme.

The ObsCoDe programme is built around four key concepts and phases:

- Exemplars
- Co-design and evaluation
- Evolution and innovation
- Implementation phases to build process infrastructure, tools and capacity.

Given the relevance of this activity to the G7 FSOI goals, it is proposed that the WG works with the ObsCoDe Advisory Group and partners to establish the programme, advise on policy priorities, scope potential exemplars of interest, and identify where national capabilities and infrastructure could contribute. Exemplars will be focused on end user needs across climate, prediction and hazard warnings, and ocean health. In the longer term, developing the process infrastructure, tools and capacity for a systematic Observing System Codesign capability is also an area for collaboration between the G7 FSOI and ObsCoDe.

## **2. Description of Activity and next steps**

The goal of this activity is to provide regular information required by funding agencies to identify implementation and investment priorities. The G7 FSOI may develop agreements and coordinate joint G7 actions for implementation.

The activity recognises that governments are asked to make decisions regularly regarding allocation of funding to support sustained observations, and investment decisions require responding in the short term to known observing system gaps where enhancements to the system can make the biggest advances now, and also to the longer-term development of an evaluation framework that will provide a more systematic approach to developing an integrated system rather than enhancing individual observing system platforms.

The development of the UN Ocean Decade programme on Observing System Co-Design (ObsCoDe) recognises that a more systematic approach is needed to observing system design and engaging with the modelling community and broader stakeholders. The ObsCoDe programme proposal has now been approved and the next steps are engagement and implementation. The G7 FSOI Task Team could help catalyse aspects of the programme, by identifying where G7 members may contribute, highlighting priorities for targeted investment.

Through these activities, priority observation needs will be tabled with the WG.

### **A next step would be to form a Task Team to**

#### ***Task 1. Review existing guidance and identify priority observation gaps and requirements.***

The working group could draw on existing observing system guidance and recent review project recommendations and feedback from operational services and stakeholders across G7 members in consultation with GOOS expert panels and Observation Coordination Group to identify

- Priority gaps where there is confidence in a proposed approach to target them,
- Requirements and uncertainties requiring some further design guidance, and
- Requirements uncertainties which could be addressed through particular pilot projects or feed into identification of exemplars focused on end user needs being developed through ObsCoDe.

The Task Team will then work with the relevant observation and modelling groups catalyse activities to develop observation strategies/pragmatic next steps to address these gaps.

Priority areas identified by the Working Group in 2017 include polar ocean regions and boundary systems (both eastern and western). The group could work with Boundary Systems Task Team of the GOOS Physics and Climate Panel and also a Boundary Ocean Observing Network Task Team of the OceanGliders network and take 'pragmatic steps in connecting our observations in our open ocean to shelf/coastal systems in priority boundary systems which are not well observed. While increasing the number of ocean gliders, for example, to address known boundary system and polar area gaps does not correspond to the 'ideal' for identifying

integrated system approaches to system evolution, it is a no-regrets option that can be targeted now while the integrated system design framework is under development.

The Team could also consider identifying more outcome-oriented priority thematic exemplars that are important motivators for addressing some of these gaps, and aligned with member policy priorities for consideration through Observing System Co-design.

- *Deliverable: A Report to the G7 FSOI Working Group on the priority gaps and requirements for coordinated investment; guidance on areas of uncertainty, and priority-use cases requiring coordinated observing system co-design.*

**Task 2. Organise a joint workshop on Observing System Co-design**, in collaboration with the ObsCoDe advisory group and GOOS to develop framework for observing system co-design.

- Draft Workshop Goals might include:
  - Evaluate lessons learnt from previous observing system reviews and evaluations to guide development of exemplars.
  - Discuss and agree potential priority exemplars based on observing system gaps, risks, policy priorities and feasibility.
  - Develop attributes for actionable outcomes of a successful co-design project.
  - Identify capability required to support development of initial exemplars.
- *Deliverable: A report on lessons learnt and best practice in observing system evaluation to inform development of Observing System Co-design, including attributes of actionable observing system evaluation outcomes, and a list of agreed priority exemplars to take forward, including capability required.*

**Task 3: To be determined depending on Task 1 and 2.**

### 3. Resourcing

Task1: 20% FTE support from G7 FSOI Coordination Centre. Expert engagement from G7 members, engagement of operational/prediction centres.

Task 2: 20% FTE support from the Coordination Centre, contribution of funding for joint workshop, expert engagement.

Task 3: To be determined.