The needs for an Arctic Global Ocean Observing (GOOS) System Regional Alliance

What is a GOOS Regional Alliance?

By the definition from the GOOS regional policy 2013 [1]:

The Global Ocean Observing System (GOOS) Regional Alliances (GRAs) are an important component of GOOS. As such, they help identify, enable, and develop sustained GOOS ocean monitoring and services to meet regional and national priorities, aligning the global goals of GOOS with the need for services and products satisfying local requirements. As an integral part of GOOS, the GRAs are tasked with adhering to the GOOS Principles (1998) of shared ocean observations, data policy, best practices and capacity development in their implementation of regional and national ocean observation systems

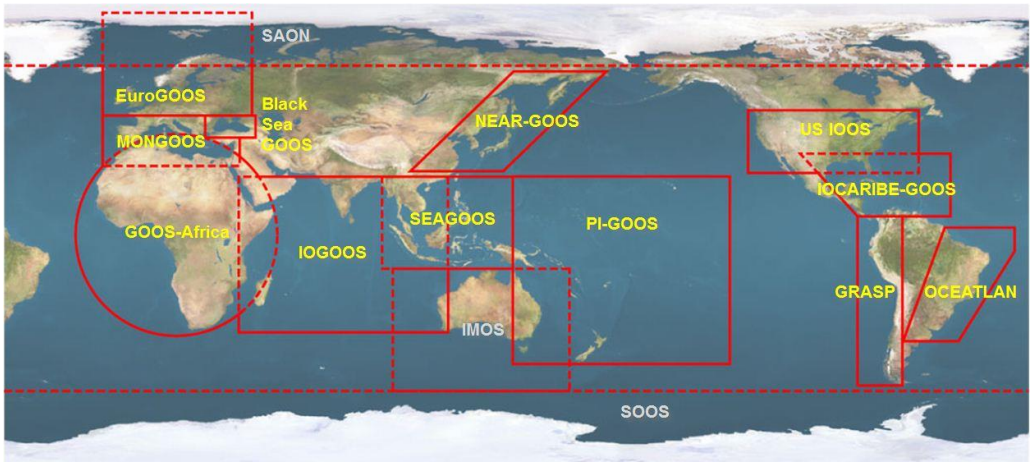


Figure 1. Coverage of GRAs

Figure 1 shows the coverage of the different GRAs in yellow and highlights the lack of sustained ocean observing system in the Arctic. In general GRAs are made up of governmental and/or non-governmental organizations, and therefore have limitations in the controls they can impose and the communities they reach.

<u>Benefits of being part of a GRA are:</u>

- Integration into a global strategy for sustained observation, using an accepted Framework for Ocean Observing [2]
- Visibility
- Support and facilitation in terms of
    - collaboration with different actors (governmental, non-governmental, industrial, academic), data management, data sharing, data-derived products and services
- Strategic investment
    - identify what is essential, avoid duplication, identify key gaps, and improve efficiency
    - Reduced and optimized costs and activities, added value for their investments
- Shared experience, best practices
- Increased capacity building

Responsibilities of GRAs are to:

- Uphold GOOS Principles and implement the Framework for Ocean Observing [2]
- Serve as a platform for coordination and facilitation of user-driven requirements for operational products and services, transboundary observing networks, data streams and related unrestricted access, information and model outputs for societal benefit, and assessment of readiness, capacity and performance of the system
- Promote and manage programmes on developing regional capacity in terms of
    - Sharing of best practices, experiences, success stories,
    - Institutional capacity (financing, win-win partnerships, co-production, collaboration with existing programmes)
    - Human capacity (e.g. scholarships, exchanges, technical trainings, leadership development, grant-writing skills)
- Encourage the development of Regional and National Ocean Observing Systems
- Be active in GOOS (responsive to GOOS implementation plan, participate in activities agreed by GOOS regional council) and report regularly to GOOS (GOOS Regional Council, bi-annual GOOS Regional Forum, annual report of activities)

Why does the Arctic need an Arctic GOOS Regional Alliance?

Several specificities of the Arctic climate, in particular its ocean, have historically inhibited observation efforts in the north, such as its remote location, harsh climate, and the presence of a partially perennial sea ice cover that renders access difficult. The last decades have shown an Arctic that is ongoing rapid changes: a warming climate that transforms the physical environment (e.g. sea ice cover as shown in Fig. 2, coastal permafrost melt, weather) and related activities (e.g. hunting, stalking and fishing, transportation, cultural activities), but also allows increased human presence in the area, whether it be for tourism, procurement or industrial and economic reasons.

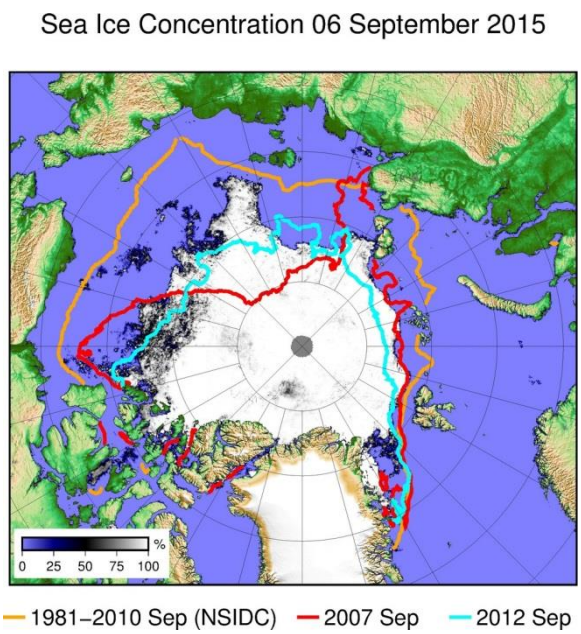


Figure 2. 2015 minimum sea-ice area (white) from AMSR2 compared to historic summer ice extents (from University Bremen website (http://www.iup.uni-bremen.de/).

These changes are putting increased pressures on populations (human and ecosystems), environment, and industries, and have intensified the need for improved operational oceanographic and climate products and services.

Several of these oceanic services have international implications, since they cross national boundaries within the Arctic. Moreover, Arctic processes and activities have global implications, justifying the need for collaboration between Arctic and non-Arctic states. In this complex system, costs are elevated and observational needs diverse and important. To successfully provide improved, sustained and useful information, a system of ocean observations requires oversight, international facilitation and cooperation for an adequate design and implementation.

In the Arctic, this involves improved observations – real-time and delayed mode - useful for :

Operational services supporting activities such as:

- Navigation: procurement, tourism, offshore operations (oil rigs)
- Stalking, fishing and other indigenous activities
- Energy and mineral exploitation
- Emergency situations, search and rescue
- Oil spill response & remediation.
- Flood and submersion risks, tides, sea level.
- Monitoring for fisheries: ecosystem-based fisheries management, sustainable aquaculture
- Risk management for buildings and infrastructure on coasts

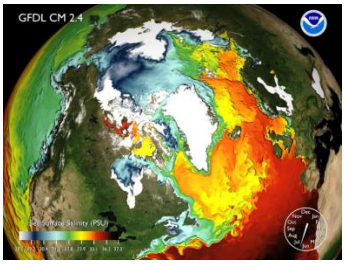


Images : Increased tourism and transportation (©Vittorio Ottonello), russian oil rig(©Russian-insider) and dependence of fishing on ice conditions (©Staffan Widstrand/Corbis) .

Climate research:

- Research on Arctic sea ice cover, sea level, ocean circulation and their role in influencing global climate change and variability
- Climate modeling (providing reliable forcing data, improving resolution and physics of models)
- Impacts of coastal erosion due to permafrost melt, sea level changes
- Ecosystem displacements
- Change in activities due to modified environment.



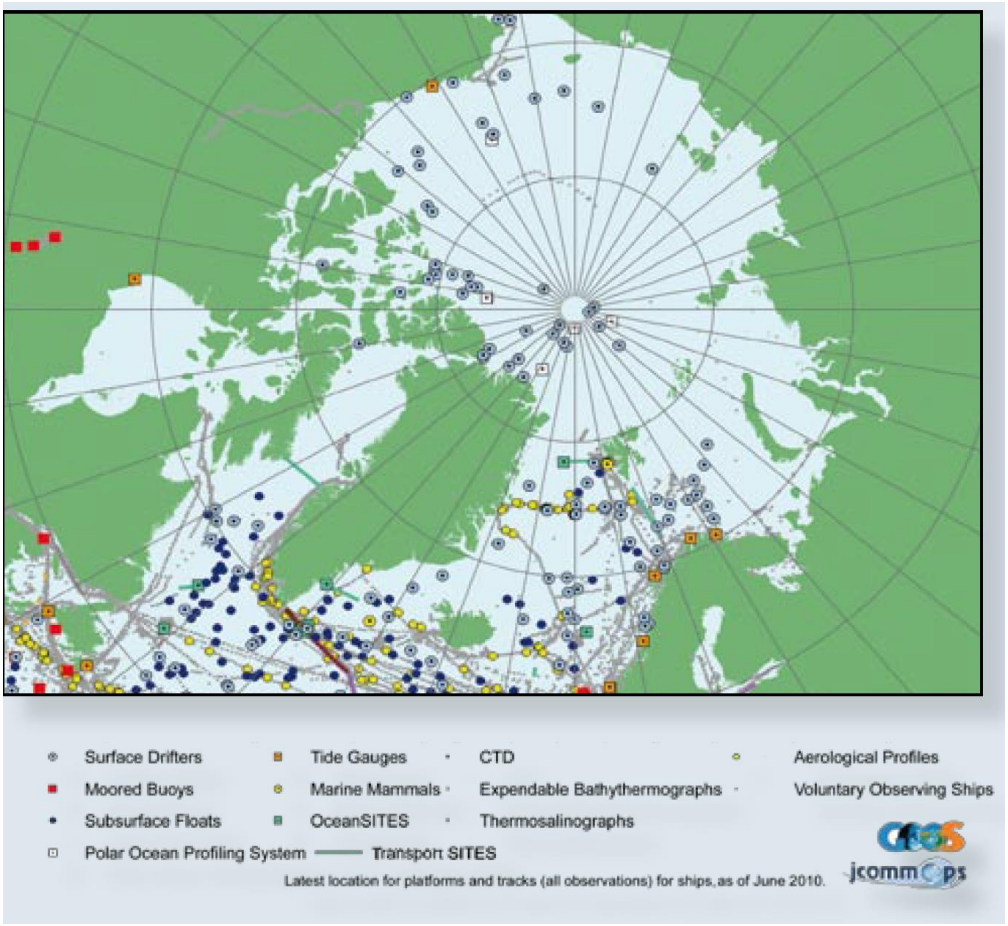


Images : Coastal erosion in Alaska (© Alaska Conservation Foundation, 2010) , Walrus on sea ice (©Solent/Steven Kazlowski/SeaPics), and sea surface temperature from GFDL model(© NOAA) .

Integrating Arctic GOOS in the pre-existing observing efforts

There are already existing ocean observing networks in place in the Arctic, some associated with GOOS as shown in Figure 1 (showing situation as of 2010). This presence and experience is of great value for the establishment of future collaborations and the development of new observing activities.

Figure 3. Array of observnig elements in place in the Arctic in 2010 [JCOMMOPS 2010, as shown in [4]]



Arctic Regional Ocean Observing System

As part of the GOOS, EuroGOOS maintains an Arctic Regional Ocean Observing System, established by a group of 19 member institutions from ten European countries, working actively with ocean observation and modelling systems for the Arctic Ocean and adjacent seas [see Table 1 in Appendix for list of its members].

Sustaining Arctic Observing Networks (SAON)

The Arctic Council initiated the Sustaining Arctic Observing Networks (SAON) process in 2007. Its purpose is to support and strengthen the development of multinational engagement for sustained and coordinated societally-relevant observations related to environmental, social, economic and cultural issues [3]. The Arctic GOOS is in line with the objectives of SAON, and can add significant GOOS expertise in terms of sustainable observations for oceanic operational and climate services and has significant experience with the implementation of regional observing systems.

Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM)

The WMO and IOC, through their Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM), support the Global Maritime Distress Safety System in the Arctic by

coordinating the dissemination of warnings and weather and sea bulletins within so-called Metareas, each under the responsibility of a National Meteorological Service. Also, the JCOMM expert team on sea ice coordinates and advises Members/Member States on products and services required by user communities in sea ice areas. This involves the establishment of international standards for sea ice service delivery in the Arctic.

Satellite Instruments

The use of satellite information to monitor the Arctic is also of great value and allows coverage that was before impossible to achieve, and will therefore be an integral part of an Arctic GOOS system. Satellite measurements are long-term efforts, and are very costly. Support at the international level is needed to facilitate collaboration between national and international space agencies to provide the data with optimized relevance for society.

Other Arctic Actors

Local efforts are also valuable in the establishment of an Arctic Ocean observing system. In fact, Arctic indigenous people are a large proportion of the population of the Arctic, are should be integral partners in an Arctic GRA. This collaboration with local populations and the integration of indigenous knowledge can be included to provide valuable measurements and create involvement in ocean research activities, for example through the implementation of community-based observation programmes or as partners in other sustained observing networks. Finally, other local actors, for example from industry and shipping, can be joined in partnerships to increase in-situ ocean measurements.

What are the requirements for the creation of an Arctic GRA?

Technically, to be recognized as a GRA, a proposed initiative must include the following:

- Evidence that a management structure is in place that can deliver an integrated and sustained system by linking, enhancing and supplementing existing infrastructure and expertise in the region.
- Provision of an acceptable plan that has been endorsed by stakeholders (data providers and users) from the region and describes the procedures by which the observing system will be established, developed, and sustained. This must include procedures for quality assurance, conformance to internationally accepted standards and protocols for measurements, data management, and communications.

Next steps for the creation of an Arctic GOOS

- Commitment from principal actors (Arctic nations, other interested states, Arctic Council, academic institutions, industrial partners, etc)
- Signature of a Memorandum of Understanding
- Establishment of basic organizational and financial structure
- Proposition to IOC

References

[1] GOOS regional policy 2013, Intergovernmental Oceanographic Commission of UNESCO, document IOC/INF-1308, published 28 May 2013, available online at http://www.ioc-goos.org/index.php?option=com_oe&task=viewDocumentRecord&docID=11235.

[2] A Framework for Ocean Observing. By the Task Team for an Integrated Framework for Sustained Ocean Observing, UNESCO 2012, IOC/INF-1284 rev., doi: 10.5270/OceanObs09-FOO, available online at: http://unesdoc.unesco.org/images/0021/002112/211260e.pdf.

[3] Sustaining Arctic Observing Networks website: http://www.arcticobserving.org/, accessed on 24 February 2016.

[4] Why Monitor the Arctic Ocean? Services to society from a sustained observing system; IOC/UNESCO 2010, available online at http://unesdoc.unesco.org/images/0018/001898/189843e.pdf.

Appendix

Table 1. List of partners contributing to Arctic Regional Ocean Observing System.

Nansen Environmental and Remote Sensing Center (NERSC)
Swedish Meteorological and Hydrological Institute (SMHI)
Institute Français de Recherche pour l'Exploitation de la Mer (Ifremer)
Institute of Marine Research in Norway (IMR)
Institute of Oceanology, Polish Academy of Sciences (IOPAS)
Norwegian Institute for Water Research (NIVA)
Danish Meteorological Institute (DMI)
Mercator Océan (MERCATOR)
University of Cambridge, Department of Applied Mathematics and Theoretical Physics (DAMTP)
Alfred-Wegener-Institut für Polar- und Meeresforschung (AWI)
Finnish Meteorological Institute (FMI)
University of Bremen, Institute of Environmental Physics (IUP)
Norwegian Meteorological Institute (met.no)
Nansen International Environmental and Remote Sensing Center (NIERSC)
Norwegian Polar Institute (NPI)
Geophysical Institute at University of Bergen (GFI)
Defence Centre for Operational Ocanography (FCOO)