

## 2020-2022 GEO Work Programme

### Implementation Plan for GEO Community Activities

#### 1. Executive Summary

This is the implementation Plan from the Sustaining Arctic Observing Networks (SAON) for ArcticGEOSS as a GEO Community Activity.

SAON's Vision is a connected, collaborative, and comprehensive long-term pan-Arctic Observing System that serves societal needs. The Mission of SAON is to facilitate, coordinate, and advocate for coordinated international pan-Arctic observations and to mobilize the support needed to sustain them. This vision is in many aspects the vision of the Group on Earth Observation globally.

The Strategy for SAON (1) describes the following three goals:

1. Create a roadmap to a well-integrated Arctic Observing System;
2. Promote free and ethically open access to all Arctic observational data; and
3. Ensure sustainability of Arctic observing.

The SAON Implementation Plan (2) outlines the objectives for each of these goals and the plans for achieving these.

In the European Commission Work Programme 2018-2020 (3), there is a call for *Supporting the implementation of GEOSS in the Arctic in collaboration with Copernicus*. The aim of the project is to advance “the operationalisation of an integrated pan-Arctic Observing System in preparation for a possible future ArcticGEOSS initiative”. The ArcticGEOSS Community Activity will be implemented through a project proposal to be submitted in a response to this call.

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#### 2. Purpose

SAON is a joint initiative of the Arctic Council (AC) (4) and the International Arctic Science Committee (IASC) (5). The SAON process was established in 2011 via the AC Nuuk Declaration (6). This declaration recognizes the *importance of the Sustaining Arctic Observing Networks (SAON) process as a major legacy of the International Polar Year for enhancing scientific observations and data-sharing*. Through ArcticGEOSS, GEO could tie into a new international policy framework to drive its mission of Earth observations for societal benefit.

The rapid on-going changes in the Arctic present an urgent need to better observe, characterize and quantify processes and properties of the Arctic system. A full integration of ground-based and satellite segments of observing system is fundamental to achieve this overarching target. The first goal of SAON is to *create a roadmap to a well-integrated Arctic Observing System*.

With ArcticGEOSS the SAON goals will extend to encompass policy relevant services as the link from the observing system to societal benefits. The need for this link has been identified in *The International Arctic Observations Assessment Framework* (7).

In various contexts, it has agreed that the key current challenges impeding the development of a globally connected, interoperable system are social and organizational rather than technical. The second goal of SAON is to *promote free and ethically open access to all Arctic observational data*.

### 3. Background and Previous Achievements

#### **3.1 Create a roadmap to a well-integrated Arctic Observing System;**

##### *3.1.1. Arctic Observations Assessment Framework*

One of the prime drivers for SAON activities is the 12 Arctic Societal Benefit Areas (SBA) defined through the International *Arctic Observations Assessment Framework* process (with the IDA Science and Technology Policy Institute (STPI)) (7). The Framework identifies *value tree analysis* as a methodology for identifying data and services that are required in order to support a specific SBA. The framework and the related *value tree analysis* approach have been followed up by the European Commission's IMOBAR project (8). The project is an assessment of the benefits of Arctic observations, compared to investment and management costs. Follow-up initiatives are ongoing in a number of SAON countries, including Finland, Japan and USA. Such assessments serve as one building block in the creation of the roadmap.

##### *3.1.2. Arctic Observing Summit*

SAON is the co-organizer of the Arctic Observing Summit (AOS). The Arctic Observing Summit (AOS) is a high-level, biennial summit that aims to provide community-driven, science-based guidance for the design, implementation, coordination and sustained long-term (decades) operation of an international network of Arctic observing systems. AOS has been organized in 2013, 2014, 2016, and 2018. The theme of the 2018 AOS was *The business case for Arctic Observing* (9). The next AOS (2020) will be held in Akureyri, Iceland; the theme will be *Observing for Action*.

##### *3.1.3 Products and services*

SAON maintains these inventories:

- SAON Inventory (10)
- SAON Data search facility (11)

In a joint effort with the Arctic Monitoring and Assessment Programme (AMAP), SAON has been responsible for these Horizon 2020 / EU-PolarNet deliverables:

- Inventory of existing monitoring and modelling programmes (September 2016) (12)
- Roadmap for optimisation of monitoring and modelling programmes (August 2019)

### **3.2 Promote free and ethically open access to all Arctic observational data.**

The second goal for SAON is to promote free and ethically open access to all Arctic observational data. The work is coordinated by the Arctic Data Committee (ADC) (13).

Current and past activities of the ADC include:

- In 2018, ADC co-organised the *Polar Data Planning Summit* and the *Polar Data and Systems Architecture Workshop* (14). The focus of the Summit was to generate detailed plans on how best to mobilise existing and soon-to-be initiated funded activities to develop a particular international data sharing case study or scenario.
- The *Polar Data Forum (PDF)* focuses on improving how people and systems can share data in a meaningful way. The goal is to move towards open and connected systems based on a culture of trust and acknowledgement of data production and use. The ADC arranged the PDF in cooperation with partners in 2013 and 2015 (15). The third PDF will be held in November 2019 in Helsinki, Finland.
- Data and system interoperability has been identified as one of the primary goals and challenges of interest to the broader polar and global community, and this was the topic of the ADC co-organised *Polar Connections Interoperability Workshop* in 2016 (16).
- ADC contributed to EU-PolarNet's report *Data management recommendations for polar research data systems and infrastructures in Europe* in 2017 (17).
- ADC was a member of the group that responded to the *Open Geospatial Consortium's Request for Information on Arctic Spatial Data* (18) in 2016.
- In 2017 ADC and partners produced the document *Polar Data and Platform Interoperability Resource Requirements* (19). It outlines financial, technical, and human resources needed to move towards a new model for polar data management.

Ongoing projects of the Arctic Data Committee include:

- Establishing a map of the Arctic data management "ecosystem." This will be both a concept map indicating projects, services and relationships as well as a geographic map indicating location.
- The *Vocabularies and Semantics Working Group* is a joint expert group of ADC, the *Interagency Arctic Research Policy Committee (IARPC)* and the *Standing Committee on Antarctic Data Management (SCADM)*. It coordinates vocabularies and semantics development activities across the polar information community.

## 4. Key Activities

In the European Commission Work Programme 2018-2020 (3), there is a call for *Supporting the implementation of GEOSS in the Arctic in collaboration with Copernicus*. The aim of the project is to advance “the operationalisation of an integrated pan-Arctic Observing System in preparation for a possible future ArcticGEOSS initiative”.

The ArcticGEOSS Community Activity will be financed and implemented through a project to be submitted in a response to this call, and SAON is engaged with the consortia that will submit a project proposal. There is a two-stage submission procedure with the first deadline February 2020 and the second September 2020.

Additional objectives of the project are:

- I. Setting up pilot services and implementing the coordinated network of those services necessary for the adaptation to climate change in the region, and
- II. Contributing to the interoperability of Arctic Data systems;

The ArcticGEOSS activities will be implemented within the framework of SAON as described below.

### **4.1 Create a roadmap to a well-integrated Arctic Observing System;**

SAON is engaged in and facilitates connections among the producers and end-users of Arctic observations in order to create and sustain an Arctic Observing System. In order to achieve this goal, SAON has adopted a community-endorsed framework, the *International Arctic Observations Assessment Framework* (7). As a follow-up to this, SAON will develop *Guidelines for contributing to SAON’s Roadmap for Arctic Observing and Data Systems* (ROADS) to be organized around *Essential Arctic Variables* (EAVs). These are conceptually broad observing categories (e.g. “sea ice”) identified for their criticality to achieving Arctic societal benefit. EAV’s are defined by their observing system requirements, which are technology-neutral and should transcend specific observing strategies, programs or regions. They are implemented through specific recommendations based on best available technology and practices. The guidelines will be published in September 2019 (20).

ArcticGEOSS plans to implement a mechanism for essential variable development. It will evolve step-wise through a series of pilot efforts to develop an EAV template that is consistent with SAON’s guiding principles, while complementary to other efforts.

ArcticGEOSS also plans to develop a series of pilot services based on identified EAVs. The number and nature of these is still to be defined. This will address the European Commission call objective I) above.

As the first pilot, the project *Research Networking Activities in Support of Sustained Coordinated Observations of Arctic Change* (21) has defined a case study that will focus on food security in coastal and marine environments in the Pacific Arctic sector. The project will link societal benefits to specific essential variables and observing system technical design and reporting requirements. The project will then develop or adapt information infrastructure around these activities to demonstrate how an internationally coordinated roadmap for Arctic observing can be designed and developed, in service to

operators, the research community and decision-makers. The project was submitted as an application to the US National Science Foundation in May 2019.

#### **4.2 Promote free and ethically open access to all Arctic observational data.**

A review of relevant Arctic data management efforts and results has guided the SAON vision for an open, interconnected, international system for sharing data across disciplines, domains, and cultures. In recognizing the elements of the envisioned system and the key challenges identified by the community, SAON focuses on improving connections, and cooperation between actors.

The *SAON Polar Connections Interoperability Workshop and Assessment Process* (16) agreed that the key current challenges impeding the development of a globally connected, interoperable system are social and organizational rather than technical: supporting human networks, promoting standards, and aligning policy with implementation.

The recent *Polar Data Planning Summit* and the *Polar Data and Systems Architecture Workshop* (14) developed a common understanding of how to develop interoperability between a number of existing Arctic data systems. The plan is to apply this understanding to the food security case study in the Pacific Arctic sector described above; this will address the European Commission call objective II) above.

The technical solutions developed within ArcticGEOSS may well be of relevance to global needs. The Arctic council Member countries are global technological leaders in many domains and their solutions are often adopted worldwide.

### **5. Relationship to GEO Engagement Priorities and to other Work Programme Activities**

GEO's mission is to connect the demand for environmental information with the supply of data and information about the Earth. It is also to advocate for broad, open data policies that helps ensure that the data collected through national, regional and global observing systems is both made available and applied to decision-making for global priorities.

GEO coordinates international efforts to build a Global Earth Observation System of Systems (GEOSS), and it links existing and planned Earth observation systems and supports the development of new ones in cases of perceived gaps in the supply of environment-related information. It aims to construct a global public infrastructure for Earth observations consisting in a flexible and distributed network of systems and content providers.

SAON through its Mission, Vision and Goals is in agreement with this. The *International Arctic Observations Assessment Framework* (7) defines 12 Social Benefit Areas (SBAs) that rely on Arctic observations. In the report, the Arctic SBAs are mapped to the GEO SBAs.

SAON is a Participating Organisation to GEO and reaches into three GEO regional structures: Americas, Europe and Asia. An ArcticGEOSS would establish a stronger tie between many national meteorological and environmental institutes and GEO.

### **5.1 Relationship to SDG Targets and Indicators Relevant to Earth Observations**

ArcticGEOSS addresses these SDG Targets:

- 13.3 (*Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning*): ArcticGEOSS services are planned to contribute to climate change related *early warning*
- 14.3 (*Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels*): Arctic marine areas are susceptible to ocean acidification: ArcticGEOSS services could enhance the understanding of the impact of ocean acidification in Arctic marine areas.
- 14.4 (*By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans (...)*): ArcticGEOSS services could contribute to science-based management plans for fisheries in the Arctic.

### **5.2 Relationship to Five Pillars of Earth Observations Support to the Paris Agreement**

ArcticGEOSS addresses *Adaptation* and *Mitigation*.

### **5.3 Relationship to GEO Cold Region Initiative (GEOCRI)**

These GEOCRI Work Plan 2017-2019 activities make reference to SAON and the organisation's contributions (22):

- 2.8: Analyze and report on alignment between GEO/GEOCRI data principles and policies and the data principles and policies established by SCAR, IASC and SAON.
- 6.1: Support SAON to develop and maintain an inventory of existing cold region Earth observations initiatives including organizations, programs, projects, networks and systems, particularly those which are active or have impact internationally and regionally.
- 6.2: Leverage GEO's international position to align other initiatives with Arctic Observing System efforts and SAON where this is not already the case (...).
- 6.3: Support SAON as the lead organization in establishing an Arctic Observing System. Support their existing efforts, share expertise. Explore the case for establishing SAON as a Regional GEO (i.e. GEO / Arctic) that would contribute to GEOCRI.

The vision of GEOCRI is to provide coordinated Earth observations and information services across a range of stakeholders. The geographical areas of GEOCRI (the world's cold regions, including the North Pole, the South Pole, Himalaya-Third Pole and mountain areas) are thematically linked together through the presence of a cryosphere (snow, ice, permafrost). The Arctic SBAs developed through the *Arctic Observations Assessment Framework* (7) has a wider scope than those related to cryosphere, and this defines the added value of an ArcticGEOSS. Through SAON, an ArcticGEOSS will be connected to and will know the sensitivity around indigenous knowledge and engagement.

ArcticGEOSS can cooperate with and contribute to GEOCRI for instance within the area of cryosphere related *essential variables*.

## 6. Governance

The governance of ArcticGEOSS is still to be defined. It will depend on the mentioned European Commission project and the consortium that will be established as a response to this.

The SAON Board is expected to have a role in the governance system. Each member of the Arctic Council (AC) has a seat on the Board, and each of the AC Permanent Participants (Arctic indigenous peoples' organizations) and each of the AC Working Groups are also entitled to one seat on the Board. Non-AC countries and international organization are invited to have a seat on the Board as long as they contribute actively to SAON activities.

SAON works through two Committees:

- The Committee on Observations and Networks (CON)
- The Arctic Data Committee (ADC, joint with IASC) (13)

The Arctic Council provides the Chair of SAON and IASC provides the Vice-Chair. The SAON Secretariat is hosted by the Secretariat of the Arctic Monitoring and Assessment Programme (AMAP) (23).

## 7. Data Policy

At minimum, SAON adheres to and promotes the IASC *Statement of Principles and Practices for Arctic Data Management* (24). This statement is consistent with a number of international data policies including those developed by WMO and ICSU bodies such as the World Data System. The GEO Data Sharing Principles have been developed under the leadership of CODATA and ICSU, and thus are generally consistent with the IASC Statement. The IASC statement uses the concept of “ethically open data” which does provide some well accepted exceptions to fully open data. A primary role of the Arctic Data Committee is to promote the IASC Principles, long-term preservation of data, norms of attribution and citation, and open data in general. ArcticGEOSS would extend these ambitions to adhere also to GEO data sharing principles, which would emphasize full free and open aspects.

## Annex 1: References

- (1) The Vision, Mission, Guiding Principles and Goals of SAON are described in the document *Sustaining Arctic Observing Networks Strategy: 2018-2028*: [https://www.arcticobserving.org/images/pdf/Strategy\\_and\\_Implementation/SAON\\_Strategy\\_2018-2028\\_version\\_16MAY2018.pdf](https://www.arcticobserving.org/images/pdf/Strategy_and_Implementation/SAON_Strategy_2018-2028_version_16MAY2018.pdf)
- (2) *SAON Implementation Plan*: [https://www.arcticobserving.org/images/pdf/Strategy\\_and\\_Implementation/SAON\\_Implementation\\_Plan\\_version\\_17JUL2018\\_Status\\_approved.pdf](https://www.arcticobserving.org/images/pdf/Strategy_and_Implementation/SAON_Implementation_Plan_version_17JUL2018_Status_approved.pdf)
- (3) European Commission: *Horizon 2020 Work Programme 2018-2020; 12. Climate action, environment, resource efficiency and raw materials*: [https://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-climate\\_en.pdf](https://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-climate_en.pdf)
- (4) Arctic Council web site: <https://arctic-council.org>
- (5) IASC web site: <https://iasc.info>
- (6) *Nuuk Declaration. On the occasion of the Seventh Ministerial Meeting of the Arctic Council, 12<sup>th</sup> May 2011, Nuuk, Greenland*: [https://www.arcticobserving.org/images/pdf/Board\\_meetings/5th\\_tromso/nuuk\\_declaration\\_final.pdf](https://www.arcticobserving.org/images/pdf/Board_meetings/5th_tromso/nuuk_declaration_final.pdf)
- (7) The IDA Science and Technology Policy Institute (STPI) and SAON (2017): *The International Arctic Observations Assessment Framework*: <https://www.arcticobserving.org/news/268-international-arctic-observations-assessment-framework-released>
- (8) *Impact assessment study on societal benefits of Arctic observing systems*: <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/impact-assessment-study-societal-benefits-arctic-observing-systems>
- (9) Arctic Observing Summit web site: <http://www.arcticobservingsummit.org/>
- (10) *SAON Inventory*: <http://projects.amap.no/directory/saon/>
- (11) *SAON Data search facility*: <https://saon.met.no/>
- (12) *Inventory of existing monitoring and modelling programmes (EU-PolarNet deliverable)*: [http://www.eu-polarnet.eu/fileadmin/user\\_upload/www.eu-polarnet.eu/Members\\_documents/Deliverables/WP2/D2\\_3\\_Inventory\\_of\\_existing\\_monitoring\\_and\\_modelling\\_programmes.pdf](http://www.eu-polarnet.eu/fileadmin/user_upload/www.eu-polarnet.eu/Members_documents/Deliverables/WP2/D2_3_Inventory_of_existing_monitoring_and_modelling_programmes.pdf)

(13) ADC web site: <https://arcticdc.org/>

(14) *Polar Data and Systems Architecture Workshop* web site: <https://arcticdc.org/meetings/conferences/polar-data-architecture-workshop>

(15) Polar Data Forum web site: <http://www.polar-data-forum.org/>

(16) *Polar Connections Interoperability Workshop and Assessment Process*: <https://arcticdc.org/meetings/adc-meetings/9-adc-meetings/36-polar-connections-interoperability-workshop>

(17) EU PolarNet: *Data management recommendations for polar research data systems and infrastructures in Europe*: [http://www.eu-polarnet.eu/fileadmin/user\\_upload/www.eu-polarnet.eu/Members\\_documents/Deliverables/WP3/EU-PolarNet\\_D3.5\\_Data\\_management\\_recommendations.pdf](http://www.eu-polarnet.eu/fileadmin/user_upload/www.eu-polarnet.eu/Members_documents/Deliverables/WP3/EU-PolarNet_D3.5_Data_management_recommendations.pdf)

(18) *Response to the Open Geospatial Consortium Request for Information on Arctic Spatial Data by the Polar Data Community*: <https://arcticdc.org/images/download/Polar-Community-OGC-ASDP-RFI-Response.pdf>

(19) *Polar Data and Platform Interoperability Resource Requirements*: [https://arcticdc.org/images/download/Polar\\_Data\\_Interoperability\\_Resource\\_Requirements\\_Submission\\_NO\\_COST.pdf](https://arcticdc.org/images/download/Polar_Data_Interoperability_Resource_Requirements_Submission_NO_COST.pdf)

(20) *Guidelines for contributing to SAON's Roadmap for Arctic Observing and Data Systems (ROADS)*: <https://www.arcticobserving.org/news/378-guidelines-for-contributing-to-saon-s-roadmap-for-arctic-observing-and-data-systems-roads>

(21) Collaborative Research: *Research Networking Activities in Support of Sustained Coordinated Observations of Arctic Change*: [https://www.arcticobserving.org/images/pdf/Board\\_meetings/20190612/05\\_RNAProposalV190531submitted.docx](https://www.arcticobserving.org/images/pdf/Board_meetings/20190612/05_RNAProposalV190531submitted.docx)

(22) *GEOCRI Work Plan 2017-2019*: [http://www.earthobservations.org/documents/2017\\_coldregions\\_geocri\\_wp.pdf](http://www.earthobservations.org/documents/2017_coldregions_geocri_wp.pdf)

(23) AMAP web site: [www.amap.no](http://www.amap.no)

(24) IASC *Statement of Principles and Practices for Arctic Data Management*: [https://iasc.info/images/data/IASC\\_data\\_statement.pdf](https://iasc.info/images/data/IASC_data_statement.pdf)

## Annex 2: Acronyms

AC: Arctic Council

ADC: Arctic Data Committee

AMAP: Arctic Monitoring and Assessment Programme

AOS: Arctic Observing Summit

CODATA: Committee on Data for Science and Technology

CON: Committee on Observations and Networks

GEO: Group on Earth Observations

GEOCRI: GEO Cold Regions Initiative

IASC: International Arctic Science Committee

ICSU: International Council for Science

IDA: Institute for Defense Analyses

OGC: Open Geospatial Consortium

PDF: Polar Data Forum

PP: Permanent Participant (Arctic Council indigenous peoples' organizations)

SAON: Sustaining Arctic Observing Networks

SBA: Societal Benefit Areas

STPI: IDA Science and Technology Policy Institute

### Annex 3: Brief CV of Project Leader

#### Jan Rene Larsen:

- Since 2011, Deputy Executive Secretary at the Arctic Monitoring and Assessment Programme (AMAP). AMAP is a working group of the Arctic Council. Secretary of the Sustaining Arctic Observing Networks (SAON).
- Involved in organizing international conferences with an Arctic Perspective, including the Polar Data Forum and the Arctic Observing Summit.
- Involved in EU Horizon2020 projects (*EU-PolarNet* and *INTERACT*) and ESA's *Arctic Mission System Study* as task lead.
- Biologist (environmental) from University of Copenhagen, Denmark, with additional background in biostatistics and computer science.