

## WP23\_25: Arctic GEOSS

1308,239

### Basic Information

#### Full title of the Initiative

ArcticGEOSS

#### Short Title or Acronym

ArcticGEOSS

#### Current category in the 2020-2022 GWP

Community Activity

#### Proposed category in the 2023-2025 GWP

GEO Initiative

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### Purpose

#### Objective

The aim of this activity is to advance the operationalization of an integrated pan-Arctic observing system. The ArcticGEOSS is a collaborative and distributed effort, building on existing initiatives, activities and projects and using the momentum and availability of already funded initiatives within the Arctic observing community. ArcticGEOSS shares the vision of the Sustaining Arctic Observing Networks (SAON): A connected, collaborative, and comprehensive long-term pan-Arctic Observing System that serves societal needs.

#### Please provide a short description of the Initiative

The rapid ongoing changes in the Arctic present an urgent need to better observe, characterize and quantify processes and properties of the Arctic system. Full integration of ground-based and satellite observing systems is fundamental to achieving this overarching target. ArcticGEOSS will offer 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 (IAOAF, 2017).

The expected outcomes for the Initiative in the years 2023-2025 can be summarized as following:

- The development and implementation of a series of well-defined priority variables (so-called Shared Arctic Variables, SAVs)
- Develop a series of pilot services based on these SAVs with documented high societal benefits that will support policy implementation. Through these implement the observation of climate change and related impacts in the

Arctic (for selected variables)

## **Why is this Initiative needed?**

Earth observations in the Arctic contribute to key national and international objectives across a range of important domains, including food, energy, water security, transportation; and natural resource development. ArcticGEOSS could help GEO to tie into an international policy framework to drive its mission of Earth Observations (EO) for societal benefits.

## **What evidence is there to support this need?**

The societal needs:

The need based on science is well document in IPCC reports, most recently stated in the IPCC "Special Report on the Ocean and Cryosphere in a Changing Climate" (SROCC): "Over the last decades, global warming has led to widespread shrinking of the cryosphere, with mass loss from ice sheets and glaciers (very high confidence), reductions in snow cover (high confidence) and Arctic sea ice extent and thickness (very high confidence), and increased permafrost temperature (very high confidence). This impacts heavily on societies in the Arctic: Since the mid-20th century, the shrinking cryosphere in the Arctic and high mountain areas has led to predominantly negative impacts on food security, water resources, water quality, livelihoods, health and well-being, infrastructure, transportation, tourism and recreation, as well as culture of human societies, particularly for Indigenous peoples (high confidence). Costs and benefits have been unequally distributed across populations and regions. Adaptation efforts have benefited from the inclusion of Indigenous knowledge and local knowledge (high confidence). The need to act in the Arctic to monitor climate change and help people to adapt is imminent."

The political mandate:

In the Arctic Council (AC) Salekhard Declaration (2006), the Council urges "Urge Member States and other entities to strengthen monitoring and research efforts needed to comprehensively address Arctic change and to promote the establishment of a circumpolar Arctic observing network of monitoring stations with coordinated data handling and information exchange for scientific data, statistics and traditional knowledge as a lasting legacy of the IPY (and as the evolving Arctic component of the Global Earth Observing System of Systems, GEOSS)". As a response to this, the SAON process was established in 2011 via the AC Nuuk Declaration. 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". In a recent call (LC- CLA-20-2020), the European Commission solicited proposals for initiatives that support "the implementation of GEOSS in the Arctic in collaboration with Copernicus". This is currently being implemented by the Arctic PASSION project.

## **Is this Initiative open to participation by representatives of any GEO Member, Participating Organization, and GEO Associate?**

Yes

## **Are you aware of other projects or initiatives at a global or regional scale (both in GEO and externally) that provide similar products or services?**

Yes

### **Please describe.**

If the GEO Cold Region Initiative (GEOCRI) is included in the GEO Work Programme, cooperation will be established with this activity. A dialogue has been active since the formation of ArcticGEOSS. As described below, the institutions behind ArcticGEOSS already collaborate with GEO-EV, GEO-MOUNTAINS, GWIS and GEO-VALUE. In this GEO Work Programme, collaborations will be sought with CAMS, C3S, EUROGEO, GEO-EV, HUMAN-PLANET, GEOSS Data, Information and Knowledge Resources, GEOSS Infrastructure Development, GEO-MOUNTAINS, and NEXT-EOS. Collaboration will also be sought with the GEO Indigenous Alliance.

It is known that other global or regional initiatives are engaged in organizing data that supports the pilot services described for this Initiative. In this case, collaboration has already been established (for example

with the Global Terrestrial Network for Permafrost (GTN-P)), or will be established.

SAON has a long-standing engagement with World Meteorological Organization and through this also with the Global Cryosphere Watch (GCW).

### **How is this Initiative unique?**

There are shortcomings in the coordination of Arctic observations that are maintained by many national and organizational institutions. This coordination gap has hampered partnership development and investments toward improved observing and data systems. The "Sustaining Arctic Observing Networks' (SAON) Roadmap for Arctic Observing and Data Systems (ROADS)" (see Sandy Starkweather et al. (2021)) address this shortcoming through generating a systems-level view of observing requirements and implementation strategies. ROADS is both a comprehensive concept, building from a societal benefit assessment approach, and one that can proceed step-wise so that the most imperative Arctic observations (described as shared Arctic variables (SAVs)) can be rapidly improved. The ROADS process and the SAV concept has been a driver for establishing Arctic PASSION and initiate the development of the pilot services described herein. ArcticGEOSS is seeking to be strong in engaging end users to make EO impactful.

**Please identify the most important actual and/or intended outputs (products, services, etc.) produced by the Initiative, along with their intended and/or actual users. This list does not need to be comprehensive but should identify the outputs which are most used and are expected to have the greatest potential impact.**

Output	Status	Users	Additional info
Integrated Fire Risk Management Pilot Service	In development	Arctic communities, people involved in wildfire risk management	This project aims to develop an integrated web-based system that, through collecting data and coupling physical and parametric models, will support the prevention and evaluation of the risk of wildfire; the sighting and monitoring of wildfires; emergency management of shutdown operations; post-event management and damage assessment. Information layers and outputs will include: risk maps, vegetation stress map, fire weather forecasts, fuel map, early identification of outbreaks, and short-term evolution of the fire event. Information and alarms can be distributed to citizens and communities.
Pan-Arctic requirements-driven Permafrost Service	In development	Research Community, Arctic Permafrost Geospatial Centre, NSF Permafrost Discovery Gateway, INTERACT station managers and users, local community, land managers, policy makers, decision makers	The objective of this pilot service is to provide a new service reporting on temperature and active layer changes which will underpin the Global Terrestrial Network for Permafrost (GTN-P); to provide near real time maps of surface changes related to permafrost thaw at high resolution available to all stakeholders; and build on ESA and Copernicus remote sensing products.
Improving safety for shipping in the polar seas	In development	All ships operating in and around sea ice in the Arctic	This project focuses on three outputs. First, use historic ship traffic data to assess shipping traffic. The second goal is to deliver near real time sea ice conditions assessment (ice charts, satellite imagery). The final goal is to use forecasted sea ice information to deliver forecasted sea ice

			conditions products and their associated POLARIS score (IMO Polar Operational Limit Assessment Risk Indexing System).
Support Indigenous food security and food sovereignty in the Pacific Arctic sector	In development	Indigenous and other Arctic communities, research community, resource managers	The Research Networking Activities in Support of Sustained Coordinated Observations of Arctic Change (RNA CoObs), in partnership with the Food Security Working Group (FSWG), works to support an Indigenous-led project on food security. These efforts tie into the broader goals of the Sustaining Arctic Observing Networks (SAON) Roadmap for Arctic Observing and Data Systems (ROADS). RNA CoObs supports the ROADS process with a focus on the Pacific Arctic sector. It seeks to 1) capture requirements for a set of shared Arctic variables with the FSWG and communities in the region; 2) collaboratively develop an engineering design for observing activities, drawing on observing system simulation to help guide this process; 3) design or adapt information infrastructure to share data and information products with users; and 4) build a community of practice cutting across regions, disciplines and knowledge systems.

**If needed, please provide additional comments or explanation to accompany the outputs table**

- no answer given -

**What kinds of decisions are the outputs of this Initiative primarily intended to support?**

"Integrated Fire Risk Management Pilot Service": When to have fire fighting resources available? What areas to patrol (fire risk maps, risk of lightning); management of the event/emergency (both with respect to people and wildlife); and post-event decisions addressed using downscaled products (monitoring of burned areas, assessing

impacts on wildlife, food security, infrastructure).

"Pan-Arctic requirements-driven Permafrost Service": Land management and urban development decisions, informing citizens on changing permafrost conditions due to global warming.

"Improving safety, efficiency and supporting situational awareness for shipping in the polar seas". Navigation decisions (tactical navigation decisions, long-term fieldwork planning, vessel type decision).

### **How will these decisions benefit from the outputs of this Initiative?**

"Integrated Fire Risk Management Pilot Service": Seasonal fire weather outlooks and near real time situational awareness. Development of a control room that will be able to have all this information in one place and make actions more efficient and tailored for specific needs of local and indigenous communities and citizens .

"Pan-Arctic requirements-driven Permafrost Service": Information about areas which are particularly vulnerable to permafrost thaw will support decision making processes in terms of future urban development, such as infrastructure or housing areas but also support decisions about potential resettlements, and supporting resilient communities in adaptation to climate change impacts.

"Improving safety for shipping in the polar seas": Safety (avoid ships of the wrong classification to be stuck in the ice, safety to the ship, maintenance, environmental safety), and efficiency (reduce fuel consumption, reduced pollution, adapt planning and risk assessments to changing sea ice regime and support search and rescue operations and oil spill response actions).

### **What kinds of impacts (for example, reduced loss of life, monetary savings, conservation of biodiversity, etc.) are anticipated as a result of the use of the outputs of this Initiative?**

At the overall level, the Initiative is closely related to the International Arctic Observations Assessment Framework (IAOAF). The IAOAF defines 12 Social Benefit Areas (SBAs) that rely on Arctic observations: Disaster Preparedness; Environmental Quality; Food Security; Fundamental Understanding of Arctic Systems; Human Health; Infrastructure and Operations; Marine and Coastal Ecosystems and Processes; Natural Resources; Resilient Communities; Sociocultural Services; Terrestrial and Freshwater Ecosystems and Processes; Weather and Climate. In the IAOAF, these Arctic related SBAs are mapped to the GEO SBAs. More specifically, impacts from the described pilot services include: Conservation of biodiversity, reduced loss of life, improved prevention and forecasting of forest fires, improved sighting and monitoring of forest fires, food security, improved emergency preparedness and management, damage assessment of forest fires, wildlife and pollution risk reduction, safe shipping, reduced risk of accidents with vessels traveling through ice-covered water, reduced fuel consumption, improved mapping of abrupt permafrost thaw, improved risk assessment of abrupt permafrost thaw for infrastructure and local communities.

The pilot service "Integrated Fire Risk Management Pilot Service" addresses the following Sustainable Development Goals: SDG 1 (End poverty in all its forms everywhere), especially SDG 1.5 (By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters) in connection with wildfires events; SDG 9 (Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation) , especially SDG 9.5 (Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending); SDG 13 (Take urgent action to combat climate change and its impacts), especially SDG 13.1 (Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries) and SDG 13.3 planned to contribute to climate change related early warning; SDG 15 (Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss), especially SDG 15.5 (Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species).

The pilot service "Pan-Arctic requirements-driven Permafrost Service" addresses the following Sustainable Development Goals: SDG 9 (Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation), especially SDG 9.5 (Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending); SDG 11 (Make cities and human settlements inclusive, safe, resilient and sustainable), especially SDG 11.3 (by 2030, enhance inclusive and sustainable urbanization and

capacity for participatory, integrated and sustainable human settlement planning and management in all countries); SDG 13 (Take urgent action to combat climate change and its impacts), especially SDG 13.1 (Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries) and SDG 13.3 planned to contribute to climate change related early warning; SDG 15 (Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss), especially 15.5 (Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species).

The pilot service "Improving safety for shipping in the polar seas" addresses the following Sustainable Development Goals: SDG 13 (Take urgent action to combat climate change and its impacts), especially SDG 13.1 (Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries) and SDG 13.3 planned to contribute to climate change related early warning; SDG 15 (Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss), especially 15.5 (Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species).

The "RNA CoObs" project establishes an Indigenous liaison team that works with the FSWG and RNA CoObs to address SAON goals of creating a roadmap to a well-integrated Arctic Observing System, promoting free and ethically open access to all Arctic observational data, and ensuring sustainability of Arctic observing by integrating a western framework with the social, economic, spiritual, and cultural needs of Indigenous Peoples and others within the Arctic. It seeks to address in particular concerns raised about the reductionist approach inherent in a shared Arctic variable and about how best to make use of research and observation efforts to assist Inuit in meeting the goals of food sovereignty and food security.

### **Has this Initiative been asked to provide specific information (for example, reports, data, services) on an ongoing basis to an international convention, organization, or other multilateral body?**

Yes

#### **Please identify the requesting organization.**

Arctic Council, European Commission, Arctic Science Ministerial

#### **Describe the nature of the request.**

In the Arctic Council (AC) Salekhard Declaration (2006), the Council urges "Urge Member States and other entities to strengthen monitoring and research efforts needed to comprehensively address Arctic change and to promote the establishment of a circumpolar Arctic observing network of monitoring stations with coordinated data handling and information exchange for scientific data, statistics and traditional knowledge as a lasting legacy of the IPY (and as the evolving Arctic component of the Global Earth Observing System of Systems, GEOSS)". As a response to this, the SAON process was established in 2011 via the AC Nuuk Declaration. 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". In a recent call (LC- CLA-20-2020), the European Commission solicited proposals for initiatives that support "the implementation of GEOSS in the Arctic in collaboration with Copernicus". This is currently being implemented by the Arctic PASSION project. The 3rd Arctic Science Ministerial "recognize the role the Sustaining Arctic Observing Networks (SAON) initiative has already played and acknowledge that supporting implementation mechanisms identified by SAON will continue to generate long-term benefits for strengthening Arctic observation and data systems". The proposed long-term actions include 1) Promote planning for international cooperation in observational efforts to monitor the accelerating changes in the Arctic environment through national and international domain awareness platforms (satellites, stations, community-led observations, vessels, buoys, and other marine technology) through or in partnership with SAON; 2) Support ongoing efforts from the IASC/SAON-led Arctic Data Committee and others to harmonize data collection and sharing, particularly those working to make Arctic data and metadata more consistent, discoverable, interoperable, ethically open and accessible, and respect the rights of Indigenous Peoples, as applicable, especially with data pertaining to Indigenous Peoples. Under the heading "Strengthen the work of SAON", near-term actions include 1) Encourage finalizing the Roadmap for Arctic Observing and Data Systems (ROADS) through the coordination and cooperation between national and international programs,

small and large projects, and infrastructures, and prioritize implementation; 2) Promote the expansion of the ROADS efforts to also reflect priorities of Indigenous Peoples; 3) Encourage SAON to update a gap analysis of where Arctic observations are missing and recommend strategies to address priority gaps.

**Please provide supporting documentation of the request.**

- documentation\_of\_the\_request.txt ([link](#))

## Technical Synopsis

**Please provide a brief description of the methods used by the Initiative to produce its (actual or planned) outputs.**

"Integrated Fire Risk Management Pilot Service":

First, similar existing services will be explored to determine information layers that can be adjusted to the scope. Secondly, suitable test areas will be identified. The various components of the systems will then be developed, tested and integrated into the IT platform. Numerical weather prediction (NWP) models and parametric models will be used, as will satellite data. Co-design and co-development of all products and outputs are pivotal to the success of this activity. The project is led by CNR (National Research Council of Italy) and partners. The Finnish Meteorological Institute will add seasonal fire weather forecasts based on Copernicus C3S data and satellite based EO on vegetation state to the service.

"Pan-Arctic requirements-driven Permafrost Service":

This project aims to amend Landsat and Sentinel-2 time-series with the permafrost temperature and active layer products by ESA CCI+ permafrost project in collaboration with the local communities working with Arctic PASSION, the INTERACT research stations, and AINA in Canada. This will help identify local priorities and co-produce products tailored to local needs and their immediate surroundings.

"Improving safety for shipping in the polar seas":

- Historical picture: Accessing good information about historical ship movements (using for example AIS, ship tracking methodology), historical ice charts, and compiling a picture of ice conditions versus ship movement and polar class.
- Current information from all the ice services (Polar view, Copernicus, etc): This will build on what already exists, and compile all this information in one place. Take this information and integrate it into a POLARIS calculation.
- Forecast sea ice risk assessments: Integrate short term and long term sea ice forecasts into the POLARIS risk assessment calculation to provide forward-looking risk assessments on tactical and seasonal timescales.

RNA CoObs approaches comprise: (i) support definition and implementation of key ROADS elements, including participation in the SAON Roadmap Task Force and providing input to the development of an Experts Panel process that includes regional representation for the RNA area of interest; (ii) for the RNA area and topics of interest identify Essential/Shared Arctic Variables, capture requirements, refine system design through inverse modeling frameworks & observing system simulation experiments (OSSEs) in support of the roadmapping process and emergence of collaborative, coordinated observing efforts addressing pressing societal needs; (iii) contribute to development of information infrastructure in support of ROADS; (iv) anchor the Arctic Observing Summit (AOS) within SAON, advancing co-production & co- management by serving as a forum for the research community, Indigenous-led initiatives, agencies, private sector and others in a collaborative planning process; through the establishment of an AOS secretariat help transition the summit from a biennial event to a sustained process; (v) support food security information needs in Pacific Arctic sector – led by the FSWG, and tying into SAON and AOS processes and collaborations.

**If you would like to provide further details on the technical methods, you may upload one or more documents here.**

- no supporting documents provided -

**Are there any significant scientific or technical challenges that need to be resolved by the Initiative during the 2023-2025 period?**



Yes

**Please describe these challenges and the steps being taken to solve them.**

A series of Shared Arctic Variables (SAVs) will be developed and implemented. As part of this, a documentation framework for SAVs will be developed.

**Does the Initiative expect to complete any key new outputs, improvements to existing outputs, or improvements to the methods of producing outputs, in the 2023-2025 period?**

Yes

**Please describe these new outputs or improvements.**

"Integrated Fire Risk Management Service": Will provide a new risk parameter based on "vegetation stress"; will provide information and tools for the management of fire events (not prioritised by the global services); will pay attention to develop outputs and information suitable for indigenous communities and citizens. Pan-Arctic 6-month forecasts will be included in the service.

"Pan-Arctic requirements-driven Permafrost Service": Will provide information in the form of maps which will support local to regional decision making processes in terms of urban development.

"Improving safety for shipping in the polar seas": Forecast POLARIS risk assessments will provide a new capability to give ships foresight of changing risk assessments to support safer operations.

"RNA CoObs": Develop information products and associated tools in support of Indigenous food security and food sovereignty in the Pacific Arctic sector.

**Please identify the key tasks that must be implemented to ensure delivery of these changes, with target dates for completion.**

Task	Task description	Expected completion (month/year)
Shared Arctic Variables (SAVs)	A series of SAVs will be developed and implemented	2025
Integrated fire risk management service	Setup web service and associated production	3/2024
Seasonal fire weather forecasts	Setup firedanger.eu site with data and fire weather indices production	3/2023
Permafrost service extension	Extend the permafrost service	?
POLARIS update	Update the POLARIS service	2025
Food security information products and tools	Develop information products and associated tools	6/2025

## Resources

**Have all resources required to implement the Initiative's planned work in the 2023-2025 period been secured?**

**Please list all financial and non-financial contributions to the Initiative (other than in-kind, voluntary participation by individual contributors) having a value of more than**

**USD 50,000.**

<b>Contributing Organization</b>	<b>GEO Status</b>	<b>Type of Resource</b>	<b>Value</b>	<b>Currency</b>
Arctic PASSION / European Commission	European Commission	Financial	15 688 978,75	EUR
IBA wild fire foresight / Finland ministry of foreign affairs	Finland	Financial	142 000	EUR
RNA CoOBS	United States	Financial	4 610 000 (+ in-kind from NOAA GOMOP AINA)	USD

## **Lessons from the 2020-2022 Period**

**Were all planned activities for the 2020-2022 period implemented as expected?**

No

**Please describe which activities were delayed or not implemented and how has this affected plans for 2023-2025.**

Planned deliverables for 2020-2022 were

1. Create a roadmap to a well-integrated Arctic Observing System
2. Promote free and ethically open access to all Arctic observational data

For "Create a roadmap to a well-integrated Arctic Observing System" (1), good progress has been achieved 2020-2022, most notably through the publication of Starkweather et al (2021) and establishing the ROADS Advisory Panel.

For the "Promote free and ethically open access to all Arctic observational data" (2), a series of workshops have been held under the heading "Polar to Global Online Interoperability and Data Sharing". One outcome is "Alignment of Polar Data Policies - Recommended Principles" by Tronstad et al. (2021).

These actions will be carried on into the 2023-25 plan.

**Were there any key challenges faced by the Initiative in the 2020-2022 period?**

No

**Were there any impacts or changes to operations due to COVID-19?**

No

**Please describe the key changes proposed for the 2023-2025 period, for example, new projects, new areas of focus, or adjustments to the activity governance.**

Focus will be on the delivery of the mentioned pilot services:

- Pan-Arctic requirements-driven Permafrost Service
- Integrated Fire Risk Management
- Improving safety for shipping in the Polar Seas
- Supporting Food Security and Food Sovereignty in Pacific Arctic

**Does the Initiative have outputs (products, services, etc.) available to users now, even**

## if only on a pilot or testing basis?

Yes

**Please provide any available information describing this usage (for example, user statistics, results of user testing) and/or feedback from users (for example, user comments, evaluations).**

- no answer given -

**Please provide supporting documentation if available.**

- saon\_data\_portal.docx ([link](#))

**Do you have evidence of any impacts that have occurred in part as a result of using the outputs of the Initiative (for example, policy decisions taken, behaviour changes by users, risks mitigated)?**

Yes

**Please provide examples, with evidence where available.**

Arctic Observing Summit, especially 2020 and 2022.

1st, 2nd, and 3rd Arctic Science Ministerials

**Please provide supporting documentation if available.**

- no supporting documents provided -

**Have there been any internal or external reviews or evaluations of the Initiative since 2019?**

No

**Please indicate any GEO Work Programme activities with which you have ongoing collaboration.**

- GEO-EV - GEO Essential Variables
- GEO-MOUNTAINS - Global Network for Observations and Information in Mountain Environments
- GWIS - Global Wildfire Information System
- GEO-VALUE - Understanding the Impacts and Value of Earth Observations

**Please indicate any additional GEO Work Programme activities with which you would like to establish new collaborations.**

- CAMS - Copernicus Atmosphere Monitoring Service
- C3S - Copernicus Climate Change Service
- EUROGEO - European Group on Earth Observations
- GEO-EV - GEO Essential Variables
- HUMAN-PLANET - GEO Human Planet
- GEOSS Data, Information and Knowledge Resources - GEOSS Data, Information and Knowledge Resources
- GEOSS Infrastructure Development - GEOSS Infrastructure Development
- GEO-MOUNTAINS - Global Network for Observations and Information in Mountain Environments
- NEXT-EOS - Next Generation Earth Observation Services

## Stakeholder Engagement and Capacity Building

## **Are there specific countries or organizations that your Initiative would like to engage?**

Yes

### **Please list these countries, regions or organizations.**

Key stakeholders at different levels, from different regions, and from all sectors (science, industry, policy). In addition the Arctic Council and the indigenous organisations engaged in the Arctic Council (the so-called Permanent Participants (PPs))

### **What are your plans to engage them?**

Arctic PASSION has comprehensive plans for involving key stakeholders at different levels, from different regions, and from all sectors (science, industry, policy) in the development of the pilot services and the Shared Arctic Variables (SAVs). This ensures that the activities are in line with the broad communities' needs and carried out in an efficient and targeted approach to facilitate the user uptake. It also allows flexible and open involvement on a co-design and co-creation approach with the major stakeholders.

## **Does your Initiative engage users in the work of the Initiative (for example, consultation, testing, co-design)?**

Yes

### **Please briefly describe the Initiative's approach to engaging users.**

For the pilot service "Integrated Fire Risk Management Service", specific areas for test cases will be identified (at the moment western Canadian Arctic/Alaska border regions and in West Siberia) and the system will be co-developed with indigenous and local communities, using a modular approach to facilitate the implementation in different conditions. There will be cooperation with Copernicus EFFIS service and with projects of the AC working groups EPPR and CAFF.

The pilot service "Pan-Arctic requirements-driven Permafrost Service" will be co-developing protocols and data streams through Community Based Monitoring (CBM). A community partnerships will be established also in collaboration with the EU-funded Nunataryuk project. This will be a platform for collaborative discussions and validation on the presence of thaw disturbances, and assessments of community vulnerability.

The pilot service "Improving safety for shipping in the Polar Seas" has established an advisory group which provides representation from Arctic maritime industry and regulatory bodies including Lloyds Regsiter, PAME, Aker Arctic, Norwegian Coastal Administration, the Nautical Institute and M Kingston Associates.

## **Does the Initiative have a user engagement strategy or similar kind of document?**

No

## **Are there categories of users that are not represented at this time, but you would like to engage?**

Yes

### **Please list these user categories or regions.**

Indigenous and local organisations will be engaged in the development of the pilot services. This engagement will be further developed and it will eventually set up a User Forum for ArcticGEOSS.

### **What are the plans for further engagement of users in the Initiative?**

See above under "Please briefly describe the Initiative's approach to engaging users"

## **Does the Initiative have a documented capacity development strategy?**

No

**Please describe the approach to capacity development that is being implemented by the Initiative?**

For the engagement of the indigenous and local organizations, funding is allocated within ArcticPASSION for their engagement and capacity building. The Initiative will be involved in the capacity development working group of the Arctic Observing Summit.

**Are there any commercial sector organizations participating in this Initiative?**

Yes

**Please list the commercial sector organizations.**

Organization name	GEO Member/PO/...	Country in which the organization is based	City in which the organization is based
Arctic Economic Council		Norway	Tromso

**Are there opportunities for commercial sector uptake of the outputs of the Initiative?**

Yes

**Please describe these opportunities.**

For the pilot service 'Integrated Fire Risk Management Service': The service will support 1) Prevention and risk evaluation of forest fires, 2) Sighting and monitoring of forest fires, 3) Emergency management of shutdown operations, and 4) Post-event management and damage assessment.

For the pilot service 'Pan-Arctic requirements-driven Permafrost Service': In addition to the communities involved in the development, it will serve the Arctic Council Working Groups, land managers, policy and decision-makers, and the scientific community.

For the pilot service "Improving safety for shipping in the Polar Seas": The approach includes the following aspects: 1) Calculate risk evaluations available for ships, 2) Deliver the risk evaluations through a map-based graphic web interface, and 3) Use forecasted sea ice information to produce forecasted scores for the planning of future vessel movements. There is potential for commercial delivery of these services or integration into existing ice services.

**Is there already commercial uptake occurring?**

No

**Are there opportunities for further commercial sector participation in the Initiative?**

Yes

**Please describe these opportunities.**

For the pilot service "Improving safety for shipping in the Polar Seas", a consortium is responsible for delivering the project aims, including partners from the European Ice Services (METNO, FMI, DMI), research vessel operators (AWI and UKRI-BAS), along with guidance from the Arctic Council Working Group, PAME, the Norwegian Coastal Administration, as well as the industry representatives AKER ARCTIC and Lloyds, and maritime education establishments such as the Nautical Institute. Members of the pilot service have already had initial contact with some of other commercial operators who are interested in the pilot service outputs.

**Does the Initiative have a plan for commercial sector engagement?**

No

## Governance

### **Please describe the roles of each of the key leadership positions, as well as any team structures involved in day-to-day management.**

The "Sustaining Arctic Observing Networks' (SAON) Roadmap for Arctic Observing and Data Systems (ROADS)" (see Sandy Starkweather et al. (2021)) seeks to generate a systems-level view of observing requirements and implementation strategies. ROADS is both a comprehensive concept, building from a societal benefit assessment approach, and one that can proceed step-wise so that the most imperative Arctic observations (described as shared Arctic variables (SAVs)) can be rapidly improved. The ROADS process and the SAV concept has been an driver for establishing Arctic PASSION and initiate the development of the pilot services described herein. A key component in the SAON governance structure is the ROADS Advisory Panel, meeting every month. It will have a key role in the development of the Shared Arctic Variables (SAVs).

In addition, a Stakeholder Forum will convene virtually annually under a facilitator, supported by the SAON Secretariat. This forum will be open for all interested parties. Helen C. Joseph from HCJ Consulting has a track record for working with SAON as a facilitator.

Between the Stakeholder Forum meetings, there will be consultations with the SAON Committees:

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

The day-to-day support for ArcticGEOSS is enabled through the resources and capacity that is provided through the Arctic PASSION project, including

- Arctic PASSION Work Package 5 will evaluate the benefits generated by the pilot services;
- In Arctic PASSION Work Package 6, approximately half of the resources are allocated to ArcticGEOSS;
- Synthesis efforts in Work Package 8 is meant to engage all of the Arctic PASSION project team in making ArcticGEOSS a GEO initiative.

### **Is there a steering committee or other governance bodies that advise the Initiative but are not involved in day-to-day management?**

Yes

#### **Please describe the roles of each body. If there are multiple governance bodies, please describe the relationships among them (such as through a governance structure diagram).**

ROADS Advisory Panel: Will have a key role in the review of the Shared Arctic Variables (SAVs) that forms the basis for the pilot services. Each SAV will be developed and documented in Expert Panels that are established within Arctic PASSION and RNA CoObs.

Stakeholder Forum: The developers and managers of the pilot services will convene virtually annually under a facilitator, supported by the SAON Secretariat. In addition to these, user communities will be invited. The review of requirements, testing and new developments will be organised, and meeting minutes will be prepared as deliverables.

- no supporting documents provided -

### **What methods does the Initiative use to communicate with its participants?**

- Email / e-newsletters
- Regular conference calls
- Website

### **Please describe the key risks that could delay or obstruct the completion of the planned activities and outputs of the Initiative, along with any actions taken to mitigate**

these risks.

Description of the hazard	Description of the possible impacts	Scale of impact	Likelihood of occurrence	Mitigation measures
Lack of engagement from stakeholders in the development and promotion of the pilot services	The services will have little relevance and/or low uptake	Limited	Not very likely	Good planning and fast reaction in case of difficulties of individual partners to find solutions for distributing their responsibilities to other partners.

**What methods are used by the Initiative to monitor its effectiveness?**

- Informal discussions with users / beneficiaries

**Would the Initiative be interested in assistance from the GEO Secretariat for developing an impact plan?**

No

**How are the results of the monitoring and evaluation activities shared with participants and the wider GEO community?**

Web site, newsletter

**Are any monitoring or evaluation activities required by funders/contributors?**

Yes

**Please describe and provide reports if available.**

There will be regular reporting to the European Commission

- no supporting documents provided -

## Participants

**Please list the active individual participants in the Initiative**

First name	Last name	Email address	Member	Org
Mikko	Strahlendorff	mikko.strahlendorff@fmi.fi	Finland	FMI - Finnish Meteorological Institute
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## Other information

Please provide any other comments or information that was not included in the



## **previous sections, but you would like to appear in the Implementation Plan.**

### Institutions engaged:

Alfred Wegener Institute, Germany  
Arctic Institute of North America (AINA), Canada  
Arctic Monitoring and Assessment Programme (AMAP) Secretariat  
British Antarctic Survey (BAS)  
Finnish Meteorological Institute (FMI)  
Institute of Atmospheric Sciences and Climate (CNR-ISAC), Italy  
Joint Research Centre of the European Commission  
Norwegian Meteorological Institute  
Norwegian Polar Institute  
Svalbard Integrated Arctic Earth Observing System (SIOS)  
University of Alaska, Fairbanks  
University of Lisboa, Portugal

### Abbreviations/acronyms:

AC: Arctic Council  
ADC: Arctic Data Committee  
AOS: Arctic Observing Summit  
Arctic PASSION: Pan-Arctic Observing System of Systems. Implementing Observations for Societal Needs  
CBM: Community-Based Monitoring  
CON: Committee on Observations and Networks  
DMI: Danish Meteorological Institute  
EAVs: Essential Arctic Variables  
EFFIS: European Forest Fire Information System  
EO: Earth Observations  
ESA: European Space Agency  
FMI: Finnish Meteorological Institute  
GEOCRI: GEO Cold Region Initiative  
GEOSS: Global Earth Observation System of Systems  
GTN-P: Global Terrestrial Network for Permafrost  
GWIS: Global Wildfire Information System  
IAOAF: International Arctic Observations Assessment Framework  
IARPC: Interagency Arctic Research Policy Committee  
IASC: International Arctic Science Committee  
IMOBAR: Impact assessment study on societal benefits of Arctic observing systems  
INFRA: Integrated Fire Risk Management Pilot Service  
IPY: International Polar Year  
NOAA: US National Oceanic and Atmospheric Administration  
PAME: Protection of the Arctic Marine Environment  
PDF: Polar Data forum  
PPs: Permanent Participants to the Arctic Council  
ROADS: Roadmap for Arctic Observing and Data Systems  
SAON: Sustaining Arctic Observing Networks  
SAVs: Shared Arctic Variables  
SBA: Societal Benefit Areas  
SCADM: Standing Committee on Antarctic Data Management  
SDG: UN Sustainable Development Goals  
STPI: Science and Technology Policy Institute

### Relevant web pages:

- Arctic PASSION: <https://arcticpassion.eu>  
- Pilot service "Pan-Arctic requirements-driven Permafrost Service": <https://arcticpassion.eu/wp4/ps2/>  
- Pilot service "Integrated Fire Risk Management (INFRA) Service"  
- Pilot service "Improving safety for shipping in the Polar Seas": <https://arcticpassion.eu/wp4/ps6/>  
- Research Networking Activities for Sustained Coordinated Observations of Arctic Change (CoObs RNA):  
<https://sites.google.com/alaska.edu/rna-observations/home>

References:

- IPCC Special Report on the Ocean and Cryosphere in a Changing Climate: <https://www.ipcc.ch/srocc/>
- Sandy Starkweather et al. (2021): Sustaining Arctic Observing Networks' (SAON) Roadmap for Arctic Observing and Data Systems (ROADS). <https://journalhosting.ucalgary.ca/index.php/arctic/article/view/74330>
- Stein Tronstad et al. (2021): Alignment of Polar Data Policies - Recommended Principles. <https://zenodo.org/record/5734900>
- The International Arctic Observations Assessment Framework (2017). <https://www.arcticobserving.org/images/pdf/misc/STPI-SAON-International-Arctic-Observations-Framework-Report-2017.pdf>

- no supporting documents provided -

## Co-Editor Management

### List of co-editors for this initiative

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