



# ARCTIC PASSION

## Deliverable 8.1 Task 8.1

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Version 1  
2-December-2022  
101003472 | Arctic Passion





ARCTIC  
PASSION

**Work package**

8 – Co-developing an integrated and sustainable pan-AOSS

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1 – AWI

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**Status**

Coordinator approved

**Dissemination level**

Public



## Deliverable D8.1: Applications for GEO Initiative to GEO Program Board (T8.1)

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### A. Background

The Group on Earth Observations (GEO) is an intergovernmental partnership that seeks to improve the availability, access and use of Earth Observations (EO). The GEO definition of EO is “... data and information collected about our planet, whether atmospheric, oceanic or terrestrial. This includes space-based or remotely-sensed data, as well as ground-based or *in situ* data”.

The focus of GEO is EO-based tools, addressing the GEO work program targets: The UN 2030 Agenda for Sustainable Development, the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction.

GEO works through two-year work plans and is currently drafting its 2023-2025 Work Programme (WP). In its work Plan, GEO operates with three levels of contributions: *Flagships*, *Initiatives*, and *Pilot Initiatives* (formerly *Community Activity*). SAON is a so-called *Participation Organization* and has historically contributed to the GEO WP through ArcticGEOSS that has had status as *GEO Pilot Initiative/ Community Activity*. The plan for the current WP is that Arctic GEOSS is developed to the *GEO Initiative* level.

### B. Process

Contributions to the 2023-2025 Work Programme have been submitted as a so-called *Implementation*

#### **Task 8.1: ArcticGEOSS as a GEO Initiative with SAON (AMAP; FMI, CNR, AINA, AWI, UKRI-BAS, SIOS) (M1- M12)**

The objective for this task is to provide support for SAON’s strategy and ROADS, and to support SAON to build on the legacy of the GEO Cold Region Initiative. We will work to establish ArcticGEOSS as a GEO Initiative. Arctic- GEOSS is already a GEO Community Activity, and Arctic PASSION will support SAON to bring Arctic-GEOSS to the next level by providing SAON with the necessary actions for a successful application as a GEO Initiative. Our WPs are addressing the GEO work program targets: the UN 2030 Agenda for Sustainable Development, the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction. Engagement with the AC and support of GEO objectives is delivered through Arctic PASSION via: (i) the identification of the Essential Arctic Variables/Shared Arctic Variables (EAV/SAVs) (WP1 and 6); (ii) providing accessible and interoperable Arctic Data in partnership with Arctic Data Committee ADC (WP2); (iii) our support for a GEO knowledge HUB to share the knowhow developed in our Pilot Services to speed development of equivalent services in other areas (WP4); and (iv) our actions to establish support for long-term funding of a well-coordinated pan-AOSS (WP7). Through these Europe can play a more prominent role in the Arctic observing and policy worlds.

Plans (IPs) through the *GEO Work Programme Implementation Plan Tool*<sup>1</sup> in April and July 2022. Both versions have been reviewed by the *GEO Water Engagement Team*. Their responses are found in Appendix B.

## C. Current status

GEO has currently compiled all summaries of all submitted IPs into their *Summary Document*<sup>2</sup> (version 4), which contains short descriptions of each of the GEO Flagships, Initiatives, and Pilot Initiatives.

The status of Arctic GEOSS within GEO is reflected in the responses from GEO:

*At this time, we recommend that Arctic GEOSS participates in the GEO Work Programme as a Pilot Initiative prior to reapplying for Initiative Status. This development can take place over the course of next year, at which point the PB (Programme Board) can reconsider the status of Arctic GEOSS (July 2022)*

and

*The decision to move to a GEO Initiative should be deferred for a year until the points noted above can be addressed (April 2022)*

The application was submitted to the Geo Week 2022<sup>3</sup> and obtained status as Pilot Initiative together with approximately 70 other applications. To summarize the process, the message from GEO is that the application should be further developed and proposes that another application is submitted within a year to obtain the desired Initiative status. Within the next year, Arctic PASSION, will work to address the questions raised by GEO in their review. Current efforts (December 2022) include further developing the governance structure for Arctic GEOSS and obtaining more comprehensive descriptions of the included Pilot Services. It should be added that the proposed collaboration with GEO-MOUNTAINS was initiated by arranging the joint session 'Mountains and Polar Regions – an exchange on Cold Regions within the GEO Work Programme' during the Geo Week 2022.

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<sup>1</sup> [https://www.earthobservations.org/adm/gwp\\_login.php](https://www.earthobservations.org/adm/gwp_login.php)

<sup>2</sup> [https://www.earthobservations.org/documents/gwp20\\_22/gwp2020\\_summary\\_document.pdf](https://www.earthobservations.org/documents/gwp20_22/gwp2020_summary_document.pdf)

<sup>3</sup> <https://www.earthobservations.org/geoweek2022.php>

## Appendix A: Arctic GEOSS Implementation Plan

### 1. Basic information

#### 1.1 Full title of the Initiative

ArcticGEOSS

#### 1.2 Short Title or Acronym

ArcticGEOSS

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

Community Activity

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

GEO Initiative

#### 1.5 Points of Contact

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## **2. Purpose**

### **2.1 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.

### **2.2 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).

### **2.3 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 (especially Arctic Council) to drive its mission of Earth Observations (EO) for societal benefits.

#### **2.3.1 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

asa 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".

The details about the implementation of the Sustaining Arctic Observing Networks (SAON) are found in:

- Sandy Starkweather et al. (2021): Sustaining Arctic Observing Networks' (SAON) Roadmap for Arctic Observing and Data Systems (ROADS).
- The SAON Strategy 2018-2028
- The International Arctic Observations Assessment Framework (2017) (all references are found in the reference section of this document)

The process of the Sustaining Arctic Observing Networks (SAON) is a system-of-systems, and there is now a readiness to integrate services into GEO.

The GEO focuses on three global priority engagement areas: the United Nations 2030 Agenda for Sustainable Development, the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction. Arctic GEOSS offers a framework for bringing GEO's engagement into the Arctic through the Arctic Council.

In a recent call (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.

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

Yes

## **2.5 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

### **2.5.1 Please describe.**

There is already a dialogue with GEO Cold Region Initiative (GEOCRI) on developing cooperation. The cooperation will most likely be about the identification and implementation of the most relevant and impactful variables for the Arctic/cold regions. A similar cooperation will be established with GEO-MOUNTAINS and their activity to define "Essential Mountain Climate Variables".

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).

## 2.5.2 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 stepwise 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.

**2.6 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.**

### **2.6.1 Output: Integrated Fire Risk Management Pilot Service**

Status: In development

Users: Arctic communities, people involved in wildfire risk management

Additional info: 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.

### **2.6.2 Output: Pan-Arctic requirements-driven Permafrost Service**

Status: In development

Users: Research Community, Arctic Permafrost Geospatial Centre, NSF Permafrost Discovery Gateway, INTERACT station managers and users, local community, land managers, policy makers, decision makers.

Additional info: 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.

### **2.6.3 Output: Improving safety for shipping in the polar seas**

Status: In development

Users: All ships operating in and around sea ice in the Arctic

Additional info: 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).

### **2.6.4 Output: Support Indigenous food security and food sovereignty in the Pacific Arctic sector.**

Status: In development

Users: Indigenous and other Arctic communities, research community, resource managers

Additional info: The Research Networking Activities in Support of Sustained Coordinated Observations of Arctic Change (RNA CoObs), in partnership with the FoodSecurity 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 theROADS process with a focus on the Pacific Arcticsector. 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.

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

Even though the mentioned services all have status 'In development', some are a continuation of existing services, especially the "Pan-Arctic requirements- driven Permafrost Service", which further develops an existing service of the "Global Terrestrial Network for Permafrost (GTN-P)".

The web sites for the mentioned services are:

- "Pan-Arctic requirements-driven Permafrost Service": <https://arcticpassion.eu/wp4/ps2/>
- "Integrated Fire Risk Management (INFRA) Service": <https://arcticpassion.eu/wp4/ps4/> and <https://rs.caedns.it/aegis> (requires login) "Improving safety for shipping in the Polar Seas": <https://arcticpassion.eu/wp4/ps6/>
- "Support Indigenous food security and food sovereignty in the Pacific Arctic sector" / Research NetworkingActivities for Sustained Coordinated Observations of Arctic Change (CoObs RNA): <https://sites.google.com/alaska.edu/rna-observations/home>

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

"Integrated Fire Risk Management Pilot Service": When to have firefighting 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". Navigationdecisions (tactical navigation decisions, long-term fieldwork planning, vessel type decision).

"Support Indigenous food security and food sovereignty in the Pacific Arctic sector": Observations and derived information products would support planning and decision-making related to food sovereignty and food security in the Pacific Arctic sector.

## **2.9 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).

"Support Indigenous food security and food sovereignty in the Pacific Arctic sector": Through support of and communication with an Expert Panel comprising Indigenous experts from the region, the initiative will gain insight into observing and related information needs (specific variables to observe, priorities with respect to location and timing, decision-making context). This guidance will be translated into specific activities facilitated through the Research Networking Activity (RNA) to help define observing requirements, create information infrastructure, and generate products addressing user priorities and needs.

## **2.10 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) ; 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).

“Support Indigenous food security and food sovereignty in the Pacific Arctic sector”: The 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. Supporting food security and food sovereignty of Indigenous coastal community residents in Arctic Alaska by providing information products relevant to short- and mid-term planning and climate-change response action. Enhancing community-scale emergency and climate change action plans tied to processes and variables covered by the activity.

**2.11 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

**2.11.1 Please identify the requesting organization.**

Arctic Council, European Commission, Arctic Science Ministerial

**2.11.2 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.

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

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

### 3. Technical Synopsis

#### 3.1 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.

##### "Support Indigenous food security and food sovereignty in the Pacific Arctic sector" comprises:

- 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.
- 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.
- Contribute to development of information infrastructure in support of ROADS.
- 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.
- Support food security information needs in Pacific Arctic sector – led by the FSWG and tying into SAON and AOS processes and collaborations.

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

[Void]

#### 3.3 Are there any significant scientific or technical challenges that need to be resolved by the

## Initiative during the 2023-2025 period?

Yes

### 3.3.1 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.

### 3.4 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

#### 3.4.1 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 prioritized 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. 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.

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

#### 3.4.2 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 and implement the permafrost service	?
POLARIS update	Update the POLARIS service	2025

Food security information products and tools	Develop information products and associated tools	6/2025
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## 4. Resources

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

4.2 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.

Contributing Organization	GEO Status	Type of Resource	Value	Currency
Arctic PASSION / European Commission	European Commission	Financial	15 688 978,75	EUR
IBA wildfire 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



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

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

No

#### **5.1.1 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.

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

No

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

No

### **5.4 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

### **5.5 Does the Initiative have outputs (products, services, etc.) available to users now, even if only on a pilot or testing basis?**

Yes

#### **5.5.1 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).**

#### **5.5.2 Please provide supporting documentation if available.**

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

**5.6 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, behavior changes by users, risks mitigated)?**

Yes

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

Arctic Observing Summit, especially 2020 and 2022. 1st, 2nd, and 3rd Arctic Science Ministerials.

**5.6.2 Please provide supporting documentation if available.**

[Void]

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

No

**5.8 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

**5.9 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

## **6. Stakeholder Engagement and Capacity Building**

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

Yes

#### **6.1.1 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 organizations engaged in the Arctic Council (the so-called Permanent Participants (PPs))

#### **6.1.2 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.

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

Yes

#### **6.2.1 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 partnership 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 Register, PAME, Aker Arctic, Norwegian Coastal Administration, the Nautical Institute and M Kingston Associates.

"Support Indigenous food security and food sovereignty in the Pacific Arctic sector" is supporting an Indigenous Liaison Team comprised of three Indigenous (Alaska Native) scholars who are working with membership of the Food Security/Food Sovereignty Working Group established under the auspices of the Arctic Observing Summit and other organizations in the region to identify priorities and needs with respect to sustained observations. Engagement mechanisms also include plans for local/regional meeting participation, such as the Alaska Forum on the Environment and dedicated visits to communities and relevant local/regional organizations.

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

No

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

Yes

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

Indigenous and local organizations 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.

**6.4.2 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"

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

No

**6.5.1 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.

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

Yes

**6.6.1 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	Tromsø

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

Yes

**6.7.1 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.

"Support Indigenous food security and food sovereignty in the Pacific Arctic sector": For the region of interest, transitioning into the commercial sector may be challenging. However, there may be opportunities in terms of working with non-profit Alaska Native corporations, and the project will explore these and other options for third-party sustainment of observing activities.

#### **6.7.2 Is there already commercial uptake occurring?**

No

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

Yes

##### **6.8.1 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.

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

No

## **7. Governance**

### **7.1 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 stepwise 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. 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 HCl Consulting has a trackrecord 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.

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

Yes

#### **7.2.1 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 organized, and meeting minutes will be prepared as deliverables.

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

Email / e-newsletters, Regular conference calls, Website

### **7.4 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.

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

Informal discussions with users / beneficiaries

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

No

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

Website, newsletter

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

Yes

### 7.6.2 Please describe and provide reports if available.

There will be regular reporting to the European Commission

## 8. Participants

### 8.1 Please list the active individual participants in the Initiative

First name	Last name	Email address	Member	Org
Mikko	Strahlendorff	mikko.strahlendorff@fmi.fi	SAON - SustainingArctic Observing Networks	FMI - Finnish Meteorological Institute
Sandy	Starkweather	sandy.starkweather@noaa.gov	SAON - SustainingArctic Observing Networks	NOAA - National Oceanic and Atmospheric Administration
Stein	Tronstad	stein.tronstad@npolar.no	SAON - SustainingArctic Observing Networks	- Norwegian PolarInstitute
Marten	Tacoma	marten.tacoma@nioz.nl	SAON - SustainingArctic Observing Networks	NIOZ - Royal Netherlands Institute for Sea Research
Peter	Pulsifer	peter.pulsifer@colorado.edu	SAON - SustainingArctic Observing Networks	University of Colorado, Boulder -University of Colorado, Boulder
Jan René	Larsen	jan.rene.larsen@amap.no	SAON - SustainingArctic Observing Networks	- Arctic Council
Vito	Vitale	v.vitale@isac.cnr.it	Italy	
Guido	Grosse	guido.grosse@awi.de	Germany	- Alfred-Wegener-Institut Helmholtz-Zentrum für Polar-und Meeresforschung
Andrew	Fleming	ahf@bas.ac.uk	United Kingdom	- British Antarctic Survey
Heidi	Sevestre	heidi.sevestre@amap.no	Norway	AMAP - Arctic Monitoring and Assessment Programme
Alice	Bradley	alice.c.bradley@williams.edu	United States	
Heikki	Lihavainen	director@sios-svalbard.org	Norway	



Joao	Canario	joao.canario@tecnico.ulisboa.pt	Portugal	
Srdan	Dobricic	srđan.dobricic@ec.europa.eu		JRC - Joint Research Center
Hajo	Eicken	heicken@alaska.edu	United States	

## 9. Other information

### 9.1 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  
FSWG: Food Security Working Group of the Arctic Observing Summit  
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  
RNA CoObs: The Research Networking Activities in Support of Sustained Coordinated Observations of Arctic Change  
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>

References:

- European Commission (2020): Supporting the implementation of GEOSS in the Arctic in collaboration with Copernicus: [https://cordis.europa.eu/programme/id/H2020\\_LC-CLA-20-2020](https://cordis.europa.eu/programme/id/H2020_LC-CLA-20-2020)
- 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>
- The SAON Strategy 2018-2028:  
[https://arcticobserving.org/images/pdf/Strategy\\_and\\_Implementation/SAON\\_Strategy\\_2018-2028\\_version\\_16MAY2018.pdf](https://arcticobserving.org/images/pdf/Strategy_and_Implementation/SAON_Strategy_2018-2028_version_16MAY2018.pdf)
- 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>

## Appendix B: Comments to submission from GEO

### 1. *Comments to second (July) version*

*Revised IP Water Engagement Team Consensus Summary:*

This IP version has several notable improvements from the initial submission; more context is available and structure for the activity. The activity shows promise for future development within GEO. Existing areas to address:

1. Further focus and clarity for goals in the Arctic is needed and what is meant by 'Arctic GEOSS'. This is not a new concept and progress to solidify this effort has been slow; many guiding documents appear to be dated as well;
2. The EC support for this effort via Arctic PASSION is very positive, however, much of the IP reads like an Arctic PASSION proposal rather than a GEO effort that is connected to GEO's priorities and other activities. This will need to be addressed for the IP to be considered as an Initiative;
3. It is hard to tell if the proposed activities are planned or ongoing- this is important because GEO Initiatives should have (even if not fully developed) existing products under development or available;
4. Arctic GEOSS should also consider collaborating with other existing and proposed GEO activities focused on Cold/Polar regions to coordinate on goals and devise a coordinated approach within GEO.
5. Additional cohesion throughout the IP would also help with overall clarity. For example the new activity related to "Indigenous food security and food sovereignty in the Pacific Arctic sector" is not fully reflected in all parts of the IP.

At present, The Engagement Team recommends further revisions as noted above and for this activity to continue as a GEO Pilot Initiative. The decision to move to a GEO Initiative should be deferred for a year until the points noted above can be addressed. The Engagement Team sees potential for future growth and development of this activity, especially given the strong connections to Arctic policy drivers.

### 2. *Comments to first (April) version*

*Water Engagement Team Consensus Summary:*

The review team recognizes the importance of sustained and coordinated observing systems in the Arctic, and the present gap within GEO in Polar regions. Furthermore, we acknowledge the mature Arctic network that has been established through Arctic GEOSS and that this will strengthen further development of this activity within GEO. The proposed initiative brings a mature community of EO groups with a focus on Arctic research, applications, and data into GEO - filling a gap in GEO's current portfolio of regional activities. We encourage the Arctic GEOSS team to continue developing their IP, clarifying their objectives, governance structure, and connections to the broader GEO Work Programme. We also acknowledge the future potential of Arctic GEOSS to further develop at a quick pace and to leverage the existing policy mandate from the Arctic Council.

At this time, we recommend that Arctic GEOSS participates in the GEO Work Programme as a Pilot Initiative prior to reapplying for Initiative Status. This development can take place over the course of next year, at which point the PB can reconsider the status of Arctic GEOSS. It should be noted that Pilot Initiatives are a critical and essential part of the GEO Work Programme, and this status represents a stage in the development of each activity within the GEO Work Programme. The Water Team would like to offer these suggestions to the Arctic GEOSS team for consideration in the next version of their IP.

It is recommended that Arctic GEOSS better clarify and define their role with respect to the GEO Work Programme, GEO's priorities, and other GEO activities. The proposed IP is very broad, with objectives that need to be better connected to one another and to other GEO activities and goals. It is highly recommended that Arctic GEOSS considers how it can leverage and collaborate with other GEO activities that are focused on Cold/Polar regions, fire weather, and essential variables. The review team noted the proposed engagement with Indigenous groups in the Arctic, and encourages Arctic GEOSS to also engage with the GEO Indigenous Alliance in this process early on. It was not clear from the IP whether there is any

current collaboration with other GEO activities. In addition, further information on current users and stakeholders would be helpful, including how the proposed outputs will be utilized. Given recent discussions about the revaluation of GEOSS and challenges in defining “a System of Systems”, it recommended that Arctic GEOSS considers a clearer and more narrow definition of what is meant by a “System of Systems” for the Arctic that better defines its value proposition and how that can be executed. It may also be more appropriate to consider a new name for the Pilot Initiative. In addition, it would be helpful to have a clearer understanding of the data architecture that is being proposed, and an understanding of this will be integrated with GEO Knowledge Hub and other data platforms. Given an interest in Polar/Cold regions activities that were submitted for the 2023-2025 GWP, the Water ET would like to encourage the Arctic GEOSS team to see how they can engage in a cross-GEO initiative on these topics.