

WP23_25: GEO Cold Regions Initiative

1530,262

Basic Information

Full title of the Initiative

GEO Cold Regions Initiative

Short Title or Acronym

GEOCRI

Current category in the 2020-2022 GWP

New activity

Proposed category in the 2023-2025 GWP

Pilot Initiative

Points of Contact

First Name	Last/Family Name	Email
Yubao	Qiu	qiuyb@aircas.ac.cn
Massimo	Menenti	m.menenti@tudelft.nl

Purpose

Objective

Cryosphere Data Stream Services in Cold Regions through the Derived and Integrated Earth Observation Products - to facilitate the provision and standardization of satellite information products in the cryosphere-dominated cold regions to meet the needs of societies, including high elevation and high latitude cold regions.

Please provide a short description of the Initiative

Under a global warming scenario, the high elevation and high latitude cold regions, dominated by the cryosphere elements, are inherently fragile to the environment, where changes in the phase of water and the induced result to the environment affect billions of human lives there and the downstream area. Societal and economic development has been leading to a growing dependence on natural, ecosystem, and environmental resources. The warming reshaped the cryosphere and its embed regions, influencing the societal benefits of water availability in the downstream areas, transportation in opening Northern Sea Routes (NSR), the infrastructure and road stabilities in permafrost-rich areas, food and agriculture strategy by blooming ecosystem, climate and weather forecasting service, and challenges addressing and assessment to the sustainable development of cold regions. Timely and accurate information on the cryosphere elements, like snow, glaciers, permafrost, freshwater ice, sea ice, and even solid precipitation, is necessary to protect fragile ecosystems and the environment, facilitate sustainable exploitation of environmental resources, provide forcing data to hydrometeorological services, support the safe use of the land and ocean facilitates, and thus evaluate and

foster addressing the sustainable development goals.

GEOCRI brings together the efforts of different science and industry communities' activities currently and stakeholders in the world's cold regions. The core interest of the GEOCRI is to bring fruitful information, gathered continuously by the national and multi-national, growing infrastructures of diverse and complementary Earth observations, to users on a global scale. The contributors to the objectives of GEOCRI are currently operating observational and data infrastructures with high-performance data streaming processing capabilities with open data principles on an international platform. Likewise, data systems have been developed and are hosting rich data assets. We expect the initiative to generate continuous data streams on Essential Cold Regions Variables (ECRVs), and provide pilot services on the water availabilities in the cold mountain area, safety transportation for the land and northern sea routes, emerging cryosphere disaster mitigation, and assessment supporting the UN Sustainable Development Goals (UN SDGs), etc.

Why is this Initiative needed?

The world's cold regions, where the cryosphere and its changes characterize the Earth system and human activities, have been highly influenced by global warming in the last decades and will be ongoing to global carbon neutrality. Its importance and driven force were described in the Conclusion and Recommendations from GEO Cold Regions Side Event in GEO X Plenary and Geneva Ministerial Summit (GEO, Switzerland, 2014), it recalls,

- (1) More than one hundred countries around the world have cryospheric elements (various forms of frozen water). These elements are the main source of fresh water, which needs long-term monitoring and modeling, especially mass balance measurement.
- (2) Cold Regions are the most ecologically and environmentally sensitive areas, and changes to these areas comprehensively affect the dynamic Earth system, impacting many aspects of society in all parts of the world.
- (3) A global, comprehensive Cold Regions Information Service will strengthen synergies among the activities of the Environmental, Climate, and Cryospheric communities across poles and mountain Cold Regions. In particular, it will support the efforts of scientists, experts, and decision-makers to ensure the sustainability of these environmentally stressed areas in an increasingly complex political and economic context.
- (4) With its strong link to user communities, GEO is developing a user-driven approach to Cold Regions that will complement the current science-driven effort.

What evidence is there to support this need?

The changing snow and ice cultivate the local and regional climate and hydrometeorological conditions modulate the economy and societal activities. In the last decades, more and more evidence of fast-changing snow and ice interrupting the traditional ways of life and resource supplies, e.g. water availability in the low land downstream area of HMA, new challenges, and shipping activities in the Northern Arctic Sea Routes, emerging hydrometeorological and geological disaster awareness and emergency responses in HMA and Siberia cold regions, greenness in high latitude Arctic region, infrastructure and railway stability in permafrost dominated regions, and land degradation and erosion at the coast area caused by the sea ice development, and etc. The cold regions had their natural remote area, lack of the data calls for more shared and integrated EO data for addressing climate actions for the UN sustainable development Goals (UN SDGs).

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.

GEO Cold Regions Initiative (GEOCRI) was endorsed in 2016 and selected as a GEO initiative in the work program of 2017-2019, which was originally derived from the component of Water - "information services for cold regions" (WA-01-03). A rationale and consensus document has been formed at GEO X Plenary and Ministerial Summit in 2014, enhancing the UpToDate development of the information service to cold regions

by different communities of international bodies. Now, several GEO initiative activities are less or more with Cryosphere elements, like Water, Mountain, and Arctic initiatives in the GEO work program. While the gaps still lie in the selected variables with data stream supplies, some of the function especially is still underdeveloped for the service practices, the activities cannot address the diverse communities in all aspects. WMO has similar activities, like the global Cryosphere watch, while it is strongly on the in-situ, and modeling for science-driven applications. Vast diverse communities and application areas by GEO are not linked and addressed. The joint essential variables have been proposed in this program discussion meeting with WMO GCW and GEO GLOWS, it will give new monuments to complement each other. New development with Arctic GEOSS, GEO NOMES, and the newly setup initiative is under development.

How is this Initiative unique?

The GEO Cold Regions Initiative (GEO CRI) has a strong legacy of understanding cold regions' environment through space observations, which is both relevant to GEO itself and accepted by users (requirement evidence on the sentinel satellite, see more about the document section of gerocri.org).

(1) The Initiative will be providing high-quality information services based on high spatial and temporal resolution products to stakeholders, relying on the fast development of the space-based data, not only for the science-driven requirement forcing data but also for societal and economic applications.

(2) The Initiative is made up of very diverse groups with experience and background covering cold regions around the globe, data providers, users, and stakeholders, its data and information stream can provide the unique standard for the global pilot service example.

(3) The Initiative has been endorsed by YOPP in 2015, and is in the process of gaining endorsements by the ISC bodies of science and GEO participant bodies, private companies of COSCO, international science programs, like the Digital Belt and Road program (DBAR), Third Pole Environment program (TPE), international research organizations, e.g., International Research Center of Big Data for Sustainable Development Goals (CBAS), and NGOs, e.g., International Polar Protection Association (IPPA).

(4) The Initiative is about the cryosphere-dominated cold regions world widely, with a different focus than mountain areas and the Arctic regions with observational networks, creating and maintaining information services based on the synergy of in-situ and space-borne data, rather than the primary data collected by operational satellites. The complementary function will be developed with the GEO program, Arctic GEOSS, GEONOME, and other international bodies.

Additional information about the information value to the different communities can be found at www.geocri.org.

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
Snow Cover (FSC and SCA)	Regularly updated	ICIMOD, Pakistan, and other countries	Algorithm has been developed, and regularly updated. Users in the water management, agriculture, and energy area by ICIMOD, countries like Pakistan, Central Asia (CA), and others
Snow Water Equivalent (SWE)	Regularly updated	Water Management, Agriculture, and energy (ICIMOD, Pakistan)	Algorithm has been developed, and regularly updated. Users in the water management, agriculture, and energy area by ICIMOD, countries like Pakistan, Central Asia (CA), and

			others
Lake ice	Regularly updated	Transportation and fishery	Algorithm has been developed, and regularly updated. Users in the area of transportation and fishery, and Climate Actions for SDGs (SDG13).
River ice	Regularly updated	Transportation	Algorithm has been developed, and regularly updated. Users in the area of transportation and fishery, and Climate Actions for SDGs (SDG13).
Sea Ice	Regularly updated	Transportation and climate actions	Algorithm has been developed, and regularly updated. Users in the area of transportation and fishery, and Climate Actions for SDGs (SDG13).
Permafrost	Occasionally updated	Transportation and infrastructure	Algorithm has been developed, and occasionally updated. Users in the area of transportation and infrastructure stabilities in cold region areas, and SDG addressing (SDG11, and SDG13)
Frost	In development	Transportation and energy risk management	Users in the area of transportation and emergence reactions in the winter time.
GLOF	Occasionally updated	Disaster, climate actions	Available but not updated periodically. User in the disaster mitigation and reactions.
Ice Jam Warning	In development	Disaster	User in the transportation and disaster mitigation and reactions
Snow Avalanche Warning	In development	Disaster/ Transportation	User in the transportation and disaster mitigation and reactions
Glacier Surface Flow Velocity	Available but not updated	SDG13, climate actions	Available but not updated periodically User in the disaster mitigation and climate actions (SDG13).
Glacier Thickness Change	Available but not updated	SDG13, climate actions, Water Availability	Available but not updated periodically. User in the

			water management, climate actions (SDG13).
Glacier Extent	Available but not updated	SDG13, climate actions, Water Availability	Available but not updated periodically. User in the water management, climate actions (SDG13).
Glacier Surge Warning and adaption	Available but not updated	Disaster, SDG13	Available but not updated periodically. User in the disaster management, and climate actions (SDG13).
Ice Chart	Available but not updated	Disaster/ Transportation	Available but not updated periodically. Users in transportation of the arctic shipping, and shipping companies, and etc.,
Snow Melt-related Flooding	In development	Disaster/ Transportation	Users in disaster and transportation, and climate actions (SDG13)
Rain-on-snow (ROS)	Planned	climate actions, SDG13	User in climate actions (SDG13)
Ice lens formation	Planned	climate actions, SDG13	User in climate actions (SDG13)
Permafrost degradation and subsidence	Planned	climate actions, SDG13	User in climate actions (SDG13)
Iceberg tracking Calving from the marine-terminated glacier (related MICI, MISI)	In development	Water management, climate change	Users in water management, climate actions (SDG13)
Derived phenology in snow and ice area	In development	transportation, energy, climate actions	Users in the area of transportation, energy, climate actions

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

For most of these data products and streams, initial data sets have been generated for 2000 – 2022 for the Polar regions and High Mountain Asia (see Table “output” part), from the early time of 2018, several projects have been started. As regards the remaining data sets, algorithms are available and evaluated. The initiative is expected to promote the additional effort of maintaining and updating such data streams and demonstrating the services at regional to global scales.

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

Providing the assessment report on the climate actions for the SDGs (SDG13.1 and 13.3); Providing the snow, GLOF, ice mapping, and chart, etc., for the water availability, downstream ecosystem impact analysis, emerging risk management, even on a daily basis, and transportation on land and Northern Sea Route, such as water availability, and its analysis, shipping advisory, and disaster risk assessment; Providing the released as standard data products for at an open science basis, that others communities or stakeholder can be accessed and referenced. Capacity building to the stakeholders jointly with the users’ communities.

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

The customs, authorization, or stakeholders (users) can access high-quality data products from the website with openly and freely, data analysis toolkits and reports are available for the assessment or information services.

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?

Reduced loss of life and properties; energy potentially providing and assessment; Risk mitigation; Climate actions for snow and ice changes in cold regions for addressing the UN SDGs (SDG6 and SDG13).

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.

Civil disaster reduction service for the springtime frost mapping; Olympic activities support by snow mapping; Snow disaster mitigation and awareness; Shipping company or polar expedition in the Arctic Sea ice-rich time; scientist and operational unit from university or research unit;

Describe the nature of the request.

information service for the emergency actions, data input for the research, and decision making. An example is Remote Sensing Facilitates Snow and Ice Occurrences Management in China (see: https://english.cas.cn/newsroom/research_news/earth/202203/t20220316_302375.shtml)

Please provide supporting documentation of the request.

- no supporting documents provided -

Technical Synopsis

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

In the past years, massive Earth observation products have been produced in international and national projects, with a focus on the synergy of in-situ and space-borne data normally. This development accelerates access to large data streams freely. This makes the information service for the cold regions feasible, even operationally to some extent. The recently created databases about the cold regions and the open access to standard data products provide both the tools and historical data required for the full fruition of information services and the consolidation of the data value chain.

The data products and information produced by advanced algorithms running on the high-performance computer system have been built for more than 5 years, for example, the setup of the International Research Center of Big Data for Sustainable Development Goals (CBAS), which is affiliated by three engineering division on the data, and information producing functions. Another good tool is the online computing capacity formed by Google Earth Engine (GEE), by which several data products have been produced. Other methods and data sources are (1) multi-resources data stream by the combination of public and private data, employing the open resource Earth observations data, like Landsat, Gaofen series, Sentinel, AMSR and MODIS, Fengyun series, and SDGSAT-1, and tools are online processing by GEE and self-developed algorithms. (2) Tools and open knowledge of the data processing tools. The method includes the physical retrieval algorithm, standard data post-processing to make the data operational and updated periodically, including snow cover, e.g., NDSI and post-process for cloud-free datasets tools, Sea Ice Concentration by ASI, NT algorithm, Sea Ice Melting ponds by MODIS algorithm (physical model), lake and river ice coverage and phenology by threshold method automatically, and etc,

As for the developed and in-development method, the continuous data stream will be operated by dedicated units that link with GEOCRI contributors, while for the planned data products, this will be continually developed by the existing projects (see below on the resource), while new group work needs to be initiated to engage new player through the open policy on the data products. At this stage, the metadata of an online database about the global cold regions has been set up, see <http://115.29.142.79/group/inventory-of-database-for-earth-three-poles>, the published dataset (high-level products) and open policies are the main challenges for the service, which will be discussed and developed by this initiative.

Open science is leading the way forward to create data services consistent with the new stage of the development of the EOs market, this development deserves high priority in cold regions, where data are sparse and difficult to obtain by local communities. Space-based products effectively bridge multiple information gaps.

The United Nations push the digital commons to promote the digital benefits of climate actions addressing sustainable development goals. The digital services are at the end of the data stream into sustainable practices, with traditional agencies calling for the data to be applicable and cost-free, for instance, monitoring shipping lanes to adapt to new challenges. Both the emerging policy mandate and the needs of private actors call for the provision of information services to the cold regions.

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.

The challenges are mainly about the data services pattern or mechanism, demonstration of service criteria, and standard of products when the users' communities have not been fully developed. While it is not the technique questions, the initiative will organize the task force or meeting to produce the standard, and technique (openly) for the world stakeholder, or even from the private sectors.

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.

Build new products with the systematic methods of a data-driven regime, i.e, when new satellite data or new in-situ data input are available, a combination of EO, modeling, and AI techniques is adopted into the data stream for the services. Besides providing the new products, and standards for the services, the sets of methods of evaluation of impacts need to be considered in the new phase of development of 2023-2025.

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)
Fundamental Task1: Essential Cold Regions Variables (ECRVs)	Essential variable for service practices, SDGs reporting, societal and economic, like disaster, and shipping, which need to be work with other communities, like WMO GCW, Arctic GEOSS, to building the international group.	6/2025
Fundamental Task2: Collections of Repository and Data Policy	Development about the connections of the database and repositories, the aim is to make the data open operationally for the services, to be working with Arctic GEOSS (SAON), DBAR-HiMAC, and TPE members.	6/2024
Fundamental Task3: Data criteria for service practices	intercomparison of the data criteria for different variables, need to work with the users communities, or research unit and scientists.	6/2024
Pilot Service Practice 1: Interaction on addressing the SDGs in cold regions by big data	Assessment of the big data for supporting the SDG13 (13.1, 13.2, 13.3) and its SDG interactions, this work needs to be led by the HiMAC group under DBAR and its facilitated unit, CBAS. The reporting area includes the vast cold area of Eurasia (observed environment sharpening changes) and Northern American or HMA regions.	6/2025
Pilot Service Practice 2: information service for shipping advisory in sea ice-rich areas	Providing the shipping advisory information by integrated activities with the data stream from different data sources, GFS, SIC, SIT, SID, Fog, wind and precipitation and etc., from different data sources.	6/2025
Pilot Service Practice 3: Water resource management in cold regions	Assess the water availability and variability in the low land area of the typical cold regions, like HMA, and other cold area, users can be ICIMOD, Pakistan, and other relevant bodies.	6/2025
Pilot Service Practice 4: Service to the emergency disaster mitigation and awareness in cold regions	Emergency actions, and information service on the flooding, arid and geology disaster services, or risk analysis for the coming warming years in cold regions.	6/2025

Resources

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

- Gap in financial resources
- Gap in human resources

What is the estimated funding gap for the 2023-2025 period?

The seed money for the workshops and meetings has been identified for online or light face-to-face meetings, while for the operational services, and development (demonstration systems are at processing by other supports), while the resource mobilization is still needed at the development phase of the initiative.

What are the essential skill sets needed by the Initiative but are not currently resourced?

Gaps exist in the system development resource, and human resources specifically in the cold region snow and ice monitoring.

What actions is the Initiative taking to obtain the required resources?

Align with the existing organization and combine with the resource projects asking for more collaborations and enhancement of each other; try to engage the private sectors.

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
Aerospace Information Research Institute, Chinese Academy of Science (AIR-CAS)	China	Financial	Data, service models, and experience for shipping in Arctic Lane environment assessment	5,870,000RMB
International Research Center of Big Data for Sustainable Development Goals (CBAS)	China	Financial	Data, and method for the massive data processing on the river, lake and sea ice: sea ice melting ponds, lake ice phenology, river ice fraction, and melting ponds	10?000,000RMB
Institute for Atmospheric and Earth System Research (INAR), Finland	Finland	Data	Data Center and projects (like: iCUP)	
National Institute of Polar Research, Japan	Japan	Data	Data Center	
National Environmental Satellite, Data, and Information Service (NESDIS), National Oceanic and Atmospheric Administration (NOAA)	United States	Data	Data Center	
CCIN/PDC	Canada	Data	Data Center	
NEXTGEOSS	European Commission	Data	Data Hub	
DBAR-HiMAC	China	Data	HiMAC Working Group and its data hub	
Polar Research Institute of China	China	Data	Polar Data Center	
International Polar Protection Association	Norway	Other	Users engagement	
Third Pole Program	China	Data	Data	
Northwest Institute of Eco-Environment and Resources	China	Financial	Observation, modelling, and synthesis reports on	7,210,000RMB

-CAS			the Arctic cryosphere and vegetation	
China Aero Geophysical Survey and Remote Sensing Center for Natural Resources (AGRS)	China	Financial	Data and tools for the climate changes, water, and disaster mitigation in HMA and Arctic regions	3,990,000RMB
International Research Center of Big Data for Sustainable Development Goals (CBAS)	China	Data	CASEarth Program data center	
Institute of Remote Sensing and Digital Earth, CAS	China	Data	EO Data Center	
Northwest Institute of Eco-Environment and Resources -CAS	China	Data	Cryospheric Data Center	
CAS Research Center for Ecology and Environment in Central Asia	China	Data	Data and projects	
Nansen Environmental and Remote Sensing Center	Norway	Data	Data	
German Aerospace Center (DLR)	Germany	Data	earth observation center (Polar and cold Regions)	

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.

The coordination and continuing support for this work without strong endorsement led to potential risks of failure for the program, this does not much influence the period of 2023-2025.

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

Yes

Please describe.

Lack of labor hours for coordination, and also fewer meetings regularly, multi-partners from different countries

were the biggest challenges, because of the Covid-19 breakout.

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

Yes

Please describe.

Fewer meetings and no trips get the thing worse.

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.

Covid-19 complicates the organization of the on-site meeting and the engagement of new stakeholders, while online tools and data exchange would be much better than nothing happening; online websites are a good way for the organization to exercise the data, so we started the www.geocri.org as a place for this initiative.

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).

[HTTP://115.29.142.79/](http://115.29.142.79/) this is a website for that, and CCIN/PDC, NEXTGEOSS, CASEarth and other repositories have been doing more.

Please provide supporting documentation if available.

- no supporting documents provided -

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.

Shipping way advisory for private cruises the Arctic Sea, and frost and snow service for south China, like: https://english.cas.cn/newsroom/research_news/earth/202203/t20220316_302375.shtml

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.

- ARCTIC-GEOSS - Arctic GEOSS
- AOGEO - Asia-Oceania Group on Earth Observations
- GEOGLOWS - GEO Global Water Sustainability
- GEOARC - Global Ecosystems and Environment Observation Analysis Research Cooperation
- NEXT-EOS - Next Generation Earth Observation Services

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

- GEO-EV - GEO Essential Variables
- GEO-WETLANDS - GEO Wetlands
- GEO-MOUNTAINS - Global Network for Observations and Information in Mountain Environments

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.

WMO (we already have a meeting in July for exchanging the development), Pakistan, ICIMOD, and CIS are possible.

What are your plans to engage them?

Remote meeting and get the data tag and open sharing.

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.

Have fewer meetings with stakeholders, and develop the potential user's engagement.

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

Yes

Please upload it.

- no supporting documents provided -

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.

Climate actions body, private sectors on data processing, and shipping company.

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

Users and stakeholder meeting.

Does the Initiative have a documented capacity development strategy?

No

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

Did not plan at this moment, but while will make connections with existing summer school and other activities

Are there any commercial sector organizations participating in this Initiative?

No

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

Yes

Please describe these opportunities.

Yes, commercial companies are welcome to have a development co-design and co-produce.

Is there already commercial uptake occurring?

Yes

Please describe the nature of this uptake and the relevant commercial sector organizations.

The private sector can provide the resource, while needs to consider helping the resource mobilization, while this needs some stratagem plan on the private development.

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

Yes

Please describe these opportunities.

Need to have some exchange of this initiative. The stakeholder, such as the shipping and energy company and data providing company are welcome for that.

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.

Dr. Yubao Qiu is the main editor, Dr. Massimo Menenti is the co-editor, and discussion mainly with the co-lead group. Dr. Yubao Qiu operates as the day-to-day management of this initiative and will try to have in-kind post-doctor or high-level Ph.D. students for helping with the day-to-day management of this 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).

The program will start to set up an Advisory Committee. Co-lead Team (PoC) is the Steering Committee (Coordinator) for GEOCRI, for providing the advisory functions, and lead the tasks, or providing resources to this initiative.

- no supporting documents provided -

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

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

Please describe.

Email communication/e-newsletters: regularly co-lead calls.

Regular conference calls: co-organize the meeting.

Website: www.geocri.org

Regular events: Planning:

Others: Twitter (https://twitter.com/geo_coldregions) LinkedIn account

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
Human Resource shortage	labor hours need to be secured.	Moderate	Possible	
engagement stratage	engagement with other communitis	Limited	Not very likely	

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

- Informal discussions with users / beneficiaries
- User or beneficiary surveys
- Website statistics
- Consultations or events
- Evaluations

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

Yes

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

- no answer given -

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

No

Participants

Please list the active individual participants in the Initiative

First name	Last name	Email address	Member	Org
Xiao	Cheng	chengxiao9@mail.s ysu.edu.cn	China	
Hiroyuki	Enomoto	enomoto.hiroyuki@ nipr.ac.jp	Japan	
Jeff	Key	jeff.key@noaa.gov	United States	NOAA - National Oceanic and Atmospheric Administration
Hanna	Lappalainen	hanna.k.lappalainen @helsinki.fi		
Ellsworth	LeDrew	ells@uwaterloo.ca	Canada	
Xin	Li	xinli@itpcas.ac.cn		CAS - Chinese Academy of Science
Massimo	Menenti	m.menenti@tudelft. nl	Italy	TU Delft - Delft University of Technology
Yubao	QIU	qiuyb@aircas.ac.cn	China	CAS - Chinese Academy of Science
Stein	Sandven	stein.sandven@ner sc.no		- Nansen Environmental Research Centre
Vito	Vitale	v.vitale@isac.cnr.it	Italy	JRC - Joint Research Center
Andreas	Dietz	andreas.dietz@dlr.d e		DLR - German Aerospace Center
Jiancheng	Shi	shijc@radi.ac.cn		CAS - Chinese Academy of Science
Daqing	Yang	yangdaqing@itpcas .ac.cn		CAS - Chinese Academy of Science
Bente Lilja	Bye	bentelil@hotmail.co m	Norway	- BLB
Peter	Pulsifer	ppulsifer@gcrc.carl eton.ca	Canada	- University of Calgary
Tonghua	Wu	thuawu@lzb.ac.cn	China	CAS - Chinese Academy of Science
Lanhai	Li	lilh@ms.xjb.ac.cn	China	CAS - Chinese Academy of Science

Chen	Ding	dingchen@starcrui e.cn	China	
Douglas	Cripe	dcripe@geosec.org	Switzerland	
Lizong	Wu	wulizong@pric.org. cn	China	
Fengming	Hui	huifm@mail.sysu.e du.cn	China	
Shiyong	Liu	shiyin.liu@ynu.edu. cn	China	

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.

All the information is on the official website of GEOCRI: www.geocri.org.

- no supporting documents provided -

Co-Editor Management

List of co-editors for this initiative

First name	Last name	Email address
Massimo	Menenti	m.menenti@tudelft.nl