

GEO Work Programme 2017-2019 Application

GEO Cold Region Initiative (GEOCRI)

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Executive Summary

The “Cold Regions”, that include the Arctic, Antarctic, high-latitude oceans, Himalaya-Third Pole and Mountain cold areas, are experiencing the fastest rate of climate, ecological and environmental change. With its abundant Earth water and relevant phase changing, the cold regions severely affect the dynamic earth’s systems, impact more than one hundred countries of billions of people living therein, and influence many aspects of society in all parts of the world. Recent scientific research is making it increasingly clear that “What happens in the poles doesn’t stay in the poles”.

Aiming to share the vision of the intergovernmental Group on Earth Observations (GEO) to address the global environmental change, and its resulting impacts and challenges on all aspects of society, an Information Service for Cold Regions was established to broaden and share Earth observations for societal benefits, and inform the decision makers, through strengthening coordination with diverse communities, engagement and collaboration of stakeholders including decision makers and etc..

Building on these accomplishments during the first phase of Information Service for Cold Regions at the first 10-year implementation of GEOSS, the GEO Cold Regions Initiative (GEOCRI) was proposed and accepted by GEO XII plenary in November, 2015, which is also a Year of Polar Prediction (YOPP) endorsed activity, and its vision is to provide coordinated Earth observations and information services across a range of stakeholders to facilitate well-informed decisions and support the sustainable development of the Cold Regions globally.

The GEOCRI mission is to develop a user-driven approach for Cold Regions information services to complement the mainly current science-driven effort, which will strengthen synergies between the environmental, climate, and cryosphere research efforts and foster the collaboration for improved earth observations and information on a global scale.

The GEOCRI community consists of a team of Task leads, contributors and observers. Contributors can join theme-specific Task Teams to work on specific activities according to their interests. The co-lead team works together on user engagement and general coordination and reporting of the GEOCRI activities. In addition, an institution, foundation or interested group can join GEOCRI as an Observer, which means that they will be updated about the progress and activities, without not directly taking part in the activities. The GEOCRI will be managed through the scientific committee.

Plan with time, approaches, milestones, and deliverables and task teams, the activities conducted in GEOCRI are grouped into six tasks: Infrastructures, Monitoring Network and Data, In-situ and Remote Sensing Integration, User Engagement and Communication, Capacity Building and Knowledge Transfer and Management and Monitoring. Each Task consists of activities with set milestones and deliverables during the Work Program 2017-2019. The range of deliverables varies from activity reports to stakeholder and user mapping to training and capacity building events and webinars. Majority of the milestones and deliverables of the 2017-2019 implementation plan are set to the two first years of the programme period in order to add new milestones and deliverables, geared towards the transition from implementation to operational stage starting in 2019 and during the next work programme period 2020 onwards.

The implementation of GEOCRI mainly rely on the in-kind contributions, and aims at leveraging the resources of participating initiatives and organizations to align with GEOCRI’s objectives.

1 SYNOPSIS OF OBJECTIVES AND BENEFITS

Recognizing that Earth Cold Regions, include the Arctic, Antarctic, high-latitude oceans, Himalaya-Third Pole and Mountain cold areas, are the most ecologically and environmentally sensitive areas to global and regional climatic and environmental change, which are relevant to GEO eight societal benefit areas, and more than one hundred countries are directly related to or lived in the Earth cold regions. The regime - “What happens in the Poles doesn’t stay in the Poles” – makes the cold region impacts spread across the whole earth planet.

A global, sustained, comprehensive Cold Region Information Service will strengthen synergies among the activities of the Environmental, Climate, and Cryospheric communities and foster the collaboration between the Arctic, Antarctic, high-latitude oceans, Himalaya-Third Pole and Mountain cold region research and operational communities. 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, and to bridge a gap between research, operational communities and decision makers.

The GEO Cold Region Initiative (GEOCRI) was initiated at GEO XII Plenary in Nov., which is also a YOPP-endorsed initiative from Dec., 2015. GEOCRI aims to coordinate global, joint efforts to provide Earth observations and information services to decision-makers over the vast cold regions by improving networks, enhancing the synergy, building practices and capacities, and addressing the scientific and societal challenges. Its goal is to “Promote Earth observations data sharing and cooperation, enabling improved information services for the inter-continent cold regions, facilitate provision of information to various stakeholder, including decision makers, private sectors”.

1.1 List of objectives and planned way of attaining them

With its strong link to user communities, GEOCRI is developing a user-driven approach for Cold Regions that will complement the current science-driven effort, and extent to the benefits of the societal benefit area through information services. The main objectives are listed below,

- Integrating, Brokering and Promoting Earth Observations over Earth Cold Regions;
- Advocating and Practicing Data Sharing;
- Building Community Portal and Services;
- Strengthening Capacity building and Partnerships.

Achieving GEOCRI goals and objectives will require constructive and transformative collaboration. Effective network and community development will be critical to the success of GEOCRI. Cooperatively establishing this cooperative model has started and will continue as GEOCRI grows.

The objective will be met through the coordinated Implementation Plan for task teams organizing, process evaluating and deliverables releasing. The activities conducted in GEOCRI are grouped into six tasks: Infrastructures, Monitoring Network and Data, In-situ and Remote Sensing Integration, User Engagement and Communication, Capacity Building and Knowledge Transfer and Management and Monitoring.

1.2 Expected outcomes, impacts and user/societal benefits

Cold regions are an intrinsically interconnected component of the Earth system, which induces global societal impact, while the environmental and human issues facing cold regions are issues for the whole planet. Through the GEOCRI, the expected outcomes, impacts and user/societal benefits are,

- Improve discoverability, accessibility and usability of cold regions Earth observation data and information by advocating broad open data policies and strengthened capacity building;

- Support existing observation networks and systems in cold regions, sharing expertise and knowledge, as well as integrating observation products into GEOSS via the GEOSS Common Infrastructure (GCI);
- Contribute to identify the gaps for observations and data/information services over cold regions;
- Facilitate full integration and interoperability of in situ and remotely sensed Earth observations in cold regions across all environmental, ecological and human domains;
- Increase the ability of all users and potential users to benefit from cold region Earth observations, including policy makers, researchers, local communities and industry, through ongoing capacity building;
- Strengthen partnerships between cold region Earth observation providers, users, funders and other stakeholders to increase efficiencies and ensure needs and requirements are effectively met.

1.3 Relevance to GEO's strategic objectives

Through GEOCRI, links can be developed among observation, research, and policy actors, creating synergies which contribute effectively and efficiently to GEO strategy, GEO's eight societal benefit areas (SBAs) as well as the UN's 2030 Agenda for Sustainable Development. GEOCRI is officially an initiative within the Water Resources Management SBA, its relevance is cross-cutting: issues in cold regions are entrenched in all domains represented by the SBAs.

- Effectively monitor biodiversity and ecosystems in cold regions and support the biodiversity and ecosystem sustainability;
- Help with all aspects of disaster management (mitigation, preparedness, warning, response and recovery) and build disaster resilience for vulnerable regions and populations;
- Inform better use of energy and mineral resources in cold regions to improve sustainability and reduce negative impacts;
- Collaborate closely with GEOGLAM to make progress and sustainably increase new opportunities established to improve food security for cold region populations;
- Address issues associated with cold regions, including infrastructure and transportation issues related to extreme temperature, permafrost and slope instability, and others;
- Help monitor environmental pollution and health risks, substantially reducing the number of fatalities and illnesses in cold regions;
- Inform urban development decisions and monitor the impacts of urban areas throughout cold regions;
- Adds further importance to effective water resources management in cold regions, which can only be achieved with appropriate Earth observations.

GEOCRI will support the 2030 Agenda for Sustainable Development, the Paris Agreement and Sendai Framework for Disaster Risk Reduction 2015-2030 to ensure effective tracking and monitoring of progress for the relevant indicators and others.

2 RELATIONSHIP TO PREVIOUS DEVELOPMENTS AND RESULTS

The GEO Cold Regions Initiative build on the successful and continuing coordination of the third component under Water SBA: Information Service for Cold Regions (WA-01-C3), which is from the legacy of GEO work program development from 2009 to 2015. WA-01-C3 has been strongly

developed for consulting and building partnership, including the activities that are for and from, WMO EC-PHORS, WMO GCW, WMO PSTG, annual GEO Work Program symposium, Arctic Observation Summit 2014 and 2016, Arctic Circle 2014 and 2015, INTERACT snow meeting, PEEEX, Eye on Eye of UNEP, and etc. The cold regions was also represented on board the SAON meetings. Several communicates, and statement have been issued and released at past phases of GEO work plan, the detailed information are,

2.1 New activity or an extension/follow-up to a previous activity

After the intensive development phase at GEO Work program (2012-2015), the group of “Information for cold regions” proposed its “global initiative” status (No. GI-11) in the GEO Work Program (2016-2025) that is a connection following up to the previous developments. The main points are,

- 1) Reconfirmation of the contributors and contribution with resource (2016~) (See section 10);
- 2) Setup up the updated lead group (10 leads, including the Point of Contact), with a good geographical distribution, and the group are still growing to have more member to continue the workload;
- 3) Starting draft the Implementation Plan of GEOCRI (IP document);
- 4) The GEOCRI group members had a side meeting in Geneva at the Work Plan Symposium 2016, and the user requirement for GEOCRI was presented at the Water side meeting;
- 5) Presented the Statement for GROCRI as the Arctic Observations Summit 2016 in Alaska, and several gatherings has been conducted in the AOS2016, and the 2nd PEEEX science meeting.

2.2 Status and outcomes of previous activity (if applicable)

At the GEOSS Work Plan, the GEO Cold Regions (WA-01-C3) were developed aiming to the gather the contributors and force on the community building, main activities are mainly include: 1) Conclusion and annual report in the past years of GEO Work Program. 2) Conclusion and Recommendations for GEO Cold Regions, from the high level side event for GEO Cold Regions.

2.3 Relationship between the new and existing activity (objectives, teams, added value to ongoing activities within and outside of GEO)

The GEOCRI’s objectives and teams totally inherit the former merit and activities from “WA-01-C3: information for cold regions”. The Point of Contact for this new proposal is the former secretary expert who worked in the GEO Secretariat, and the whole co-lead and contributor group remain most of the former members, and recently recruited and engaged new members and activities and contributors.

The GEOCRI co-lead group and contributors is now continuing the activities and conferences within and outside GEO, while providing an intensive and explicit added-value on the GEOCRI’s information service nature, user’s engagement, task definition for fostering implementation, resource mobilization, and institutional organization mechanism, and etc.

3 PARTICIPANTS AND CONTRIBUTORS

3.1 Organizations, institutions, government agencies, private sector

Currently, GEOCRI Partners are mostly organizations, institutions, government agencies from the GEO members and Participant Organizations. There are showed in the Table 1.

Table 1: Organizations, institutions in GEOCRI

Members and POs	Organizations, institutions, government agencies and Private Sectors	Programs and Activities
Canada	AAFC	AAFC
	University of Alberta	
	University of Waterloo	PDC etc.
China	Institute of Remote Sensing and Digital Earth(RADI), CAS;	DBAR; SOTP;
	China Metrological Administrator (CMA)	
	Beijing Normal University	
	Cold and Arid Regions Environmental and Engineering Research Institute (CAREERI), CAS	CARD
	Institute of Tibetan Plateau Research (ITP), CAS	TPE
	Tibet Meteorological Bureau	
Denmark	Denish Metrological Institute (DMI)	
Finland	University of Oulu	INTERACT
	University of Helsinki	PEEX
	University of Helsinki, Finnish Meteorological Institute	PEEX
Germany	Alfred-Wegener-Institut (AWI)	
	Deutsches Zentrum für Luft- und Raumfahrt (DLR)	
	University of Bonn	
Iceland	Conservation of Arctic Flora and Fauna (CAFF)	CAFF
India	ISRO-SAC	ISRO-SAC
Italy	Institute of Atmospheric Pollution Research (CNR-IIA)	
	Institute of Atmospheric Science and Climate (ISAC-CNR)	CNR IADC
	Institute for Electromagnetic Sensing of Environment (IREA-CNR)	
	National Research Council of Italy (CNR)	
Japan	National Institute of Polar Research (NIPR), Arctic Environment Research Center (AERC)	
	Japan Marine Science and Technology Center (JAMSTEC)	
Netherland	Delft University of Technology	Dragon Program
	University of Twente	
Norway	Nansen Environmental and Remote Sensing Center (NERSC)	
	Norway Space Centre (NSC)	SIOS
	Norwegian Computing Centre	
	Norwegian Meteorological Institute (MET Norway)	
Spain	Institute of Sea Science	CSIC
USA	Lamont-Doherty Earth Observatory	
	National Snow and Ice Data Center; University of Colorado at Boulder	SAON DCON
	NOAA/NESDIS	GCW etc.
United Kingdom	The University of Edinburgh	
ISDE	International Society of Digital Earth (ISDE)	DBAR

ICIMOD	International Centre for Integrated Mountain Development(ICIMOD)	
WMO	World Meteorological Organization (WMO)	WCRP, GCW, WWRP YOPP
<i>To be added.</i>		

3.2 Their roles in/contributions to the project

The organizations, institutions, government agencies and private sector are the tangible and representative unit for implementation the GEOCRI’s mission with the common understanding of its nature of information services to the end. The members of leads and contributors will liaise to their own and represented agencies and programs, and act as the sub-task contributors and leads under the designed tasks.

The Point of Contact and leads formed lead group for GEOCRI this stage, who are the main and active members to foster this initiative, and play key role in its coordination and implementation stage. The contributor are mainly those who could representation the national, regional or international program and projects, and provide contribution to the GEOCRI implementation directly. While, the observers are those who are kept informing, and providing guidance, resource and funder agency, such as governmental bodies, national and private foundation, and etc.

GEOCRI’s contribution unit and its group members will also liaise and work in collaboration with other GEO initiatives, including GEOBON, GFOI, GECO, GEOGLOWS, GEO-GNOME, GSNL, Global Wildfire Information System, GEO-DARMA and GEOGLAM, and regional GEOSS, like AmeriGEOSS, EuroGEOSS, etc.

4 DESCRIPTION OF ACTIVITIES

4.1 Tasks definition, overall logic and phasing

The activities conducted in GEOCRI are grouped into six thematically overarching Tasks: 1) Infrastructures, 2) Monitoring Network and Data, 3) In-situ and Remote Sensing Integration, 4) User Engagement and Communication, 5) Capacity Building and Knowledge Transfer, and 6) Management and Monitoring. The tasks –coordinated by Task Teams- and related activities are the fundamental elements for liaising, coordination, implementation and reporting. All contributors can suggest activities. Contributors can assign themselves to work for different tasks and related activities; these will form Task Teams. Task Teams will decide on the planning and responsibilities of their activities, and the set milestones and deliverables will be reported to the co-leads and presented to contributors who will provide feedback. Activities are prioritized by the co-leads group, or later by the science/advisory group once established in 2017. The hierarchy structure of the tasks and activities showed in the figure below.

Each task consists of activities with set milestones and deliverables during the Work Program 2017-2019. These are presented in the Gantt chart in section 6. The range of deliverables varies from activity reports to stakeholder and user mapping to training and capacity building events and webinars. Majority of the milestones and deliverables in the Implementation Plan for 2017-2019 are set on the two first years of the programme period in order to later add new milestones and deliverables, geared towards transition to implementation and operational stage starting in 2019 and during the next work programme period 2020 onwards.

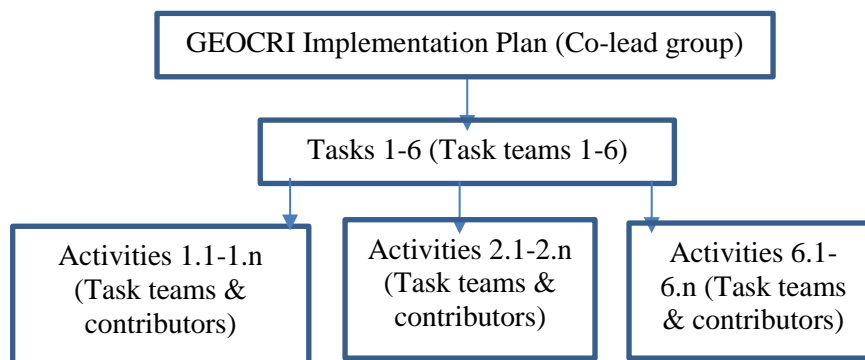


Fig 1. Hierarchy structure of the activities organized by GEOCRI

Capacity building and training activities include events to educate new generation of scientists to work on Cold Region related questions, which can be done especially with a focus on supporting young scientists from developing regions of the High Mountain and Arctic areas, including indigenous youth. Capacity building and training activities will be planned and conducted in collaboration with relevant key actors in the field (e.g. University of the Arctic network and APECS, PEEEX, TPE, DBAR etc). Another focus in the field of training and capacity building will be in providing technical advice and facilitating institutions hosting cold regions data to register their datasets to GCI and/or GEOSS Data-Core.

4.2 Tasks description

Below are the descriptions of the tasks, and related activities and task teams during 2017-2019. The specific timelines, milestones and deliverables for each activity are provided in Gantt chart in section 6.

Task 1. Infrastructures (Task Team: Hannele Savela, Jeff Key, Vito Vitale, Angelo Viola, Stefano Nativi, Tuukka Petäjä)

A1.1 Create dialogue between infrastructure networks for collaboration and more efficient use of infrastructures. **M1.1a:** Cold regions related infrastructure networks and projects invited to GEOCRI (III2017), **M1.1b:** Meeting arranged to facilitate collaboration (III2018), **D1.1:** Minutes of the meeting (IV2018)

A1.2 Advocate and support incorporation of different research infrastructure catalogues on cold regions (e.g. INTERACT, Eu-PolarNet, UArctic). **M1.2a:** Cold regions related infrastructure catalogue hosts contacted (III2017) **M1.2b:** Training/webinar for technical support (III2018) **D1.2:** Summary of the development (XII2019)

A1.3 Interoperability of GEOCRI with the GCI (resources registration and brokering, Community portal development, etc.). **D1.3** (XII2019)

A1.4 Promote a dialogue to realize connection along longitudinal/latitudinal transect on specific items (e.g. tall towers for ABL, flux measurements). **M1.4** (VI2019)

A1.5 Consolidating operational users' needs and information gaps to support development of future Arctic infrastructure (e.g. ESA Polaris and EU PolarNet). **M1.5:** Analysis of existing and ongoing consultations on user needs and information gaps (III2018). **D1.5:** Summary of the identified needs and gaps and action plan of the support process (III2019)

Task 2. Monitoring Network and Data (Task Team: Jeff Key, Yubao Qiu, Julie Friddell, Peter Pulsifer, Tom Barry, Hiroyuki Enomoto, Massimo Menenti, Weicai Wang, Carolina Gabarró, Emilia Garcia Ladona, Tao Che, Rui Jin, Youhua Ran, Hanna Lappalainen)

A2.1 Identify and document needs and requirements for cold region Earth observation data and information for all users. Make regular updates as needs and requirements change and emerge. Coordinate user requirements with WMO and its Rolling Review of Requirements (RRR) mechanism. **M2.1:** Analysis of existing and ongoing consultations on user needs (XII 2017). **D2.1:** Summary of the identified needs and requirements and action plan. XII2018).

A2.2 Start to define specific GEOCRI essential variables (e.g. Sea Ice...) and non-specific essential variables (valid and necessary for any region or domain). A way to start is to propose adopting many of the variables defined in the Climate domain (ECV's). Work with ECVs, EBVs. **M2.2:** document articulate the variable for cold regions.(VI2018), **D2.2:** variable table IX2019.

A2.3 Incorporate cold region databases, such as the Arctic Data archive System (ADS), and ICIMOD's Regional Database System, the Arctic Biodiversity Data Service, and the Italian Arctic Data Centre (IADC) into the GCI. **M2.3:** Institutions hosting Cold region databases identified and contacted (XII 2017). **D2.3:** List of Cold Region database holders + promotional material (XII 2017).

A2.5 Engage with Arctic Portal to explore potential for registering datasets hosted on their websites with GCI. CCIN/ PDC. **M2.5:** Arctic Portal contacted for discussions (VI2017).

A2.6 Support GCW in the development and expansion of CryoNet, identifying best practices for observations, sharing open data principles and capacity development activities. Allow for discovery of CryoNet through GCW Data Portal. Incorporate CryoNet data into GCI. **M2.6:** Discussions initiated with GCW and possibilities for supported activities and related actions identified (VI2017).

2.7 Support ICIMOD in developing a HimalyanGEOSS, sharing GEO's broad open data principles and capacity building expertise, and register Himalayan observations into the GCI. Connect other initiatives, such as TPE, WMO/GCW, PEEX, and WCRP/CliC to maximize the effectiveness and scope of the Himalaya GEOSS. **M2.7 :** ICIMOD contacted for discussions (III2017), **D2.7:** Jointly produced action plan for possible collaboration and related activities (IX2017).

A2.8 Analyze and report on alignment between GEO/GEOCRI data principles and policies and the data principles and policies established by SCAR, IASC and SAON. **M2.8:** Analysis completed (III 2018), **D2.8:** Report on the alignments in the data principles (XII 2018).

A2.9 Support the Digital Belt and Road (DBAR) initiative to broker the related activities with the big data platform along the Belt and Road region. **M2.9:** Create the interface with DBAR.(III2017), **D2.9:** Developmetn report (III2018).

Task 3. Integrating in situ and Remote Sensing Observations (Task Team: Hannele Savela, Yubao Qiu, Jeff Key, Emilio Garcia Ladona, Massimo Menenti, Vito Vitale, Eugenio Sansosti, Weicai Wang, SAON, Tao Che, Rui Jin, Youhua Ran, Tuukka Petäjä)

A3.1 Establish a forum for meeting and dialogue to encourage links and collaboration of cold regions in situ and remote sensing communities. **M3.1a:** Relevant community members identified and contacted. (IX2017), **M3.1b:** Joint meeting or webinar arranged (III2019), **D3.1a:** Meeting minutes (IV2019), **D3.1b:** Joint publication (XII2019)

A3.2 Develop a set of Cold Region Sensitive Indicators and ECRVs, based on the excise of ECVs and EBVs, to provide the most needed observations parameter over Earth cold regions. **M3.2:** Relevant community members identified and contacted. (IX2017), **D3.1a:** List of the variables or indicators for Earth cold regions, **D3.2b:** Joint Publications (XII2019)

Task 4. User Engagement and Communication (Task Team: Co-leads, Jan Rene Larsen, Hannele Savela, Courtney Price, Yubao Qiu)

A4.1 Establish a science advisory group within GEOCRI to ensure awareness of science priorities established by such efforts as the SCAR Horizon Scan and the IASC ICARP III, and to identify any gaps based on the work of GEOCRI. **M4.1:** Potential Science Advisory Group members invited (I2017). **D4.1:** Science Advisory group established and convened first time (VI2017).

A4.2 Maintain regular communications with all GEOCRI participants, GEO secretariat and other members of GEO community with updates on activities. Help to forge synergies and collaborations between GEOCRI. **M4.2:** GEOCRI meetings (on-line or physical (XII2017-2019), **D4.2:** Minutes of the meetings (XII2017-2019).

A4.3 Engage with current non-GEO member cold region countries to explore potential for membership – notably Bhutan, Bolivia, Kyrgyzstan, Mongolia and others. Engage existing members and participating organizations to participate in GEOCRI activities more actively. **M4.3:** Country representatives and potential new contributors contacted to initiate discussions (VI2017).

A4.4 Look to engage new organizations working in cold regions with GEOCRI and GEO. **M4.4:** Campaign to invite new contributors to GEOCRI conducted (VI2017), **D4.4:** Promotional material (XII2019).

A4.5 Liaise with other GEO activities to find potential synergies and map potential overlaps with them. **M4.5a:** Related GEO activities contacted for discussions (XII2017). **M4.5b:** Potential synergies and overlaps identified (VI2019). **M4.5c:** Map of potential synergies and overlaps with an action plan of possible collaboration (XII2019).

A4.6 Promote and advocate the use of coordinated, comprehensive and sustained cold region Earth observations to inform decisions and actions by policy makers, industry, local communities, researchers and others. **M4.6:** Participation with presentation(s) to joint forums with different stakeholders (ongoing 2017-2019), **D4.6:** Presentations, abstracts, statements, white papers.

A4.7 Advocate defining of cold regions earth observations essential variables (EVs) to more effectively meet the cold region Earth observation needs and requirements of users. **M4.7a:** Key actors for defining the cold region key variables identified (XII2017), **M4.7b:** Key actors contacted for discussions (III2018), **D4.7:** Work plan for defining the cold regions earth observations essential variables (XII2018).

A4.8 Develop GEOCRI logo and visual branding. Push for GEOCRI, GEO and GEOSS to feature in cold region Earth observation relevant reports and documents where appropriate. **M4.8:** GEOCRI logo and visual branding developed (XII2017), **D4.8a:** Logo (XII2017), **D4.8b:** Visual image instructions (XII2017).

A4.9 Leverage GEO's international standing and reputation to help secure a mandate from the highest government levels for fully integrated observing systems for cold regions. This mandate must not only be from cold region countries, but fully international due to the global significance and interest in cold regions. **M4.9** (XII2019)

A4.10 Coordination input from the ocean monitoring communities, including several larger ongoing efforts were suggested to be engaged. **M4.10:** Connect with EuroGOOS, CMEMS, Copernicus Climate services, JPI Climate services, ESA, CCI, EumetSat Satellite Application Facilities (VI2018).

Task 5. Capacity Building and Knowledge Transfer (Task Team: Hannele Savela, Peter Pulsifer, Julie Friddell, Weicai Wang, Massimo Menenti, other Co-leads)

A5.1 Increase awareness of possibilities related to GEOCRI, GCI and GEOSS Data-CORE. **M5.1:** Ongoing process 2017-2019. **D5.1:** Promotional material, e-mail campaigns etc. in 2017-2019.

A5.2 Arrange practical training on incorporating data to GCI and GEOSS Data-CORE. **M5.2a-c, D5.2a-c:** Webinar training on how to tag data to GEOSS Data-CORE and/or register it to GCI (XII2017, XII2018, XII2019).

A5.3 Arrange training to build capacity and educate new generation of researches on cold regions (e.g. via UArctic network and APECS). **M5.3:** UArctic and APECS contacted and invited to collaborate (III2017). **D5.3:** Plan on possible jointly arranged training (IX2017).

Task 6. Management and Monitoring (Task Team: Jeff Key, Hannele Savela, SAON, JAMSTEC, Hiroyuki Enomoto, Tom Barry, Julie Friddel, Vito Vitale, Weicai Wang, Yubao Qiu)

A6.1 Support SAON to develop and maintain an inventory of existing cold region Earth observations initiatives including organizations, programs, projects, networks and systems, particularly those which are active or have impact internationally and regionally. **M6.1:** Existing cold region Earth observations initiatives identified (XII2019). **D6.1:** List of existing cold region EO initiatives (XII 2019).

A6.2 Leverage GEO's international position to align other initiatives with Arctic Observing System efforts and SAON where this is not already the case, including WMO (EC-PHORS, GCW, PRCC, WWRP etc.) WCRP (CliC), PPP/YOPP, INTERACT, EU-PolarNet and the successful candidate for the H2020 topics BG-09 and BG-10 in 2016 and BG-11 in 2017. **M6.2:** Discussions initiated with SAON (III2017), **D6.2:** Plan of support activities to SAON (XII2017).

A6.3 Support SAON as the lead organization in establishing an Arctic Observing System. Support their existing efforts, share expertise. Explore the case for establishing SAON as a Regional GEO (i.e. GEO / Arctic) that would contribute to GEOCRI. **M6.3:** XII2019

A6.4 Engage with GEOBON and CAFF/CBMP, to support the development of ArcticBON (with GEOBON) and integrate it as the biodiversity component of the Arctic Observing System. **M6.4, D6.4:** Start discussions with relevant representatives and initiatives for possible collaboration (III2017)

A6.5 Support AmeriGEOSS in developing observing systems for mountain regions in the Americas, including the Andes and Rockies, as well as North American Arctic and South American sub-Antarctic. Engage with other initiatives such as WMO/GCW, WCRP/CliC and others to collaborate and maximize the effectiveness and scope of cold region components of the AmeriGEOSS. **M6.5:** AmeriGEOSS contacted for discussions (VI2017), **D6.5:** Minutes of the meeting(s).

A6.6 Support observing system networks, including WMO/EC-PHORS in developing, expanding and sustaining the terrestrial Antarctic Observing Network (AntON), and SCAR/SCOR with the interdisciplinary Southern Ocean Observing System as well as support the development of new observing systems such as SCAR's AntOS, working with key regional actors such as SCAR, SOOS, WCRP/CliC, WMO/GCW, PPP/YOPP, COMNAP etc. and research institutions active in the Antarctic (AAD, AARI, AntarcticaNZ, AWI, BAS, BAI, CSIC, USAP, etc.). **M6.6:** Discussions initiated with Antarctic observing system networks key actors (XII2018), **D6.6:** Summary of key support actions during the GEO Work Program 2017-2019 (XII2019).

A6.7 Engage with existing observing networks in cold regions, such as GTN-P, GLISN, GLMS, GCW, SIOS, etc. and emerging cold region regional observation networks to contribute to GEOCRI. Promote incorporation of data from these networks to GCI. **M6.7a:** Existing networks contacted and invited (III2018), **M6.7b:** Emerging networks contacted (XII2017-VI2019), **D6.7:** Face-to-face or on-line meetings and their minutes.

6.8 The co-lead group to set up the management system for the GEOCRI, the ToR, and inviting an advisory board for GEOCRI. **M6.8:** propose a management system (XII2017), **D6.8:** ToR and scientific Advisory Board (2017, GEO XIII).

4.3 Capacity building, science & technology, training activities, and communication, outreach and branding

There will be specific tasks with set milestones and deliverable devoted to Capacity building (T5, A5.2), science & technology (T4, A4.6; T6, A6.8), training activities (T5, A5.3) as well as to

communication/outreach and branding activities (T4, A4.8; T5, A5.1). The branding, as well as communication and outreach activities will be aligned with the general GEO brand and guidelines.

4.4 Expected connections to other areas of the GEO Work Programme

Cold Regions related earth observations and services are cross-cutting all GEO SBA's, and therefore several connections to other areas of the GEO Work Programme –for example with GEOBON- are expected in 2017-2019, and establishing and securing connections with relevant GEO Initiatives and flagships are included in, for example, T4. A4.4. and A4.5 and T6, A6.4.

5 INVOLVEMENT OF END-USERS

5.1 How established user communities link to, or participate in the initiative

Cold region Earth observation user communities include scientists, policy-makers, industry, business and commerce, students, and local communities. Earth observation data and information should meet the needs and requirements of these different user communities. GEOCRI User engagement will be done by utilizing several modalities ranging from face-to-face events and capacity building to on-line surveys and –ultimately- operational services developed in contact with the users.

In 2017-2019, the first stage of activities by the User Engagement and Communication Task Team will include the identification of current and potential user communities, and their specific features, and consultation with these user communities about their needs and expectations on the content and modality of the information services that they would like GEOCRI to offer. For example, the ESA – NRSCC / Dragon Program is entering its 4th cycle. The Hydrology and Cryosphere Theme focuses on the HMA region and involves about 100 potential users of GEOCRI information. The ESA and EC H2020 arctic observation projects, the Copernicus Climate Change service, and the user requirement conference, like the Polar and Snow Cover applications: user requirements workshop, are the good practice for coordinating the users requirement. Others will be from the user model of the mature information services program and newly setting up projects in different countries.

The second stage will be planning, development and implementation of the services based on the user community identification and consultation. Continuous dialogue and engagement with the user communities is needed at all stages of GEOCRI activities.

5.2 How the activity will benefit stakeholders

GEOCRI benefits all stakeholders by supporting the provision of accurate and timely Earth observation data and information. GEOCRI contributes to all eight GEO SBAs. In addressing all eight of the GEO SBAs, GEOCRI's benefits are wide reaching with impacts in all domains as well as cross-cutting issues like climate change. Furthermore, GEOCRI, through its contributors, engages with a range of stakeholders, including scientists, policymakers, local communities and businesses. Close stakeholder engagement will ensure that GEOCRI works to effectively address user needs and requirements to maximize benefit.

Examples of expected benefits to stakeholders include improved mitigation of the local inhabitants to the climate change effects, improved climate-change related decision making at national, regional, international and global level, more efficient use of research infrastructures in cold regions, and improved open data availability of cold regions related Earth observations.

5.3 How the activity will feed into decision-making processes

By leveraging the global visibility and convening power of GEO, GEOCRI makes a positive contribution to national, regional and international decision-making processes and science strategies. GEOCRI, via its contributors, feeds reliable, science-based Earth observation data and information to

policy makers, enabling better, well-informed and more effective decisions in cold regions and beyond.

6 PLANNING, INCLUDING SPECIFIC MILESTONES AND DELIVERABLES

6.1 Implementation Plan

The planned tasks and related activities will be implemented by the Task Teams according to the timetable provided in the following Gantt chart. The chart includes the milestones and deliverables that have been defined for each activity. The team of co-leads will coordinate the overall progress in the implementation as well as provide support to the Task Teams where needed.

6.2 Monitoring and evaluation approach, including feedback from participants/partners

Continuing monitoring and evaluation approach will be applied in GEOCRI. The progress will be monitored by reports produced by the GEOCRI co-leads and provided to the GEO Program Board as requested. The progress reports will also be communicated to the whole GEOCRI community. Feedback about the quality of the GEOCRI practices and on the progress achieved will be collected from GEOCRI community at regular time intervals, at least twice during the program period. The results of the feedback will be compiled, analyzed and published, together with related plans for improvement, with the reporting. Feedback will also be collected from the end-users, once the operational stage of the planned services to users is reached.

6.3 Reporting to participants and to GEO PB/Secretariat

Reporting on GEOCRI will be done according to the general GEO requirements, via progress reports by the Task Teams to co-leads and via short summaries of the recent developments, presented to all contributors. The necessary reporting of the activities and plans – e.g. the implementation and work plan – will be provided to the GEO Secretariat and Program Board, then to the GEO ExCOM and Plenary. Summaries of GEOCRI activities and achievements will also be provided to the observers and stakeholders to keep them updated on the progress.

Table 2. Milestones and Deliverables

Task/ Activity	2017				2018				2019			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Task 1: Infrastructures												
A1.1	M1.1a				M1.1b	D1.1						
A1.2	M1.2a				M1.2b							D1.2
A1.3												D1.3
A1.4										M1.4		
A1.5					M1.5				D1.5			
Task 2: Monitoring Network and Data												
A2.1				M2.1				D2.1				
A2.2						M2.2						D2.2
A2.3				M1.3, D1.3								
A2.5		M2.5										
A2.6		M2.6										
A2.7	M2.7		D2.7									
A2.8					M2.8			D2.8				
A2.9	M2.9				D2.9							
Task 3: Integrating in situ and Remote Sensing Observations												
A3.1			M3.1a	D3.1a					M3.1b			D3.1b
A3.2			M3.2					D3.2a				D3.2b
Task 4: User Engagement and Communication												
A4.1	M4.1	D4.1										
A4.2												M4.2, D4.2
A4.3		M4.3										
A4.4		M4.4										D4.4
A4.5				M4.5a						M4.5b		M4.5c
A4.6												M4.6, D4.6
A4.7				M4.7a	M4.7b			D4.7				
A4.8			M4.8, D4.8ab									
A4.9												M4.9
A4.10												
Task 5: Capacity Building and Knowledge Transfer												
A5.1												M5.1, D5.1
A5.2				M5.2a				M5.2b				M5.2c
A5.3	M5.3						D5.3					
Task 6: Management and Monitoring												
A6.1												M6.1, D6.1
A6.2	M6.2			D6.2								
A6.3												M6.3
A6.4	M6.4, D6.4											
A6.5		M6.4, D6.5										
A6.6								M6.6				D6.6
A6.7					M6.7a					M6.7b		
A6.8				M6.8, D6.8								

7 DATA MANAGEMENT & DATA POLICY

7.1 Description of the key datasets used or created by the activity

The dataset distributes around the data holders and project coordinators, that are from the contribution list and here name a few of the most important ones, for example, those from SAON, GCW Portal, INTERACT, TPE, GEOSS, and etc. (see section 10)

7.2 Degree of adherence to the GEOSS Data Sharing and Data Management Principles

GEO has been a leader in the development of data sharing principles and this has, in turn, provided an excellent foundation for governments, institutions, researchers and others to develop sound data policy. At the same time, polar organizations have been actively developing data statements and policy to help guide the collection, use, stewardship and preservation of data. For example, in 2013 the International Arctic Science Committee released the IASC Data Statement (see <http://iasc.info/data-observations/iasc-data-statement>). This statement makes assertions about the value of open data, the need to provide fair attribution for data creation, and the value of professional data management. This statement references several other established data statements and policies from the WMO, and ICSU, and we have seen recent developments from ICSU and others in this area (<http://www.icsu.org/news-centre/press-releases/press-releases-2015/leading-science-groups-urge-global-accord-on-open-data-in-a-big-data-world>, <https://www.force11.org/group/joint-declaration-data-citation-principles-final>).

7.3 Contributions to the GEOSS Data CORE and Interoperability with the GCI

Many data statements and policies in existence provide data producers and users with extensive choice, however this can also make it difficult for members of the community to know which statement or principle is most relevant and appropriate for their needs. GEO and GEOCRI are in an ideal position to make a contribution through the analysis of these statements and policies with the goal of identify core elements that are common to all. This would help the community to evaluate if they need to develop new policies or if an existing policy/statement can be adopted. Additionally, this would support members of the community in establishing if their data policies contain necessary elements and will be compatible with other policies. The results of this effort can effectively be used as a policy broker with the GEO DAB and other system. A task has been added to the Tasks list in this document with the intention of working with the broader GEO community on this effort.

The use of GEOSS resources will be advocated both within the GEOCRI and to the identified key Earth observation user communities. The dialogue will be two-directional in a manner that encourages both the use of the GEOSS resources and provision of new resources to GEOSS.

The first stage is to integrate the existing cold regions datasets, products and services to the GCI via the GEO Discovery and Access Broker (GEO DAB) and GEOSS Data-CORE. The work in this field is led by the Data Task Team that will identify and approach the relevant data producers and facilitate the integration by provision of information and training. In the second stage, new datasets, products or services within GEOCRI community will be developed and integrated with the GCI and/or GEOSS Data-CORE.

GEO's advocating of broad open data policies and data sharing principles is replicated by GEOCRI as well as its contributors and community. GEOCRI shares knowledge, best practices and training to build capacity in this area.

A broad integration and comparison of existing data principle and policy from different communities, for example, SAON, GEOSS, SOOS, etc., are encouraged to be bridged together, also with the effort from the communities of CODATA and WDS.

8 RISK ASSESSMENT

8.1 Risk assessment

GEOCRI aims at sharing of various observations and data, and practical use to providing the information service globally - with a global and coordinated standard. GEOCRI plan to make many challenges for scientific, technical, and then social contributions from the climate research collaborations. The risks below could be the resource optimal utility and management challenges,

- Under the limited human and funding resource, it is apprehensive about exhaustion of activity, and restriction of resources. GEOCRI has the deviation of an activity area called a cold region, therefore concentrates the active time of activity etc;
- Since activity is begun newly, the difference of opinion, the inconsistency of the enforcement method, duplication of activity, lack of activity, etc. may take place at the first stage. GEOCRI will challenge them by discovering the best way to solve them.

8.2 Risk mitigation plan and required resources

In actual activity, many partner's activities are bases of the implementing GEOCRI cooperation. Partner's activities are integrated to GEOCRI implementation as an initiative of GEO. To integrate those activities with the clear target of plan, sharing of a concept are fundamental. This will be, especially at the early stages, discussions and confirmation of problems and progresses are important.

GEOCRI co-leads and partners should utilize any opportunities of discussion and share ideas, by holding a meeting of Co-Lead and calling to a partner, it advances certainly, the directivity of enforcement is maintained and stagnation is avoided.

8.3 Risk management procedures

The monitor of the activity situation of the early stage and re-examination of transparency and a plan are effective in order to avoid a risk. The technical problem of these observations may be thrown into relief with enforcement. Sharing and conquering it is also asked for the challenge of activity of GEOCRI.

It is effective as risk management to have the examination activities which check and share the difficulty of observation which a cold region has especially, and have a clue to problem solving. GEOCRI co-leads and partners challenge to keep discussion and share ideas.

9 MANAGEMENT AND GOVERNANCE

9.1 Organizational structure

The management structure for GEOCRI is presented in the Figure 2.

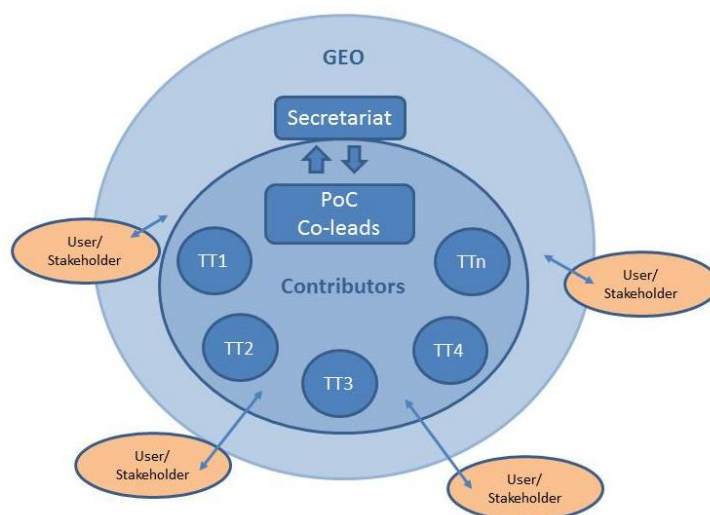


Fig 2. GEOCRI Management Structure

The GEOCRI community consists of contributors that are arranged into theme-specific Task Teams according to their interests. Each Task Team has a list of activities that they work on, and report their progress to the team of co-leads, consisting of nine GEOCRI members and the Point of Contact. The co-lead team works together in producing the Implementation Plan and the Work Plan for the GEO Work Programme, with the assistant of GEO Secretariat, and offer over all coordination of GEOCRI activities and efforts.

Task Teams convene when necessary, whereas the co-lead team convenes at least twice a year. All GEOCRI members are kept informed about the progress via summaries provided through an e-mailing list and by arranging face-to-face meeting where possible (e.g. as side events to GEO meetings and at major scientific conferences).

All GEOCRI contributors have a possibility to contribute to the work and implementation plans, and take part in those Task Teams where they find their contribution is most suitable. In addition, an institution or organization can join GEOCRI as an Observer, which means that they will be updated about the progress and activities, without not directly taking part in the activities.

Terms of Reference (ToR) will be developed in 2017 to verify the management and coordination structure of GEOCRI. All the management activities need to follow up the Term of Reference, which will be changed in two year, at the face to face meeting.

9.2 Project coordinator and supporting organization

The task group and co-lead will annually work together to coordinate, support and endorse updates on the initiative and provide guidance to the tasks implementation, teleconferences are held as needed.

9.3 Advisory/steering committee

An Advisory Committee, consisting of high-profile scientists will be convened in late 2016-early 2017. The group will convene when necessary to provide advice on the GEOCRI activities. The

Advisory Committee is GEOCRI's counselling and recommendation body. It shares its vision and user's requirement with the GEO Plenary. It is made up of stakeholders, including the governors, end-users, and policy makers from the members and Participating Organizations.

9.4 Communication with partners and participants

The GEOCRI communication with partners and participants include two parts, 1) one is that the progress will be monitored internally by collection of feedback from the GEOCRI community at regular time intervals. That will including the feedback from participants/partners through the meeting, and tasks. 2) And another is the reporting on GEOCRI that will be done via progress reports of the Task Teams to co-leads and short summaries of the recent developments, presented to all contributors. Also, necessary reporting of the activities and plans – e.g. the implementation and work plan – will be provided to the GEO Secretariat and Program Board, then to the GEO ExCOM and Plenary.

Summaries of GEOCRI activities and achievements will also be provided to the observers and stakeholders to keep them updated on the progress.

10 SUMMARY OF COMMITTED RESOURCES AND ANNUAL BUDGET(S)

GEOCRI's resources are predominantly in kind efforts, and are aimed at leveraging the resources of participating initiatives and organizations to align with GEOCRI's objectives. Here is the list of actions and funding that could report to GEOCRI and contribute to GEOCRI activities at 2017 and later on, including the source of data and funding under an annual ways and project packages,

- The Global Cryosphere Watch (**GCW**):2nd Asia CryoNet meeting in Feb. 2016 in Russian Federation. CryoNet in the Region and identify best practices for observing.
- **SAON**: Documenting and understanding the Arctic data management ecosystem; Inventory of arctic observational projects as a contribution to EU PolarNet; (CBM) atlas.
- **CAFF/CBMP**: Arctic Biodiversity Data Service (ABDS) as biodiversity data sharing and as a source of data for ecosystem-based management, interoperability with partners such as GBIF, OBIS and PDC.
- **INTERACT**: Building capacity for research, monitoring and in-situ observations throughout its pan-arctic station network, and outreach to policy makers, other stakeholders and the general public. In 2016-2020, INTERACT receives funding of 10 M€ funding from the EU-H2020.
- **PEEX**: PEEX metadata collection and build a Modelling Demo ("PEEX View"), 3rd PEEX science meeting in MOSCOW.
- **SIOS**: Implementation phase with a full-fledged activity during 2016, establishment of the knowledge centre in Longyearbyen. (In kind and international resources for 2016 to be identified; Norway will contribute at least 1 000 000 EUR, Italy to CCT-IP: 100, 000 Euro).
- **IADC** (Italian Arctic Data Centre): the portal of the Italian research activities in the Arctic. A distributed cyber-infrastructure NDAC in the frame of the Antarctic Research National Programme (PNRA), in a unique Polar Data Infrastructure (PDI) (Euro: 200.000).
- Establish flagship stations within the **Third Pole** region for observation and monitoring; (US Dollars : \$200,000), rain gauge up to 6500 m in a river basin of the Tibetan Plateau.
- Snow Observations over Tibetan Plateau (**SOTP**): The remote sensing snow cover products over Tibetan Plateau, with in-kind and somehow \$120,000 support from NSFC (2014~2018).
- The inventory of snow over China was just proposed with an amount of \$ 3.9M for the period 2017~2021.

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- The monitoring of freezing and thawing cycle over China was granted with \$140,000 from NSFC for the period 2015~2018.
 - **ESA – MOST / NRSCC \ Hydrology and Cryosphere Theme** under the 4th cycle 2016~2020 of the: program (Dragon 4). Six projects have been selected and launched in July 2016. Total resources estimated at 2M€.
 - CNR through Climate Change Integrated Project (**CCT-IP**): upgrading of Ny Alesund as observation super-site in the Arctic (Euro: 100.000).
 - A Chinese cubesat named **TW-1A**: polar sea ice observation in both Polar Regions, proposed by Beijing Normal University and developed by Chinese Academy of Sciences.
 - The observations by the intended **Chinese Water Cycle Mission (WCOM)**: Monitoring of water resources as SWE, precipitation and soil moisture.(\$1.5M).
 - Cryosphere Monitoring Programme (**CMP**): Snow, glacier, glacial lake and GLOF over Nepal, Bhutan and Pakistan, supported by The Norwegian Ministry of Foreign Affairs (\$700,000).
 - Through the Belmont Forum Initiatives, Italy contributes to Cooperative Research Activities (**CRA**) of the Arctic Observing and Research for Sustainability and of the Mountains as Sentinels of Change. (Euro: 200.000).
 - JAMSTEC, NIPR and Hokkaido University: Arctic Data Archive System (**ADS**), as a part of GEOSS Portal, in the “**Arctic Challenge for Sustainability Projects (ArCS)**” supported by MEXT (ca. \$ 8.3M).
 - The “Modelling Freeze-Thaw Processes with Active and Passive Microwave Observations” (SAMP Freeze/Thaw) project supported by the Netherlands Organisation for Scientific Research.
 - Harmonizing and collecting observations in Greenland and surrounding waters by Denmark;
 - The **Year of Polar Prediction (YOPP)**: A key element of WMO-WWRP Polar Prediction Project (PPP). GEOCRI are additional polar observations at its Core Phase (mid-2017 to mid-2019).
 - Cold and Arid Regions Science Data center at Lanzhou, China (CARD), World Data System (WDS): supported by Cold and Arid Regions Environmental and Engineering Research Institute (CAREERI), CAS, WDS, and NSFC projects.
 - **Third Pole Environment (TPE)**: The acquisition of valuable field data to share with the general academic community for enhancement of scientific understanding in the region. A data portal (<http://en.tpedatabase.cn/>)
 - Chinese Academy of Sciences grant a 45M RMB (~0.9M US dollar) to promote the pan-third pole environmental observations and understanding the snow and glacier change from 2016~2021.
 - The **Barcelona Expert Center (BEC)** at ICM-CSIC:Remote sensing observations of Sea Surface Salinity at high latitudes. Arctic sea ice concentration, and sea ice thickness from the ESA SMOS mission, several high precision GPS buoys (SATICE) deployed in the Arctic (<http://satice.icm.csic.es/>)
 - Pollution & Environmental Protection: GMOS Observational programme for mercury. Master sites of GMOS for both Polar Regions, with a strong policy mandate from both Minamata and Stockholm conventions. The Flagship on “Tracking Persistent Pollutants” beneficial for GEO.

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- **JAMSTEC**: Hydrographic observation in the Arctic ocean for coming several years, and will provide data through the web (ADS and, JAMSTEC site).
 - **WDCDGG** (World Data Center-D for Glaciology and Geocryology): The collection, management, analysis, and publish the Cryosphere Database in China.
 - **INTAROS** (Integrated Arctic Observation system) received more than 15 million EUR from the EU framework program Horizon 2020 from 2016 to 2020. The overall objective of INTAROS is to develop an integrated Arctic Observation System (iAOS) by extending, improving and unifying existing systems in the different regions of the Arctic, which is implemented in partnership with the following Norwegian institutions: NERSC, UiB, IMR, UNIS, NORUT, NIVA and DnV GL, as well as with 41 partners from other countries worldwide.

ANNEXES

A. Acronyms and Abbreviations

AAD	Australian Antarctic Division
AARI	Arctic and Antarctic Research Institute
AC	Arctic Council
ACAP	Arctic Contaminants Action Program, AC Working Group
ACAP	Arctic Contaminants Action Programme, AC Working Group
ADS	Arctic Data archive System
AH	Arctic Health
AI	The Arctic Institute
AMAP	Arctic Monitoring and Assessment Programme, AC Working Group
AntarcticaNZ	Antarctica New Zealand
AntON	Antarctic Observing Network
AP	Arctic Portal
APECS	Association of Polar Early Career Scientists
Arctic BON	Arctic Biodiversity Observation Network
AUV	Autonomous Underwater Vehicle
AWI	Alfred Wegener Institute
BAI	Bulgarian Antarctic Institute
BAS	British Antarctic Survey
CAFF	Conservation of Arctic Flora and Fauna, AC Working Group
CARD	Cold and Arid Regions Science Data Center at Lanzhou
CAREERI, CAS	Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Science
CAS-NASA HMA	Chinese Academy of Science - National Aeronautics and Space Administration High Mountain Asia Workshops
CBMP	Circumpolar Biodiversity Monitoring Program
CCIN	Canadian Cryospheric Information Network
C-DAC	Centre for Development of Advanced Computing
CLiC	Climate and Cryosphere
COMNAP	Council of Managers of National Antarctic Programs
CMA	China Metrological Administrator
CNR-IIA	Institute of Atmospheric Pollution Research
CSIC	Spanish National Research Council
DRAGON	ESA – NRSCC Program / Hydrology and Cryosphere Theme
DMI	Danish Metrological Institute
EC-PHORS	WMO Executive Council Panel of Experts on Polar and High Mountain Observations, Research and Services
EPPR	Emergency Prevention, Preparedness and Response, AC Working Group
ESA	European Space Agency
FIES	Food Insecurity Experience Scale
GCI	GEOSS Common Infrastructure
GCW	Global Cryosphere Watch
GECO	GEO Global Ecosystem Initiative

GEO	Group on Earth Observations
GEO DAB	GEO Discovery and Access Broker
GEOBON	GEO Biodiversity Observation Network
GEOCRI	GEO Cold Regions Initiative
GEO-DARMA	GEO Data Access for Risk Management
GEOGLAM	GEO Global Agricultural Monitoring Initiative
GEOGLOWS	GEO Global Water Sustainability
GEO-GNOME	GEO Global Network for Observation and Information in Mountain Environments
GEOSS	Global Earth Observation System of Systems
GEOSS Data-CORE	GEOSS Data Collection of Open Resources for Everyone
GEUS	Geological Survey of Denmark and Greenland
GFOI	GEO Global Forest Observations Initiative
GINR	Greenland Institute of Natural Resources
GLISN	Greenland Ice Sheet Monitoring Network
GLMS	Glacier Lake Monitoring System
GLOF	Glacial Lake Outburst Flood
GMOS	Global Mercury Observation System
GSNL	GEO Geohazard Supersites and Natural Laboratories
GTN-P	Global Terrestrial Network for Permafrost
H2020	Horizon 2020
HKKH	Hindu Kush –Karakoram– Himalayas
HRCF	Himalayan Research and Cultural Foundation
IASC	International Arctic Science Committee
IASC-SAON ADC	IASC-SAON Arctic Data Committee
ICARP III	The Third International Conference on Arctic Research Planning
ICIMOD	International Centre for Integrated Mountain Development
INTERACT	International Network for Terrestrial Research and Monitoring in the Arctic
IPA	International Permafrost Association
IPCC	Intergovernmental Panel on Climate Change
IREA-CNR	Institute for Electromagnetic Sensing of Environment
ISAC-CNR	Institute of Atmospheric Science and Climate
ISRO-SAC	Indian Space Research Organization – Space Application Center
ISDE	International Society for Digital Earth
ITP	Institute of Tibetan Plateau Research
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
NERSC	Nansen Environmental and Remote Sensing Center
NIPR	National Institute of Polar Research
NSIDC	National Snow and Ice Data Center
NSC	Norway Space Centre
PAGE21	Changing Permafrost in the Arctic and its Global Effects in the 21st Century
PAME	Protection of the Arctic Marine Environment
PDC	Polar Data Catalogue

PEEX	Pan-Eurasian Experiment Program
PPP	Polar Prediction Program
PRCC	Polar Regional Climate Centre
RADI, CAS	Institute of Remote Sensing and Digital Earth, Chinese Academic of Science
S:GLA:MO	Slope Stability and Glacial Lake Monitoring
SAON	Sustaining Arctic Observing Networks
SAON CON	SAON Committee on Observing Networks
SBA	GEO Societal Benefit Area
SCAR	Scientific Committee on Antarctic Research
SDG	Sustainable Development Goal
SDWG	Sustainable Development Working Group, AC Working Group
SIOS	Svalbard Integrated Arctic Earth Observing System
SOOS	Southern Ocean Observing System
SOTP	Snow Observations over Tibetan Plateau
TPE	Third Pole Environment
UArctic	University of the Arctic
UAV	Unmanned Aerial Vehicle
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
USAP	United States Antarctic Program
WCRP	World Climate Research Programme
WDCDGG	World Data Center-D for Glaciology and Geocryology
WMO	World Meteorological Organization
YOPP	Year of Polar Prediction

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