

## International access to research infrastructure in the Arctic

## Commentary

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**Abstract**

Reliable access to Arctic research infrastructure is critical to the future of polar science. In cultivating proposals, it is essential that researchers have a deep understanding of existing platforms when selecting the appropriate research site and experimental design for projects. However, Arctic infrastructure platforms are often funded as national assets, and choices for what would be the best platform for the project are sometimes at odds with a researcher's ability to gain access. Researchers from Arctic and non-Arctic nations are poised to benefit from reducing barriers and increasing cooperation around transnational access to Arctic infrastructure, allowing scientists to successfully execute the research that is most needed rather than what is just logistically feasible. This commentary provides a summary of findings from a workshop held at the 2021 Arctic Science Summit Week to discuss navigating “transnational” or “cross-border” access to national research infrastructure. This workshop brought together users and operators of Arctic infrastructure platforms with the three goals of identifying challenges, best practices, and possible next steps for improved collaboration.

**Introduction**

Physical access to research infrastructure in the Arctic – polar research vessels, stations, and aircraft – is essential for polar science. Knowledge about the availability and services of existing platforms is key to selecting the appropriate research site and experimental design for projects. In practice, this means that operators and managers of these infrastructures need to cultivate strong communications efforts with the scientific community. Communication is also paramount in outlining each platform's guidelines, which ensures well-prepared and efficient visitors. Facilitating this exchange of information and making space available for access is already challenging at the national level. Adding an international dimension to operations makes it even more demanding, especially since it requires that additional funding mechanisms are in place to implement links between scientists and infrastructure. The rapid pace of change outlined in the recent 2021 Arctic Report Card (Moon *et al.* 2021) also underscores the imperative for coordination between nations on Arctic science. The pan-Arctic impacts of human-induced climate change cannot be tackled by one nation alone, and international collaboration is a significant step in the direction of increased understanding of the Arctic as a whole.

These topics were identified as timely for discussion and increased cooperation. A workshop entitled “International Access to Research Infrastructure in the Arctic” was held virtually at the 2021 Arctic Science Summit Week. The workshop was organised by members of the Forum of Arctic Research Operators (FARO), Association of Polar Early Career Scientists (APECS), Arctic Research Icebreaker Consortium (ARICE), and International Network for Terrestrial Research and Monitoring in the Arctic (INTERACT). Participants of the workshop were users, operators, and coordinators of Arctic infrastructure platforms. The overall goal of the workshop

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was to initiate a dialogue and build a network to facilitate access for international scientists to national research facilities and infrastructure in the Arctic.

Initially planned for in-person, the workshop was pushed to an online format due to the COVID-19 pandemic. The event drew 71 participants at its peak, and the agenda was structured with a mix of plenary and breakout sessions. The day started off with overviews from organisations currently engaged in efforts to facilitate transnational access to Arctic research infrastructure. This plenary session included presentations from FARO, APECS, ARICE, INTERACT, The Svalbard Integrated Arctic Earth Observing System (SIOS), European Polar Board, and The Pacific Arctic Group.

Special attention was given to a presentation on the Agreement of Enhancing International Arctic Scientific Cooperation (Arctic Council, 2017) by Frej Dichmann, Deputy Head of Division for the Danish Agency for Science and Higher Education. The agreement was signed by the eight Arctic States in May 2017 during the 10<sup>th</sup> Arctic Council Ministerial in Fairbanks, Alaska, and entered into force in May 2018. The intention of the agreement is to facilitate access by scientists of the eight Arctic States to Arctic areas that each State has identified, including entry and exit of persons, equipment, and materials; access to research infrastructure, facilities, and data; and access to research areas. The agreement also calls for the parties to promote education and training of scientists working on Arctic matters.

The agreement has resulted in the implementation of a reporting system for citizens of the eight Arctic Council member states. Scientists can report if they experience bottlenecks and barriers to working in other Arctic countries to a specific national point of contact responsible for the national implementation of the agreement. There is currently no reporting system for scientists in non-Arctic states, but the agreement holders are looking into different options, one of these being through existing Arctic research organisations (e.g. International Arctic Science Committee (IASC) which is an observer to the Arctic Council). The eight parties to the agreement meet once a year and discuss reported barriers and best cases, and information on how they implement the agreement. There is not yet a standardised form for this cooperation, but the reporting and collection of information is approached differently by each of the eight Arctic States.

After plenaries, participants were asked to self-select into either a land-based or marine-based discussion group based on their personal interests and past experiences. These two groups then had facilitated discussions mapping challenges, good practices, and tools for access to their respective Arctic infrastructure platforms. Through discussion, the land-based group identified a number of barriers to effectively conducting research in international spaces and collated recommendations and good practices to increase cooperation and collaboration. However, these challenges/recommendations are good principles for any international effort or Arctic research infrastructure and should be shared with the broader Arctic research community. The marine-based discussion highlighted several special considerations for transnational access to national ship programmes faced by ocean-going scientists.

## Challenges and recommendation for international Arctic research efforts

### *Defining a common direction*

**Barrier:** National research priorities are often at odds with international research agendas. Funding is usually aligned with

national science priorities which then impacts access to research infrastructure and permits which are regulated through national legislation. The Arctic research community would benefit from the synchronisation of the many actors and activities to implement international research agendas for the entire Arctic (e.g. through the IASC International Conference on Arctic Research Planning (ICARP) IV initiative, the Arctic Council, Arctic Council monitoring and assessments working groups such as AMAP or CAFF, and other regional strategies and organisations). While multiple international Arctic research priority roadmaps, such as the Integrated European Polar Research Program, ICARP III, and Sustaining Arctic Observing Networks (SAON), already exist, little is done to secure the implementation of these commonly developed agendas and their harmonisation with national priorities, where differences in priorities can mean barriers for research.

Currently, there is little to no harmonisation of regulations (permits) for access concerns addressed in the Agreement of Enhancing International Arctic Scientific Cooperation (Arctic Council, 2017), little coordination between national funding systems, and only a few internationally coordinated multidisciplinary research initiatives in Arctic research.

**Good Practices and Recommendations:** Synchronising the scientific themes of research funding calls across countries could be a big step forward in coordinating Arctic research across international borders. This requires lobbying among funding bodies, politicians, and policy makers to advocate for increased cooperation between nations as key foci in future funding calls. Coordinated research calls would facilitate increased international cooperation around infrastructure because national priorities would then be in line with international ones.

The MOSAiC expedition (Multidisciplinary drifting Observatory for the Study of Arctic Climate – <https://follow.mosaic-expedition.org/>) was highlighted as a great example of a truly international and multidisciplinary research project. The SAS (Synoptic Arctic Survey – <https://synopticarcticsurvey.w.uib.no/>) project was also mentioned as an example of internationally coordinated effort to study the Arctic Ocean through coordination of many nationally owned assets. More projects focusing on interdisciplinarity and cooperation across borders are recommended as a way forward and should be a central goal for major funding bodies.

Intergovernmental organisations, such as the Arctic Council and the United Nations' Intergovernmental Panel on Climate Change (IPCC), should use their influence to coordinate national research priorities. Internationally agreed research roadmaps and agendas should serve as inspiration for implementation across the eight Arctic countries focusing both on research infrastructure challenges and science agendas.

### *Facilitating cooperation across disciplines*

**Barrier:** A key challenge identified by the group was related to cooperation, knowledge sharing, and establishing synergies across traditional disciplinary “silos” between terrestrial, marine, freshwater, and atmospheric research. Many disciplines/actors see themselves confronted with similar challenges. Researchers need to learn from each other and establish a mechanism for sharing information and best practices.

**Good Practices and Recommendations:** Organisations and scientists should work together to break down barriers between disciplines and knowledge systems. Joint events and more cross-cutting/interdisciplinary cooperation/projects are recommended

to improve cooperation, knowledge sharing, and establishing synergies.

It was recommended that major science and logistics organisations (e.g. IASC, FARO) lobby the big funding actors like the EU Commission (Arctic Cluster, Infrastructure and Research Cluster) and possibly also national funding bodies and the Arctic Council to facilitate interdisciplinary and cross-realm cooperation as key elements in future funding calls.

### *Gaps between short- and long-term funding*

**Barrier:** Both operators and scientists identified a funding gap between short- and long-term funding (for both science and infrastructure) as another barrier. While transnational access funding programmes are already available for short-term funding (INTERACT and ARICE), there is a need to secure funding of long-term research and monitoring targeting societal challenges and international science agendas.

**Good Practices and Recommendations:** Arctic groups need to promote the importance of long-term Earth observations for understanding ecosystem processes, documenting variability, and trends of key climate and ecosystem variables. The funding gap between short-term and long-term funding should be addressed by international and interdisciplinary funding programmes. International science and logistics organisations could work jointly to lobby among relevant major funding bodies and intergovernmental organisations that may influence national priorities.

SIOS is a model that coordinates international observing systems for long-term measurements in and around Svalbard that could serve as inspiration for further increased cooperation on the road towards Sustaining Arctic Observing Networks. Securing funding for coordination efforts is also key to international collaboration, sharing of best practices, implementation of standards etc., benefitting long-term infrastructure operations and science coordination.

### *Navigating permit systems, shipping, and transport*

**Barrier:** Scientists are held responsible for ensuring they have all relevant permits, permissions, and paperwork for, for example, accessing research areas and taking samples and then shipping them home. Navigating the mire of all the different national permit systems is a challenge, and no country provides a single-entry point for scientists or a central research coordination platform. Many scientists identify this ever-changing landscape of complex regulations as a bottleneck to their research and a big hurdle to international and cross-border research activities. Due to the COVID-19 pandemic, cross-border travels have become even more difficult.

**Good Practices and Recommendations:** Access to information and communication of regulations was identified to be key in addressing this issue. Providing easy access to updated information on national permit systems and possibly webinars could serve as important action points for governments and organisations to strive for improved information sharing. Although regulations are subject to quick change, efforts should be made to make information available and accessible for scientists to help them reach their destination and obtain all relevant permits to comply with national legislation. A single-entry point website for scientists or a specific contact point in each of the Arctic countries could direct potential applicants to the relevant permits needed for a specific study.

The Agreement of Enhancing International Arctic Scientific Cooperation (Arctic Council, 2017) could be key to solving this issue by easier movement of researchers, research equipment, and samples across the Arctic region. Participants recognised benefits of a reporting system where citizens of Arctic nations can report barriers to science cooperation experienced in other Arctic countries. Issues can then be raised within the framework of the agreement. Participants highlighted the need for finding a solution where non-Arctic citizens can also report their barriers.

The Arctic Council agreement could also provide an overview of national permit systems that are distributed across many different national administrative units and websites. Only Svalbard seems to have a single-entry point for scientists. It is difficult for scientists to navigate and identify all relevant permits needed to conduct science in each Arctic country. Although infrastructure operators can help guide scientists, this remains a significant challenge. Whether the agreement can help solve this issue remains to be seen.

Under the framework of the INTERACT III project, the INTERACT Station Managers' Forum (SMF) in collaboration with APECS has launched a platform of the most common types of permits needed to conduct science in Arctic countries. The platform is hosted on the INTERACT website (<https://eu-interact.org/>), and it is the hope that scientists, international research infrastructure organisations, national authorities, and Arctic Council members find it useful. INTERACT recognises the need for help from these communities to review the information and provide corrections or recommendations for changes to ensure that the information is up-to-date and remains a valuable resource for scientific, logistical, and governmental purposes.

### *Data management and access: funding, standardisation/harmonisation*

**Barrier:** Standardisation of field methodology and data harmonisation efforts are key to comparing data sets and producing robust science assessments. Several thematic scientific networks have developed standard field methodologies or provide recommendations for data harmonisation within specific disciplines. The use of such standards for data collection should be expanded to facilitate robust assessments. Additionally, as methodologies may change over time, standardisation or harmonisation of data across time and between different countries is needed.

Sharing of data is key to maximising the output of scientific endeavours and several organisations work on developing standards for data management and sharing. However, funding for data management is often not sufficient to ensure proper handling and sharing of data, both at a research station and at research project level.

The key words in this discussion were **standard methodologies/harmonization**, consistency, and implementation of the **FAIR principles** (Findable, Accessible, Interoperability, and Reusable).

**Good Practices and Recommendations:** Good examples of instances where standardised data lead to high-impact publications should be communicated to relevant agencies and funding bodies (by, e.g. IASC, scientific networks, and infrastructure operator organisations). Science infrastructures should also be proactive about cataloguing data, advertising the instrumentation available on site, and educating researchers on past, present, and future efforts associated with the research platform. The science community (IASC, scientific networks, and infrastructure

operators) should also lobby for adequate funding for data management and communicate this issue to relevant authorities and funding bodies.

The EU was mentioned as an important funder also working to ensure proper data management. The INTERACT Virtual Access Program (<https://dataportal.eu-interact.org/>) developed with EU funding was mentioned as a good example and tool for improved open sharing of data from research stations.

As a classic example to be followed, the World Meteorological Organization has been able to provide worldwide harmonised data, thus being able to produce reliable weather forecasts. IASC and SCAR were mentioned as organisations that could help to identify areas with insufficient data standards. Seminar participants recommended that a working group could be formed to develop standards, where these are lacking, for example, under the auspices of SAON.

It should also be communicated clearly that scientists should have a plan for archiving and sharing data, preferably using the FAIR principles (Wilkinson, Dumontier & Aalbersberg, 2016), and that funding bodies could make it compulsory to share data and require a data management plan from applicants.

### Special considerations for ship-based work

**Barriers:** While all the previously mentioned barriers/recommendations would apply to any established platform with the capability to host international researchers, it was universally acknowledged that ship-based work has its own special set of challenges. Polar Research Vessels (PRVs) often have much higher operational costs and longer lead times for planning cruises. Because of this large economic investment, national priorities often outweigh the provision of transnational access. Additionally, bilateral agreements to negotiate access and cost sharing are challenging to establish and maintain in the long run. This is reflected both in the lack of unified planning or information sharing tools among PRV operators and funding. In the words of one of the participants, “[f]or some nations the ships are funded (and fully booked) and there is ‘only’ a negotiation of how to distribute across national projects, while others have limited funds and/or no national access.”

National prioritisation does not lead to more efficient use of PRVs. In a previous workshop that ARICE organised with European Research Vessel Operators in 2019, this lack of coordination was reported to lead to duplication of efforts, sub-optimal use of vessels, and limitations in the temporal and geographical scope of research (<https://www.ervo-group.eu/np4/np4/44.html>).

Other obstacles that were noted in the discussion included lack of incentives for operators to facilitate international berth sharing, integration of individual projects or work packages into the overall scientific programme of a cruise, lack of time to make arrangement for funding, logistics, language (especially for Russian cruises), transportation of samples, and permits.

With reference to the question of which party is the leading force in enabling transnational access, two different lines of thought were discussed: “Science needs to lead the way, funding agencies will follow” vs. “Once the vessel is available, science will come.” Both arguments had supporting examples (e.g. “when Germany provided Polarstern for MOSAiC, science flourished”), but it was a highlight from both sides that the availability of vessels is a key point. Different time scales were also identified as a crucial aspect for transnational access to PRVs. It was mentioned that “funding agencies don’t want to commit to long-term planning”

and that Arctic science “should compete with other excellent science.” On the other hand, planning a long time in advance reduces the flexibility for ad-hoc projects.

One of the participants with a background in research funding highlighted that a major challenge was not finding resources to fund research but sustaining the research infrastructure and guaranteeing access to it.

**Good Practices and Recommendations:** The suggestions to overcome the challenges focused on the establishment of mechanisms that would allow for

- Truly joint planning (not only passive participation but also impact on route and Scope of Work)
- Funding and allocation of (international) ship time
- Joint funding calls for research by multiple national research funders
- Harmonisation of planning schemes and timing of calls across PRVs
- Increased remote access to vessels (increasing the scientific value at low additional cost)

One concrete suggestion would be that PRV operators start to publish multi-year cruise plans – even if that meant that some of the plans were not yet fully funded (or fully confirmed). An existing example of this kind of information sharing is the “Tentative timetable for IB Oden” published by the Swedish Polar Research Secretariat (<https://www.polar.se/en/expeditions/timetable-for-expeditions/>).

Other suggestions for reaching the above-mentioned goals included the following:

- “An agreement on accepting each other’s proposal evaluation system on an international level could make the possibility of international third-party funding much easier to implement”
- “Once a platform is supported nationally, with open berths, you can build international opportunities to address common science questions”
- Establishment of a funding system like the International Ocean Discovery Program for PRV-based research in the High Arctic
- Increased “science diplomacy by utilising platforms like the Arctic Science Ministerial to bring forward a scientific agenda”
- “Bringing national agencies together to discuss”
- “An international funder agreement to support national science toward common, high priority international science questions”
- “Two types of transnational calls could be considered – long-term, detailed scientific collaboration and more opportunistic offers of spare berths on already planned cruises available at short(er) notice”

The ongoing cooperation with IASC including the ongoing ICARP IV planning was highlighted as one possible platform for taking concrete steps towards more sustained transnational access and international coordination: “Those IASC countries that want to can commit multi-year funding to get time and berths on icebreakers. Such a mechanism would allow both smaller parties to join planned cruises but also larger joint projects with participants from several countries. Of course, based on scientific excellence. And if there are no good proposals coming from groups in a given country each year, that country’s funding is not used.”

The participants highlighted that both the international scientific and science policy community had already started to take steps towards common prioritisation of topics that could work as a basis for starting the higher-level negotiations necessary for the establishment of the aforementioned tools. One of the recent activities

that were highlighted in discussion was the United Nations Ocean Decade and its regional plan for the Arctic Ocean (2021). A question was raised about how to connect this regional planning to the new framework programme Horizon Europe and associated initiatives such as Mission Starfish Europe 2030 (European Commission, Directorate-General for Research and Innovation et al. 2020).

One of the participants with a background in research funding noted that instead of focusing on existing funding streams, it might be most beneficial to aim to access new funding streams. This will be a longer process that will require a lot of coordination between different national funding horizons. In the United States, for example, a funding agency must put in a budget request three years in advance before they can access the money. As such, it is recommended to have at least two levels of planning towards the aforementioned goals: one for existing funds which with the community could carry out smaller efforts and then targeting the longer-term funding to larger joint proposals, such as joint cruises like the MOSAiC campaign. To achieve something like this, the operators of vessels need to come up with a frame of reference on how much a berth on-board a vessel costs in different conditions and geographical regions. Even though this varies, the funders cannot work with hypothetical berths. They need a budgetary frame. The decision-makers will also need concrete suggestions for different models of joint funding.

## Conclusion

Above challenges and recommendations for improved international coordination of research platforms and science in the Arctic necessitates collaboration across all stakeholders from scientists, thematic scientific networks, international multidisciplinary science organisations, infrastructure platforms and organisations, national governments and intergovernmental organisations and funding bodies. The dialogue around the identified challenges at this workshop thus needs to be expanded and continued in a number of multilateral initiatives. IASC (representing the science community) and FARO (representing the infrastructure community) could be facilitators of such processes.

While sustained institutional change can only come from the top-down, it is equally important to continue grassroots efforts for

increasing international access and collaboration. Cross-cutting meetings are vital for bringing different organisations and operational groups together to exchange information and increase awareness. Arctic Science Summit Week and Arctic Circle meetings are ideal places to institute standing discussions between users and operators of Arctic infrastructure platforms from across the globe. Increasing interaction between marine and terrestrial groups is also important to share best practices and align efforts to increase transnational access to research platforms.

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