SIOS Marine Network: 1st workshop summary

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Introduction

Svalbard Integrated Arctic Earth Observing System (SIOS) is an international consortium that cooperates to develop and maintain a regional observing system in and around the Norwegian archipelago Svalbard in the European High-Arctic. Svalbard is an ideal platform for environmental research due to its location, accessibility and well-developed infrastructure leading to establishment of high-quality research programmes by many institutions. SIOS brings together the existing research infrastructure and resulting data of its currently 24 members from 9 nations into a multidisciplinary network dedicated to addressing Earth System Science questions related to environmental change. The focus lies on cross-disciplinary processes and interactions between the spheres that make up the Earth system (biosphere, geosphere, atmosphere, cryosphere, and hydrosphere). The central node of SIOS is the SIOS Knowledge Centre (SIOS-KC), which delivers and coordinates services to the SIOS community.

SIOS publishes an annual report on the State of Environmental Science in Svalbard (SESS report), compiled by authors from the multidisciplinary and international scientific community. The report summarises the state of current knowledge of key Earth System Science parameters in the Svalbard region, highlights unanswered questions and gaps in observations, and eventually recommends research priorities for the following year(s). The SESS report is an important mechanism for developing the integrated observing system and prioritising funding needs. It is also an important outreach tool towards stakeholders and policy makers.

In the first SESS report, published in 2019, two of the chapters highlighted the need for closer collaboration between the owners and operators of the various marine infrastructures in the Svalbard region (Cottier et al, 2019 and Bensi et al, 2019). In addition, SIOS-KC has received requests from the marine science community for support to accessing ship time and help to service moorings. In response to this the SIOS marine infrastructure network was initiated. The network was launched in a workshop organised by SIOS-KC in collaboration with key partners.

Summary of workshop 19th November 2020

The first workshop of the SIOS marine infrastructure workshop was held online Thursday 19th November 2020 (SIOS, 2020). The workshop was organised and planned by SIOS-KC, Manuel Bensi (National Institute of Oceanography and Applied Geophysics), Arild Sundfjord (Norwegian Polar Institute), Frank Nilsen (University Centre in Svalbard) and Agnieszka Beszczynska-Möller (Institute of Oceanology Polish Academy of Sciences). 65 people registered for the workshop and at the most 60 people were in attendance on the day.

The following is a summary of what was presented and discussed at the workshop. Each presenter was asked to include their current marine infrastructure, their plans

for development of infrastructure, their main logistical challenges and wishes, and what they hoped to get out of the SIOS marine network.

Marine infrastructure presented

The marine infrastructure that was presented during the meeting are shown in figure 1 and table 1. It covers infrastructure owned by 12 institutions from 7 countries and represents a wide geographic coverage of western and northern Svalbard. The largest concentration of long-term measurements is in the western fjords Kongsfjorden and Isfjorden, as well as the seas off the west-Spitsbergen coast.

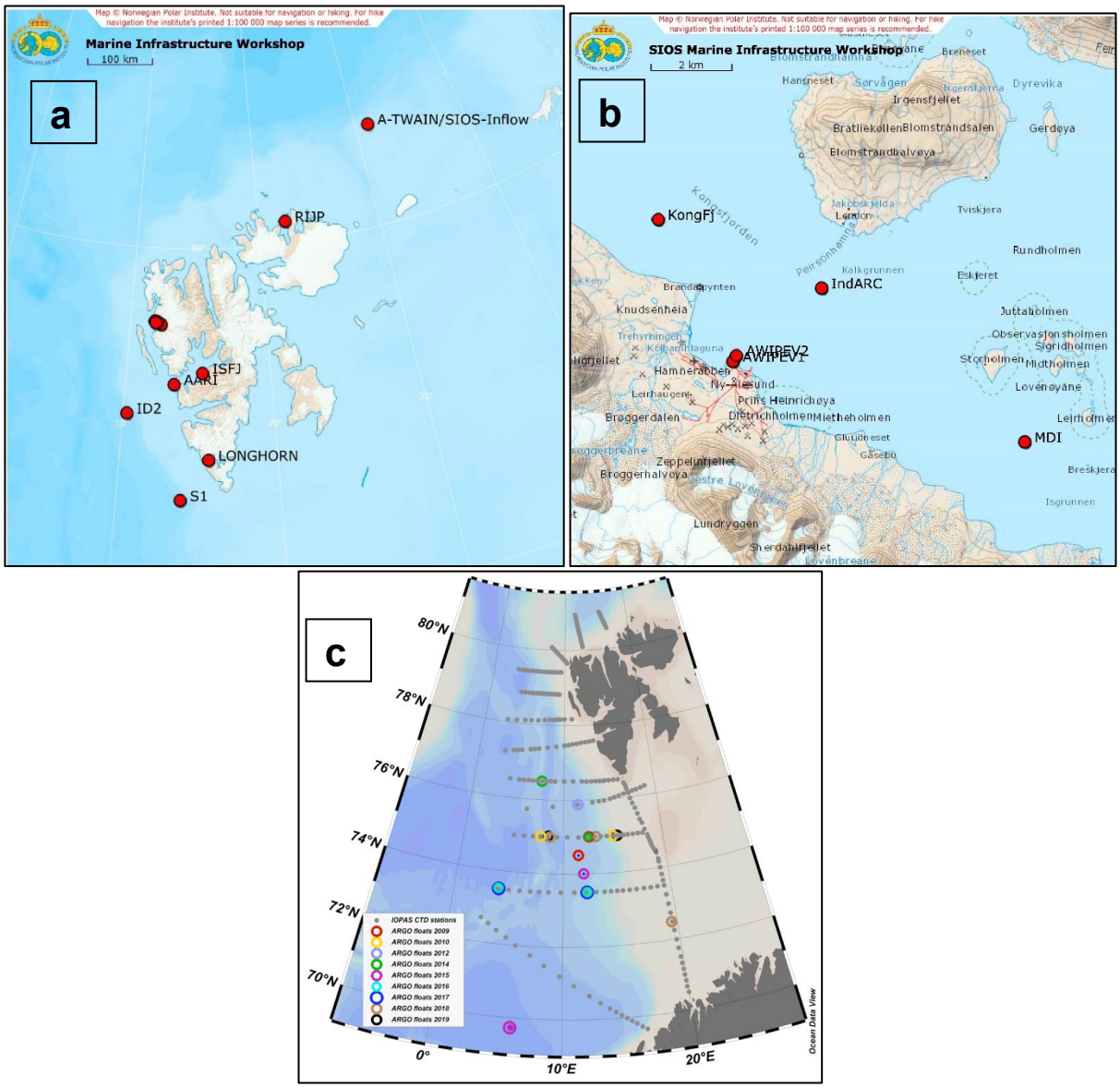

Figure 1: Maps of Svalbard showing a and b) the mooring and other infrastructure presented at the marine infrastructure workshop and c) AREX cruises and Locations of deployments of ARGO-Poland floats by Institute of Oceanology Polish Academy of Sciences. The dots in Kongsfjorden in figure 1a represent several moorings, as shown in figure 1b.

Other marine infrastructure in the SIOS network that are relevant in this context, but were not presented during the workshop, are:

- Ocean Glider, West Spitsbergen Current – UiB
- K-Lander - UiT/CAGE
- Oceanographic Bouy In Adventfjord – NIVA
- Fram Strait moorings – NPI / AWI

Table 1: List of the marine infrastructures presented at the marine infrastructure workshop. The locations of the infrastructures are shown in figure 1. Where available, a hyperlink to the entry of the infrastructure in the SIOS Observation Facility Catalogue (https://sios-svalbard.org/sios-ri-catalogue) is included in the table.

Name of infrastructure	Responsible Institution(s)	Country
A-TWAIN/SIOS Arctic Ocean Inflow Observational Node	Norwegian Polar Institute (NPI), Institute of Marine Research (IMR)	Norway
Isfjorden Smart Buoy	University Centre in Svalbard (UNIS)	Norway
Mooring Dirgibile Italia	National Research Council of Italy (CNR)	Italy
Mooring S1	National Institute of Oceanography and Applied Geophysics (OGS)	Italy
Mooring ID2	National Institute of Oceanography and Applied Geophysics (OGS)	Italy
IndARC mooring	National Centre for Polar and Ocean Research (NCPOR)	India
AWIPEV-COSYNA Mooring	Alfred-Wegener-Institute, Helmholtz Centre for Polar and Marine Research (AWI)	Germany
AWIPEV Underwater Observatory	Alfred-Wegener-Institute, Helmholtz Centre for Polar and Marine Research (AWI)	Germany
AARI oceanographic buoy	Arctic and Antarctic Research Institute (AARI)	Russia
Rijpfjorden mooring	Scottish Association for Marine Science (SAMS) / UiT Arctic University of Norway (UiT)	United Kingdom / Norway
Kongsfjorden marine observatory	UiT Arctic University of Norway (UiT)	Norway
LONG-term oceanographic monitoring in HORNsund region	Institute of Geophysics Polish Academy of Science (IGF-PAS)	Poland
AREX cruises	Institute of Oceanology Polish Academy of Sciences (IOPAS)	Poland
ARGO Poland	Institute of Oceanology Polish Academy of Sciences (IOPAS)	Poland

Planned developments

The planned or suggested developments for marine research infrastructure presented include are presented grouped into 6 categories below. For institution acronyms see table 1.

Upgrades to infrastructure:

- Acoustic modem to retrieve data from sub-surface mooring (UNIS)
- Add instrumentation (sea surface level, weather station, sediment trap etc.) (CNR)
- Add light measurements (SAMS / UiT)
- More sensors to mooring (sediment traps, pCO2 etc.) (NCPOR)

Changes to monitoring programme or methods:

- Integrate autonomous platforms with more regular surveys (SAMS / UiT)
- Expand measurements to open ocean (NCPOR)
- Expand phytoplankton detection methods (e.g. DNA), increase vertical and spatial resolution (UoG)
- Extend duration and spatial extent of measurements through the water column (OGS)
- New moorings in Hornsund and north of Svalbard (IOPAS)

Modelling:

- Model the consequences of the change of Hornsund from a fjord to a sound

Data management:

- Make data visualisation for SIOS web page (UNIS)
- Data delivery to SIOS via NIRD by late 2021 for Kongsfjorden and Rijpfjorden moorings (UiT)
- Make data openly available (IOPAS)

Funding:

- Secure long-term funding for Rijpfjorden mooring (SAMS / UiT)

Collaboration:

- There is room for more sensors on the Isfjorden mooring, which could be offered to other users in the network (UNIS)
- Work to optimise arrangement of observatories to avoid overlap and ensure better spatial coverage (AARI)
- Stronger collaboration between Kongsfjorden observatories (NCPOR)

Logistical challenges and wishes

The presenters were asked to highlight their main logistical challenges and what they would like to see going forward. There were many points in common between the different presenters, and the most important ones are listed below.

- There needs to be more calibration and inter-calibration of mooring sensors so that measurements from different parts of Svalbard can be compared.

- Many institutions lack reserve sets of equipment, making the long-term time series vulnerable. As a community the SIOS marine network could consider having supplies available in Svalbard that may be accessed on short notice.
- Sea ice is a risk factor for moorings and can cause severe damage. Better forecasting of fjord ice would help to launch rescue missions if necessary.
- Researchers are dependent on availability of large vessels to service moorings. An annual Svalbard moorings cruise could be organised by the community to guarantee the necessary ship time to all users.
- The impact of activity on the fjord environment could be reduced by using a locally sourced or reusable ballast system.
- Increased focus on having good technical staff for pre- and post-recovery actions is needed. A task team should be considered that could offer logistical services targeted at marine scientists more widely (for a fee).
- There is a need to link the marine sciences to the wider Earth system science community.
- It would be beneficial to make better and easily accessible information for researchers, e.g. on waste management procedures.
- An annual meeting of the marine network to address mooring activities, solve problems, avoid duplication, and streamline protocols should be initiated.
- Standardised and open sharing of data is essential. As much as possible, data should be available near-real time.
- SIOS could maintain a list of lost and found research infrastructure.

Desired outcomes of the marine network

The final item the presenters were asked to consider was what they were hoping to get out of being part of a marine network. This item generated the most engaged discussions and many suggestions.

Science optimisation:

- Joint, multidisciplinary projects and papers
- Increased use of marine network data also outside the marine community
- Increase resolution of measurements, e.g. a monthly or weekly Atlantic water index
- Integration of observations to maximise resolution
- Link the needs of modellers to the process of determining the priorities for infrastructure and monitoring programme development, use modelling data to plan projects
- Extend monitoring programme by cooperating with more institutions
- Joint planning on placement of infrastructure to avoid duplication and get better spatial coverage
- Write a SESS report chapter linking all marine observational infrastructure in Svalbard
- Prioritisation and harmonisation of measurements and variables. Important for a future meeting to take place soon, it is easier to argue for continued funding if the system is integrated

- Challenge: moorings are often funded through projects, so the set of sensors is for a specific purpose. This can make it hard to harmonise variables

Information:

- Overview of the activities and plans of SIOS members, e.g. mooring maintenance, available ship time etc.

Logistics:

- Cooperation on mooring maintenance to optimise logistics and improve resilience
- Greater reliability of operations & cooperation
- Open access to research infrastructure

Data management:

- More open sharing of FAIR data
- Improve comparability of measurements, harmonise data collection and protocols
- Engage with the SIOS core data process to ensure the important marine variables are included

Networks and projects to collaborate with:

- Kongsfjorden flagship
- Nansen Legacy
- INTAROS
- EMSO
- All Atlantic Research Alliance

Conclusions and recommendations

The workshop was well attended, and the participants were engaged. There is a strong desire for greater collaboration, as the summary of the talks and discussions presented above shows. The community is interested in cooperating on science and research infrastructure optimisation, data sharing, and logistics. SIOS-KC is considered a useful tool to facilitate this kind of cooperation, e.g. through planning and funding workshops, making information sharing platforms and supporting data management.

Next steps

The next steps for the SIOS marine network, based on the input from the workshop, are identified as follows:

1. Prioritisation of variables
    a. Harmonisation
    b. Consider the needs of end-users (e.g. modellers)
    c. Basic suite of standardised measurements for Svalbard moorings
2. Identify and fill marine RI gaps
    a. Good coverage on west coast of Spitsbergen, sparce elsewhere
    b. Prioritise fjords, coastal and open sea in the east of Svalbard?
    c. Further afield – Arctic ocean, sea ice areas

   d. Potential for increased use of Ferryboxes?
3. Promote more long-term all year time series
   a. Collaboration to ensure better coverage of sensors (joint funding)
   b. Help and support with data management
4. Annual meeting to discuss needs
   a. Scientific needs, collaborative projects
   b. Logistical needs

References:

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