SVALBARD INTEGRATED ARCTIC EARTH OBSERVING SYSTEM

The recommendations from the State of Environmental Science in Svalbard (SESS) report for SIOS Access Call 2020

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1. Introduction

SIOS publishes an annual report on the State of Environmental Science in Svalbard (SESS), compiled by a multidisciplinary and international community. The SESS report has several goals: (a) to summarise the latest developments in the Svalbard environment and provide users with the core data underpinning our knowledge of the changes, (b) point out knowledge gaps for Earth System Science issues in the Svalbard region that are important for society, (c) provide recommendations regarding how to develop the observing system, thus forming the basis for the work programmes of SIOS for the coming year(s). The SESS report highlights questions that remain unanswered and recommends solutions in terms of research infrastructure improvements and research priorities. It is an arena for open sharing of ideas and discussions on which measures should be taken to enable scientists to provide observations needed to gain a holistic view of the Earth System of Svalbard and the Arctic in general.

SIOS Access Call provides access to the SIOS research infrastructure for the purposes of conducting Earth System Science research and monitoring as well as promote more efficient use and better integration of the observing system. Applicants must meet the criteria of being in line with the core scientific priorities of SIOS and recommendations from the SESS report.

This document highlights the most relevant recommendations for the SIOS Access Call from SESS reports published in 2019 and 2020. Within the disciplines represented in the SESS report, recommendations were selected that are relevant for the integration of the observing system and communities, high scientific quality, data harmonisation as well as development of the long-term monitoring.

2. SESS report recommendations

Recommendations from the various SESS report chapters address mainly very detailed observational and analytical requirements. However, several general recommendations have been given:

- Promote collaboration between RI and scientific exchange among scientists/ strengthen the network of Svalbard scientists.
- Access proposals to observatories and observational facilities shall utilise and/or expand the running observations and research programmes as well as help to develop new long-term monitoring sites and series.
- SIOS provides access to a wealth of data, which should be used, e.g. for campaign planning or analyses and interpretation of obtained data.
- Support the exchange of the data and linkages between historical and present data.
- Many observations can be utilised by several “disciplines”, for example, deposition process on snow, which relate to atmospheric transport and can affect the biota of the underlying soil. Access planning and subsequent data analyses and interpretation should address these.
- Carry out the disciplinary and/or cross-disciplinary studies at multiple sites across Svalbard using standardised protocols.
- Developing methodologies that combine field-based measurements with remote sensing and improve the modelling.

Here are some specific recommendations, grouped according to their main discipline:

Atmosphere

Atmosphere research is a well-developed topic on Svalbard and within SIOS. The priority is to promote better coordination of observations at existing sites between the different research fields and developing remote sensor methods. Existing observational programmes could be extended by measurements of aerosol precursors like MSA, VOCs, DMS, and naturally charged ion clusters. Black Carbon (BC) is a big topic, which still can be expanded by performing vertical BC profiling measurements (e.g. on available balloon platforms). Contributions to the investigation of BC – cloud interactions are needed. BC wet and dry deposition processes, as well as trends, should be further assessed on Svalbard. On a methodological aspect, the comparability and accuracy of atmospheric BC measurements should be improved.

Atmosphere related access proposals should aim for joint campaigns concerning aerosol observations in different seasons with different platforms (especially a comparison between balloon-, UAV-borne and remote sensing instruments (like LIDAR) should be performed).

Generally, the link between the various atmospheric measurements in Svalbard and climate modelling on scales from LES (Large Eddy Simulation) to regional modelling should be a topic also for access proposals.

Ocean

Ocean studies are extremely important as the ocean shapes the climate of the Arctic that needs to be addressed more broadly. Firstly, there is an urgent need to develop marine environment observation infrastructure. This could be realized by setting up the autonomous observational sites for long-term monitoring, to achieve time series on ocean dynamic, biogeochemistry and ecology.

The measurement/sampling possibilities could be extended by the winter/spring season campaigns and by using non-scientific ships, e.g. tourist vessels (e.g. for Continuous Plankton Recorder). Additional multibeam surveys to investigate the shelf-slope dynamics and sampling of marine sediments are needed to deepen the knowledge on geological history of Svalbard.

High-resolution numerical models could be prepared to interpret better the relationships between different environmental compartments, e.g. ocean and atmosphere. A programme of harmonisation of marine measurements around Svalbard would be desirable to ensure homogeneous data collection in different areas.

Cryosphere

Glaciers and snow are essential components of the Svalbard environment and have a long-term series of observations. Considering new measurements techniques and needs arising from the urgent issue of climate change it is crucial to implement new instruments and methodologies in cryospheric research, including:

Utilise/develop new tools to better quantify wet snow properties, with a focus on remote sensing and model validation as well as carry out coordinated studies of snow cover contamination and better quantification of the ice amount in snow packs at multiple sites. Expand the snow cover monitoring to the central and eastern Svalbard in order to obtain robust monitoring over different climate and snow conditions.

Detailed measurements to quantify and understand frontal ablation and its drivers and to separate its components submarine melting and calving and their relative importance related to surface mass balance. Extend the datasets of near-front ice thickness, improve the glacier spatial resolutions and increase the access to database of simulated climatic mass balance, melt, runoff, etc. across Svalbard to directly reach out to glacier-related disciplines (e.g. marine biology, hydrology, seismology). Acquire data and information for development of a coupled glacier mass balance-glacier dynamics model that can be applied to investigate the effects of different climate scenarios.

Developing tools based on optical and radar satellite remote sensing for supporting the established monitoring methods for landfast sea ice.

Maintain existing monitoring networks and instrumentation of the permafrost essential climate variables (ECV) to achieve long-term, field-based knowledge of the impacts of climate change on polar landscapes.

Terrestrial/Lithosphere

The biotic and abiotic components of the ecosystem are sensitive to climate change. Studies of these changes are crucial for a better understanding of the Earth System.

To improve the location of glacier seismicity, structural investigation on crustal scales should be performed, which will benefit from network extensions and temporal seismic deployments for structural and/or cryoseismological studies.

Obtain additional multi-corer samples in key areas to deepen the knowledge on the sedimentary records.

Conduct a comprehensive microbial biodiversity and habitat classification study across Svalbard. Carry out time-series studies on the microbial activity at key 'indicator' sites to establish the stability of microbial communities. Link current and future flux measurements to concurrent microbial activity as well as vegetation. There is a need to develop methodologies that combine field-based measurements and near ground sensors of plant productivity with data from satellites.

3. Conclusion

Access proposals shall try to answer the above-listed research recommendations from the previous SESS reports. Cross-disciplinary contributions shall be prioritised, e.g. interdisciplinary studies linking soil (permafrost), snow and atmospheric research, and/or effects on biota or biodiversity. Remote sensing products, e.g. from satellite or aircraft observations provided by SIOS should be used to make access activities more efficient, for example for the planning of field sites and/or campaign timing. Efforts to ensure homogeneous data collection in different areas with particular attention to the SIOS core data are recommended.