Summary of SSF recommendations

Results from workshops arranged or financed by SSF
and Ny-Ålesund flagship documents

2009-2014

Version: October, 2014
Update by: Marianne Johansen

The '*SSF recommendations'* is a summary of the conclusions and recommendations from the workshop reports from Ny-Ålesund Flagships and SSF Workshops (organized by SSF or researchers with SSF strategic funding support).

The flagship programmes in Ny-Ålesund have been developed according to the goals of the Ny-Ålesund Science Plan and are closely related. They will be further harmonized in order to establish an integrated research and monitoring programme for Ny-Ålesund/Kongsfjorden.

The document will be updated with the conclusions from workshops organized in the future

SSF Strategic objectives:

- Increased scientific cooperation within Svalbard research
- Increased coordination of activities
- Open sharing of data
- Reduced environmental impact

Workshop overview

Black text: Conclusions from workshop reports listed in this document and included in the *SSF Priorities*.
Grey text: Workshop reports not yet published.

- No. 5: *New technology for bridging the Arctic knowledge gaps* (Hven 2014)
  Organized by SSF

- *Calving and Surging Glaciers: Observations, Modelling, Predictions* (Utrecht, 2014)
  SSF funded workshops

- *Workshop on collaboration and coordination within the Ny-Ålesund Atmospheric Flagship Programme* (Potsdam, 2014)
  SSF funded workshops

- *Kongsfjorden Ecosystem –new views after more than a decade of research* (Senja, 2014)
  SSF funded workshops

- *Workshop: Proterozoic and Lower Palaeozoic basement of Svalbard - state of knowledge and new perspectives of investigations* (2013)
- **SSF funded workshops**

- *Cooperation on Arctic bivalves* (Tromsø, 2014)
  SSF funded workshops

- *The Permian Strata of Svalbard* (2013)
  SSF funded workshops

- *The CRYO-FImBack workshop - Atmospheric forcing and surface energy balance - impacts and feedbacks on the Arctic terrestrial cryosphere* (2013)
  SSF funded workshops

- *Svalbard Snow and Avalanche Science Workshop* (2013)
  SSF funded workshops

- *1st Science-Industry platform on expedition cruise tourism in Svalbard* (Oslo, 2012)
  SSF funded workshops

- *Workshop to develop and explore new approaches to analysing past, present and future climate dynamics* (2013)
  SSF funded workshops

- No. 4: *Zackenberg & Nuuk - what can we learn for Svalbard?* (Copenhagen 2013)
  Organized by SSF

- *Past, current and future research on kittiwakes in Kongsfjorden: The opportunity of an international integration* (Norw. Univ. of Science and Technology, March 2013)
  SSF funded workshops

- *Barents Sea Ice sheet – insights into the climatic sensitivity of marine based ice sheets.* (UNIS, 2013) **SSF funded workshops**

- No. 3: *Changes in snow/ice and pollutants and their effects on terrestrial ecosystems* (Oslo, 2012) – **Organized by SSF**

- *Svalbard Early Career Researcher Network – online workshop* (APECS, 2012) **SSF funded workshops**

- *Developing joint future permafrost hydrology research in Svalbard* (HYDRO-PERM) (UNIS, 2012) - **SSF funded workshops**

- *No. 2: Geology of Svalbard - Environmental changes in Svalbard since the last glacial maximum - integrating marine and terrestrial records* (Tromsø, 2011) **Organized by SSF**

- *Glaciology* (Tromsø, 2011) **Ny-Ålesund flagship initiation workshops**

- *No. 1: Pan-Svalbard Cooperation - Management, Glaciology, Upper atmosphere* (RV Horyzont, 2009) **Organized by SSF**

- *Terrestrial Ecosystems* (Oslo, 2009) **Ny-Ålesund flagship initiation workshops**

- *Atmospheric research* (Kjeller, 2008) **Ny-Ålesund flagship initiation workshops**

- *The Kongsfjorden System - marine research* (Ny-Ålesund, 2008) **Ny-Ålesund flagship initiation workshops**

SSF funded workshops:

Workshop: Proterozoic and Lower Palaeozoic basement of Svalbard - state of knowledge and new perspectives of investigations (Winfried Dallmann, 2013)

Recommendations from the workshop:

Regional research in Svalbard

Recommendation #1: **Deciphering events in the Southwestern Basement Province affected by the West-Spitsbergen Fold Belt**

Problems with interpretation of the Southwestern Basement Province are the result of a complicated sequence of deformation events prior to and during the Caledonian Orogeny, which were overprinted by the West Spitsbergen Fold Belt tectonics in the Palaeogene. Severe segmentation and tectonic juxtaposition of pre-Caledonian terranes, has made the evolution of the region difficult to unravel.

Recommendation #2: **Correlation and unification of nomenclature of basement stratigraphy in the Southwestern Basement Province**

The Southwestern Basement Province extends over a large distance from north to south and various research groups have worked in different subareas. Consequently, unified stratigraphic and tectonostratigraphic nomenclatures have rarely been applied and meaningful correlations are difficult.

Recommendation #3: **Provinciality of igneous rocks of the Southwestern Basement Province**

Geochemical investigations of the meta-igneous rocks of the Southwestern Basement Province are expected to provide important data on their geotectonic settings, which will further an understanding of the geotectonic history of the basement province and of the fold belt.

Recommendation #4: **Discrimination of Caledonian and older deformation events in the Southwestern Basement Province**

In recent years, studies have identified deformation events that took place prior to the Caledonian Orogeny, such as the ca. 640 Ma old Torellian event. This discovery confirmed the importance of a Cryogenian-age unconformity, which had previously been thought to have been of Grenvillian age. Discrimination and timing of other Precambrian deformational episodes in the region are critical to further understanding of the geotectonic history of this basement province.

Recommendation #5: **Fault reactivation and basin evolution**

Post-Caledonian sedimentary basins of Svalbard and elsewhere on the Barents Shelf have in many cases been controlled by the reactivation of pre-existing faults or shear zones within the basement. A better understanding of such basement structures will undoubt-edly provide information on how they have contributed to the evolution of the sedimentary basins.

Recommendation #6: **Basement sources of younger clastics and thermochronology**

A more detailed knowledge of basement lithologies is required to enable identification of the provenance of younger sedimentary basin fills throughout Svalbard. Such studies have been scant and few if any have been combined with thermochronological studies to understand basin evolution from inception to inversion and uplift. On-shore based studies of this type can act as proxies to help understand, in particular, hydrocarbon evolution in adjacent offshore basins.

Recommendation #7: **Defining the origin of Caledonian granites**

Late Caledonian granitic intrusions of NW Spitsbergen (Albert I Land, Oscar V Land) and N Nordaustlandet, while being well known from an age and compositional point of view, are poorly understood geochemically. Geochemical modeling of the magma source generation would help to define the tectonic setting of Svalbard during Caledonian Orogeny. Identification of sources and evolution of granitic melt and associated migmatites will help to determine the range of interactions between mantle and crust in the convergent environment. Results from different Late Caledonian igneous provinces of Svalbard should be compared and Northeastern ProvinceNorth-western ProvinceSouth-western Province100 km Pre-Devonian basementDevonian and younger correlated with adjacent Caledonian crustal units. These studies will provide new data to develop models for reconstructing the Arctic Caledonides.

*Recommendation #8:***Composition of the lower crust and mantle beneath Svalbard**

Of fundamental importance for our understanding of the Caledonian structure on Svalbard is the composition of the lower crust and upper mantle. Unique evidence has been obtained from xenoliths in recent volcanic vents located on both sides of the Breibogen Fault Zone in Svalbard´s Northwestern Province. More work is needed, in particular on the crustal xenoliths from both sides of this fault, to define the Caledonian structure.

Arctic correlation

Investigations of the Circum-Arctic tectonic evolution are a relative recent field of research, as significant data have become increasingly available during the last two decades.

*Recommendation #9:***The extent of the Grenville-Sveconorwegian Orogen in the Arctic**

Evidence for the presence of late Grenville-age Orogeny in eastern Greenland (Renlandian Orogeny) and on Svalbard (Nordaustlandet Orogeny) has been available since the mid 1990s. Sedimentary successions involved in this mid Tonian tectonothermal event host detrital zircon populations that were derived from source terrains similar to those in the type areas of the Grenville and Sveconorwegian orogens. The Grenville-Sveconorwegian Orogen may well have continued northwards into the high Arctic. This hypothesis needs further investigation; it influences not only reconstructions of the 1.0 Ga Rodinia super-continent, but also an understanding of the sgnificance of lithospheric inheritance for Caledonian Orogeny.

Recommendation #10: **Svalbard – NE Greenland/Pearya correlation**

The Pearya Terrane of northern Ellesmere Island, like the basement of Svalbard, is interpreted to have been assembled during Caledonian Orogeny. The need for unravelling the tectonother- mal history of Pearya is critical. Given the evidence that both areas, as well as northeast Greenland, were only a few hundred kilometres apart during the late Palaeozoic and Mesozoic, integrated stratigraphic, petrographic, including geochemical and isotopic studies are now needed to investigate any commonality in their respective evolutionary pathways.

Recommendation #11: **Reconstruction of the northern Iapetus Ocean development**

The basement of Northeastern and Northwestern Svalbard is very similar to correlatives in the Caledonides of northeastern Greenland and the latter are well established parts of the Laurentian margin. Sedimentary and volcanic sequences intruded by magmatic rocks in Svalbard should be reinvestigated to see if they can be related to stages in the development of the Iapetus Ocean. Geochronology and stratigraphy of these rocks still need improvements and redefinitions.

Recommendation #12: **Torellian orogen and unconformity**

The relatively recent unveiling of the 640 Ma old Torellian event in southwestern Svalbard, an approximate correlative of Timanian Orogeny along the northeastern margin of Baltica, raises the question of how significant this event was in terms of geotectonic origin and regional distribution. It would be important to know if it can be identified, not only in other areas in Svalbard, but also in northern Greenland and perhaps farther west in Pearya and beyond.

Collaboration / events

Recommendation #13: **Integration of geological and geophysical methods**

Workshop participants unanimously expressed the need of better collaboration between geologists and geophysicists. Collaboration with geoscientific institutes that already have experience with Svalbard research, like Institute of Geophysics - Polish Academy of Sciences (IGF PAS), Fed. Inst. of Geosciences and Natural Resources (BGR, Germany), should be encouraged.

Recommendation #14: **Joint meeting at EGU in Vienna**

The next General Assembly of the European Geosciences Union, held in Vienna, 27 April – 2 May, 2014, will be a convenient occasion to gather relevant researchers to continue discussions on the various aspects of Svalbard basement research. It is recommended, therefore, to arrange a special session on this topic.

Application of remote sensing/geophysical methods

Recommendation #15: **Broadening of application of remote sensing techniques**

Remote sensing techniques such as SAR (Synthetic Aperture Radar), hyperspectral and ETM (Enhanced Thematic Mapper) data combined with ground-truthing are capable of providing a powerful array of new approaches to exploring the structure and composition of Svalbard's bedrock. To date these techniques have rarely been employed for bedrock investigations. They have, however, provided valuable new data for the investigation of glacial processes in Svalbard and other regions.

Recommendation #16: **New seismic profiling along the northern coast**

Although seismic reflection profiling across the northern offshore area of Svalbard was carried out in the 1970s the results were not fully released and some reprocessing of the data could help to improve understanding of the tectonic architecture of the adjacent onshore regions. It is important to better define the continuation of the major faults onto the offshore platform and what kind of basement underlies, for example, the Devonian Basin of northern Svalbard. To better understand the entire Caledonian structure of this northwestern part of the Barents Shelf, a new wide angle and CMP reflection profile will be necessary. The results would be of importance for all other seismic studies of the region.

Recommendation #17: **Application of 3D-photogeology and 3D-structural modeling**

3D-photogeology (photogrammetry) and 3D structural modeling (Svennevig, abstract, this volume) is a suitable method to obtain a large quantity of high-quality structural data in remote areas, where logistics are difficult. The application of the method to structural problems on various scales in Svalbard has the potential to solve long-standing geological questions – and rise many new ones – as recent results from eastern North Greenland have shown. The method could be applied using satellite or aerial images from previous surveys, or from oblique photos taken from ships, helicopters, snow mobiles or drones.

Recommendation #18: **Recognition of the palaeomagnetic record of Svalbard**

Palaeomagnetism is the only method which can quantify the former position of the crustal units. Pre-Devonian palaeomagnetic records of the various terranes is still poorly recognized. Priorities: defining primary magnetic directions from the rocks which has not been subjected to Caledonian metamorphism, dating of secondary magnetic Caledonian overprints, integration of structural and palaeomagnetic studies in the West Spitsbergen Fold Belt, reconstruction of the basement geometry during the subsequent stages of deformation.

*Recommendation #19:***Promoting young carriers in Svalbard geological basement topics**

It is suggested to strengthen efforts to promote topics related to Arctic basement geology in universities. In particular, young scientists who conduct scientific investigations involved in SvalGeoBase topics should be encouraged and supported.

Workshop participants:

1. Mariusz Burzyński, Uniwersytet Warszawski, Poland
2. Karoline Bælum, Svalbard Science Forum, Longyearbyen, Norway
3. Jerzy Czerny, AGH Univ. of Science and Technology, Kraków, Poland
4. Winfried Dallmann, Norsk Polarinstitutt, Tromsø, Norway
5. Synnøve Elvevold, Norsk Polarinstitutt, Tromsø, Norway
6. David Gee, Uppsala University, Sweden
7. Piotr Głowacki, Inst. of Geophysics, Polish Academy of Sciences, Warsaw, Poland
8. Pierpaolo Guarnieri, GEUS Geol. Surv. of Denmark and Greenland, Copenhagen, Denmark
9. Karolina Kośmińska, AGH Univ. of Science and Technology, Kraków, Poland
10. Nikolay Kuznetsov, Russian Academy of Science, Moscow, Russian Federation
11. Grzegorz Lipień, KGHM, Poland
12. Jarosław Majka, Uppsala University, Sweden
13. Andrzej Maksym, PGNiG, Poland
14. Geoffrey Manby, Museum of Natural History, London, UK
15. Patricia Manby, London, UK
16. Maciej Manecki, AGH Univ. of Science and Technology, Kraków, Poland
17. Marek Matyjasik, Weber State University, Ogden, UT, USA
18. Krzysztof Michalski, Inst. of Geophysics, Polish Academy of Sciences, Warsaw, Poland
19. Karsten Piepjohn, Fed. Inst. of Geosciences and Natural Resources, Hannover, Germany
20. Kristian Svennevig, GEUS Geol. Surv. of Denmark and Greenland, Copenhagen, Denmark
21. Rafał Szaniawski, Inst. of Geophysics, Polish Academy of Sciences, Warsaw, Poland

SSF funded workshops

Cooperation on Arctic bivalves (Jasmine Nahrgang, 2014)

Recommendations will be added here soon

Workshop participants:

1. Hector Andrade, Akvaplan-niva
2. Igor Bakhmet, Institute of Biology, Karelian Research Centre, RAS
3. Jørgen Berge, University of Tromsø /University Centre In Svalbard
4. Steven Brooks, Norwegian Institute for Water Research
5. Lionel Camus, Akvaplan-niva/ University of Tromsø
6. Michael L.Carroll, Akvaplan-niva
7. Laurent Chauvaud, LEMAR/UMR 6539, Institut Universitaire Européen des Sciences de la mer
8. Marianne Frantzen, Akvaplan-niva
9. Ingeborg Hallanger, University of Tromsø
10. Haakon Hop, Norwegian Polar Institute
11. Bjørn Munro Jenssen, Norwegian Unversity for Science and Technology/UNIS
12. Galina Kolyuchkina, P.P.Shirshov Institute of Oceanology, RAS
13. Ekaterina Korshunova, Akvaplan-niva/University of Tromsø
14. Joanna Legezynska, Department of Marine Ecology, Institute of Oceanology, PAS
15. Julia Lukina, Northern Arctic Federal University (NarFU)
16. Igor Manushin, PINRO, Murmansk
17. Jean-Charles Massabuau, University of Bordeaux and CNRS UMR 5805-EPOC
18. Emma Michaud, LEMAR/UMR 6539, Institut Universitaire Européen des Sciences de la mer
19. Nathalie Morata, LEMAR/UMR 6539, Institut Universitaire Européen des Sciences de la mer
20. Jasmine Nahrgang, University of Tromsø /University Centre In Svalbard
21. Alexey Pavlov, Norwegian Polar Institute
22. Laura Petes, NOAA Climate Program Office
23. Paul E.Renaud, Akvaplan-niva
24. Richard Joelle, LEMAR/UMR 6539, Institut Universitaire Européen des Sciences de la mer
25. Kjetil Sagerup, Akvaplan-niva
26. Adriana Sardi, Akvaplan-niva/ University of Tromsø
27. Mikael Sejr, Aarhus University, Arctic Research Centre (ARC)
28. Petr Strelkov, Dept. Ichthyology & Hydrobiology, St. Petersburg State University
29. Alexey Sukhotin, White Sea Biological Station, Zoological Institute, RAS
30. Jakob Thyrring, Aarhus University, Arctic Research Centre (ARC)
31. Mikko Vihtakari, Norwegian Polar Institute/ University of Tromsø
32. Andrey Voronkov, Institute of Marine Research

SSF funded workshops

The Permian Strata of Svalbard (David Bond, 2013)

Recommendations will be added here soon

Workshop participants:

1. Dierk Blomeier, Norwegian Polar Institute
2. David Bond, Norwegian Polar Institute
3. Werner Buggisch, GeoZentrum Nordbayern, University of Er¬langen-Nuremberg
4. Carl Erik Dons, Lundin Norway As
5. Anna Dustira, Department of Geology, University of Tromsø
6. William Foster, School of Geography, Earth and Environ¬mental Sciences, University of Plymouth
7. Thomas Goode, Ocean and Earth Science, National Oceanog¬raphy Centre, Southampton
8. Stephen Grasby, Geological Survey of Canada
9. Svetoslav Georgiev, AIRIE Program, Department of Geoscienc¬es, Colorado State University
10. Sten-Andreas Grundvåg, The University Centre in Svalbard
11. Tatiana Grunt, Laboratory-studio "Living Earth", Moscow
12. Michael Joachimski, GeoZentrum Nordbayern, University of Er¬langen-Nuremberg
13. Jochen Knies, Geological Survey of Norway
14. Olga Kossovaya, A.P. Karpinski Russian Geological Research Institute, St Petersburg
15. Gunn Mangerud, Department of Earth Science, University of Bergen
16. Atle Mørk, Sintef Petroleum Research, Trondheim / De¬partment of Geology and Mineral Resources Engineering, NTNU, Trondheim
17. Hans Arne Nakrem, Natural History Museum, University of Oslo
18. Micha Ruhl, Nordic Center for Earth Evolution (Nord¬CEE), Copenhagen University
19. Holly Stein, AIRIE Program, Department of Geoscienc¬es, Colorado State University / CEED Cen¬tre of Excellence, University of Oslo
20. Yadong Sun, Key Laboratory of Geobiology and Environ¬mental Geology, China University of Geo¬sciences, Wuhan
21. Richard Twitchett, School of Geography, Earth and Environ¬mental Sciences, University of Plymouth
22. Dieter Weyer, Natural History Museum of Berlin
23. Paul Wignall, School of Earth and Environment, University of Leeds

SSF funded workshops

The CRYO-FImBack workshop - Atmospheric forcing and surface energy balance - impacts and feedbacks on the Arctic terrestrial cryosphere (Bernd Etzelmuller, 2013)

Workshop outcomes and recommendation

Forcing: A major problem in prescribing the forcing of current atmospheric models remains the correct description of processes and fluxes at the landatmosphere interface. In high latitudes, this is particularly problematic due to highly dynamic snow and ice cover prevailing throughout a large portion of the year. In addition, modelling of arctic clouds, including their phase, height and optical thickness, presents a major challenge with strong implications for the simulation of a future climate. The workshop discussed these problems, and the scientific community is aware about the shortcomings of climate models within these areas. The surface energy balance is the key interface between land and atmosphere, and the fluxes of radiation, momentum and sensible and latent heat must be correctly reproduced in modelling.
The workshop recommended a better collaboration between field scientists, who compile measurements of the surface energy balance, and modellers to validate the land-surface exchange modules in larger-scale atmospheric models. In particular complete data sets containing all or at least a large part of the model variables, e.g. soil moisture and temperature in conjunction with measurements of sensible and latent heat, can help to detect model shortcomings and subsequently improve its performance.

Impact: Predicting the impacts of a changing climate on arctic land ecosystems is challenging, since the governing processes mostly occur on spatial scales much smaller than the typical resolution of atmospheric models. This is especially problematic since many impacts, e.g. the occurrence of landslides following permafrost thaw, have a highly non-linear dependency on atmospheric parameters and occur on localized points.
To overcome this problem, we recommend statistical approaches in conjunction with further downscaling of atmospheric models. We aim to further explore the latter by generating a ten-year time series of high-resolution atmospheric data for Svalbard using the Weather Forecasting and Research Modes WRF. This data record would be a basis for further testing and analysis of impact analysis and modelling on glacier mass balance and permafrost thermal regime.

Feedback: Changes in components of the terrestrial Cryosphere can trigger prominent feedbacks on the climate system, which can lead to both amplification and dampening of the current warming trend. Among those are the release of greenhouse gases from thawing permafrost soils, increases in the surface radiation budget through earlier snowmelt and deposition of black carbon on the snow surface, as well as the dynamic instability of glaciers and ice caps leading to fast degradation and associated freshwater discharge in the

Arctic ocean.

The workshop has identified a range of research fields in the terrestrial Cryosphere, where a close collaboration between modellers and scientists involved in field measurements may facilitate future breakthroughs. Among glaciers and permafrost, where significant improvements in the representation in models are already under way, these fields involve cloud microphysics, snow physics and processes related to modification of the landcover. However, the interaction between field scientists and modellers is in most cases restricted to simple data exchange, so that e.g. the significant potential in the process knowledge obtained by field scientists is little used for model development. The workshop recommended some "true" collaboration by involving field scientists directly in model development and modellers participating in measurement campaigns. This is especially fruitful if such collaboration can be sustained over longer time through common science projects and interdisciplinary research groups.

Workshop participants:

1. Kjetil Aas, University of Oslo
2. Terje Berntsen, University of Oslo
3. Julia Boike, Alfred Wegener Institut
4. Hanne H. Christiansen, University Centre in Svalbard
5. Thorben Dunse, University of Oslo
6. Bernd Etzelmuller, University of Oslo
7. Hubert Gallee, University of Grenoble
8. Kjersti Gisnås, University of Oslo
9. Stephan Gruber, University of Zurich, Carleton / University, Ottawa
10. Mauro Guglielmin, University of Insubria
11. Jon Ove Hagen, University of Oslo
12. Keith Hines, Ohio State University
13. Jon Egill Kristjansson, University of Oslo
14. Maria Norman, Uppsala University
15. Torbjørn Østby, University of Oslo
16. Halvard Pedersen, Svalbard Science Forum
17. Veijo Pohjola, Uppsala University
18. Dagrun V. Schuler, Norwegian Meteorological Institute (MET Norway)
19. Anna Sjöblom, University Centre in Svalbard
20. Frode Stordal, University of Oslo
21. Sebastian Westermann, University of Oslo

SSF funded workshops

Svalbard Snow and Avalanche Science Workshop (Markus Eckerstorfer, 2013)

Recommendations and Roadmap

The following section provides our key recommendations for future snow and avalanche research, education, and forecasting/outreach in Svalbard as subdivided in our three categories:

All:

• Re-start database of avalanche observations based on field observations. Embed avalanche observations into the UNIS field reporting guidelines. Include these snow, climate, and avalanche observations into Regobs.no.
• Improve climate and snow observations by developing additional monitoring sites and expanding current locations. Include these hydro-meteorological data into eklima.no.

Research:

• Focus on research that is unique to the location, but with wider implications (e.g. slushflows, cornice growth and failure, snow and avalanche interactions with periglacial landforms, snow and avalanches and climate change).
• Continue research with a process- and field-based component that makes good use of the easy access and proximity of the field sites in Svalbard.
• Develop a range of methods and tools to collect avalanche occurrence data at wider spatial scales (e.g. field surveys / UAV / satellite / terrestrial laser scanning).
• Improve our understanding of cornices. How fast can they grow? How do they grow? How can we modify this through structural mitigation (e.g. wind baffles, wind fences, jet roofs)?

Education:

• Develop an intensive snow-focused, highly field-based graduate (M.S. and Ph.D.) snow course at UNIS that capitalizes on the unique location and the easy field access.
• Increase the graduate level student enrolment focused on snow and avalanche projects.
• Increase the public outreach and offer presentations and courses by avalanche experts.

Avalanche Mitigation and Forecasting:

• Include Svalbard as a region for avalanche forecasting by NVE; possibly adjust the NVE model towards a Svalbard specific model.
• Consider passive avalanche control through use of wind fences / baffles / jet roofs to minimize cornice development above the student housing in Nybyen, Longyeardalen valley, Longyearbyen.

Workshop participants:

1. Alexander Prokop,Institute of Mountain Risk Engineering, Department of Civil Engineering and Natural Hazards, University of Natural Resources and Life Sciences, Vienna, Austria
2. Christian Jaedicke, Norwegian Geotechnical Institute (NGI), Oslo, Norway
3. Christopher D'Amboise, Norwegian Water Resources and Energy Directorate (NVE),Oslo, Norway
4. Elke Morgner , Red Cross Longyearbyen, Norway
5. Hanne H Christiansen, University Centre in Svalbard (UNIS), Longyearbyen, Norway
6. Jordy Hendrikx , Snow & Avalanche Laboratory, Department of Earth Sciences, Montana State University, Bozeman, MT, USA
7. Karl Birkeland, USDA Forest Service National Avalanche Center, Bozeman, MT, USA
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12. Patrick Nairz, Avalanche warning service Tirol, Innsbruck, Austria
13. Ron Simenhois, Coeur Alaska, Juneau AK, USA
14. Stefan Margreth, WSL, Institute for Snow and Avalanche Research (SLF), Davos, Switzerland
15. Stephan Vogel University Centre in Svalbard (UNIS), Longyearbyen, Norway
16. Wesley Farnsworth University Centre in Svalbard (UNIS), Longyearbyen, Norway

SSF funded workshops

1st Science-Industry platform on expedition cruise tourism in Svalbard
(Grete K. Hovelsrud, 2013)

Scientific recommendations.

There is an emerging importance of:

1. Understanding interactions between cruise tourists and operators and local communities, challenges and benefits.
2. Understanding impact to environment and cultural heritage.
3. Understanding how climate change is directly affecting expedition cruise tourism activities or how other sectorial or regulatory activities affected by climate change are indirectly influencing expedition cruise tourism.
4. Understanding the role of state and non-state actors and institutions, at various levels, in governing expedition cruises.
5. Understanding what role the industry is playing in generating and updating its knowledge base to be able to operate sustainably, such as collaboration in science projects, observation systems, monitoring efforts, knowledge transfer.

Action points:

1. There is an increasing importance of including cruise tourism operators in the research agenda. It should be evaluated when and how cruise operators can contribute to the scientific research.
2. Develop a database of contact points. In setting up research projects or industry project it is often not clear who to involve and how. The development of a database of relevant contact points or a match maker might be warranted.
3. A key joint action in improving the science-industry interface is in enhancing the communications between both domains. Important to note is that AECO is already setting the example in good communication, presenting itself as intermediary between industry, policy and science. It would have to be the responsibility of both science and industry to let each other know about highlights and opportunities, critical challenges and issues, and venues for discussion and collaboration.

Workshop participants:

1. Albina Pashkevich, Dalarna University, Sweden
2. Arvid Viken, Tromso University, Norway
3. Åsa Lindgren, Polar Quest Expeditions, Swedish Polar Programme, Sweden
4. Chris Ware, University of Tromso, Norway
5. Dagmar Hagen, Norwegian Institute for Nature Research, Norway
6. Frigg Jørgensen, Association of Arctic Expedition Cruise Operators, Norway
7. Grete Hovelsrud, Nordland Research Institute, Norway
8. Ilja Lang, Association of Arctic Expedition Cruise Operators, Denmark
9. Jackie Dawson, University of Ottowa
10. Jens Kristian Steen Jacobsen, Norwegian Centre for Transport Research, Norway
11. Julia Olsen, Nordland Research Institute, Norway
12. Kaja Høvding Davidsen, Svalbard Science Forum, Svalbard
13. Kristinn Berg Gunnarsson, Icelandic Tourism Research Centre, Iceland

14. Linde van Bets, Wageningen University, the Netherlands
15. Machiel Lamers, Wageningen University and Research Centre, the Netherlands
16. Magnus Andersen, Norwegian Polar Institute, Norway
17. Nils Boisen, WWF Norway
18. Ricardo Roura, Groningen University, the Netherlands
19. Ronny Brunvoll, Svalbard Travel, Longearbyen, Svalbard
20. Troels Jacobsen, Oceanwide Expeditions, Denmark

SSF funded workshops

Workshop to develop and explore new approaches to analysing past, present and future climate dynamics (Ole Humlum, 2013)

Recommendations will be added here soon

Workshop participants:

1. Nicola Scafetta, ACRIM & Duke University
2. Jens Olaf Pepke Pedersen, National Space Institute, Technical University of Denmark
3. David Archibald, Institute of World Politics
4. Petr Chylek, Los Alamos National Laboratory
5. Nils-Axel Mörner, private firm in Paleogeophysicsb & Geodynamics
6. Harald Yndestad, Aalesund University College, Aalesund
7. Willie Soon, Harvard-Smithsonian Center for Astrophysics
8. Jens Morten Hansen, Geological Survey of Denmark and Greenland (GEUS).
9. Tom V. Segalstad, University of Oslo
10. Ole Henrik Ellestad, Former Research Director SINTEF
11. Oddbjørn Engvold, University of Oslo
12. Jan-Erik Solheim, Department of Physics and Technology, University of Tromsø
13. Fred Goldberg, CEO Swedish Polar Institute
14. Ole Humlum, Department of Geosciences, University of Oslo

SSF funded workshops

Past, current and future research on kittiwakes in Kongsfjorden: the opportunity of an international integration (Claus Bech, 2012)

Recommendations will be added here soon

Workshop participants:

1. **Frédéric Angelier,** Centre d'Etudes Biologiques de Chizé, CNRS
2. **Tycho Anker-Nilssen,** Norwegian Institite for Nature Research
3. **Claus Bech,** Department of Biology, Norwegian University of Science and Technology
4. **Vegard S. Bråthen,** Department of Biology, Norwegian University of Science and Technology
5. **Jan Ove Bustnes,** Norwegian Institite for Nature Research
6. **Olivier Chastel,** Centre d'Etudes Biologiques de Chizé, CNRS
7. **Sebastien Deschamps**, Norwegian Polar Institute
8. **Morten Frederiksen,** Department of Biosciences, Århus University
9. **Geir Wing Gabrielsen,** Norwegian Polar Institute
10. **Oddvar Heggøy,** Department of Biology, Norwegian University of Science and Technology
11. **Alexander S. Kitaysky,** University of Alaska, Institute of Arctic Biology
12. **Martin Kristiansen,** Norwegian Polar Institute
13. **Børge Moe,** Norwegian Institite for Nature Research
14. **Bethany F. Nelson,** Centre for Ecology & Hydrology, Edinburgh, UK
15. **Solveig Nilsen,** Department of Biology, Norwegian University of Science and Technology
16. **Elin Noreen,** Department of Biology, Norwegian University of Science and Technology
17. **Gail Robertson,** Institute of Biodiversity, Animal Health and Comparative Medicine
18. **Hanno Sandvik,** Department of Biology, Norwegian University of Science and Technology
19. **Jannik Schultner,** Department of Biology,Norwegian University of Science and Technology
20. **Dagfinn B. Skomsø,** Department of Biology, Norwegian University of Science and Technology
21. **Sabrina Tartu,** Centre d'Etudes Biologiques de Chizé, CNRS
22. **Simone Vincenzi,** Department of Mathematics and Statistics, The Jack Basjin School of Engineering, University of California
23. **Jorg Welcker,** Norwegian Polar Institute
24. **Alexis Will,** University of Alaska, Institute of Arctic Biology
25. **Rebecca Young,** University of Alaska, Institute of Arctic Biology

SSF funded workshops

Barents Sea Ice sheet - insights into the climatic sensitivity of marine based ice sheets (Anne Hormes, 2012)

The workshop participants decided upon recommendations for longterm research path:

- The spatial coverage and thickness of the Barents Sea Ice sheet at LGM and earlier glacial events are poorly understood and more data are needed, especially from eastern and southern Svalbard, in order to enhance ice sheet reconstructions at different time slices.
- Map data need to be compiled for sea floor deposits in the Barents Sea to define boundary conditions for ice sheet models: Sea floor conditions might be classified as bedrock, stiff over consolidated till and potentially deformable till.
- An open access database is needed for modeling projects and to identify regions where new data are needed. The GIS webportal of the DATED database will be publicly available after publication of the paper describing the database (http://uib.no/project/dated). The paper submission is planned for summer 2013.
- We identified the need for a protocol defining stringent criteria for data that are needed for the models. The DATED database project group is keen to discuss developing this protocol.
- Marine projects need to be become more visible in the RIS database
- Possibility for future meetings within the PAST Gateways (Palaeo-Arctic Spatial and Temporal Gateways) network, as several of the workshop participants are part of this network - http://www.geol.lu.se/pastgateways/
- Increase of logistical cooperation (scientific integration, permission, environmental) is anticipated to be improved by using the PAST Gateways network.
- Increased scientific cooperation is anticipated through the co-supervision of Master and PhD students

Workshop participants:

1. Helena Alexanderson Lund University, SE
2. William Austin St. Andrews, UK
3. Karoline Baelum Svalbard Science Forum, NO
4. Lilja Run Bjarnadottir NGU, NO
5. Teena Chauhan UNIS, NO
6. Julian Dowdeswell Scott Polar Institute, UK
7. Eythor Gudlaugsson University of Tromsø, NO
8. Mona Henriksen University of Ås, NO
9. Kelly Hogan Scott Polar Institute, UK
10. Anne Hormes UNIS, NO
11. Nick Hulton University of Edinburgh, UK
12. Ólafur Ingólfsson University of Iceland, IS
13. Simon P. Jessen University of Tromsø, NO
14. Nina Kirchner Stockholm University, SE
15. Jon Landvik University of Ås, NO

16. Eiliv Larsen NGU, NO
17. Henriette Linge University of Bergen, NO
18. Astrid Lysså NGU, NO
19. Rune Mogensen ConocoPhilips, NO
20. Per Möller Lund University, SE
21. Riko Noormets UNIS, NO
22. Heidi Sevestre UNIS, NO

SSF funded workshops

Svalbard Early Career Researcher Network – online workshop (APECS, 2012)

Workshop report:

The workshop was a webinar consisting of presentations, three keynote speakers and 11 disciplinary presentations, and a Q and A sessions.

For recordings from the webinar see www.vimeo.com/apecs.

Mailinglist for exchange of information between early career researchers and senior scientists working in Svalbard: Svalbard@apecs.is.

Database of APECS mentors currently working in Svalbard: http://apecs.is/research/svalbard.

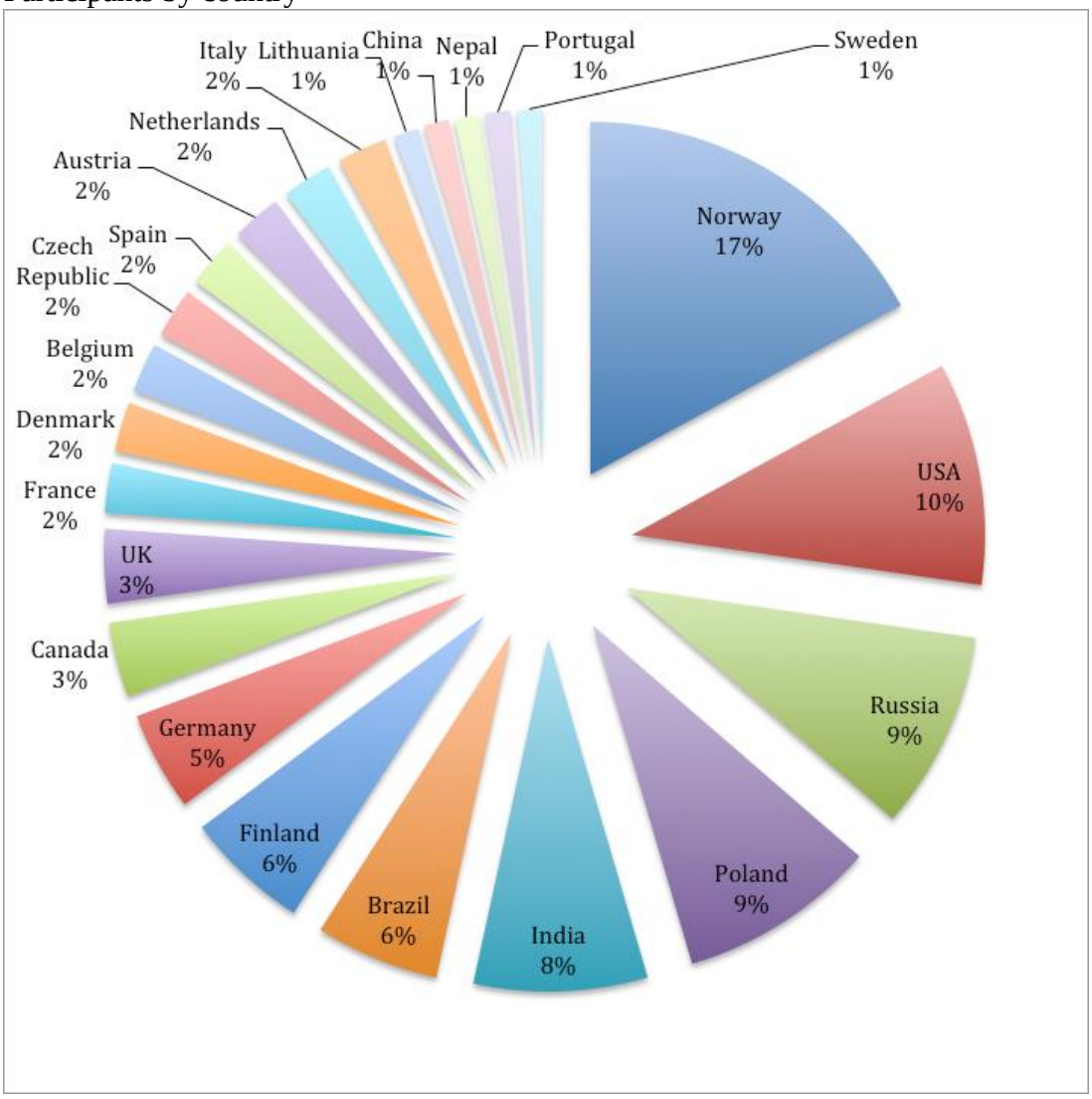
If you would like to know more about APECS Svalbard group and/or sign up for a Svalbard mailing list, please contact Svalbard-info@apecs.is

Keynote Speakers:
Ole Arve Misund, *UNIS, Norway*
Education, Logistics and Infrastructure on Svalbard
Kim Holmen, *Norwegian Polar Institute, Norway*
Research and International Cooperation on Svalbard
Vigdis Lonar Barth, *Norwegian Space Centre, Norway*
Data sharing policy and data management on Svalbard (incl.!SIOS)

- Permafrost
  StefanieHärtel, *Center for Permafrost, Dept. of Geography Geology, Univ. of Copenhagen & UNIS*
- Glaciology
  Torbjørn Østby, *Department of Geosciences, University of Oslo, Norway*
- Atmospheric science
  Tiina Kilpeläinen, *Finnish Meteorological Institute, Finland*
- Geology
  Kirstin Werner, *GEOMAR, Germany*
- Sea Ice
  Justin Beckers, *Department of Earth Atmospheric Sciences, Univ of Alberta, Canada*
- Oceanography
  Fred Wobus, *School of Marine Science and Engineering, University of Plymouth, UK*
- Marine ecosystems
  Ingeborg G. Hallanger, *University of Tromsø, Norway*
- Terrestrial ecosystems
  Liliana Keslinka-Nawrot, *University of Gdansk, Poland*
- Limnology/freshwater systems
  Trine Holm, Institute of Ecology, University of Innsbruck, Austria
- Social Science
  Frigga Kruse, Arctic Centre, University of Groningen, Netherlands

- Education and Outreach
  Bart Peeters and Ingeborg Pay, *IPY Field Summer School 201*!

Workshop participants:
Participants by country



SSF Cooperation workshop No. 4 (Copenhagen, 2013):
Zackenberg & Nuuk - what can we learn for Svalbard?

Workshop report:

Workshop recommendations

The workshop concluded with a series of recommendations that would add value to the current research through increased cooperation and joint efforts. The recommendations all have the potential to fill gaps in knowledge, combine different fields of research and create more cooperation and collaboration across the largest climatic gradient in the Arctic. The recommendations will be part of the SSF priorities that are relevant in relation to strategic funding. The recommendations are (in non-prioritised order):

Ny-Ålesund basic monitoring programme

The establishment of a Ny-Ålesund basic monitoring programme inspired by the Zackenberg model would add significant value to Svalbard as a scientific platform.

Information exchange

Establishing a forum for annual information exchange on scientific and logistics issues across the Fram Strait.

Cross-Fram Strait studies

Facilitate and initiate common projects/programmes across the region and encourage exchanges of researchers and students between Svalbard and Greenland. Large-scale, cross-Fram Strait studies are good candidates for large international projects.

Joint funding programmes

Differences in the timing and structures of national funding models can impair cooperative efforts. Joint Greenlandic-Norwegian-Danish calls for funding and cooperation agreements are key to initiating international and interdisciplinary regional studies.

Develop and apply common tools/technology across sites

The continuity of long-term observations must be ensured, and monitoring and data archiving should follow international standards.

Produce a long-term observation review report/synthesis/paper for Svalbard

A review will identify gaps in the existing cross-gradient research and current monitoring in Svalbard, and help to identify new possibilities for cooperation projects.

Potential Cross-Fram Strait Research Topics

The workshop participants suggested the following examples as potential cross-Fram Strait research topics:

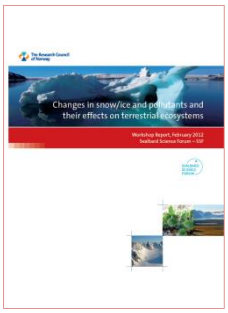
- Snow monitoring
- Sea ice investigations
- Melting of Greenland and Svalbard glaciers
- Sea bird observations, e.g. Ivory Gulls and their contamination by pollutants
- Vegetation (e.g. ITEX programme)
- Biodiversity in Svalbard and Greenland fjords
- Multi-location satellite validation
- Remote sensing of climate gradients on land (glaciers, permafrost, soil, vegetation etc.)

Workshop participants:

1. Christian Wiencke, Alfred Wergner Institute, Germany
2. David Gremillet, CEFE/CNRS
3. Elisabeth Cooper, ITEX /University in Tromsø
4. Elisabeth Råstad, Kings Bay, Ny-Ålesund
5. Fred S Hansen, UNIS
6. Geir Wing Gabrielsen, Norwegian Polar institute (NPI) / NySMAC
7. Georg Hansen, Norwegian Institute for Air Research (NILU)
8. Hanne Christiansen, UNIS / CENPERM
9. Inger Solheim, Norwegian Polar institute (NPI)
10. Jan Rene Larsen, SAON
11. Jon Børre Ørbæk, Norwegian Research Counsil /SIOS
12. Josef Elster, Centre for Polar Ecology
13. Kaja H. Davidsen, SSF
14. Karoline Bælum, SSF
15. Kim Holmén, Norwegian Polar institute (NPI) /SIOS
16. Mads Forchhammer, Institute for Bioscience - Arctic Research Centre, Roskilde
17. Masataka Shiobara, National Institute of Polar Research Japan (NIPR) /NySMAC
18. Masaki Uchida, NIPR
19. Henrik Spanggaard Munch, Aarhus University/Zackenberg
20. Morten Rasch, DMU /Zackenberg
21. Morten Skovgaard Olsen, AMAP/ Danish Energy Agency
22. Nick Cox, BAS/ NERC / NySMAC
23. Niels Martin Schmidt, Aarhus University/ Zackenberg
24. Piotr Glowacki, Polish Polar station, Hornsund
25. Roland Neuber, Alfred Wegner Institute, Germany /NySMAC
26. Stephen Hudson, Norwegian Polar institute (NPI)
27. Vito Vitale, Station Dirigibile Italia /NySMAC
28. Yoo Kyung Lee, Korea Polar Research Institute (KOPRI) / Ny Ålesund

SSF Cooperation workshop No. 3 (Oslo, 2012):

Changes in snow/ice and pollutants and their effects on terrestrial ecosystems



Workshop report:
http://www.forskningsradet.no/servlet/Satellite?c=Nyhet&pagename=ssf%2FHovedsidemal&cid=1253982549187

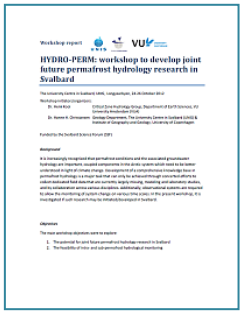
Recommendations
The workshop decided on eight projects that would add value to current research by promoting increased cooperation and joint activities. Each of these has the potential to fill main knowledge gaps, combine different fields of research and generate more cooperation and collaboration. The workshop report describes these projects in detail (titles in non-prioritised order):

1. Identification of climatic parameters that have been recorded;
2. Spatial and temporal variability of snowpack properties in non-glaciated areas;
3. Meltwater release of pollutants to terrestrial ecosystems;
4. Local pollution vs. long-range transport: biomonitoring and source markers;
5. Impacts of winter stress events: Extreme winter weather and pollution shock on community development;
6. Spring: Changes in onset of spring and impact in terrestrial ecosystems;
7. Autumn: Date of onset of soil freezing and snow cover in the autumn;
8. SNOW.MELT - Impact of snowmelt on soil development.

Workshop participants:
1. Geir Wing Gabrielsen, Norwegian Polar Institute (NPI) + UNIS, Norway
2. Krzysztof Migala, University of Wroclav, Poland
3. Elisabeth Cooper, University of Tromsø, Norway
4. Stef Bokhorst, Swedish University of Agricultural Sciences, Sweden
5. Josef Elster, University of South Bohemia, Czech Republic
6. Heikki Hänninen, University of Helsinki, Finland
7. Jan Kavan, University of South Bohemia, Czech Republic
8. Lennart Nilsen, University of Tromsø, Norway
9. Åshild Ø. Pedersen, Norwegian polar Institute, Norway
10. Bronisław Wojtuń, University of Wroclav, Poland
11. Piotr Glowacki, Polish Academy of Sciences, Poland
12. Mariusz Grabiec, University of Silesia, Poland
13. Elisabeth Isaksson, Norwegian polar Institute, Norway
14. Bartek Luks, Polish Academy of Sciences, Poland
15. Anna K. Sinisalo, University of Oslo, Norway
16. Irina Solovyanova, Arctic and Antarctic Research Institute of Roshydromet (AARI, Russia
17. Terry Bidleman, University of Toronto + Umeå University, Sweden/Canada
18. Crispin Halsall, Lancaster University, United Kingdom
19. Kaj Mantzius Hansen, Aarhus University, Denmark
20. Mark Hermanson, University Centre in Svalbard (UNIS), Norway
21. Roland Kallenborn, Norwegian University of Life Sciences + NILU, Norway
22. Margit Schwikowski, Paul Scherrer Institute, Switzerland
23. Birgit Sattler, University of Innsbruck, Austria
24. Sergey Vlasov, North-West Branch of Research and Production Association 'Typhoon', Russia
25. Halvard R. Pedersen, Svalbard Science Forum, Norway

SSF funded workshops No. 1 (UNIS, 2012)

Developing joint future permafrost hydrology research in Svalbard (HYDRO-PERM)



Workshop report: http://www.forskningsradet.no/prognett-ssf/Nyheter/Report_from_the_HYDROPERM_workshop/1253982582533/p1253969737318

Key scientific challenges regarding the permafrost hydrology of Svalbard identified by the participants:

The overall Earth System Science level:

- Missing understanding of the present status/functioning of permafrost- groundwater systems in Svalbard.
- Missing understanding of the degree to which the present situation is in a transient state reflecting past climate, sea-level variation and/or landscape changes/developments.
- Missing understanding of the future development of the coupled hydrological –permafrost system under climate change (both on relatively short and long time scales

Detailed level:

- Identification of recharge areas and recharge conditions.
- Identification of possible diffuse discharge (through permafrost, submarine).
- Improved understanding of pingo hydrodynamics.
- Improved understanding of age/residence time and flow paths of groundwater (e.g., presence of palaeo-groundwater).
- Improved understanding of subsurface processes determining water quality (reactive transport and microbiology).
- Identification of groundwater-glacier interaction (2-way coupling).
- Improved understanding of groundwater – surface water (including snow and icings) interaction (quality/quantify, active layer vs. deeper groundwater contributions).
- Improved understanding of active layer hydrology (e.g. ice-wedge polygon influences on water tables and drainage).

Some of the specific challenges listed above have been, or are being partially addressed, within existing research projects in Svalbard, albeit often indirectly and to a limited extent. In many of these projects, workshop participants are/were involved. However, there is no overall permafrost hydrology research project planned or occurring in Svalbard.

Among the participants, numerous **research methods/tools** were mentioned/proposed that are valuable or essential to address the inferred challenges. This diverse set combines methods often used in different disciplines, demonstrating the great potential for collaborative research across disciplines.

Several presentations addressed borehole methods and results that are relevant to assess the **feasibility of intra- and sub-permafrost hydrological monitoring** in Svalbard, where 'hydrological' refers to water potentials (hydraulic heads/pressures), groundwater flow and groundwater quality. However, there was too little time to evaluate feasibility, notably technical aspects, in a comprehensive way.

Conclusions and recommendations

There is large potential to develop comprehensive, joint permafrost hydrology research in Svalbard and particularly in the sedimentary landscape of Adventdalen, with its existing research infrastructure.

- Key scientific challenges have been identified linking existing permafrost, periglacial and geological studies and monitoring platforms, with the study of the subsurface hydrological regime. A research project with this theme in Svalbard would be unique and complement permafrost research elsewhere.
- There is broad interest and multidisciplinary expertise for collaborative research under this theme.
- The different researchers have a 'common language' allowing effective interaction/communication.
- A comprehensive set of methods exist that have been little or not yet used to address the challenges. And at least never been used together for this purpose.
- Svalbard is the only suitable field site for such research in Europe, hosting favorable geographical, geological and hydrological conditions.
- Svalbard can serve as an important proxy study site, generating key permafrost hydrological knowledge for other areas in the Arctic.
- The excellent accessibility, logistics and availability of very high-quality research facilities are unique for high Arctic settings, and extremely advantageous to conduct this type of Earth System research.

Preliminary assessment suggests intra- and sub-permafrost groundwater monitoring is feasible; however, this should be evaluated more comprehensively.

Workshop participants:

1. Victor Bense, Univ. of East Anglia, Norwich, UK
2. Alvar Braathen, Univ. Centre in Svalbard (UNIS), Norway
3. Hanne H. Christiansen, Univ. Centre in Svalbard (UNIS), Norway
4. Sara Cohen, Univ. Centre in Svalbard (UNIS), Norway
5. Jon Engstrom, Geol. Surv. of Finland (GTK), Finland
6. Hakan Eriksson, Longyearbyen water supply, Norway
7. Wesley Farnsworth, Uni. Centre in Svalbard (UNIS), Norway
8. Bjorn Frengstad, Geol. Surv. of Norway (NGU), Norway
9. Thorbjørn Gilberg, SIOS at UNIS, Norway
10. Sylvi Haldorsen, Norw. Univ. of Life Sciences, Norway
11. Andy Hodson, Univ. of Sheffield & UNIS, UK
12. Ole Humlum, Univ. of Oslo & UNIS, Norway
13. Henk Kooi, VU Univ. Amsterdam, The Netherlands
14. Anna Liljedahl, Univ. of Alaska, Fairbanks, USA
15. Christelle Marlin, Univ. Paris-Sud, Orsay, France
16. Brian Moorman, Univ. of Calgary, Canada
17. Aga Nowak-Zwierz, Univ. of Sheffield, UK
18. Karoline Bælum, Svalbard Science Forum (SSF), Norway

SSF Cooperation workshop No. 2 (Tromsø, 2011):

Geology of Svalbard - Environmental changes in Svalbard since the last glacial maximum - integrating marine and terrestrial records


Svalbard Science Forum

Workshop report: Geology of Svalbard:

Environmental changes in Svalbard since the last glacial maximum - integrating marine and terrestrial records

Svanø Centre, Tromsø, Norway, 27-29 April 2011

The idea of the workshop within Svalbard geology developed 2 years ago. However, it has taken about 1.5 years of planning and searching for a suitable theme before the workshop planning group has made it happen. The planning group was led by Matthias Forwick (UiT), Anne Hormes (UNIS), Riko Noormets (UNIS), Rita Novotnova (UNIS), Grzegorz Rachlewicz (UAM, Poland) and Katarzyna Kaczmarska (SSF), and they have decided that focus should be on 'Environmental changes in Svalbard since the last glacial maximum - integrating marine and terrestrial records'.

The workshop took place at the Svanø Centre, Tromsø on 27-29 April 2011 and it gathered 22 geologist (mostly with interest in sedimentology) from both terrestrial and marine geological communities. The key Svalbard geologists were invited to participate but the workshop was open to all. The workshop aimed to bring together scientist from multiple disciplines dealing with the reconstruction of environmental change on Svalbard since the last glacial maximum. Participants from 8 countries (UK, Iceland, Norway, Russia, Estonia, Sweden, Poland, the Netherlands, UK, USA, Estonia and Finland and Norway) was represented by 5 people from 7 institutions (UNIS, NPI, UiT, UiB, UoS, UMiK and SSSF). All participants are very active in field-based research in Svalbard and they will continue their activities at least for the next 2-5 years.

The main workshop goals were to:

1. exchange knowledge between terrestrial and marine scientists
2. identify critical scientific questions and define ways to answer them
3. inform about ongoing research activities and projects,
4. find common scientific goals possible to implement (develop project ideas)
5. define regions and areas of interest for different groups (where to concentrate efforts, anticipated bottlenecks) where potential collaboration would be possible
6. coordinate future research plans

The main part of the workshop was dedicated to individual presentations that included the scientific interest, as well as current and planned research activities of the presenter. The ensuing main aim is a large degree used to identify potential areas of interest and to discuss possibilities for joined research in the future. This session was extremely useful for both participants and planning group as it provided ideas for research activities.

Page 1 of 3

The outcome

- A core of terrestrial/marine geology forum has been created. Since it is a challenge to combine, compare and couple different scales and sizes of process studies in terrestrial and marine environments the forum will focus on this uneasy problems and discuss ways to solve them. Next workshop 2013?;
- Modern processes in geology (e.g. sediment fluxes and depositional architecture) with transect-based observations in 4-5 key locations (Adventdalen, Billefjorden/Petuniabukta, Braganzavågen, Linnédalen and Tempelfjorden/Sassenfjorden) have the potential to be the first step for collaboration. The group is interested in meeting on board of Horyzont (in 2012?) to have a field trip to all the key locations and to discuss in field the possibilities for a joined project and the implementation phase (Maria Jensen from UNIS is the contact person for this group);
- Another potential field of collaboration could be research with focus on specific time scales e.g. LIA, last 2000 years, past warm events etc.;
- A need to interact with permafrost and periglacial scientists has been identified (joined session during some meetings in the future?);
- East Svalbard will become a key area for future investigations (hydrocarbon industry), therefore regular & informal Svalbard meetings, exchange information with people from different disciplines and working on different time scales with added benefit of better coordinated research will be both useful and necessary also in order to receive permissions from Governor to access key locations in Eastern Svalbard for geological sampling;
- Logistical benefits: building on existing work and keeping in mind existing material (e.g. cores and samples), taking advantage of UNIS (its location, staff in geology department being part of the group and using students to help out while learning);

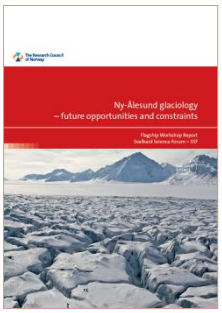
Workshop report: http://ssf.npolar.no/documents/Report_geology_Workshop2011.pdf

Workshop participants:

1. Ólafur Ingólfsson, University of Iceland
2. Eiliv Larsen, Geological Survey of Norway
   Marek Zajaczkowski, Polish Academy of Sciences , Poland
3. Sergei Korsun, Shirshov Institute of Oceanology, Russia
4. Anne Hormes, UNIS, Norway
5. Maria Jensen, UNIS, Norway
6. Riko Noormets, UNIS, Norway
7. Maarten Prins, VU University Amsterdam , The Netherlands
8. Osip Kokin, Russian Academy of Sciences, Russia
9. Julian Dowdeswell, University of Cambridge, United Kingdom
10. Mike Retelle, Bates College, USA
11. Jon Landvik, Norwegian University of Life Sciences , Norway
12. Bernd Etzelmüller, University of Oslo, Norway
13. Rein Vaikmäe, Tallinn University of Technology, Estonia
14. Seija Kultti, University of Helsinki, Finland
15. Helena Alexanderson, Lund University, Sweden
16. Simon Troelstra, VU University Amsterdam, The Netherlands
17. Jostein Bakke , University of Bergen, Norway
18. Matthias Forwick, University of Tromsø, Norway
19. Dorthe Klitgaard Kristensen, Norwegian Polar Institute, Norway
20. Witold Szczuciński, Adam Mickiewicz University, Poland
21. Grzegorz Rachlewicz, Adam Mickiewicz University, Poland
22. Marzena Kaczmarska, SSF, Norway

Ny-Ålesund Flagship Programme (Tromsø 2011):

Glaciology – future opportunities and constraints



Workshop report:
http://www.forskningsradet.no/servlet/Satellite?c=Nyhet&pagename=ssf%2FHovedsidemal&cid=1253982511759

Ny-Ålesund is an ideal site for glaciological research; despite its remote location, it provides an excellent logistical base for fieldwork programmes. Apart from large ice caps, most types of glaciers found in Svalbard and even the High Arctic are located around Ny-Ålesund: fast-flowing, surge type, polythermal, and calving glaciers. Some of the longest Arctic mass balance time series have been recorded for two Ny-Ålesund glaciers, Midtre Lovénbreen and Austre Bøggerbreen, and many other relevant long-term measurements are available as well.

In terms of the overall science, many processes crucial for future glacier behaviour are still relatively poorly understood. In particular, such important processes as calving, surging, sliding, and glacial drainage are still important open research topics. Ny-Ålesund glaciers provide a useful laboratory for studying these.

In terms of our local knowledge, a handful of glaciers have been studied extensively in the Ny-Ålesund area, mostly with respect to mass balance and hydrology. However, there are still gaps in our knowledge. We know little about spatial and temporal distribution of snow on the landscape and regional scale. While there are a number of mass balance programmes established in the areas immediately adjacent to Ny-Ålesund, we still know little about ice and meltwater fluxes from glaciers outside of this immediate area, and such basic information as bed topography is still missing for most of the glaciers around Ny-Ålesund.

The workshop identified several topics to be focused on in the future, based on the knowledge gaps, existing long-term series and advantages of Ny-Ålesund's location, see report for more information:

1. Mass balance
2. Dynamics
3. Hydrology
4. Snow
5. Ice cores
6. Biochemistry

Integrated Glacier Observatory IGLO
Currently, research groups are not well integrated across national boundaries, and research activities at the different glaciers are often not coordinated. A joint programme to coordinate those activities would facilitate integration, reduce costs and minimise the environmental footprint of glaciological research. Ultimately with better integration and coordination, larger projects with a potentially higher scientific value would be possible. Ideally, more could be accomplished through teamwork than through the uncoordinated efforts of individual scientists or small research groups.

The suggested IGLO observatory would facilitate sharing of data (including e.g. satellite data), seek to avoid research duplication, and develop new methodology. Integration could be achieved within glaciological systems (e.g. regional catchment studies) or with other systems, such as marine and terrestrial systems.

An essential component of such a joint observatory would be a mechanism for sharing logistics, methodology, instruments, data, education and outreach activities.

Suggestions for joint efforts

Joint efforts could be joint campaigns, joint investments or integrated large-scale projects. The importance of including studies on permafrost, sedimentology and other related topics in joint studies was also pointed out. The group discussed several potential initiatives:

- Combine long-term mass balance monitoring efforts of the different groups.
- Jointly improve techniques for mass balance calculations and process studies.
- Develop new monitoring techniques for calving.
- Establish a permanent hydrological station at Austre Lovénbreen, similar to Bayelva: these would serve as reference sites for two different types of glaciers. Make seasonal hydrographs available for other researchers.
- Conduct airborne LIDAR and radar campaigns for the entire area.
- Update Kongsfjorden bathymetry to include new areas exposed by retreating glaciers.
- Combine maps of Svalbard glaciers where mass balance measurements are conducted.
- Use the small and medium glaciers in Kongsfjorden/Kaffiøyra as a laboratory for modelling.
- Study the linkage between hydrology and calving dynamics.
- Integrate glaciological and marine studies (Kongsfjorden System flagship):
  - Kongsfjorden is the only fjord system where enough information of freshwater, inflow and icebergs are available to establish a water balance;
  - Conduct organic and inorganic matter outflow studies.
- Integrate glaciological and terrestrial studies (Terrestrial Ecosystem flagship):
  - Colonisation of glacier forelands;
  - Snow remote sensing.
- Permafrost/active layer coupling to glacier retreat.
- Develop a uniform digital elevation model (DEM) for the Kongsfjorden area that is open, accessible and integrated with the glacier database by Norwegian Polar Institute.

IGLO Instruments
The observatory could invest in instruments which could be shared by the glaciology research community in Ny-Ålesund. These might include:

- Brandalpynten as an instrumental platform, with power supply (e.g. small wind plant);
- Glacier AWS system (with live data transfer to web);
- Cryospheric toolkit

Workshop participants:

1. Jack Kohler, Norwegian Polar Institute, Norway
2. Irek Sobota, Nicolaus Copernicus University, Poland
3. Andy Hodson, University of Sheffield, United Kingdom
4. Jon Ove Hagen, University of Oslo, Norway
5. Madeleine Griselin, CNRS TheMA, Université de Franche-Comte, France
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SSF Cooperation workshop No. 1 (RV Horyzont, 2009):

Pan-Svalbard Cooperation - Management, Glaciology, Upper atmosphere

Workshop report:
http://ssf.npolar.no/documents/Workshop_Report_SSF-JCI2009.pdf

- New workshops as joint cooperation initiatives could involve researchers from these disciplines: Oceanography, Permafrost, Marine environment and Biology/climate change.

Upper Atmosphere:

- Studying the solar energy input into upper atmosphere – this will require better synchronization of all measurement campaigns and use of instruments that might not have been exploited enough in the past; also calibration of all optical instruments will be done to ensure comparable data sets.
- Radio tomography and active experiments (heating) – planning the heating experiments in synchronization with other measurements;
- Further work on space weather impact on navigation and radio communication in the high Arctic – the exchange of all available data will be improved, some GPS instruments will be moved to more suitable locations instead of having them all gathered in 1 place (e.g. in Ny-Ålesund are several GPS located next to each other – some will be moved to Barentsburg, Svea, Isfjord and maybe Hopen);
- Joint large and long-term measurement campaign during the next solar maximum: 18-month-long continuous measurements (e.g. Oct 2012-March 2014) would be extremely valuable and might provide answers to many open questions; that would repeat the EISCAT IPY programme with added value of Doppler Sounder and optical measurements done at the same time.
- Student/researcher mobility scheme would be a great addition: especially important is to find sources to cover travel and living expenses in Svalbard as many researchers and students could benefit from UNIS short courses in upper atmosphere processes;
- The next workshop in the working group is planned in 2010 in Barentsburg with focus on solar energy input to upper atmosphere.

Glaciology:

The current location of glaciological study sites is largely determined by the location of the established research bases. The concentration of effort in one region means that many other areas are seriously under-represented in the mass-balance record, and it is uncertain to what degree the existing records are representative of Svalbard as a whole. There is therefore a clear need to facilitate glaciological research in more remote parts of the archipelago, as well as continuing support for the established research bases. Two main research aims were identified:

- to obtain a comprehensive view of current glacier mass changes for the whole of Svalbard: o need for more balanced regional coverage of glaciers
    - focus on in situ measurements to provide ground truth for satellite studies (e.g. converting glacier elevation changes into volume change)
    - High spatial and temporal resolution ice velocity and calving flux measurements for the whole archipelago are recognized as a high research priority – calving and surge are both great contributors to loss of mass from Svalbard glaciers, current data cannot serve as reference for the whole Svalbard as these processes are highly variable on several time scales and the velocity measurements taken occasionally may deliver results that vary greatly from long-term values;
    - Determining total ice volume and subglacial topography - a widespread program of airborne radar surveys is required in order to know the thickness and volume of ice; closely spaced survey lines are necessary;

- to develop a better understanding of fundamental glaciological processes – there is a clear need to improve the representation of dynamic processes in glacier models, and to collect data specifically for purposes of model testing and validation. Key areas are: o Calving processes and the dynamics of tidewater glaciers, and their climatic and oceanographic controls;
    - Controls on surging behaviour;
    - Glacial hydrology, and its links to glacier dynamics;
    - Glacier thermal regime and temperature evolution, including superimposed ice formation.

These aims are complementary, and are equally important for assessing the impact of past, present and future climate change on the Arctic cryosphere.

Interactions with other disciplines necessary for further progress and stimulation (e.g. oceanography, glacial ecosystems, proglacial permafrost, river runoff and sediment fluxes)
It is proposed to organize inter-disciplinary workshops in Svalbard, to promote collaboration and cross-fertilization of ideas, methods and perspectives.

Data availability – suggested actions:
- the construction of an extended glacier inventory for Svalbard, including data such as DEMs, satellite imagery, and air photographs, as well as mass balance and other data;
- increasing access to published papers and unpublished reports, by extending the Research in Svalbard (RIS) collection; and
- contributing data layers and imagery to Google Earth.

Logistical and environmental issues:
- Efficient fieldwork requires comfortable and secure accommodation, and the capabilities of research scientists would be much improved if it were possible to erect camp facilities, such as temporary cabins, where needed. Helicopter availability and landing permissions were also identified as a key area of concern.
- The needs of the scientific community and environmental concerns could be reconciled through coordinated liaison between scientists and the Governor's office. It is hoped that such a community communication channel could play a role in resolving conflicts of interest and informing policy development.

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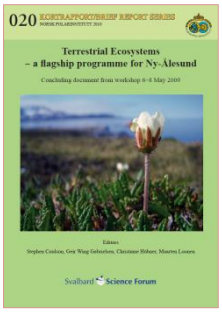
Ny-Ålesund Flagship Programme (Oslo 2009):

Terrestrial Ecosystems in Ny-Ålesund



Workshop report:
http://www.forskningsradet.no/servlet/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadername1=Content-Disposition%3A&blobheadervalue1=+attachment%3B+filename%3D%22FlagshipTerrestrialEcosystem10%2C0.pdf%22&blobkey=id&blobtable=MungoBlobs&blobwhere=1274501888554&ssbinary=true

The workshop initiated the Terrestrial Ecosystem Flagship Programme as part of a NySMAC science plan and discussed focal areas for future research based on current gaps of knowledge and needs for infrastructure improvements.

Gaps of knowledge and infrastructure improvements

- Implementation of long-term data collection requires improved organization, standardization and access to the research community.
- Installation of permanent monitoring instrumentation at several locations in the Kongsfjorden area to record spatially explicit baseline data and to improve replication. Reference areas should be designated.
- Also experimental manipulations need recognition as research tool to understand ecological processes and should be maintained over longer time periods.
- A prime requirement is for a central Terrestrial Laboratory Facility with key equipment and facilities. The laboratory should be permanently staffed and record scientific activity.
- Moreover, the need for a mobile field laboratory was recognised. The existing greenhouse and the facilities to maintain animals require renovation

Future research priorities

Focus on a watershed approach, integrated multi-thematic studies and improved interactions with marine and atmospheric research.

Four integrative projects were proposed:

1. The project *'Polar terrestrial ecosystems resilience to variability and change'* will exploit the natural variability in the Kongsfjord region, together with complimentary experimentation, to quantify the response of ecosystems to environmental variation and to provide baseline information on genetic diversity and ecosystem processes.
2. The project *'Dynamic interactions of the cryosphere and biosphere'* will quantify and understand the coupling between cryosphere and biosphere across multiple spatial and temporal scales. Key objectives will be to close the carbon cycle and to link permafrost/snow dynamics and geology with biological processes.
3. The project *'Marine-terrestrial links including pollutant fluxes'* will investigate the fluxes of matter, energy and pollutants between marine and terrestrial ecosystems. Flux processes, and their inter-annual variation, will be quantified and diverse webs compared. Understanding biodiversity is a baseline requirement for any programme addressing ecosystem structure, function and response to variability and change.
4. Therefore, the project *'Biodiversity and the history of the Svalbard terrestrial biota'* will combine classical and molecular approaches to the study of biodiversity, in conjunction with dispersal and colonisation processes at various spatial scales. The importance of human impact on biodiversity will also be quantified.

The establishment of a *High-Arctic Land Observatory (HALO)* as part of SIOS was proposed to further integrate and coordinate terrestrial research within Ny-Ålesund and with other polar research bases.

Main features of the Terrestrial Ecosystems Flagship:

Ny-Ålesund Terrestrial Integrated Research

- Ny-Ålesund is a key location for terrestrial research in the High-Arctic offering unique collaborative opportunities (outstanding international and multidisciplinary research community.
- Ny-Ålesund as a site for high-quality terrestrial research and monitoring has to focus on the international multidisciplinary synergies within Ny-Ålesund as well as collaborative efforts with other terrestrial stations in the Arctic and sub-Arctic.
- Abiotic measurements relevant to the terrestrial ecosystem need to be intensified and supplemented and their long-term perspective secured. This will provide background data for all research projects.
- Winter studies on the terrestrial ecosystem need to be strengthened to understand the overwintering strategies of the flora and fauna and their adaptations to the short summer.
- Ossian Sarsfjellet is an important plant protection area and requires careful managent. Removal of the reindeer or construction of exclusion fences should be considered.
- Monitoring programmes should document the impact of research and non-research activities, such as infrastructure and tourism, in Ny-Ålesund and in the surroundings.

Flagship innovations

- The establishment of a High-Arctic Land Observatory (HALO) will enable further integration and coordination of terrestrial research under the flagship programme within Ny-Ålesund and with other polar stations. HALO will be part of SIOS.
- HALO will maintain existing and establish new biotic and abiotic data series over meaningful timescales. Ny-Ålesund will be an important long-term reference site providing open access baseline data for detecting future changes in the terrestrial system.
- Reference sites will be designated for monitoring natural changes and will be fully instrumented to record relevant parameters. In combination with long-term manipulative experiments unique possibilities will be provided for studies on the mechanisms of arctic ecosystems.
- A dedicated Terrestrial Laboratory Facility, comparable to The Kings Bay Marine Laboratory, will complement and extend fieldwork. A mobile field laboratory unit will complement the Ny-Ålesund terrestrial laboratory facilities. The existing greenhouse will be refurbished and will comprise an important unit in the infrastructure for terrestrial research in Ny-Ålesund.

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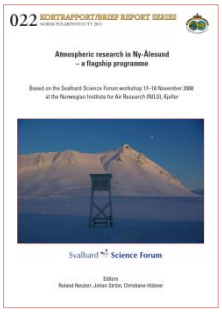
Ny-Ålesund Flagship Programme (Kjeller 2008):

Atmospheric research in Ny-Ålesund



Workshop report:
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The workshop initiated the Atmospheric Research Flagship Programme as part of a NySMAC science plan and discussed focal areas for future research based on current gaps of knowledge and needs for infrastructure improvements.

The flagship programme aims to establish a unique international long-term atmospheric monitoring and observation platform supported by all research institutions represented in Ny-Ålesund and thus to realize a supersite, allowing investigations of the complex Arctic System with a multidisciplinary approach. Interdisciplinary observations will be performed elucidating interaction processes on sea, snow and ice surfaces and the atmosphere. Special emphasis will be laid upon the impact of climate change on the Arctic environment.

In Ny-Ålesund, long-term measurements of several key climate parameters from the surface level up to the ozone layer have been performed for decades already. Such comprehensive data sets are available from very few sites in the Arctic and the data are continuously fed into global networks. Ny-Ålesund offers excellent conditions for scientific research, due to its accessibility and international and multidisciplinary character. For atmospheric research, Ny-Ålesund offers the possibility to perform continuous measurements both close at sea level and at 475 m of altitude within a relatively pristine environment. Also, its location under the magnetospheric cusp makes it a unique place for observing the solar wind and magnetosphere interaction on the dayside.

Future research priorities:

- Long term observations of key parameters concerning climate change
- Planetary boundary layer (PBL) research
- Studies and monitoring of long range transport of pollutants
- Arctic ozone layer and UV research
- Ionospheric / magnetospheric research
- Validation and synergistic analyses of satellite data

Main features of the Atmosphere Research Flagship:

Atmospheric research in Ny-Ålesund

- Several long term measurements of key climate parameters from the surface up to the ozone layer have been performed for decades already.
- Continuous measurements both from sea level to 30 m, and at 475 m altitude at the Zeppelin Mountain observatory give a unique possibility to investigate the lower atmosphere inside and outside the Planetary Boundary Layer.
- The geographical position allows studies of many aspects of the Arctic environment. For example, Ny-Ålesund is located at the junction of the warm Atlantic current with the cold Arctic basin, and the magnetospheric cusp has here its projection in the polar atmosphere.
- The geographical position also provides the possibility to measure both the pristine, clean Arctic atmosphere with minimal background values and increased pollution episodes due to long range atmospheric transport processes.

- Ny-Ålesund, with the Svalbard Rakettskytefelt, a launch site for sounding rockets (SvalRak), is the only place in the high Arctic where the entire air column from sea surface to 350 km altitude can be investigated in detail by sounding rockets.
- The interdisciplinary and truly international research activities covering a broad range of research aspects in the Arctic, act as a catalyst to spawn new scientific questions and to attract new young scientists.
- In general, Ny-Ålesund is easy accessible, has a highly developed logistical infrastructure with regular flights, a harbour, accommodation, meeting and lab facilities, and high speed Internet.

Flagship vision

- Realize a supersite to investigate the complex coupled Arctic System with a multidisciplinary approach, studying e.g. interaction processes between sea, snow and ice surfaces and the atmosphere. The motivation is to reduce uncertainties in climate forcing components and to improve climate model simulations. Multidisciplinary and comprehensive data sets, as well as interactions with other flagship programmes will be utilised.
- Establish and maintain a long-term atmospheric monitoring and observation platform supported by all research institutions represented in Ny-Ålesund.
- Enlarge the Ny-Ålesund perspective to the pan-Svalbard area by integrating it as a key element in Svalbard Integrated Arctic Earth Observing System (SIOS), and to contribute to a circum-Arctic network.

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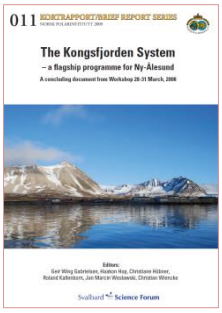
Ny-Ålesund Flagship Programme (Ny-Ålesund 2008):

The Kongsfjorden system



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Knowledge gaps and future research priorities
During the workshop, gaps in knowledge and accordingly, future research priorities were identified:

- *Database for long-term data series*
- *Meta-databases for Kongsfjorden (coordination and development)*
- *Real-time monitoring of Kongsfjorden*
- *Oceanographic knowledge gaps to be filled*
- *Effects of turbulence*
- *Monitoring Kongsfjorden phytoplankton*
- *Organic carbon mineralization*
- *Changes in the pelagic fish community of Kongsfjorden*
- *Clams as environmental indicators*
- *Long-range pollutants and effects on biota*
- *Interactive effects of rising temperatures and enhanced UV-radiation*
- *Feedback mechanisms from the biosphere to the atmosphere*
- *Project overlap and coordination*

Proposed projects to fill the gaps

In order to fill the identified knowledge gaps, new project ideas were developed during the workshop. These initiatives will contribute to an integrated approach to better understand the seasonal and annual dynamics of the Kongsfjorden ecosystem in the light of pollutant effects and climate change. The research will include atmospheric and oceanographic monitoring and molecular, cellular, organismal and community responses at all trophic levels:

1. ATMOKONG: Atmospheric monitoring in the Kongsfjorden Ecosystem
2. Towards real-time monitoring of Kongsfjorden
3. The influence of terrigenous processes on the function of the Kongsfjorden system
4. Impact of climate change and pollution on seabirds in Kongsfjorden
5. Interactive effects of various abiotic factors on organisms and communities
6. Changing of the spring bloom timing in Kongsfjorden?
7. CLIM-CLAM: Clams as climate indicators and environmental monitors in Svalbard waters
8. Winter studies in Kongsfjorden
9. Climate and environmental development of the Kongsfjorden system during the last 13 000 years

Main features of the Kongsfjorden System Integrated Research Flagship

Kongsfjorden System Integrated Research

- Kongsfjorden System is an established reference site for Arctic marine studies with great potential for international, multidisciplinary collaboration due to the presence of the international research platform in Ny-Ålesund.
- Kongsfjorden represents a natural laboratory in the Arctic and is an established reference site in close proximity to Kings Bay Marine Laboratory.

- Kongsfjorden functions as a climate indicator on a local scale because it is directly influenced by climate related changes on Spitsbergen Shelf and Fram Strait.
- Kongsfjorden and the adjacent Zeppelin Station for Atmospheric Monitoring and Research represent the most important environmental monitoring locations in the Arctic.
- Ny-Ålesund is an ideal site for studies of environmental contaminants due to the established research infrastructure with the Zeppelin Station for Atmospheric Monitoring and Research.

Flagship innovations

1. Kongsfjorden contains several moored installations for monitoring physical and biological parameters. A new cabled installation to Kings Bay Marine Laboratory would allow for real-time data retrieval from an oceanographic monitoring platform.
2. The ongoing long-term atmospheric monitoring programmes in Ny-Ålesund should be linked to the comprehensive hydrological, oceanographic and marine biological research programmes performed in the Kongsfjorden ecosystems. For this purpose, an integrated comprehensive monitoring station needs to be established on the central islands within Kongsfjorden.

The monitoring programme of atmospheric pollution at the Zeppelin Station will be further developed and linked to the marine research activities in order to identify the major drivers influencing the atmosphere/ocean surface interface. This will be supplemented by a marine monitoring platform that will allow real time monitoring of oceanographic and biological parameters in the fjord. The effects of discharges of terrigenous organic carbon and terrestrial particles from permafrost soils on the physiology of benthic organisms will be investigated.

Workshop participants:

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