

Ny-Ålesund Science Plan

Priorities for the period 2015-2020

Endorsed by Ny-Ålesund Science Managers Committee: 22.09.2015

1. Introduction

The Ny-Ålesund mission statement¹ declares the overall goals for the entire Ny-Ålesund area. The goal of this Science Plan is to further develop the science conducted in Ny-Ålesund to be an excellent contribution to Arctic research and monitoring, where Ny-Ålesund shall cement its role as an outstanding observatory, laboratory, and field base for Arctic research. Ny-Ålesund is a Norwegian research and monitoring infrastructure facility, hosting international research projects, programmes and stations. Ny-Ålesund shall strive for acting as a well-coordinated facility with one Interdisciplinary Monitoring Programme and four research Flagship Programs. Ny-Ålesund shall at the same time maintain the scientific quality and integrity of the individual stations, institutions, and research groups. The Ny-Ålesund research community promotes a policy of open and free exchange of scientific data, based on mutual trust and respect for the intellectual property rights.

The Ny-Ålesund Science Plan applies to the research area including Kongsfjorden, the Brøgger peninsula and surroundings, the adjacent glaciers and the land areas owned by Kings Bay AS. In this frame the researchers, projects, programmes and stations unified under this science plan will be recognized as members of the Ny-Ålesund International Scientific Community (NISC).

2. Overall vision for the plan period

- NISC will be a primary observational base in the Arctic for environmental research and monitoring.
- NISC will host research in scientific areas that have clear benefits from performing the research in the pristine environment that this natural laboratory provides.
- The stations and researchers within NISC will try to secure, maintain and proliferate long-term time series of environmental parameters, and will work together on setting up one coordinated Monitoring Program.
- NISC will as a coordinated science platform, be a primary showcase of international achievements in the Arctic.
- NISC core scientific foci are defined through the four flagship programs.
- NISC will facilitate cooperation with all other research bases in Svalbard, integrating researches in a pan-Svalbard perspective.
- NISC aim at limiting the environmental footprint of the research activity. NISC support the project "Limits of acceptable change", and aim at monitoring key environmental state variables and indicators to assure the pristine environment is not affected.

NISC promotes

- New complementary research activities aiming to integrate and not duplicate existing ones.
- High ethical standards with respect to experiments involving animals and humans.
- A research environment with open access and free exchange of scientific data.
- A research environment based on trust and respect for the intellectual property rights.
- Joint research activities involving new trans-national collaboration.
- The continued emphasis on monitoring and the protection of long term data series.

¹ Appendix 1

- Research and operational activities utilizing green technologies.

NISC does not support

- Research activities that pollute or permanently disturb the local environment.
- Activities that have negative impact on the environment, and that reduce the quality of existing research and the sites for potential future environmental research areas.

3. Scientific focus

The world is experiencing changes in the global climate, with unequivocal warming of the climate system. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased. The observed warming is occurring faster in the Arctic than elsewhere in the world. However, the rate of change of different geophysical parameters of the Arctic system varies highly. Ny-Ålesund is located at the northernmost point of the warm Atlantic Ocean inflow, the West Spitsbergen Current, and has a pivotal location enabling observations of relevant parameters in the ocean, on land, and in the atmosphere.

NISC is ideal for research and monitoring of contemporary environmental changes related to climate change issues, long range transport of pollutants, UV-radiation and related biological effects, physiology, eco-toxicology, Arctic marine and terrestrial ecosystems, as well as research from other disciplines. With its multidisciplinary research environment, NISC provides unique opportunities for scientific synergies.

NISC science and institutions shall contribute to climate research programs and international networks; notably the development of SAON, GAW, GCW, SIOS, COAT, BSRN, GRUAN, INTERACT, ACTRIS, and ICOS². NISC shall also contribute to strengthen standardization of procedures and traceability of measurements. Ny-Ålesund has a great potential for comparative Svalbard, pan-Arctic and bi-polar studies based on its broad measurement programs.

Research within NISC is comprised of activities from all stations with its various institutional, national and international programmes. Substantial portions of these activities are related and complementary. To release the full potential of these complementarities, and simultaneously increase the influence of NISC in the scientific debate, the researchers are asked to contribute to the four flagship Programs. The four Flagship Programs are covering the four main systems in Ny-Ålesund, and adequately cover most of the research and monitoring already performed. Each flagship program will be guided by a science group. The science groups will be responsible for calling for meetings for the Flagships to discuss milestones and goals for the programs, as well as revisions of gaps in knowledge and measurement programs.

Four flagship programs have been agreed on, and scientists active within NISC are encouraged to focus on developing the science and outcome of the flagships. Instead of establishing additional Flagship Programs for Ny-Ålesund, the four Programs could be extended to include also additional supplementing themes. Detailed information about the flagships can be found on the Flagship

² SAON: Sustained Arctic Observing Network (Arctic Council); GAW: Global Atmospheric Watch (World Meteorological Organization); GCW: Global Cryosphere Watch (World Meteorological Organization); SIOS: Svalbard Integrated Earth Observing System (European Strategy Forum for Infrastructure); COAT: Climate-Ecological Observatory for Arctic Tundra; BSRN: Baseline Surface Radiation Network; GRUAN: Global Climate Observing System Reference Upper-Air Network, INTERACT: International Network for Terrestrial Research and Monitoring in the Arctic; ACTRIS: Aerosols, Clouds, and Trace Gases Research Infrastructure Network; ICOS: Integrated Carbon Observation System

webpages and documents³. During the science plan period the Flagship programs will seek to integrate institutional contributions into scientific challenges that no single institution or group could tackle in solitude.

Based on the research and monitoring performed in the Flagship Programmes, NISC will contribute to develop one coordinated, multi-disciplinary Monitoring Program for Ny-Ålesund. The program will aim at addressing all stages of planning, collecting, storing and dissemination of the long-term monitoring data in Ny-Ålesund.

Activities that are endorsed flagship activities will be prioritized when infrastructure or human resources in Ny-Ålesund limit activities.

The NISC flagship programs

The Kongsfjorden System

The Kongsfjorden System is an established reference site for Arctic marine studies and represents a natural laboratory in close proximity to Marine Laboratory. Kongsfjorden is directly influenced by inflow of warm Atlantic Water and therefore is a highly sensitive marine system to climate change in the Arctic and represents one of the most comprehensive environmental monitoring location in the Arctic.

The flagship states the following future research priorities:

- A combination of atmospheric measurements of long-range pollutants with measurements of contaminant levels in the biota
- Studies of feedback mechanisms from the biosphere to the atmosphere
- Investigation of interactive effects of rising temperatures and enhanced UV- radiation
- Studies of changes in the pelagic fish community of Kongsfjorden
- Studies of organic carbon mineralization and sedimentation
- Studies of water exchange and mass balance processes in the fjord, at the major sea-glaciers' interface as well as studies on small scale turbulences
- Studies of seawater masses and their interaction with freshwater
- The use of clams as environmental indicators
- A monitoring programme for phytoplankton
- Monitoring and modelling of the underwater light climate (joint cooperation with the Atmosphere Flagship)
- Land-Fjord interactions (impact of terrestrial run-off and freshwater discharge; joint cooperation with the Glaciology and Terrestrial Ecology Flagship)
- Studies on seasonal drivers of Kongsfjord ecosystem functioning, including overwintering strategies in benthic and pelagic communities (joint cooperation with the Terrestrial Ecology Flagship)

Long-term monitoring is required for some of these objectives. In particular two major monitoring infrastructure innovations are planned. First, a cabled oceanographic monitoring platform that will allow real-time data retrieval, and second, an integrated comprehensive monitoring station on the central islands within Kongsfjorden to monitor and study the processes on the atmosphere/ocean surface interface. In order to meet the defined research priorities, future collaborative projects shall foster the interaction between and integrate the expertise from the other flagships.

The terrestrial ecosystem

The heterogeneity of the area, the proximity between the marine and terrestrial environments

³ <http://nysmac.npolar.no/>

and the long record of research makes Ny-Ålesund a key location for terrestrial research in the High-Arctic. This area provides unique opportunities for in depth studies of life and ecosystem processes in Arctic environments.

The flagship states the following future research priorities:

- Population studies of terrestrial biota (e.g. size, mortality, reproduction).
- Food web trophic interactions (e.g. microbes, insects, vegetation, geese, reindeer, arctic fox, polar bears).
- External drivers of population and ecosystem change (e.g. snow, ground ice, fjord ice, plant phenology, season length, pollutant fluxes).
- Integrative ecosystem studies across terrestrial, marine and freshwater systems to assess ecosystem resilience, variability and change.

The establishment of a High-Arctic Land Observatory (HALO) is proposed to further integrate and coordinate terrestrial research within Ny-Ålesund, Svalbard and with other polar research bases. Here long-term data series will be maintained providing open access long-term baseline data. Brøgger Peninsula is newly designated as a COAT-site (Climate-Ecological Observatory for Arctic Tundra). COAT is a system for long-term adaptive ecosystem monitoring based on food-web theory, and aims to become the world's most comprehensive and management relevant long-term research enterprise for arctic terrestrial ecosystems. In this regards reference sites will be designated for monitoring natural changes and will be intensively instrumented to record relevant parameters.

The atmospheric research

In Ny-Ålesund, several long term measurements of key climate parameters from the surface up to the stratosphere (ozone layer) have been performed for decades. The location under the magnetospheric cusp furthermore makes it a unique place for observing the solar wind and magnetosphere interaction on the dayside. The data are continuously feeding global networks. Such comprehensive data sets are available from very few sites in the Arctic.

The basic question for the Atmosphere Flagship research programme has been summarized as "Climate change in the Arctic: How do we tackle the challenge?" The general answer provided is to develop collaboration and joint research actions.

The research topics within the Atmosphere flagship programme can be grouped in three major fields: (i) lower atmosphere, (ii) aerosols and clouds, (iii) Long range transport, modelling, and satellite data. Specifically for the next planning period the following nine activities were identified:

- Long term observations of key parameters related to climate change,
- including meteorological networks
- Atmospheric boundary layer (ABL) processes,
- including surface energy budget and vertical fluxes of mass, heat, and momentum
- Interaction of snow and atmosphere
- Clouds, Humidity, and Precipitation
- Atmospheric aerosols and their climate effects
- Monitoring and studies of atmospheric composition and short and long range transport of pollutants
- Monitoring of Arctic ozone layer and UV variability
- Investigate Regional Representativeness, including Satellite Validation
- Ionospheric/magnetospheric research

The flagship aims to establish a unique international long-term atmospheric monitoring and observation platform in Ny-Ålesund supported by all research institutions belonging to NISC. On this base we hope to achieve the realization of a supersite to investigate the Arctic System with a

multidisciplinary approach, supported by new and upgraded technologies. In particular Interdisciplinary observations will increase the comprehension of the interaction processes at the interfaces between sea-, snow-, ice surfaces and atmosphere to provide an improved assessment of the impact of climate change on the Arctic environment.

An cross cutting activity planned to be developed is to establish a calibration infrastructure for meteorological and atmospheric research sensors to standardize the accuracy and the quality of the atmospheric parameters. The structure should be implemented in the frame of NISC.

Glaciology

Ny-Ålesund is an ideal site for glaciological research. Despite its remote location, it has an excellent logistical base for fieldwork programmes. Apart from large ice caps, most glacier types found in Svalbard, and even the High Arctic, are located nearby Ny-Ålesund: fast-flowing, surge type, polythermal, and calving glaciers. Two of the longest Arctic mass balance time series are measured on glaciers in Ny-Ålesund, Midtre Lovénbreen and Austre Bøggerbreen. Many relevant long-term measurements exist for these glaciers as well as the surge-type glacier Kongsvegen, and the tidewater glacier Kronebreen, part of the Holthedalfonna glacier system. The presence of glaciers with positive snow accumulation, such as Høltedahlfonna, together with a long record of mass balance measurements permit the recovery of ice core samples for paleoclimate reconstruction. The presence of annual snow, generally until the end of May, also makes Ny-Ålesund an ideal site to study snow evolution processes and to evaluate interaction between surface snow and atmosphere.

The flagship prioritized topics to be focused on in the future are:

- Glacier mass balance
- Glacier dynamics
- Glacier hydrology
- Annual snow layer evolution
- Interaction between snow and atmosphere
- Ice cores (for climate and contaminant studies)
- Glacier biogeochemistry

4. Coordination activities within NISC

Information tools

- The NySMAC webpage³ contains information about the Flagship Programs as well as the Monitoring Program. We are working on a metadatabase for ongoing monitoring which will include metadata with link to the measurements time series.
- All research projects in Svalbard are obliged to register in the database Research in Svalbard (RiS)⁴. RiS is a tool administered by Svalbard Science Forum (SSF) for information about research projects on Svalbard. The project leaders are encouraged to update their RiS projects with field reports and lists of publications.

Research facilities

NISC offer a range of research facilities, among them the Marine Laboratory, common laboratories (including the Atmospheric Laboratory at Gruevbadet) and the boat Teisten, all run by Kings Bay. Additional facilities include the Zeppelin Observatory at 475 m.a.s.l., the Admundsen-Nobile Climate Change Tower (CCT) at height 32 m, and the Underwater Long Term Fjord Observatory in Kongsfjorden.

⁴ <https://www.researchinsvalbard.no/>

Tools for scientific cooperation

- **The Ny-Ålesund Science Managers Committee (NySMAC)**
NySMAC was established to enhance cooperation and coordination among researchers and research activities within NISC. NySMAC includes representatives from all parties with major vested interests in Ny-Ålesund, and meets twice yearly. NySMAC provides advice and comments on research projects, research planning and coordination, infrastructure development, and environmental protection.
- **Ny-Ålesund Scientific seminars**
The Ny-Ålesund Scientific seminars, initiated by NySMAC are organized every two years for scientific exchange and communication both within the NISC research community and with the outside world.
- **SSF financed workshops**
SSF finances scientific seminars bringing together international scientists to discuss topics of particular scientific interest to facilitate thematic development of NISC.
- **The Ny-Ålesund Symposium**
Kings Bay organize the high-level event, The Ny-Ålesund Symposium on a regular basis on polar topics of choice to promote NISC
- **Flagship meetings**
Each flagship program's scientific committee will organize flagship meetings when needed, either as separate meeting locations, or by taking advantage of other meeting occasions, for example as listed above.

5. Implementation of the Science Plan

All institutions are committed to promoting and creating incentives for their scientists to adhere to the goals of the science plan.

- NySMAC is responsible for overseeing the implementing of the science plan.
- The Flagship Programmes science committee is responsible for the science plan within each Flagship Program.
- Kings Bay is responsible for the infrastructure, transport and accommodation services for the research activities, and for developing the infrastructure in the necessary direction for the research and monitoring development.
- Each station is responsible for making the content and intention of the Science Plan known to the station personnel and its users.
- Norwegian Polar Institute has a role as a catalyst and organizer for the implementation of the science plan.
- SSF is responsible to interlink the research in Ny-Ålesund with the corresponding research taking place in Longyearbyen, Hornsund and Barentsburg. SSF is responsible for the RiS portal. SSF supports the Flagship Programs through Svalbard Strategic Grants and other calls for funding.

Appendix 1

Mission Statement for Ny-Ålesund

Adopted by NySMAC 24 Aug. 1997

Background

The Norwegian government has formulated as a goal that Ny-Ålesund is to be developed into a leading international Arctic environmental research and monitoring station.

The Norwegian Ministry of Environment White Paper #42 "Norwegian Polar Research", 1992-93, states that:

- A prerequisite for Ny-Ålesund continuing to attract Norwegian as well as foreign scientific activities is that the local human impacts on the environment are kept at a very low level.
- Other activities in the area must adapt to the conditions set by scientific research and monitoring

The following Mission Statement was adopted by the Ny-Ålesund Managers Committee at the 7th NySMAC meeting 24 August 1997:

The mission of Ny-Ålesund, Svalbard, is to

1. serve as an international station for scientific research and monitoring;
2. encourage international scientific cooperation;
3. give priority to scientific research and monitoring that is dependent on the near pristine environment or unique qualities of the Ny-Ålesund area, in particular research related to long range pollution, climate change and polar ecology;
4. preserve the near pristine environment of the Brøgger Peninsula and the Kongsfjorden area, as well as the cultural heritage of Ny-Ålesund;
5. keep local human environmental impacts at the lowest possible level so as not to jeopardise scientific research and monitoring;
6. give scientific research and monitoring priority over other local human activities, such as tourism and commercial fishing;
7. be a prime example of the sustainable operation and development of a research station in the Polar Regions.

The success of the station will be judged on its scientific merits and achievements.