

International Polar Year in Finland

International Polar Year 2007-2008 in Finland

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ARCTIC CENTRE

Cover photos by Emilie Beaudon, Arctic Centre, University of Lapland.
This report has been compiled by System Analyst Arto Vitikka, Arctic Centre.

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Foreword

The Finnish International Polar Year was launched at the Arctic Centre in Rovaniemi on March 1st, 2007 in parallel with the global opening. The honorable President of Finland, Tarja Halonen, was the benefactor of the IPY in Finland. The opening seminar was attended by over one hundred participants from 16 organizations including representatives from the Ministry of Education, the Ministry of the Environment and the Sámi Parliament. As celebratory symbols, the Nordenskiöld commemorative coin by Nordic Moneta and the Finnish IPY stamp from Finnish Post were published. The Arctic Centre of the University of Lapland together with the Thule Institute of the University of Oulu served as the IPY Secretariat for Finland.

During the IPY, Finnish research institutions carried out the following main IPY activities (these are projects coordinated in Finland and international projects in which Finnish researchers took part): Change and variability of Arctic Systems Nordaustlandet, Svalbard - Kinnvika; Developing Arctic modeling and observing capabilities for long-term environmental studies (DAMOCLES); Assessing senses of place, mobility and viability in industrial northern communities (BOREAS - MOVE INNOCOM); Yamal NASA project; Community adaptation and vulnerability in Arctic regions (FIN - CAVIAR); Finland's aerosol research in Antarctica (in cooperation with the POLAR-AOD project); Heliosphere Impact on Geospace; Linguistic and Cultural Heritage Electronic Network - (LICHEN); Economy of the North; Antarctic Climate Evolution (ACE); Arctic Palaeoclimate and its Extremes (APEX); Arctic Summer Cloud Ocean Study project (ASCOS); and Radioactivity of the Russian Arctic Seas project.

Finnish scientists participated in over 50 international IPY projects. Finland did not allocate any special funding for IPY research activities; nevertheless, as Finland has high-level expertise in northern and arctic research (see http://www.arcticcentre.org/arcticresearch), Finnish scientists were successful in raising external funding for their research to enable their participation in the IPY. The funding for IPY projects was received through general calls by the Academy of Finland on top of the participating institutes' own budgets.

Finnish IPY activities also included education and outreach. For example, the Kinnvika project cooperated with Finnish schools in preparing a Kinnvika Net School and a feature document film will be released for international distribution in 2010. Additionally, a major science centre exhibition, "Arctic in Change", was opened in April 2007 at the Arctic Centre.

Today, the political interest in Arctic issues has increased in Finland. Finland is preparing a national strategy for the Arctic and a Finnish Arctic Committee is being established. Furthermore, the Ministry for Foreign Affairs of Finland recently published an overview of Finnish research activities in the Arctic. There is no doubt that without Finland's involvement in the IPY, these processes would not have been initiated. The initiation of these processes is clearly a legacy of Finland's involvement in the IPY.

This report compiled by the Arctic Centre briefly summarizes the scientific work done during the International Polar Year in Finland. For more information visit: http://www.arcticcentre.fi/ipy

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Earlier Polar years and Finland

The First International Polar Year (IPY) from 1882–1883 was provoked by the Austrian explorer Karl Weyprecht, who believed that the fundamental problems of meteorology and geophysics were most likely to be found near the Earth's poles. Sodankylä and Kultala, at Ivalojoki River in Northern Finland, were among the original research sites of the First IPY.

The Second IPY (1932–1933) was proposed by the International Meteorological Organization to promote advances in meteorology, magnetism, atmospheric science, and in the "mapping" of ionospheric phenomena. Arctic research escalated during the Second IPY.

The International Geophysical Year (IGY) was held in 1957–1958 to celebrate the anniversaries of the First and Second IPYs, and it turned out to be a success. Among other achievements, the continental drift theory was confirmed, the world's first satellites were launched, and the first informed estimates of the total size of Antarctica's ice mass were yielded. The Kinnvika research station in Nordaustlandet, Svalbard, was originally built in cooperation between Sweden, Finland and Switzerland during the IGY. On July 18th 1957, the Finnish ship RV Aranda occupied Hydrographic Station No. 35 in Kinnvika, Murchisonfjorden during the first Finnish polar marine expedition.

Source: Proceedings of the Finnish National IPY Conference Antti E.K. Ojala (Guest editor) and Keijo Nenonen (Research director) Geological Survey of Finland B.O. Box 96, FI-02151 Espoo, Finland

RV Aranda during the International Geophysical Year.
Photo: Arctic Centre, University of Lapland

IPY Congress in Finland

The IPY started in Finland with the Congress of the International Polar Year 2007/08 - IPY 07/08 celebration of Finnish geoscientific studies in Polar areas (November 2008).

The congress covered a wide range natural sciences, including geology, geophysics, hydrology, atmospheric sciences, geography, marine research, geodesy, glaciology, and arctic geotechnics. It was organised by the Geological Survey of Finland, the Geological Society of Finland, the Geophysical Society of Finland, the Finnish National Committee of Quaternary Research (INQUA), and the Finnish National Committee on Arctic and Antarctic Research.

Publication of the congress (edited by Antti E.K. Ojala) contains 13 peer-reviewed papers that are based on presentations given at the congress. The first paper by *Vihma et al*. introduces highlights of atmospheric surface layer research in the Finnish Antarctic programme during the last 20 years. A paper by *Sutinen et al*. suggest that snowmelt infiltration contributes significantly to ground water reserves. *Pirazzini* and *Meinander et al*. then discuss about challenges related to of snow and ice albedo measurements and parametrization. *Ruotoistenmäki and Lehtimäki* and *Korhonen et al*., as well as *Vanhala et al*., present the applicability of geophysical measurements in permafrost related studies. *Immonen et al*. and *Valppu et al*. discuss about interglacial-glacial climate change based on marine sediment records from Antarctic and Arctic sites. *Paatero et al*. presents results from recent ARCOS expedition, and *Virkkula et al*. introduces a review of aerosol research at the Finnish Antarctic research station Aboa. Finally, *Marnela et al*. and *Rudels et al*. present results from studies of circulation and water mass transformation and doublediffusive convection of the Arctic Ocean, respectively.

The publication is available on-line at the address: http://www.geophysica.fi/

Arctic Centre, University of Lapland

http://www.arcticcentre.org

The Arctic Centre at the University of Lapland is a national research institute and a science communicator. It conducts and conveys internationally recognised, multidisciplinary research concerning Arctic, communicates widely on Arctic issues to national and international specialists as well as general public, maintains a science centre and trains experts on the Arctic. The scope of the Arctic Centre's research is circumpolar and it focuses on three main themes: Global Change, Sustainable Development and Environmental and Minority Law.

The researchers at the Arctic Centre took part in IPY endorsed projects Kinnvika, Damocles, Yamal NASA project, BOREAS - MOVE INNOCOM, and FIN - CAVIAR.

Change and variability of Arctic Systems Nordaustlandet, Svalbard - Kinnvika

Summary of the final report by IPY-Kinnvika 2005-2009
Paula Kankaanpää & Veijo Pohjola (23. Feb. 2010)

IPY-KINNVIKA 07-09 was an international and multidisciplinary research consortium aimed at understanding the past, present and future environmental changes in the High Arctic. It consisted in a cluster of scientific expeditions during springs and summers 2007, 2008, 2009 to the still today fairly unexplored Nordaustlandet in Svalbard area (Fig.1 & 2). A reconnaissance trip to Kinnvika was made in 2005. The planning process of the whole project started already in 2002-03.
IPY Kinnvika project was named after the Swedish-Finnish-Swiss research station built during the last IGY 57-58 at 80°N on the western shore of Nordaustlandet. The Kinnvika project was launched by the Arctic Centre in Finland in 2003. As the parallel initiative developed in Uppsala University, Sweden it was decided to create a common project. The Arctic Centre led the project until 2006 after which the leadership was taken over by Department of Earth Sciences of the Uppsala Univeristy. The long-abandoned Kinnvika installations were chosen, and we were kindly given permission of the Governor of Svalbard to use the historical site as our IPY 07-09 camp. The station was handed back to the Governors office in September 2009, and the inspection thereafter was pleased with our way to maintain and hand over the station to the Governors hands.

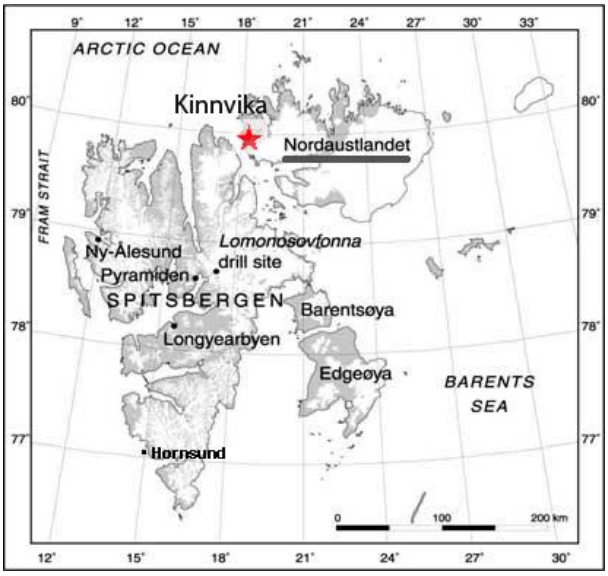

Fig.1. Location of Kinnvika.

Fig. 2 Kinnvika station in spring 2009. (Photo:Veijo Pohjola)

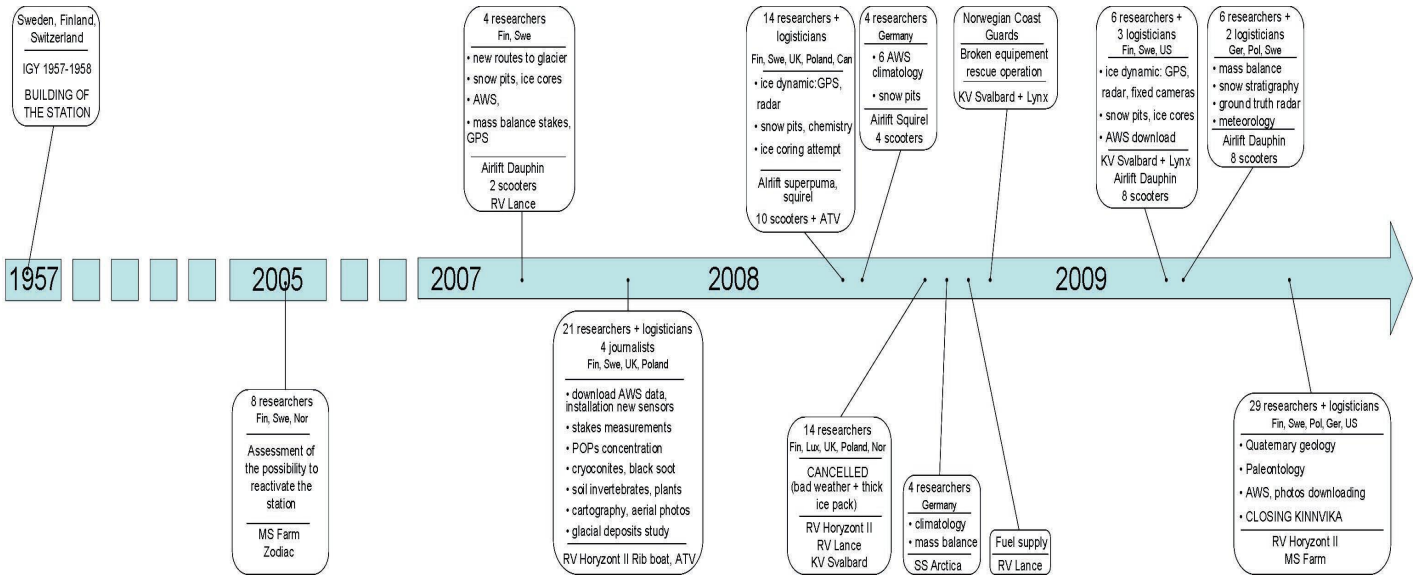

Fig. 4. (Drawn by Emilie Beaudon)

Although the logistical challenges were large, we managed to bring in 69 persons from nine countries to carry out field work during the project representing disciplines of glaciology, geology, biology, atmospheric and environmental sciences (Figure 3.) Altogether 1305 man days were spent in the Murchinson Bay area during six campaigns within the project in 2007-2009. Figure 4. shows the time line of the expeditions and the most relevant facts regarding each specific expedition. Of the six campaigns, only the summer expedition of 2008 was suboptimal. This was due to heavy summer ice conditions that prevented any ship based science at the planned period.

Total funding, including the research funds for each participating group was approximately 3.7 million EUR, with a partition of the following parts: Research 2.7 M EUR, Logistics 1.0 M EUR. Plus the outreach budget by participating companies.

Research was made on the following themes (Figure 5.):

- Natural climatic variations during one glacial cycle at the northwestern edge of the Barents ice sheet
- Mass-status, mass-prognostics and calving dynamics of Nordaustlandet ice sheets.
- Atmospheric and cryospheric boundary layer transfer and dynamics.
- Atmospheric transfer of chemical and physical constituents to the High Arctic
- The Lower Palaeozoic geological succession in Nordaustlandet
- Taxonometry of flora, fauna and micro-organism communities on ice caps
- Geodetical, terrestrial and bathymetrical maps of Nordaustlandet

IPY-Kinnvika disciplines

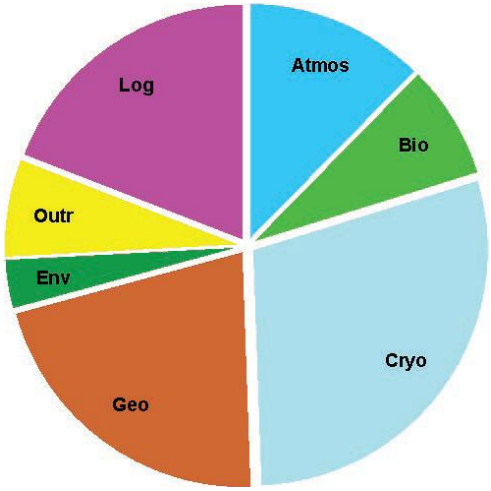

Figure 4. The number of persons per disciplines and logistics of IPY-Kinnvika. Total 69 persons

IPY-Kinnvika nations

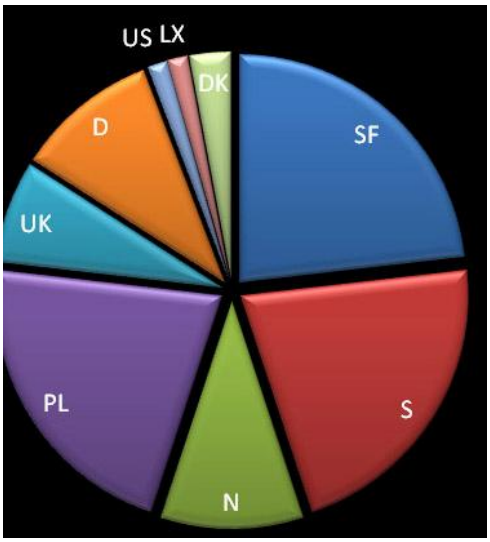

Figure 5. The distribution of the nationalizes of the 69 participating individuals in IPY-Kinnvika expeditions.

RESULTS

1. Scientific papers

Over ten scientific papers are under preparation. A specific issue in Geografiska Annaler under negotiation to be published in 2010-11. Some papers are published already:

- Beaudon, E. and Moore, J.: Frost flower chemical signature in winter snow on Vestfonna ice cap, Nordaustlandet, Svalbard, The Cryosphere, 3, 147-154, 2009.
- Salonen, V.-P.; Kaakinen, A.; Kubischta, F.; Eskola, K.O.; Oinonen, M.J. Weichselian glacial sedimentology and stratigraphy in Murchisonfjorden area, Nordaustlandet, Svalbard [3.9 Mt pdf]. Arctic change 2008: conference programme and abstracts, Québec (Qc), 9-12 December, 2008, ArcticNet, 2008, p. 145-146
- Kaakinen, Any, Veli-Pekka Salonen, Frauke Kubischta, Kari O. Eskola and Markku Oinonen. Weichcelian glacial stage in Murchisonfjoren, Nordaustlandet, Svalbard. Boreas. 29th January 2009.
- Macias Fauria, M, A. Grinsted, S. Helama, J. C. Moore, M. Timonen, E. Isaksson, and M. Eronen (2009) Unprecedented 20th century low values of sea ice extent in the Western Nordic Seas since A.D. 1200. *Climate Dynamics,* doi: *10.1007/s00382-009-0610-z*

- Zwinger, T. and J. C. MOORE, (2009) Diagnostic and prognostic simulations with a full Stokes model accounting for superimposed ice of Midtre Lovenbreen, Svalbard, *The Cryosphere* 3, 217-229
- Sinisalo, A., and J.C. Moore, (In Press) Antarctic blue ice areas (BIAs) - towards extracting paleoclimate information, *Antarctic Science*
- Divine D.V., E. Isaksson, H. Meijer, R.S.W. van de Wal, T. Martma, V. Pohjola, J. Moore, B. Sjögren and F. Godtliebsen 2008 The deuterium excess record from a small Arctic ice cap *Journal of Geophysical Research 113, D19104, doi:10.1029/2008JD010076, 2008*
- Pohjola, Veijo: Arctic warming: a perspective from Svalbard. Global Change NewsLetter, 69: pp. 9-11; IGBP Secretariat, Royal Swedish Academy of Sciences, Stockholm, Sweden; illus. incl. geol. sketch map; 2007 ISSN: 0284-5865
- Pohjola, Veijo: KINNVIKA - a multidisciplinary and multinational platform for Arctic warming and impact research during the fourth International Polar Year. Swedish Polar Research Secretariat yearbook, 2007, 106-111, ill., diags., map
- Wråkberg Urban. IPY Field Stations. Functions and Meanings. In Global Interdisciplinary Studies Series. Legacies and Changes in Polar Sciences. 2009. Jessica M. Shadian and Monica Tennberg (eds).

2. Presenations

Presentations of material from the KINNVIKA expeditions:

- The Nordic branch meeting of the International Glaciological Society 2007, 2008, 2009
- The American Geophysical Union Fall meeting 2009
- The Nordic Geological winter meeting 2010
- Plus presentations on various relevant workshops 2007-2010

3. Education

- 6 PhD thesies are under preparation

4. Popular publications

- A "Kinnvika –legacy" book under preparation
- Brochure Swedish Polar Research Secretariat
- Several newspaper articles in Helsingin Sanomat and Lapin Kansa during 2005-08

5. Outreach

TV & Film

- A full movie by Kinovid Productions Ltd. & WildFin Ltd. will be published in 2010
- Four different short documentaries on Swedish TV4 news, and 'in sofa' discussions about the expeditions at three different stages of the KINNVIKA operations
- Finnish YLE TV1, Prisma: document about the feasibility trip to Kinnvika in 2005

Radio

- Various radio broadcasts on Swedish radio 2007-2008 and Finnish radio in 2005

Internet

- Kinnvika website
- Kinnvika netschool

School co-operation

- In August 2007, Kinnvika project supported fifteen Finnish high school students (Alppila, Espoo and Koillis Helsinki lukio) to spend a week in Svalbard in order to get a realistic and multidisciplinary picture of the Arctic.

Exhibition

- Aranda, Kinnvika 1957 photo exhibition by Forum Marinum, Åbo Akademia at the Arctic Centre during 2007-2008.

Seminar

- Kinnvika seminar at the Swedish Polar Museum in Gränna 2007
- Public lectures in 2008- 2009 in the Arctic Centre, Arktium –house Rovaniemi

Commercial

- Metsä-Tissue Serla TV add and cover paper text campaigns. Outreach articles.

5. Data policy

- IPY-Kinnvika project has followed the objective of IPY 2007-2008 data management and metadata to ensure the security, accessibility and free exchange of relevant data that both support current research and leave a lasting legacy. The Kinnvika website has been used actively to collect the material.

Future co-operation

The post-IPY program is developed along different lines. One theme that is elaborated is "The Vestfonna ice cap dynamics in space and time"where most of the Earth Science oriented teams are cooperating in a network to solve questions and procedures in order to study this particular object that is a major entity on Nordaustlandet. Specialists meet on various occasions to perpetuate this issues, and 3 PhD students and 3 postdocs warrant the development. We have further planned a KINNVIKA workshop on the research vessel RV Horyzont in Poland in October 2010. This vessel was the same vessel we utilized in the summer operations 2007-2009 withing KINNVIKA. In addition we are presently negotiating a special volume in a scientific journal to publish a part of the work coming out of KINNVIKA.

Conclusions

We are grateful especially to Nordic Council of Ministers that provided the essential "seed and clue" funding for the project. We are also grateful to all that have helped and assisted IPY-KINNVIKA to succeed during the 2009 campaigns and especially for Nordic Council of Ministries and Metsä-Tissue Serla. Among these the services and strengths of Airlift, The Governor of Svalbard's office, The Norwegian Polar Institute are deeply acknowledged. The Polish Academy of Sciences, The Polish Marine Academy, The Norwegian Coast Guard and The Swedish Polar Research Sectereriat has largely assisted our logistical strains, and been superb supporters of our endeavors. We have further been supported by financial means Metsätissue/Serla oy, The Polish Academy of Sciences, the Finnish Academy, the Swedish Science Council and The Swedish Polar Research Sectereriat without which we would have been grounded long time ago. We are also grateful to Naviga, Restaurang Busen, and Ingenjör Poulsen AS their services.

The different team's reports / blogs are given here www.kinnvika.net

Annex.

Organization of the KINNVIKA project

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- Jan-Erik Johansson, Lasse Tano, Logistical Officers, SWEDARCTIC
- Mika Kalakoski, Logistical Officer, FINNARP - email: mika.kalakoski (at) fimr.fi

Supporting Organizations

- Nordic Council of Ministers
- Swedish Polar Research Secreteriat
- Polish Academy of Sciences
- Swedish Science Council
- Academy of Finland
- Metsä Tissue - Serla
- University of Lapland, Arctic Centre, Finland
- Uppsala University, Sweden

Participating scientists and institutions

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USA (3): Mark Hermanson University of Pennsylvania; Regine Hock, Bob McNabb University of Alaska Fairbanks

Yamal NASA project

Research Professor Bruce Forbes participated in the the **Yamal NASA** project which was part of Greening of the Arctic, an IPY project led by the University of Alaska, Fairbanks (http://www.geobotany.uaf.edu/goa/). Results of this work "Russian Arctic warming and 'greening' are closely tracked by tundra shrub willows" were published in the Global Change Biology 2009.

Taking sample slices from the trunks of willow in the Nenets Autonomous Okrug. The microscopic annual rings can represent nearly a century of growth and faithfully document summer temperatures for about 65 years. Photo: Bruce Forbes.

Publication: Forbes, B.C., Macias Fauria, M. & Zetterberg, P. (2009) Russian Arctic warming and 'greening' are closely tracked by tundra shrub willows. Global Change Biology doi: 10.1111/j.1365-2486.2009.02047.x.

Developing Arctic modeling and observing capabilities for long-term environmental studies (DAMOCLES)

Researchers Anna Stammler-Gossman took part in the DAMOCLES project which was an endorsed IPY project. There the starting point of to study was to estimate the potential impact of predicted climate change on several economic activities in the Russian European North /Russian part of the Barents region, including fishery and shipping. The aim of current analysis was thus to consider the likely response of the practice of fishery and shipping to climate change and to changes in the socioeconomic and political setting, taking the same timescale as the DAMOCLES project as a whole, and allowing for regional differences.

Assessing senses of place, mobility and viability in industrial northern communities (BOREAS - MOVE INNOCOM)

Researcher Florian Stammler was leading the Assessing senses of place, mobility and viability in industrial northern communities project. The project was f unded by the Finnish Academy, under the auspices of the ESF EUROCORES Programme BOREAS. MOVE is an endorsed IPY project (www.alaska.edu/boreas/move). This research proposes a comparative analysis of mobility and settlement in and around communities of industrial workers in Northwest Russia/Siberia.

Community adaptation and vulnerability in Arctic regions (FIN - CAVIAR)

Research Professor Monica Tennberg and the Sustainable Development research group at the Arctic Centre participated in the **Community adaptation and vulnerability in Arctic regions** (FIN - CAVIAR) project which was a part of IPY Caviar project. The broad goal of CAVIAR is to enhance the theory, empirical understanding, and practical application of processes that shape vulnerability and adaptation in communities across the polar region. The FIN-CAVIAR project was funded by the Academy of Finland.

Publications

- Stammler-Gossmann, A. (2009) Who is indigenous? Construction of 'indigenousness' in Russian legislation. International Community Law Review 11(1):69-102.
- Stammler-Gossmann, A. (2009) Negotiating the indigenous status in the Russian Federation. *Arctic & Antarctic International Journal of Circumpolar Socio-cultural Issues* 3: 7-51
- Stammler-Gossmann, A. (2010) Political animals of Sakha Yakutia. In Stammler, F. & Takakura, H. (eds.). *'Good to eat', 'good to live with': Social significance of animals in*
- *nomadic pastoral societies of the Arctic, Africa & Central Asia*. Sendai: Northeast Asian Studies Series.
- Stammler-Gossmann, A. (2010 forthcoming) 'Translating' vulnerability at the community level in the Russian North (Case study: Nelmin Nos, Nenets Autonomous Okrug). In Hovelsrud, G.K. & Smit, B. (eds.) *Community adaptation and vulnerability in the Arctic region*. Springer.
- Stammler-Gossmann, A. (forthcoming) Dynamic landscape: A community and its 'agenda' for change. Tennberg, M. et al., *Governing the Uncertain: Climate Change Adaptation in Russia and Finland.*
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- Tennberg M., Vuojala-Magga, T., Turunen (2010) Ivalo River and its people: There have always been floods - what is the difference now? In. Hovelsrud, G.K. & Smit, B. (eds.), *Community Adaptation and Vulnerability in the Arctic Regions*. Springer
- Vuojala-Magga, T. (2009) Simple things but complicated skills. Sami skills and tacit knowledege in the context of climatic change. In T. Äikäs (ed.), *Mattut Maddagat. The Roots of Saami Ethnicities, Societies and Spacies/Places.* Sastamala:Vammalan Kirjapaino Oy
- Vuojala-Magga, T.(2010) Knowing, training, learning: the importance of reindeer character and temperament for individuals and communities of humans and animals. In F. Stammler & H. Takakura (eds.) *Good to Eat, Good to Live with: Social significance of animals in nomadic pastoral societies of the Arctic, Africa & Central Asia*. Northeast Asian Studies Series. Sendai: Centre for Northeast Asian Studies.
- Vuojala-Magga, T., Turunen, M., Tennberg M.(forthcoming): Resonance strategies of Sami reindeer herding during climatically exceptional years in Northernmost Finland in 1970-2008. (submitted to a journal with a referee practice in January 2010)

- Vuojala-Magga, T. (forthcoming) The only thing you can rely on is your own action - Sámi world of reindeer, work and income. In Monica Tennberg et al., *Governing the Uncertain: Climate Change Adaptation in Russia and Finland.*

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Snow and Ice Activities in IPY

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Snow and ice form a key part of the polar regions. They appear in the form of atmospheric ice, seasonal snow cover, ice sheets and glaciers, frozen ground, lake ice and river ice, and sea ice. In the Geophysics Laboratory of the Department of Physics snow and ice research has been the leading research topic. IPY participation focused on glaciers and sea ice.

Glacier research

The Geophysics laboratory was a partner in the international IPY Kinnvika research programme. The main research area was Nordaustlandet, Svalbard where the glacier thermally active surface layer (10 m thick) was examined. Additional process studies were made in Spitszbergen glaciers in Svalbard. The result contain the heat budget of Svalbard glaciers, particularly in spring and summer season, and optical properties of near-surface snow. For bi-polar aspects, comparisons were performed with our similar studies in Dronning Maud Land, Antarctica.

Kinnvika research lasted through the whole IPY period and has continued also thereafter. The research team consisted of professor Matti Leppäranta, Olli-Pekka Mattila and Juho Vehviläinen. Both Mattila and Vehviläinen spent half year in UNIS (Universitetsstudiene i Svalbard, Longyearbyen) due to our close collaboration with Norwegian snow and glacier scientists.

Sea ice

Professor Matti Leppäranta was an active partner in IPY international sea ice summer schools. He gave lectures on sea ice dynamics in summer schools in Svalbard and Shanghai in 2007, which led to contrinbutions in lecture notes publications and preparation of the 2nd edition of sea ice dynamics textbook. Leppäranta also took actively part in IPY related sea ice conferences and symposia and continued research on seasonal sea ice zone in international collaboration.

Publications

- Goldstein, R.V., N.M. Osipenko and M. Leppäranta (2009) Relaxation scales and the structure of fractures in the dynamics of sea ice. Cold Regions Science and Technology 58: 29–35.
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History of growth and decay of Vestfonna glacier during the last glacial cycle

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http://www.helsinki.fi/geology/index.html

The project is a part of the IPY-research initiative: "Change and variability of Arctic Systems Nordaustlandet, Svalbard, #58, KINNVIKA, Veijo Pohjola (Sweden). It sstarted Jan 1st 2007, and it will continue until Dec 31st 2010. We have performed three field trips to Murchisonfjorden area (Kinnvika), Nordaustlandet and achieved research material to investigate the environmental history of the western sector of Vestfonna glacier. The investigations have three interconnected targets, and they are providing data for several PhD and postdoctoral studies.

The research includes sedimentological studies from onshore sections, foraminiferal studies from shallow and deep water sediments, paleolimnological studies to analyse climate parameters, age determations, analyses of glacioisostatic shore line development and mathematical modeling of the glacier through time. The research has been carried out with strong cooperation with the Kinnvika-community, and Polish research team supported by MS Horyzont II.

The Finnish group consists of following researchers:
- Professor Veli-Pekka Salonen, group leader
- PhD Anu Kaakinen, sedimentologists; glacial history
- PhD Seija Kultti, analysis of shore line displacement based on drift wood
- PhD Antti Ojala, marine coring, mineral magnetism
- MSc Frauke Kubischta, foraminiferal analysis, past sea surface temperatures
- MSc Tomi Luoto, chironomid analysis, paleotemperature reconstructions
- PhD Liisa Nevalainen, cladocera and diatoms analyses; lake ecosystem shifts
- MSc Kati Laakso, glacial modelling

Two scientific papers have been published thusfar, and the project results have been presented in a number of scientific meetings. There will be approximately 6 to 8 more papers to be published by the end of the year as the major outcome of the project. In addition, a documentary film entitled "Kinnvika - the last border" by Petteri Saario will be presented in fall 2010.

Funding: Academy of Finland

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Finland's aerosol research in Antarctica during the International Polar Year 2007-2008

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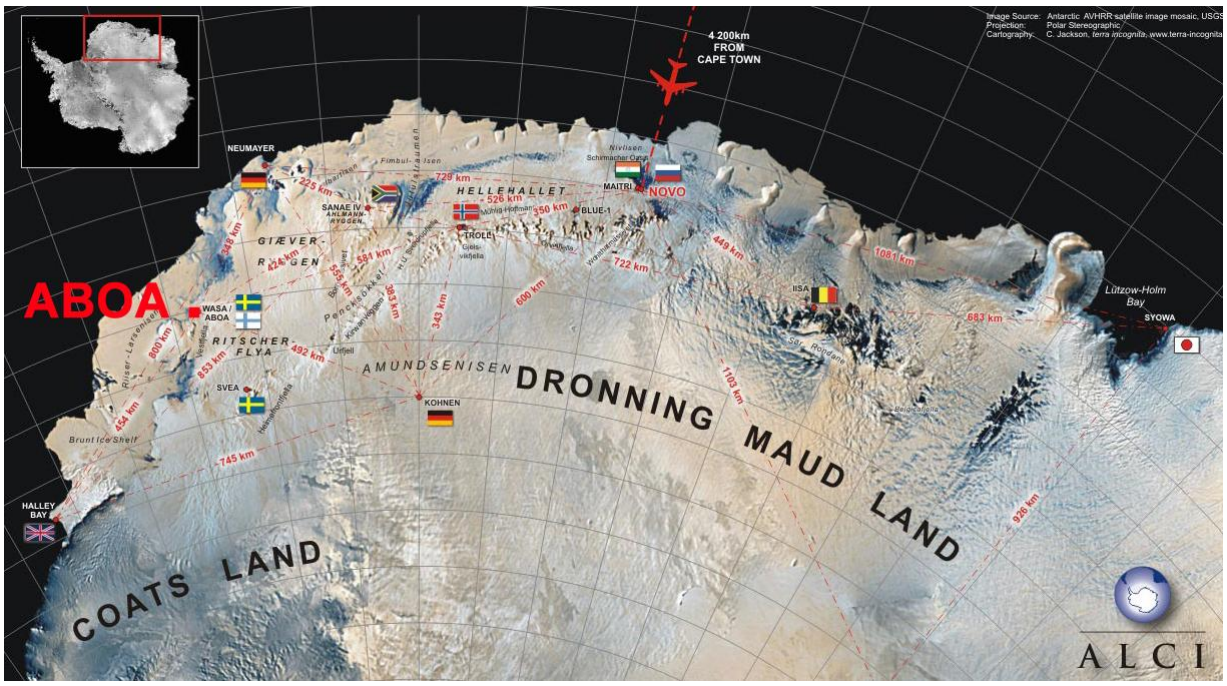
Background

All main aspects of aerosols – chemical composition, physical properties, and processes from their origin to removal from the atmosphere to the snow surface – have been studied at the Finnish Antarctic research station Aboa (73°03'S, 13°25'W) in Queen Maud Land, Antarctica, since December 1997, mainly in the austral summers. The station is located on the nunatak Basen 480 m above sea level and approximately 130 km south of the ice edge of the open ocean of Weddell Sea.

The general objective of the aerosol research has been to study aerosol formation and other processes in a pristine and clearly natural environment. We have tried to find answers to detailled questions such as 1) what are the main factors affecting particle concentration, 2) where does the particle formation actually take place, close to the surface or higher up in the atmosphere, above the sea or far away in the middle of the continent, 3) what are the chemical compounds that lead to the growth of the aerosol, 4) do the particles grow into climatically relevant sizes, and 5) how does particle chemical composition change when marine aerosols get transported to inland and how does this relate to the coast-inland gradient in the chemical composition of snow. The work has been a cooperation of the aerosol research groups of University of Helsinki (UHEL) Department of Physics and the Finnish Meteorological Institute's (FMI) Air Quality Research.



Location of the Aboa station (Map by ALCI, http://www.alci.info/dromlanflightmap.html)

Research during during the International Polar Year 2007-2008

The aerosol measurements made in the summers of 2006/2007 and 2007/2008 were a contribution to the International Polar Year (IPY) project POLAR-AOD: a network to characterize the means, variability, and trends of the climate-forcing properties of aerosols in polar regions (IPY EoI ID No: 299). In the summer 2007/2008 there was also a cooperative project with the Swedish Institute for Space Research (IRF, Kiruna)

concerning air mass vertical transport. In summer 2007/2008 also trace gas concentrations, for instance surface ozone and volatile organic carbon (VOC) concentrations were measured at Aboa. The ozone measurements were a contribution to the autonomous surface ozone monitoring network in Dronning Maud Land, Antarctica, an IPY project coordinated by the British Antarctic Survey. In addition to the measurements at Aboa, both UHEL and FMI aerosol research groups have had close cooperation with the Italians. Both groups sent instruments to the high plateau station Dome C where the overwintering Italian team takes care of them. These measurements include aerosol number size distributions in the size range 10 nm – 15 µm with a differential mobility particle sizer and an optical particle counter as well as light absorption coefficient at three wavelengths. A continuous time series exists since December 2007, covering the whole IPY and beyond, to the present day. Results of these measurements during the IPY have so far been published by Asmi et al. (2009a, 2009b) and Virkkula et al. (2009a, 2009b)

Launching a sounding balloon at the Antarctic. Photo Aki Virkkula.

Publications

- Asmi, E., Frey, A., Virkkula, A., Ehn, M., Manninen, H. E., Timonen, H., Tolonen-Kivimäki, O., Aurela, M., Hillamo, R., and Kulmala, M. (2009a) Hygroscopicity and chemical composition of Antarctic sub-micrometre aerosol particles and observations of new particle formation, *Atmos. Chem. Phys. Discuss*., 9, 27303-27357.(www.atmos-chem-phys-discuss.net/9/27303/2009/acpd-9-27303-2009.pdf)
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Finnish Meteorological Institute - Stratosphere and space research

The Finnish Meterological Institute (FMI) participates to several research projects which the IPY Project Office has endorsed as IPY core activities. More information:
http://www.fmi.fi/research_polar/polar_10.html

Finland coordinated the "Heliosphere Impact on Geospace" project. The project was be run by a federation of 29 international research groups from which the ICESTAR and IHY communities will carry the management responsibilities and will serve as the contact point towards the IPY Project Office.

The scientific work conducted during the "Heliosphere Impact on Geospace" project has three main themes:

- Coupling processes between the different atmospheric layers and their connection with solar activity
- Energy and mass exchange between the ionosphere and the magnetosphere and
- Inter-hemispheric similarities and asymmetries in geospace phenomena

More information available at the address www.ava.fmi.fi/ipyid63/

Several Finnish IPY projects utilised the versatile EISCAT radars which were used for example in ionosphere and aurora research. The EISCAT Scientific Association operates three incoherent scatter radars in Tromsø (Norway) and on Svalbard. The UHF radar, which operates at 930 MHz, is the only tristatic incoherent scatter radar in the world. The transmitter is located in Tromsø and additional receiver sites are in Kiruna (Sweden) and Sodankylä (Finland).

MIRACLE network has also been used together with EISCAT and ESA Cluster to study the mesoscale ionosphere and magnetosphere coupling processes. Both ground-based and satellite data has given new information on Earth's magnetosphere. The Magnetometers - Ionospheric Radars- Allsky Cameras Large Experiment (MIRACLE) is a two-dimensional instrument network constructed for mesoscale studies of auroral electrodynamics, which is maintained and operated as international collaboration under the leadership of the Finnish Meteorological Institute. Finnish researchers also developed during IPY tools for modelling the magnetic field of the magnetosphere. These tools are in important role in the research where ground-based and satellited data are combined.

Since the days of the second and third IPY-campaigns the research which traditionally has been based heavily on ground-based observations has received more and more support also from different satellite missions. Today ground-based and satellite data are used fluently together in order to quantify the importance of various coupling processes between the solar wind, magnetosphere, ionosphere and thermosphere.

Besides the Cluster, other important partners for Finnish research have been the German-Danish CHAMP and NASA's Themis projects. Data on magnetic fields collected by CHAMP has been used in the research of southern and northern auroras. Finnish development on data analysis tools was used in the Themis project to study the "space tornados" in the magnetosphere. Finnish researchers also took part in the development of GAIA virtual observatory (gaia-vxo.org).

Also the coupling between the activity of the Sun and the geographical differences in surface temperatures in the northern regions has been studied with long-term time series magentic and meteorological data. Modelling tools for this is being developed in Finnish-British cooperation.

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Suomalaista yläilmakehä- ja avaruustutkimusta IPY-kampanjan aikana

Suomalaiset koordinoivat IPY-kampanjan aikana monikansallista hanketta otsikolla ”Heliosphere impact on geospace ” (Heliosfäärin vaikutus Maan lähiavaruudessa). Hankkeeseen osallistui tutkijoita 22 eri maasta ja töitä tehtiin kolmen yleisteeman alla: (i) kytkentäilmiöt ilmakehän eri kerrosten välillä ja niiden vaihtelut Auringon aktiivisuuden ajamana, (ii) Maan magnetosfäärin ja ionosfäärin väliset massan, liikemäärän ja energian kulkeutumismekanismit, ja (iii) eteläisen ja pohjoisen napa-alueiden erot ja samankaltaisuudet yläilmakehän ja avaruuden kytkentäilmiöissä.

Monet IPY-vuosien suomalaishankkeet hyödynsivät Fennoskandiassa ja Huippuvuorilla toimivaa monipuolista mittalaitteistoa. EISCAT-suurtehotutkia (http://eiscat.se) käytettiin mm. ionosfäärin D-kerroksen elektronipopulaation kuumennuskokeissa ja revontulivyöhykkeen pohjoisreunalla esiintyvien kaarten elektrodynamiikan tutkimuksessa. Huippuvuorten tutkilla tehtyä ennätyspitkää yhtenäistä ajoa hyödynnetään ionosfäärissä esiintyvien liikkuvien häiriörintamien ja niihin liittyvien neutraali-ilmakehän aaltojen tutkimuksessa. Magnetometrien ja revontulikameroiden muodostamaa MIRACLE-verkkoa (http://space.fmi.fi/MIRACLE) on käytetty yhdessä EISCATin ja ESA:n Cluster-satelliittihankkeessa kerätyn datan kanssa mesoskaalan (L~10-1000 km) magnetosfääri-ionosfäärikytkentäilmiöiden tutkimuksessa. Maanpinnalta ja satelliiteista käsin kerättyjä havaintoja yhdistämällä on saatu uutta tietoa mm. Maan magnetosfäärin pyrstössä tapahtuvasta magneettisesta rekonnektiosta, sen synnyttämistä nopeista virtauksista pyrstössä ja näiden ilmiöiden ”jäljistä” ionosfäärissä. Suomalaisvoimin kehitettiin myös magnetosfäärin magneettikentän mallinnustyökaluja, jotka ovat keskeisessä osassa maanpinta- ja satelliittihavaintoja yhdistelevässä tutkimustyössä.

Clusterin ohella suomalaisen tutkimuksen kannalta tärkeitä ovat olleet myös saksalais-tanskalainen CHAMP-satelliittihanke ja NASA:n Themis-hanke. CHAMPin keräämää magneettikenttä-aineistoa on käytetty eteläisen ja pohjoisen revontulivyöhykkeiden globaalin skaalan sähkövirtajärjestelmien tutkimuksessa. Themisin ja sitä tukevan laajan maanpintalaiteverkon avulla pystyttiin ensi kerran keräämään vakuuttavaa havaintomateriaalia magnetosfäärissä ajoittain esiintyvistä jättiläismäisistä

”avaruustornadoista”. Suomalaisvoimin kehitettyä data-analyysimenetelmää käytettiin tornadon ionosfääripäähän syntyvän pyörteen tutkimuksessa. Suomalaiset osallistuivat myös Themis-hankeen puitteissa avatun GAIA-virtuaaliobservation (http://gaia-vxo.org/) kehitystyöhön.

Auringon aktiivisuuden ja Maan napa-alueiden pintalämpötilojen maantieteellisen jakauman välistä kytkentää on tutkittu pitkien magneettisten ja meteorologisten aikasarjojen avulla. Tutkimus paljastaa, että geomagneettisesti aktiivisten jaksojen aikana pintalämpötilat jollain tietyillä korkeilla leveyspiireillä olevilla alueilla ovat muutamia asteita kylmempiä tai lämpimämpiä kuin samoilla alueilla magneettisesti hiljaisina jaksoina. Auringon hiukkaspurkausten ajamia muutoksia yläilmakehän kemiassa ja niihin liittyviä vaihteluita keski-ilmakehän otsonipitoisuudessa pidetään yhtenä todennäköisimmistä selitysmekanismeista havaitulle kytkennälle. Mallinnustyö tämän tulkinnan vahvistamiseksi on käynnissä suomalais-englantilaisena yhteistyönä.

Suomalaista yläilmakehä- ja avaruustutkimusta IPY-kampanjan aikana ovat tukeneet eritoten Suomen Akatemia, Oulun yliopisto ja Ilmatieteen laitos.

University of Oulu - Thule Institute

http://thule.oulu.fi/
http://www.oulu.fi/english/

Thule Institute is a unit of the University of Oulu focusing on the development and coordination of research and teaching cooperation in the field of Northern and Environmental Issues, one of the University's areas of focus.

The basis of research consists of research programmes focusing on northern and environmental issues: Global Change in the North, Northern Land Use and Land Cover as well as Circumpolar Health and Wellbeing.

Linguistic and Cultural Heritage Electronic Network - LICHEN

Dr Lisa Lena Opas-Hänninen
http://www.lichen.oulu.fi

University of Oulu coordinates the IPY endorsed **Linguistic and Cultural Heritage Electronic Network - LICHEN** project, which is a multidisciplinary research project focused around the preservation and analysis of minority languages spoken on the circumpolar regions. The international project team has partner institutions and members from Finland, Norway, United States and the United Kingdom.

The aim of this project is twofold:

- to collect data and collate information on two minority languages, Kven and Meänkieli, spoken in northern Europe and secondly,
- to create easy-to-use tools that will allow the speakers of these languages, researchers and the general public access to the data and information.

The project will use these two minority languages to investigate best practices in the collection, management and online display of linguistic and cultural data, but the results of the project are widely applicable to the collection and preservation of other languages and cultures.

This project stands out because of the cooperation between the philologists and the Faculty of Technology, in particular the MediaTeam Oulu research group, whose expertise in the application of computing to natural language processing and multimedia technologies far exceeds that of any humanities computing unit. Their research activities include pattern recognition and digital signal processing applications, many of which they have applied to textual, oral and visual data. They have already built the basic database, which is now being tested with various different types of data. The intention is that within this project new, exciting tools for oral and visual data be developed to answer to the needs of the intended audiences of the project, ie the speakers of the languages, the public at large and other researchers facing similar issues regarding the preservation of minority languages. This level of collaboration between the linguists and engineers has attracted attention internationally and brought a wide network of international collaborators to the project.

In collecting data to study the linguistic and cultural heritage of the North, the project will develop new, specialized tools for linguistic and cultural research, following an open standards model to ensure interoperability. Within the project we will create an electronic framework for the collection, management, online display, and exploitation of data on the languages and cultures of the North, which is also applicable to other data that represent regional, social and other varieties of languages. The basic database for the framework has been developed and is in its test phase and some of the central tools for text analysis will be built upon it before the beginning of this project. The main concern of this project is to build tools for non-textual data. To achieve this we rely on close collaboration between several well-established corpus projects to discuss common goals, needs and problems and to identify best practices. Thus the research will look for

new ways in which ICT (Information and Communications Technology) can benefit humanities scholarship and involve a broader range of humanities scholars in ICT.

Using the developed electronic framework collaborators in the project aim to collect, preserve and disseminate information about the languages spoken in northern Europe, thus also enabling research on them. This will also help to promote the linguistic confidence and self-image of the speakers of these languages, strengthening their cultural awareness and facilitating cross-cultural communication between these peoples in an age of rapid global change.

Finally, the results of the project will not only benefit the academic community but also enable the general public (for example schoolchildren and their teachers) to access information on the languages spoken in the region and, in the case of the languages included here, to access actual linguistic and cultural material through the framework. This is important since the promotion of the languages and cultures of a region can affect tourism, which plays an increasingly important economic role in these regions.

Economy of the North

Research Professor Ilmo Mäenpää from Thule Institute took part in the Economy of the North project which published *The Economy of the North 2008* report. The report presents a comprehensive overview of the economy of the circumpolar Arctic, including the traditional production activities of the indigenous people. The report discusses the importance of the Arctic economy from a global perspective, with particular focus on the natural resources in the Arctic region. More information on the project and the publication is available at the address: http://portal.sdwg.org/content.php?doc=78

Antarctic Climate Evolution (ACE)

Research Professor Kari Strand from the Thule Institute took part in the **Antarctic Climate Evolution (ACE)** project. ACE is one of the Scientific Committee on Antarctic Research (SCAR) Science Programs since 2004. ACE is an international research initiative to study the climate and glacial history of Antarctica through palaeoclimate and ice-sheet modelling investigations, purposefully integrated with geological evidence for past changes. Read more on ACE from the address:
http://www.csam.montclair.edu/earth/eesweb/scar_ace/

Arctic Palaeoclimate and its Extremes (APEX)

Professors Juha-Pekka Lunkka and Kari Strand took part in the **Arctic Palaeoclimate and its Extremes (APEX)** project. APEX is a network research programme aiming to understand Arctic climatic changes beyond instrumental records. Particular emphasis is to focus on the magnitude/frequency of the climate variability and, in particular, the "extremes" versus the “normal” conditions of the climate system. It is an interdisciplinary programme that integrates marine and terrestrial science and utilises modelling and field observations. APEX involves scientists from 15 European countries, Canada and USA. More information from the address: http://www.apex.geo.su.se/

University of Eastern Finland, Kuopio Campus

Petri Vaattovaara
http://www.uku.fi/english/

University of Eastern Finland, Kuopio Campus, has an international reputation in the fields of health, environment and well-being, with particular strengths in biotechnology, biosciences and molecular medicine.

Arctic Summer Cloud Ocean Study project (ASCOS)

Researchers from the University of Eastern Finland, Kuopio Campus, were involved in the Arctic Summer Cloud Ocean Study project (ASCOS). The Arctic Summer Cloud Ocean Study is a scientific ice-breaker borne mission to the high Arctic Ocean. The focus is on the physical and chemical processes leading to cloud formation, and scientists ranging from chemists and biologists to oceanographers and meteorologists will contribute.

The Finnish contribution to the experimental part of ASCOS consisted of researchers and instruments from the Finnish Meteorological Institute (FMI) and the University of Eastern Finland (UEF). The FMI's measurement programme consisted of meteorology, ozone and radioactivity soundings, a UV radiation sensor, a visibility meter, a ceilometer, filter sampling for radionuclide, heavy metal and PAH analyses, canister sampling for VOC analyses, fog droplet and aerosol particle size distribution measurements, an ozone monitor, and a sea water bubble camera. The UEF measurement programme consisted of ultrafine particles organic fraction measurements.

Funding for Petri Vaattovaara's work came from the Finnish Cultural Foundations 'Lapin maakuntarahasto - Nordenskiöld grant'.

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ASCOS tutkimusretki

Petri Vaattovaara

Tarkoituksen toteutuminen

Tutkimusmatkan tarkoituksena oli tutkia Arktisen jäämeren tuottamien hiukkasten koostumusta. Tämä tarkoitus toteutui sillä osallistuin tutkijana ASCOS (Arctic summer cloud ocean study) retkikuntaan kuuluen erittäin pienten hiukkasten koostumusta tutkivine hiukkastutkimuslaitteistoineni (UFO-TDMA (ultrafine organic tandem differential mobility analyzer) Arktiselle jäämerelle tehdylle IPY (international polar year) vuoden tutkimusmatkalle ruotsalaisen jäänmurtaja Odenin mukana 29.7-11.9.2008.

Tutkimusmatkan aikana suorittamieni juuri syntyneitä hiukkasia mittaavan ensimmäistä kertaa arktisella jäämerellä käytetyn UFO-TDMA laitteen mittausten aikana saatiin arvokasta tietoa arktisella jäämerellä syntyneiden 6-60 nm hiukkasten koostumuksesta muuntumisesta kokoluokasta toiseen eri ajan hetkillä eri tyyppisissä olosuhteissa. Muun retkikunnan ja jäänmurtajan mittalaiteet sopivat täydentävästi yhteen oman laitteistoni kanssa ja laitteet yhdessä täydentäen toinen toistensa antamaan informaatiota tuovat uutta tietoa arktisen luonnon, hiukkasten ja pilvien muodostumisen vuorovaikutuksista ja siten auttavat ymmärtämään arktista ilmastoa ja vaikutuksia arktiseen elämään.

Petri Vaattovaara sekä UFO-TDMA laitteisto jäänmurtaja Odenilla

Oman laitteistoni lisäksi olin tutkimusmatkalla mukana monessa ennalta suunnittelemattomassa toimessa. Yleisesti ottaen napa-alueiden tutkimuksesta tuli kokemusta niin jäälauttaan kiinnitettynä kuin avomerelläkin. Samoin osallistuin tutkimukseen niin laivalta, jäältä kuin ilmastakin, sisältäen mm. hiukkasvuon mittausta jäällä ja avonaisissa railoissa, hiukkasmittauksia helikopterissa alailmakehässä

muutamissa sadoissa metreissä sekä erilaisia avustavia tehtäviä luotauspallojen lähettämisessä yläilmoihin ja auringonsäteilyn mittauslaitteiston kanssa.

Kokemuksena tutkimusretki oli ainutlaatuinen muutenkin kuin itse tutkimuksen vuoksi, esimerkiksi harvemmin tulee ajeltua moottorikelkalla tai hiihdellä suksilla lähellä pohjoisnapaa jääkarhujen haistellessa ruokaa ympäristössä. Tuohon liikkumiseenkin sai tärkeää koulutusta jääkarhuilta suojautumiseen mm. ammunta- ja käyttäytymiskoulutuksen muodossa, ase olikin aina jäällä liikkuessa matkassa. Toisinaan olin jäällä ainoastaan jääkarhuvartijan roolissa.

Suurin osa ajasta kului kuitenkin jäänmurtajan neljännellä kannalla sijainneessa hiukkasmittaus kontissa, jossa oman laitteistoni lisäksi huolehdin myös ilmatieteen laitoksen itselleni tutun hiukkasten kokoa mittaavan laitteiston käytöstä. Sen lisäksi, että tutkimusretki oli antoisa niin tutkimuksen kuin muutenkin kokemusten kannalta, niin yksi jatkon kannalta tärkeimmistä retken tuloksista oli uusiin tutkijakollegoihin tutustuminen tiiviin useita viikkoja kestäneen matkan aikana. Tutkimusmatka on poikinut uusia ideoita ja sitä kautta uusia projektit on suunnitteilla, vaikka tämän tutkimusmatkan tulosten käsittely on vielä kesken. Kansallisuuksia oli retkikunnassa toistakymmentä (kaikkiaan 33 tutkijaa 12 eri maasta ja neljätoista kansallisuutta).ja ehkä konkreettisin esimerkki yhteistyön onnistumisesta ja merkityksestä omalle tutkijanuralleni on australialaisen kollegan esittämä kutsu 3-vuotiseksi vierailevaksi tutkijaksi hänen kotiyliopistoonsa Australian Brisbaneen.

Tähän tutkimukseen Lapin maakuntarahaston myöntämällä Nordenskiöld stipendillä on joka tapauksessa ollut jo nyt valtava vaikutus tutkijan uraani ja tulevat vuodet näyttävät mitä on pitemmän kantaman merkitys niin itseni kuin arktisen tutkimuksen kannalta.

Tutkimuksen vaiheet

Kaikkinensa koko Arktisen jäämeren hiukkasten koostumuksen tutkimusprojekti on ollut monivaiheinen ja matkasuunnitelmiin on tullut jos jonkinlaista muutosta välillä ihan viime hetkilläkin.

Rahoituksen varmistuttua oli edessä jäämeren risteilyä valmisteleva workshop Ruotsin Tukholmassa syyskuussa.2007 ja toinen vielä vuoden 2008 keväällä. Vuoden 2008 alkupuoli sisälsi runsaasti tutkimusmatkojen, kuljetusten ja matkaamisen huolellista suunnittelua ja valmistelua. Mittalaitteen varustautuminen mittauksiin laivassa ja muutenkin epätavallisessa ympäristössä lisäksi oma varustelu nousi tärkeäksi osaksi valmistautumista, sillä osallistujilta vaadittiin riittävän fyysisen kunnon, vaatetuksen ja tietyn lääkintävarustuksen lisäksi täysimääräinen terveystarkistus todistuksineen ja mm. täysin kunnossa oleva hammaskalusto ilman reikiä sekä useita pakollisia rokotuksia.

Kesällä 2008 olikin sitten jo vuorossa oman laitteiston kuljettaminen ja kiinnitys jäänmurtaja Odenille. Tämä ei tapahtunutkaan ennakkotietojen mukaan Huippuvuorilla vaan Ruotsin Landskronassa, jossa laiva oli samalla kunnostettavana ja uusittavana.

Asennusmatkan jälkeen oli vuorossa Odenin kuljetus tutkimuslaitteistoineen Longyearbyeniin Huippuvuorille. Astuin laivaan Göteborgissa ja suoritin myös mittauksia aina Itämereltä läpi Pohjanmeren ja Norjan meren Arktiselle jäämerelle Huippuvuorten Longyearbyeniin. Laivamatkan alussa 10 henkinen tutkimusryhmä suoritti viimeiset näytteenottoon ja laitteistojen käyttöön liittyvät asennukset ennen mittausten aloittamissa, matka-ajan kattaen 12.6-24.6.2008.

Asennuksen ja siirtymän välissä oli muutaman päivän tauko ja myös siirtymän ja varsinaisen jäämeren tutkimusretken välissä oli tauko, lähes kuukauden mittainen, sillä Oden oli toisen tutkimusryhmän käytössä Grönlannin rannikolla Huippuvuorille saapumisen jälkeen. Tosin viikon hyttejämme käyttivät myös pohjoismaitten tulevat kuninkaalliset, jotka toimivat kansainvälisen polaarivuoden suojelijoina ja näin tutustuivat elämään jäänmurtajalla. Joka tapauksessa matkasin Huippuvuorille takaisin epätietoisina siitä milloin tarkalleen saisimme Odenin jälleen käyttöömme. 31.7.08 sitten tuli tieto, että laivaan saa mennä virittämään laitteistot taas uudelleen käyttökuntoon. 2.8.08 lähdettiin sitten liikkeelle kaikki valmiina. Sitä ennen meillä oli kuitenkin mahdollisuus ihailla lähes täydellistä auringonpimennystä (93.5%). Laivan

jäänmurto-ominaisuutta tarvittiin ensimmäisen kerran aamuyöstä neljäs elokuuta juuri avomeren mittausaseman päätteeksi. Avomeriaseman lisäksi meillä oli mennen tullen mittausasemat myös osittain jäätyneellä alueella. Nuo mittausasemat olivat sellaisia, ettei vuorokauden aikana juurikaan nukuttu, vaan seurattiin tapahtumia lähes kellon ympäri. Pahimmalla ahtojääalueella etsiessämme ankkuroitumispaikkaa, jolloin ahtojään läpi puskettiin tauotta 4 vrk, en suorittanut mittauksia jäänmuurosta johtuneen epävakaan tärinän vuoksi. Näin säästin mittalaitetta mahdolliselta rikkoontumiselta. Joillakin laitteet olivat riikkoontuneet jo edellisen tutkimusryhmän jäänmurtoretken aikana. Jääasemalle (87.20 N, 5W), jossa jäänmurtaja kiinnitettiin jäälauttaan ja iltäpäivällä olimme jälleen valmiit aloittamaan mittaukset. Pidimme aseman välillä laivaa kääntäen tuulen suunnan mukaan aina aamuyöhön 2.9.08 asti. Kun saapuessamme asemalle, jäänpinnalla oleva lumi oli paljolti sulanut ja jäissä oli halkeamia niin, että hylkeiden uiskentelua pystyi seuraamaan, niin lähtiessä lämpötila oli laskenut plussan puolella alle -10 asteeseen ja jäässä ei ollut sulaa tai avoimia kohtia. Samaa tullessa ja lähtiessä oli se, että jääkarhut kävivät sekä tervehtimässä että hyvästelemässä meidät. Ilma oli pääosin hyvin pilvissä ja harvoin yöttömän yön aurinko pilkisti valokuvausta varten pilvien raosta. Arktisen talven alkaessa painaa päälle murtauduimme ahtojään läpi takaisin avomerelle lähellä Huippuvuoria, joissa suoritimme viimeisen mittaukset ennen Longyearbyeniin saapumista. Tavoitteiden mukaisesti niin uusia meren eliöiden tuottamista höyryistä kuin meriveden pärskeistä mitattuja hiukkasia oltiin onnistuneesti mitattu ja itse asiassa analyysiäkin jo laivassa olo aikana tehty mielenkiintoisimmista havainnoista.Takaisin kotona perheeni parissa pitkän matkan jälkeen olin 11.9.08.

Varsinaisen tutkimusretken jälkeen oli vielä vuorossa laitteiston purku Odenilla ja takaisin kuljetus. Tämä tapahtui Ruotsin Landskronasta käsin, kuten oli tapahtunut menomatkallakin. Näin oli laitteisto saatu takaisin Kuopioon lähes neljän kuukauden matkalta kokien niin arktisen kevään kuin syksynkin, matkaten Landskronasta Longyearbyeniin, Itä-Grönlannin rannikolle, lähelle pohjoisnapaa ahtojääalueelle ja takaisin Landsronaan Huippuvuorten ja Koillis-Atlantin kautta, nähden näin niin pohjoismaitten kruunun perilliset kuin pohjoisen meret säineen ja arktisine elämineen.
Tutkimusretken jälkeen onkin sitten ollut vuorossa kerätyn tiedon käsittelyä ja analysointia.

STUK - Radiation and Nuclear Safety Authority - Laboratory of Northern Finland

The Radiation and Nuclear Safety Authority (STUK) is a regulatory authority, research centre and expert organisation whose mission is to protect people, society, the environment and future generations from the harmful effects of radiation. The research conducted by STUK yields new information related to the use, occurrence and effects of radiation. STUK has important safety co-operation also with the Russian nuclear power plants of Leningrad and Kola.

STUK run with the Murmansk Marine Biological Institute (MMBI) the 'Radioactivity of the Russian Arctic Seas' project. During August 2007 the project made a cruise to the Barents Sea during which altogether about 60 samples were collected from the bottom sediments, sea water, fish and other organisms. The special interest was on artificial radioactive materials caesium, strontium and plutonium. The concentration of these was small compared to the Baltic Sea, where remarkable amounts of these materials were transported from Tshernobyl.

From the analyses one can see that if for example the activity level of plutonium is increasing from the earlier samples, this could mean that the radioactive waste at the bottom of the Barents Sea is being dispersed. The results did not show any evidence that this had happened. Polonium-210, radium-226, uranium-235 and kalium-40 analyses from the sediments tell that they are at the same level as in the Baltic Sea.

Samples were collected again in August 2009 from the Barents Sea. Results of the studies will be presented at the Oslo Science Conference June 2010.

More information: http://www.stuk.fi

Säteilyturvakeskus (STUK) tutki Venäjän arktisten merien radioaktiivisuutta

Elokuussa 2007 STUK osallistui yhteistyössä venäläisen Murmanskin Meribiologisen Instituutin (MMBI) kanssa näytteenottomatkalle Barentsin merelle. Matkan aikana kerättiin yhteensä noin 60 näytettä pohjasedimentistä, merivedestä, kaloista ja muista eliöistä. Mielenkiinnon kohteena olivat erityisesti keinotekoiset radioaktiiviset aineet, cesium, strontium ja plutonium. Näiden aineiden pitoisuudet olivat pieniä verrattuna Itämereen, jonne tuli huomattava määrä Tshernobyl-laskeumaa.

Näytteistä mitattujen keinotekoisten radionuklidien ja niiden aktiivisuussuhteiden perusteella voitiin päätellä niiden alkuperä. Jos esimerkiksi plutoniumin aktiivisuustaso osoittautuu mittauksessa aiempaa suuremmaksi, voisi se olla merkki siitä, että meren pohjaan upotetut ydinjätteet ovat lähteneet leviämään. Mistään tällaisesta ei tulosten mukaan ole viitteitä. Sedimenttinäytteistä mitattiin luonnon radioaktiivisista aineista polonium-210, radium-226, uraani-235 ja kalium-40. Näiden aineiden pitoisuudet olivat samaa tasoa kuin Itämeren sedimenttinäytteissäkin.

Elokuussa 2009 tehtiin toinen yhteinen näytteenottomatka Barentsin merelle, jolta Suomeen saatiin suuri määrä erilaisia ympäristönäytteitä. Tuloksia on tarkoitus esitellä IPY Oslo Science konferenssissa kesäkuussa.

The Snowchange.org Community and IPY 2007-2009

Snowchange is a not-for-profit independent cooperative organisation with headquarters in Finland. The international community network of Snowchange spans all eight Arctic states. Most of the member communities and families are from the various Arctic Indigenous Nations and other subsistence communities.
The work of Snowchange involves working with the various Northern areas and peoples on the topics of ecological, especially climatic and weather changes from the scientific and traditional knowledge point of view. In addition to the community documentation Snowchange as well works to advance local Indigenous knowledge in the global context and advance decolonisation of the North in the face of rapid changes.

The Snowchage took part in following projects and activities during IPY:

- Traditional landuse of the Kola Sami in cooperation with the Sami Council and the sami communities in the Kola Peninsula. The project was funded by the Barents Secreteriat, Murmansk State Technical University and Sami Council.
- Snowchange conferences 'Traditions of the North' in Yakutsk in April 2007 and symposium in Taranak, New Zealand during December 2008. Communication of the symposium is available here
- Snowchange coordinated educational cooperation between school in Inari and a nomadic school in Nutendl in Siberia. The theme was traditional ecological knowledge and climate change. Snowchange partly funded the nomadic school.

More information: www.snowchange.org / www.lumi.fi or Tero Mustonen: tero@lumi.fi

Osuuskunta Lumimuutoksen (Snowchange) toiminta kansainvälisen polaarivuoden aikana 2007-2009

Osuuskunta Lumimuutos (Snowchange) on itsenäinen, tieteellinen ja pohjoisen perinnekulttuureja tukeva kansalaisjärjestö Suomessa. Osuuskunta Lumimuutoksen toiminta kansainvälisen polaarivuoden aikana 2007-2009 käsitti seuraavat projektit ja toiminnat:

- Kuolan saamelaisten perinteinen maankäyttö: Yhteistyössä useiden rahoittajien, Saamelaisneuvoston ja Kuolan niemimaan saamelaisyhteisöiden kanssa Lumimuutos selvitti perinteisen maankäytön sekä poronhoidon avainkysymyksiä Luujärven piirikunnassa 2007-2009. Hanketta rahoittivat muun muassa Barentsin sihteeristö, Murmanskin teknillinen valtionyliopisto, Saamelaisneuvosto ja Lumimuutos. Hankkeen loppukirja "Eastern Saami Atlas" julkaistaan syksyllä 2010.
- Snowchange – konferenssit: Vuoden 2007 Snowchange-konferenssi, "Traditions of the North", järjestettiin huhtikuussa 2007 Siperian Jakutiassa, Sahan tasavallassa, evenkien kotiseutualueella Neriungrin ja Iengran kylissä. Konferenssin tarkoitus oli, että pohjoisen alkuperäiskansat, tutkijat ja kansalaisjärjestöt keskustelevat luonnon monimuotoisuuden, ilmastonmuutoksen ja alkuperäiskansojen perinteisen tiedon kohtalonkysymyksistä. Paikalla oli Alaskan inuiitteja, saamelaisia, sekä lukuisa joukko Siperian alkuperäiskansojen delegaatioita. Tapahtumaan osallistui myös Uuden Seelannin maoreja. Ideana oli, että polaarivuoden juhlistamiseksi eteläisen pallonpuoliskon alkuperäiskansat vierailisivat aluksi arktisella alueella, ja sitten vuonna 2008 pohjoisen ihmiset etelässä. Vuoden 2007 tapahtuman päärahoittaja oli Northern Forum.
- Joulukuussa 2008 Taranakissa, Uudessa Seelannissa järjestettiin Snowchange 2008 Symposium. Siihen osallistui suomalaisten lisäksi Alaskan ja Kanadan alkuperäiskansojen delegaatioita sekä laaja poropaimentolaisryhmä Jakutiasta. Vuoden 2008 tapahtuman päärahoittajia olivat JMK Fund ja Walter and Duncan Gordon Foundation sekä paikalliset maoritahot. Tapahtumien loppulauselma on luettavissa täällä.
- Alkuperäiskansojen koulutusyhteistyö: Vuosien 2007-2008 aikana Inarin koulu ja Jakutiassa, Siperiassa sijaitseva Nutendlin paimentolaiskoulu aloittivat perinteisen tiedon ja ilmastonmuutoksen osalta yhteistyön, jota koordinoi Osuuskunta Lumimuutos, joka myös osittain rahoittaa Nutendlin paimentolaiskoulua.

Annexes

Arctic expertise in Finland - brochure produced by the Ministry for Foreign Affairs of Finland

Authors: Paula Kankaanpää and Sampo K. Saarinen.

The brochure can be downloaded from these addresses:

Suomeksi:
http://formin.finland.fi/public/download.aspx?ID=55627&GUID={FDAA0B56-8030-47EA-9C57-3100196FDC75}

In English:
http://formin.finland.fi/public/download.aspx?ID=55636&GUID={745C0C44-2B7D-4895-B472-64D141A323E4}

Русская версия - In Russian:
http://formin.finland.fi/public/download.aspx?ID=55637&GUID={5467227D-D8D0-4C1A-BA7E-0BD4A3E3E84C}

Special Issue: Proceedings of the Finnish National IPY Conference - Foreword

Authors: Antti E.K. Ojala and Keijo Nenonen

The whole publication is available on-line at the address: http://www.geophysica.fi/

Arctic expertise in Finland

MINISTRY FOR FOREIGN AFFAIRS OF FINLAND
2009

This publication is one in the series of three brochures published by the Ministry for Foreign Affairs in autumn 2009, which provide information about Finland's policy on the northern and arctic regions and Finland's neighbouring area cooperation. The two other publications are entitled Northern Dimension and Neighbouring Area Cooperation. The brochure has been prepared by the Unit for Regional Cooperation in the Department for Russia, Eastern Europe and Central Asia in cooperation with stakeholders.

The brochure can be downloaded from these addresses:

Suomeksi:
http://formin.finland.fi/public/download.aspx?ID=55627&GUID={FDAA0B56-8030-47EA-9C57-3100196FDC75}

In English:
http://formin.finland.fi/public/download.aspx?ID=55636&GUID={745C0C44-2B7D-4895-B472-64D141A323E4}

Русская версия - In Russian:
http://formin.finland.fi/public/download.aspx?ID=55637&GUID={5467227D-D8D0-4C1A-BA7E-0BD4A3E3E84C}

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The authors of the brochure, except the Foreword, are Paula Kankaanpää and Sampo K. Saarinen.

Table of contents

Foreword

The Arctic region will play an increasingly important role in international, environmental and economic policy contexts in future. The receding ice cover induced by climate change and the development of sophisticated technologies will make it easier to harness Arctic natural resources and open new marine transport routes. These changes will also make the region more interesting in terms of foreign and security policy. It is in Finland's interest to be a versatile and influential actor in Arctic matters.

Finland implements its Arctic policy at three levels. At the global level, Finland contributes to efforts leading to more effective enforcement of international agreements and cooperative arrangements so that they would serve as a comprehensive legal foundation for all Arctic action, including navigation and protection of the environment.

At the EU level, Finland has taken an active part in keeping Arctic questions on different agendas. The EU Commission's Communication on the Arctic region in November 2008 was a significant new opening and brought Arctic questions on the Union's political agenda in a new manner.

International cooperation at the regional level takes place in the framework of the Arctic Council. All the eight Arctic countries – the Nordic countries, Russia, Canada and the United States – are members of the Council and the indigenous peoples of the region participate in its work through their sub-regional organisations. The Arctic Council plays a key role especially in promoting scientific research relating to climate change.

Finland is an Arctic country. One third of our country is located north of the Arctic Circle. In winter time, it gets frosty and the ground is normally covered in snow even in the southernmost parts of the country. Finland would not have been able to develop into a modern society without expertise in winter navigation, construction of infrastructure that withstands freezing, energy service in cold climate, and sustainable forestry.

Arctic policy is implemented jointly by all sectors of the public administration. Successful cooperation requires seamless collaboration between the regional actors, the business community, universities and sectoral research institutes.

This publication is meant to serve as a general survey of the versatile Finnish expertise in Arctic matters and know-how related to cold climate. The main themes of Arctic research and product development are presented, supplemented by relevant examples. This special knowledge lays the foundation for extensive economic activity related to Arctic conditions, which cannot be dealt with in greater detail in this concise presentation. The text has been produced by the Arctic Centre, at the request of the Ministry for Foreign Affairs. The publication is a part of a series illustrating Finland's policy and activities in the northern and Arctic regions and its neighbouring area cooperation with Russia.

Alexander Stubb
Minister for Foreign Affairs

Preface

The Arctic countries comprise Finland, the other Nordic countries, Canada, Russia and the USA. Finland has a long tradition of research in Arctic regions and other expertise which has evolved naturally as a result of the living conditions and out of necessity to adapt to a cold living environment. Finland's geographical position and familiarity with Arctic regions and conditions make the country a true expert and multi-skilled actor in Polar issues.

Arctic Region

The southernmost border of the Arctic is defi ned in three different ways: in the international cooperation carried out by the Arctic Council, it is the Arctic Circle in Finland; in the natural sciences, it is based on either the Arctic Circle, the tree line, the southern limit of tundra or permafrost, or average temperature at below +10 degrees °C in June; in the social sciences, it corresponds to the areas populated by the Arctic indigenous peoples.

Arctic research and training in the northern universities of Finland

Finland's expertise in Arctic questions essentially relies on state-of-the-art, multidisciplinary Arctic research and training. The universities established in the north have found Arctic issues a natural fi eld of operation and matters are often viewed from multidisciplinary angles. Many researchers and experts in the northern regions have been trained in these universities. The University of Lapland and the University of Oulu foster knowledge related to the Arctic region through a joint research strategy.

Research focusing on the Arctic and the north is carried out in many other Finnish universities and heir research stations, too, some of which will be introduced later on the pages of this publication. Finnish researchers took an active part in the projects of the international Polar Year (IPY 2007–2008). The Academy of Finland supports research related to the north and the Arctic region by means of allocating funds from its general funding programmes.

University of Lapland
The University of Lapland is the northernmost university in the European Union. The research on the Arctic and on the North conducted in the different faculties of the university deal with the communities, people and livelihoods, especially tourism, in the region. The location of the university on the Arctic Circle guarantees hands-on expertise and contacts with the local people and representatives of the indigenous peoples. Finnbarents, a joint unit of the University of Lapland and Rovaniemi University of Applied Sciences, promotes projects in the Barents region. The University of Lapland has developed a high profi le in research in the Arctic and northern issues thanks to the Arctic Centre, a leading centre of excellence established in 1989 as an institute of the university.

Arctic Centre
The Arctic Centre is a national and international hub of information and centre of excellence, which conducts multidisciplinary research in changes in the Arctic region and in their impacts.

The research group on Global Change investigates the effects of increasing economic activities on the Arctic ecology, environment and communities. The group specialises in the study of the impacts of Arctic energy industries in Siberia in cooperation with researchers, indigenous peoples, local inhabitants, industries and administrative authorities. The group also studies climate change using mathematical modelling and analysing the climate records and glacier evolution. The Sustainable Development group addresses issues linked with environmental policy and economy and communities' adaptation and vulnerability. Its other research topics include indigenous peoples' traditional knowledge, and Sámi politics and identity.

The Arctic Centre houses the Northern Institute for Environmental and Minority Law (NIEM), which focuses on legal issues relating to Arctic indigenous peoples and environmental law as it applies in the Arctic and northern regions.

A multidisciplinary graduate school of the Academy of Finland, ARKTIS, is also located in the Arctic Centre. The Arctic Centre provides one-year Arctic Studies -packages and offers research services to companies and cities requesting environmental and social impact assessments of their projects.

The Arctic Centre communicates scientific information related to the Arctic region to the general public, schoolchildren and decision-makers. The Science Centre exhibitions display the results of Arctic research interactively and inform about the Arctic nature and people of the region. Nearly a hundred thousand persons visit the Arktikum House every year, half of them tourists from abroad.

University of Oulu
The University of Oulu is an international science university, known for its research in the Arctic and cold climate since its foundation in 1958. The university specialises among other things in aspects of the North and the environment. These matters are studied and taught in the faculties of Science, Technology, Medicine, Humanities, Education, and Economics and Business Administration.

Thule Institute
Thule Institute is an expert institute of the University of Oulu, focusing on northern and environmental issues. It operates four units: Centre for Arctic Medicine, the Northern Environmental Research Network (NorNet), NorTech Oulu environmental technology unit, and the Oulanka Research Station.

The institute's multidisciplinary activities concentrate on three research programmes and related training. Global Change in the North looks at how predicted environmental changes in northern areas are reflected in nature and how they shape the preconditions of human activity especially in the north. Ways are also sought to mitigate changes and to adapt to them. Northern Land Use and Land Cover is a programme that concentrates on changes caused by land use and seeks to encourage sustainable use of natural resources and protection of nature. The third programme, Circumpolar Health and Wellbeing, studies the health and wellbeing of people in the north, heath care, health risks and adaptation to the northern environment.

In the Thule Institute, the Centre for Arctic Medicine studies the health and wellbeing of people in circumpolar areas. Field research is done in cooperation with the Jaeger Brigade of Sodankylä, and the Kastelli Research Centre in Oulu provides facilities for cold exposure laboratory research.

The Environmental Technology Development Programme seeks answers to problems caused by cold climate and works out technical solutions to improve infrastructure and energy-efficiency in the north. Other projects in the Thule Institute are Environmental and Resource Economics, and Human-Environment Relations in the North.

Rovaniemi University of Applied Sciences (RAMK)
The Rovaniemi University of Applied Sciences specialises in research, training and development work related to the north and cold conditions. The natural conditions in the northernmost university of applied sciences in Europe in the Finnish Lapland provide a setting for activities that are not possible anywhere else. The key themes include Arctic testing and product development, snow and ice in the built environment, and sustainable use of the natural resources of the north. The Arctic Power laboratory addresses issues related to technologies meeting the demands of cold and winter conditions. The ENVI Virtual Center of Wellness Campus (European Network of Living Labs, ENVI) offers a variety of training and research facilities to acquire skills required for providing safety and wellness in cold conditions.

University of the Arctic
The University of the Arctic (UArctic) is an international cooperative network of universities, colleges and other educational institutions with 110 member organisations. The fi rst Council meeting of the network was held in Rovaniemi in June 2001. The University of Lapland is in charge of the administrative governance and coordination of UArctic. UArctic offers multidisciplinary training, student exchanges and cooperation across different disciplines, focusing on issues pertaining to the North. Key areas of activity until 2013 will be climate change, the North as an energy region (economic, cultural, environmental and technical opportunities, demands and impacts), and the promotion of culturally relevant training and education in the North. The Thematic Networks Coordination Offi ce of UArctic is located in the Thule Institute of the University of Oulu.

Supporting the culture and livelihoods of the Arctic population

In Finland, the Arctic region comprises the Province of Lapland. The regions of Oulu, Kainuu and Northern Karelia also take part in the Arctic cooperation.

The Sámi are an indigenous people in northern Scandinavia and regions of the Kola Peninsula in the north of Europe. About 8,700 Sámi live in Finland, and it is estimated that some 3,000 of them speak either North, Inari or Skolt Sámi as their mother tongue.

Lapland Chamber of Commerce
The Lapland Chamber of Commerce is the northernmost chamber of commerce in Europe. Some of its about 400 member companies specialise in Arctic business and Arctic technology. The Lapland Chamber of Commerce plays a key role in the cooperation and networking in the Barents Euro-Arctic region. It holds the presidency of the Euro-Arctic Chamber of Commerce (EACC) and the chairmanship and secretariat of the Barents Business Advisory Group (BBAG).

Educational Centre of the Sámi Area
The Educational Centre of the Sámi Area, Sámi oahpahusguovddáš, is a legally independent educational institution offering training in a variety of subjects, established in 1989 in Inari. Education is given in Finnish and Sámi. The mission of the centre is to support and promote the Sámi languages, culture and livelihoods. Vocational upper secondary education and training is designed to serve the needs of the Sámi region. Additional and continuing education, Sámi culture education and general education for adults are also provided.
A Sámi Cultural Centre, which is under construction in Inari, is scheduled be in operation in 2012.

One of the strengths of the educational centre is an efficient network of cooperation with other educational institutions and organisations maintained by indigenous peoples in the Arctic region in Russia, Canada, Alaska, Greenland and Norway, such as the Sámi High School, Sámi Joatkkaskuvla. The principal forms of cooperation include development of reindeer herding training and support of occupations linked with reindeer herding in a manner that respects the traditions of the indigenous peoples and the environment. The Educational Centre of the Sámi Area has started active cooperation with the universities of Lapland and Oulu.

Giellagas Institute
The Giellagas Insitute in the Faculty of Humanities of the University of Oulu takes responsibility for the academic education and research of Sámi language and Sámi culture in Finland. Sámi language and culture have been taught and studied in the university since 1970. The subjects taught at the Giellagas Institute are Sámi as a mother tongue or a foreign language, Sámi culture and interpretation of Sámi. Research in the institute concentrates on enhancement of knowledge of the Sámi languages and Sámi culture, history and society. Research is carried out in cooperation with other research institutions specialising in the same fields of study.

Research focusing on the diversity of Arctic nature

Familiarity with the special features of the Arctic nature calls for sustained research and field work over a long period of time, which is why a network of research stations and institutions has been founded north of the Arctic Circle. Reindeer herding, which is a typical occupation in the Arctic region, is a distinct aspect of the interaction between the northern nature and man and of the multidisciplinary research.

Finnish Environment Institute
The Finnish Environment Institute, SYKE, takes part in a number of projects carried out within the Arctic Council's Arctic Monitoring and Assessment Programme (AMAP), in which information is collected about environmental toxins, radio-activity, climate change, ozone depletion and increasing UV radiation and, most recently, short-lived substances with an impact on climate. SYKE is also involved in the Arctic Council's Action Plan to Eliminate Pollution of the Arctic (ACAP). In cooperation with its research partners, SYKE has studied contaminants in lake sediments and the movements of harmful airborne substances.

Lapland Regional Environment Centre
The Lapland Regional Environment Centre is active in the northernmost regions of Finland and its tasks comprise monitoring the environmental load of Lapland, the state of the environment and the materialisation of natural and cultural values. Participation in the management of environmental issues of the north at international level is also one of the fields of operation of the Lapland Regional Environment Centre. It also takes an active part in the Arctic and Barents cooperation and the Arctic Council's AMAP. North Calotte and Neighbouring Area Cooperation as well as cooperation related to the bordering waters has been done for a long time with Sweden, Norway and Russia. The Lapland Regional Environment Centre has also cooperated with the environment authorities of Russia since 1987 to develop work done in laboratories and to monitor the state of the environment.

Finnish Forest Research Institute
The Finnish Forest Research Institute, Metla, carries out research related to the forests and nature of the north. Metla's northernmost units are located in Rovaniemi and Kolari. Metla is involved in several international collaborative research projects dealing with climate change in the north.

Its research unit in Rovaniemi follows the growth and regeneration of tree species in tree line tests in the northern and alpine tree line areas in the Finnish Lapland. Being susceptible to climate change and volatile conditions, tree line forests are important subjects of study when the impacts of climate change are assessed and monitored.

Metla is responsible for the national forest inventory. The inventory is an extensive monitoring system, covering the forests and forest resources of the northern parts of Finland, producing information about such matters as forests' carbon reserves and diversity. High quality research focusing on Arctic populations is also done in Metla as well as studies concerning reconciliation of forestry and reindeer herding. The need to reconcile occupations is highlighted in the north where forestry together with reindeer herding and tourism are important sources of income.

Finnish Game and Fisheries Research Institute
The Finnish Game and Fisheries Research Institute (RKTL) has several units in the very north of Lapland. In the Reindeer Research Station in Kaamanen, Inari, research work concentrates on reindeer and reindeer herding. Economic success factors of reindeer husbandry is a project which studies the impacts of support measures and subsidies on reindeer husbandry and marketing of reindeer meat. Salmon research is also one of the areas of Arctic expertise of RKTL. RKTL has four units in Lapland which concentrate on the fishing industry and fish farming in the north.

MTT Agrifood Research Finland
The special conditions in Lapland, such as short growing season and oligotrophic soil, have an influence on the growth and qualities of plants. The concentration of functional food components in plants increases as a result of short exposure to light and low temperature. New functional food products can be processed using the resources available in the north. The northernmost unit of MTT Agrifood Research Finland in Rovaniemi supports plant production in the extreme conditions north of the Arctic Circle and envisages changes that will take place as a result of climate change in agriculture and horticulture and the natural product business.

Kilpisjärvi Biological Station
The Kilpisjärvi Biological Station, located in Enontekiö, is a part of the Faculty of Biosciences of the University of Helsinki. Long-term follow-up studies, which have received international recognition, form the core of the research activities at the station. Series of observations concerning population dynamics of small mammals (rodents) have been collected for over 50 years. Long-term projects also include studies on the periodicity in the quality and quantity of vegetation in the fjell region and on climate change and its impact on the ecosystems of the north. The station is also active in geographical and geophysical research, and it accommodates the Seismological Station of the University of Helsinki.

Värriö Subarctic Research Station
The Värriö Subarctic Research Station in Salla, which belongs to the Faculty of Agriculture and Forestry of the University of Helsinki, has specialised in research of the Arctic nature for over 40 years. Long-term research projects at the station include systematic snowline tracking and observation of big game. Other topics of research are, for example, measurements of beneficial aerosols produced by coniferous forests and the fall-out of emissions to the environment.

Kevo Research Institute
The Kevo Research Institute of the University of Turku is located in Utsjoki. The research station has been engaged in carrying out diverse ecological, environmental, and geographical research since the late 1950s. The Institute is well known internationally for its expertise in plant-herbivore interactions and the impacts of changes in the environment. The Kevo Research Institute and the weather station of the Finnish Meteorological Institute, which is located in the area, systematically collect material from the environment. In addition to the regular weather forecasts, information is collected about, for example, air quality, aero-biology and pollen fall-out.

Oulanka Research Station
The Oulanka Research Station, which belongs to the Thule Institute of the University of Oulu, is located in the Oulanka National Park in Kuusamo. The station promotes research and education focusing on the natural resources, the environment and tourism. In addition to research activities, the station has conducted long-term monitoring and surveys of the environment since 1967, which help find answers for example to questions raised by climate change.

Expertise in Arctic climate and soil

The characteristics of Arctic atmosphere and soil differ from those found elsewhere on the Earth. Research and understanding of these phenomena call for knowledge of the region, high technology and detailed monitoring, including monitoring stations and satellites.

Arctic research at the Finnish Meteorological Institute
The Finnish Meteorological Institute FMI is a service and research institution, whose Arctic expertise is dealt with in this brochure in two separate chapters.

The FMI Arctic Research Division studies the different layers of the polar atmosphere, biosphere and earth and produces diverse and accurate information about the atmosphere, climate and the environment. The Division comprises the Arctic Research Centre in Sodankylä (FMI-ARC) and the aurora research group in Helsinki.

The FMI-ARC functions as a versatile observation and research station. Comparative material is produced by means of atmospheric sounding, measurements and observations on the earth. A Satellite Data Centre, which supports several polar satellites, operates in the FMI-ARC and it is becoming the leading support and research station in the development of satellite methods in the Arctic and northern regions. The Centre conducts, among other things, aerosol, ozone and UV radiation research and measures the impact of snow cover on climate. Research and accumulated data are related, above all, to the circulation of carbon and water. A special aspect of the North Calotte area is the link between atmospheric phenomena with the conditions in the near-earth space and solar activity, which has been a subject of systematic study at the FMI for decades. The aurora borealis (the Northern Lights) phenomenon is registered using MIRACLE all-sky camera (ASC) imaging.

The FMI's atmospheric research station at Pallas focuses on greenhouse gas measurement. Together with the FMI-ARC, it forms the Pallas- Sodankylä Global Atmosphere Watch (GAW), which is equipped with state-of-the-art satellite technology. The FMI also participates in the reconstruction of the important Tiksi Hydro-meteorological Observatory in Siberia, which complements the network of GAW stations in the north.

The FMI carries out physical oceanography research and studies sea ice and shipping weather also on the Arctic and Antarctic Oceans. The goal is to observe climate variations and changes and make experimental research on the interaction processes between seas, sea ice and atmosphere, including carbon dioxide exchange. At the same time, remote sensing and modelling methods are developed to help follow and predict changes in the environment.

Geological Survey of Finland
The fields of expertise of the Geological Survey of Finland (GTK) in the northern Arctic regions are geological mapping, soil surveys and exploration of natural resources. Soil map surveys and bedrock mapping produce information and digital observation data for use in research, building, planning and environmental management. The mineral potential research identifies commercially significant mineral deposits and prospective terrains to serve the needs of mining industries.

The GTK's Arctic research programmes have produced a method based on geophysical, electric and electromagnetic soundings, which can be used to monitor the structure and changes in the surface layers and melted top layer of permafrost. The mapping technique can be applied, for example, to help construct roads, pipelines and production plants on a sustainable foundation in the oil and gas production areas of the Russian Arctic regions.

The GTK is involved in the coordination and development of groundwater research in the Arctic regions. The objective is to clarify the impact of the ice age cycle on the composition of bedrock water, hydrological flow of groundwater and the physical characteristics of rock. The phenomena are examined especially from the point of view of permanent disposal of spent nuclear fuel. Physical and geochemical observation and survey material is collected from regions covered by permafrost or ice in Canada and Greenland, where the bedrock and other conditions resemble those in Finland.

For groundwater surveys, the GTK develops new methods, which would facilitate operation in exceptionally cold conditions. The surveys are expected to benefit Arctic research also more widely, and support is obtained not only from the GTK and other financiers but also from the NASA Astrobiology Institute.

Study of snow, ice and frost in the University of Helsinki
In the Department of Geology of the University of Helsinki, Arctic research is carried out in three different research groups, which examine events during and after the ice age. The research focuses especially on the margins of ice sheet in Svalbard and the Arctic regions in Canada and on trends in vegetation in Eurasian tundra. The objective is to obtain more detailed information about long-term climate change in the north and to contribute to climate change modelling and understanding of the process.

A cryosphere – snow and ice – research group works in the Department of Physics of the University of Helsinki. Arctic research of this group includes lakes in Lapland tundra, glaciers in Svalbard, polar oceanography and Arctic sea ice. Practical applications are linked with Arctic seas, above all with the exploitation of oil and gas resources, shipping and environmental protection. Particularly in the dynamics of drift ice the group has gained a high scientific profile. In other fields the group has significantly contributed in snow ecology.

The Department of Geography of the University of Helsinki has been engaged in research of permafrost in Lapland and Canada for a long time. The themes of research have included, for example, different ground frost manifestations, the effects of wind and evolution of wind-worn deflation areas in Arctic regions.

Regional laboratory of the Radiation and Nuclear Safety Authority in northern Finland
The Regional Laboratory in Northern Finland of the Radiation and Nuclear Safety Authority (STUK) in Rovaniemi is the northernmost laboratory specialising in monitoring of radioactivity in the EU. It is part of the network that is monitoring and evaluating the Arctic environment. The Regional Laboratory in Northern Finland is responsible for research dealing with food chains and radioecology and radioactivity analyses of food and environmental samples.

STUK's research focuses on both artificial and naturally occurring radioactive substances. Environmental research projects have been expanded to cover also the Arctic sea and coastal areas in northeast Russia. One project examines radioactive fallout in snow and investigates possibilities of decontamination in case of an accident.

Sodankylä Geophysical Observatory
The Sodankylä Geophysical Observatory, established in 1913, is an independent department of the University of Oulu. Research in the Department concentrates, among other things, on the Earth's magnetic field, near-earth space of the polar region, radar test systems, cosmic rays, and development of research methods and observation activities. The Sodankylä Geophysical Observatory is one of the sites of EISCAT, a leading international research organisation operating incoherent scatter radar systems.

Arctic shipping, ice research and off-shore technology

The Baltic Sea freezes every year and if the winter is severe, all Finnish ports are frozen. Our country is dependent on effective winter navigation and icebreakers, which has contributed to the development of top level expertise and applied research in the field of Arctic maritime technology in Finland. Ice service for ships sailing on icy seas is based on a long experience of use of satellite remote sensing technology and on observation networks and knowledge of the geophysical characteristics of sea ice.

Finnish companies possess extensive expertise in arctic shipbuilding and in many other Arctic industries suitable for Arctic conditions. Finnish shipyards have traditionally been in the vanguard in the construction of icebreakers and vessels for Arctic conditions. Therefore Finnish companies meet all the required criteria of participation in big energy and infrastructure projects in the Arctic region.

In this brochure, only a few examples of the large variety of Finnish companies' Arctic expertise are presented. The companies that are mentioned below are examples of the numerous success stories of the Finnish businesses that have expertise in Arctic matters. The Ministry of Employment and the Economy and the Finnish Funding Agency for Technology and Innovation (Tekes) support Finnish companies' Arctic research and development work.

Ice service of the Finnish Meteorological Institute
Safe and effective management of Finnish merchant shipping in the winter requires accurate and reliable information about the ice conditions in the Baltic Sea and any changes there. The principal users of the Finnish Meteorological Institute's ice service are merchant vessels and icebreakers. Vessels are sent real-time ice maps which are produced by

means of satellite images, radar images and coastal observation stations. The research and services conducted on the Baltic Sea can be applied also in the Arctic regions.

In its sea ice research, the Meteorological Institute concentrates on R&D of remote sensing methods and ice modelling. Remote sensing research of sea ice also includes upkeep and development of top level technical satellites. Earth exploration satellites are used, for example, to gauge the thickness of ice.

The ice cap of seas has an effect on wave formation and water level variations. The Finnish Meteorological Institute operates weather prediction models, which take into account the northern conditions and the influence of ice.

Study of ships and offshore structures at the VTT Technical Research Centre
VTT Technical Research Centre of Finland is a globally networked multi-technological research organization. Its Arctic expertise is discussed in two different sections below.

The principal topics of interest in VTT's research concerning cold climate and Arctic technologies are ice-going vessels and offshore structures. VTT participates in the design of icebreaking vessels at all stages of the planning. Special attention is paid to structural solutions of ships and ice loads as well as ships' performance in ice-covered seas. VTT has also been involved in the development of international regulations pertaining to ice-going ships.

VTT carries out model tests to determine ice-going ships' performance on open seas. Full-scale tests in ice-covered sea conditions are made on the Baltic Sea and the Arctic Ocean and inland on the Saimaa channel. They measure ships' performance in different conditions and the ice load of the hull and propeller. The long-term research material is used in computing models to predict ships' performance. Full-scale tests also investigate the physical characteristics of ice.

VTT and the Finnish Maritime Administration cooperate in developing ice-breaking service on the Baltic Sea. Operative tools can be used to illustrate the ice situation and vessels' location at sea. Strategic tools can be used to simulate winter navigation and to estimate the need of icebreakers in different areas and in different ice conditions.

Testing of ice rubble load against maritime structures and ships has been a significant element of the development of Arctic technology. In the past years, VTT has developed, above all, numerical, element-based modelling. This material model of ice can be applied to optimal measurement of maritime structures, such as sea wind power plants. VTT has also investigated icing of splash water on ships and maritime structures by means of theoretical modelling.

Study of ice at the Helsinki University of Technology
The Helsinki University of Technology is the oldest university of technology in Finland and it is dealt with in this publication in two different chapters. As from 1 January 2010, it will be part of the new Aalto University. Increasing utilisation of wind power and plans to build wind power plants at sea in areas that freeze in the winter require engineer-level expertise in ice research. Applied ice research is also needed in the exploration and mapping of natural resources in ice-capped Arctic regions. One of the most active domains of study at the Department of Applied Mechanics of the Helsinki University of Technology is ice research. The principal subjects of research are ice load against ships and maritime technological structures and ships' performance in ice conditions. Mechanical properties of ice and winter navigation systems have also been studied. The University of Technology has an ice basin, which is perfectly suited to testing of ships and other maritime structures in ice conditions.

Finnish Maritime Administration
The Finnish Maritime Administration is responsible for safety at sea in Finland. From the point of view of maritime safety, it is important to pay attention to loads on ship structures in ice conditions, ships' power requirement, and ice class. The Finnish Maritime Administration participates in the promotion of navigation skills in ice conditions together with the other countries bordering the Baltic Sea. It also ensures that icebreakers are available and capable of navigating in different extreme conditions. The Finnish Maritime Administration takes responsibility for an effective icebreaker assistance service using, for example, a sophisticated IBNet traffi c information system for icebreakers.

Floating ice fi elds and ridged ice put great strains on the strength and resistance of vessel structures as well on the durability of other technology and reliability of operation in extreme conditions.

Determining ice loads and strains and their inclusion in the planning process has called for sustained research, based on practical experience and measurements and physical and theoretical models. Arctic conditions are also taken note of in fairway design, canals and navigation aids and in the planning of waterway maintenance equipment in icy and frost heave conditions.

As a result of the reorganisation of the government transport administration, the functions of the Finnish Maritime Administration will be shared by two new government agencies, Transport Infrastructure Agency and Transport Safety Agency as from 1 January 2010.

Finstaship
Finstaship specialises in Arctic navigation and icebreaking, providing icebreaking services with its icebreakers and multipurpose icebreakers. Finstaship assists vessels in ice, plans routes and provides related navigation guidance. With its high level of expertise, Finstaship ensures effective and safe winter navigation in Finland's marine areas.

Finstaship's fl eet comprises 29 vessels; three of them are strong multipurpose icebreakers, fi ve are traditional icebreakers, and the rest are other ice-going vessels. The well-equipped multipurpose icebreakers Botnica, Fennica and Nordica have been designed to operate in diffi cult conditions and perform challenging tasks in both gas and oil fi elds and expeditions in different parts of the world. Multipurpose icebreakers can assist drilling in Arctic conditions by means of ensuring protected entry to and exit from the Arctic region and by keeping fl oating ice packs at a safe distance from the drilling site.

Related to the reorganisation of the government transport administration, Finstaship will become a state-owned company as from 1 January 2010.

Offshore Technology Center
Finnish industries' expertise in exploitation of oil and gas resources in Arctic sea areas is based on longterm research and product development. Offshore Technology Center, also known as OffshoreTC, has been founded by Finnish businesses in the field to follow information, coordinate joint projects and take care of training. The owners, among others, Aker Offshore, Aker Solutions, Deltamarin, Finstaship, Havator, Quattrogemini, Sweco Industry, Rautaruukki and Wellquip, are engaged in Arctic oil and gas projects especially in the Russian sea areas.

Other companies in the field in Finland are, for example, Technip, Wärtsilä, GS-Hydro, Lamor, Cargotech and ABB, whose activities cover construction of drilling platforms, energy production, piping solutions, cargo management and oil recovery.

Aker Arctic Technology Inc.
Aker Arctic Technology Inc. was established in 2005 to continue the successful research and product development operations of Kvaerner Masa-Yards' Arctic Technology Centre. Research and product development conducted in field and laboratory environments in its ice model testing facility focus on maritime transport, ships and ports. The company also provides training for crew members.

In addition to two shuttle tanker traffic systems to be built on the Barents Sea, the company develops and studies transport systems to carry natural gas and minerals, and research and production drilling systems in the Arctic regions. Aker Arctic has created several successful ship concepts for Arctic navigation, such as the first Arctic shuttle tankers in the world. The company has also a full-scale package of ice-going ship designs.

Deltamarin Ltd
Deltamarin Ltd specialises in maritime design, engineering and contracting services and takes part in several projects in the Artic Sea region. Deltamarin was responsible for Finland's contribution to the Arctic Council's Arctic Marine Shipping Assessment report. Together with other Finnish stakeholders, Deltamarin has also been involved in the development and provision of training for crews on Arctic vessels. The company has contributed to the planning of Finnish icebreakers and several other commercial ships designed for Arctic conditions. Deltamarin also participates in the challenging Sahalin projects in the Russian Far East.

ILS
ILS is a private engineering company, known for its icebreakers. The company has designed several ice-going ships, built in shipyards in different parts of the world. ILS has created the fi rst multipurpose icebreaker in the world, capable of operating effectively also at open sea. Finnish multipurpose icebreakers Fennica, Nordica and Botnica have been designed by ILS and built in a Finnish shipyard. Passenger vessels and ferries in the Turku, Åland Islands and Stockholm archipelagos have been built according ILS's design. The vessels operate twelve months a year, also in ice conditions. Consultation and research related to Arctic navigation and techniques is an important part of ILS's activities. It is engaged for example in surveying of Arctic transport systems and investigation of ice conditions.

Neste Oil & Neste Shipping
Neste Oil Corporation, which specialises in refi ning traffi c fuels, derives its strength from its long experience of transporting oil in cold conditions. All the vessels used by the company have been designed to operate in demanding environments and vessels equipped with twin engines are built for icy conditions. Neste Oil participates in Arctic projects in Russia related to energy, warehousing and transport logistics.

Neste Shipping is an expert in maritime transport and the requirements that cold conditions set on vessels. The company has developed several methods to improve vessels' capacity and safety. Its innovations range from an integrated bridge for controlling the hull to satellite navigation in icy conditions. Neste Shipping's cargo handling simulator provides an opportunity for practical training in steering a ship in varied Arctic conditions. The company also cooperates with shipbuilders and designers, universities, VTT Technical Research Centre and other research institutes.

Adaptation to Arctic conditions

Because of the Northern conditions, especially cold winters, snow and ice, society needs to provide sustainable special solutions and Arctic expertise for building, research and everyday life. Adaptation to the northern cold conditions has been possible thanks to the long traditions and modern, determined research and development work.

Expertise in Arctic building of the VTT Technical Research Centre
VTT's Arctic expertise also covers ground freezing and building in cold environments. Accumulation of ice on power lines, TV towers and propeller blades of wind power generators caused by cloud droplets and freezing precipitation is one of the topics under active research in the Centre. VTT is a lead expert in the world in modelling freezing. VTT has responded to the demand for wind power plant technology by developing a blade-heating system and by equipping a wind tunnel for freezing tests.

VTT has investigated soil freezing, frost heave and thawing and its effects for over 20 years and developed a major part of the relevant design methods and practices currently in use in Finland. The results are applied in building foundations, underground piping and road and street construction. VTT's special knowledge can also be used when the load capacity of thawing ground and use of freezing technology in connection with ground tunnels are estimated.

Accumulation of ice is linked with ice sheet adhesion, that is, gravitation towards different materials. VTT has studied theoretical and experimental reduction of adhesion and developed anti-freeze coatings to minimise adhesion. In cooperation with companies and the Helsinki University of Technology, VTT studies and models also ice friction. Applications of this modelling include, for example, winter tyre development, reduction of slipping accidents, and development of winter sport equipment.

Study of friction at the Helsinki University of Technology
In the Department of Engineering Design and Production of the Helsinki University of Technology, a group of researchers specialising in vehicles and mobile working machines is studying the contact and friction between tyres and road. The group has developed several measurement devices for laboratory and field tests of friction. The Cold Chamber with its massive walls and temperature between +50 and -50 degrees Celsius provides good preconditions for testing.

Road Administration
The Road Administration takes care of road maintenance in winter in Finland. The roads have to sustain considerable changes in weather conditions and temperature and the main highways have to be in driving condition irrespective the amount of snow. It is important to have large and sophisticated snow clearance equipment and to organise the use of the equipment effectively. In roads' winter maintenance, weather technology and weather forecasts are also used.

In the design of Finland's road network, attention has been paid to ensure that low temperatures and freezing do not break or change road structures but they remain in driving condition even if the conditions become locally difficult.

Managed expansion and shrinking of road structures must be made possible and roads are designed taking into account their bearing capacity and impacts of ground freezing. The work is based on expertise in material technology, which has been obtained as a result of decades of active research and testing.

Relate to the reorganisation of the government transport administration, the new Transport Infrastructure Agency will assume responsibility for the functions of the Road Administration as from 1 January 2010.

Testing vehicles in winter conditions
Many car manufacturers test their vehicles' suitability to the Arctic conditions in Lapland, where several Finnish enterprises specialise in testing. Test World, which is based in Ivalo, is the northernmost centre that tests cars and tyres. The development of winter tyres by the Finnish Nokian Tyres is based on their familiarity with the demanding winter conditions and special expertise. The company's 700-hectar testing centre in Ivalo concentrates on R&D work during the months from November until May.

Research of international relations and military training in northern conditions

Finland follows closely developments in the Arctic regions and attends to the security of its northern areas. To this end, high-level research on international politics concerning the Arctic region is conducted, taking note of the Arctic conditions also in military training.

The Finnish Institute of International Affairs
The Finnish Institute of International Affairs in Helsinki is a leading research institute in Finland specialising in international relations. The Institute launched a new research programme in 2008, entitled International Politics of Natural Resources and the Environment, one theme of which is to study the changing politico-economic position of the Arctic region. The objective is to analyse domestic and foreign policies of the five coastal states and the role of other international actors now that climate change and melting of sea ice are changing the strategic status of the Arctic Ocean.

The Finnish Defence Forces / Jaeger Brigade in Sodankylä
The Jaeger Brigade in Sodankylä provides training in Arctic conditions. It is the northernmost regiment of the Finnish Defence Forces training units specialising in regional battle in the demanding conditions of northern Finland. The Jaeger Brigade uses, examines and develops military equipment, tactics and methods that are suitable for northern regions. Research is conducted in cooperation with the neighbouring countries and with civilian research institutes. The Arctic conditions in Lapland offer an excellent setting for research and development.

Special Issue: Proceedings of the Finnish National IPY Conference

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Foreword

The polar regions are facing increasing changes due to emerging resource exploitation, infrastructure development and the use of the Arctic Sea shipping route, as well as tourism and the predicted change in the climate. It is essential to investigate and understand how these environments respond to changes due to the complex interplay of biological, physical, chemical, and social processes. Only by understanding these systems will we be able to ensure their sustainable use and natural resource exploitation.

The Arctic and Antarctic areas are internationally important and attractive for scientific research because they are known to be the most sensitive areas to environmental and climate change. These areas have unique geographical locations and natural conditions, and therefore play a crucial role in various global-scale studies. Multi-disciplinary research on the polar regions is often emphasized. It improves our understanding of the interactions between all the components of Arctic and Antarctic systems, including the atmosphere, ocean, land, ice and biosphere, as well as social processes. Together, these studies will allow us to prepare for and adapt to the foreseen global impacts of future environmental and climate changes.

The First International Polar Year (IPY) from 1882–1883 was provoked by the Austrian explorer Karl Weyprecht, who believed that the fundamental problems of meteorology and geophysics were most likely to be found near the Earth's poles. Sodankylä and Kultala, at Ivalojoki River in Northern Finland, were among the original research sites of the First IPY. The Second IPY (1932–1933) was proposed by the International Meteorological Organization to promote advances in meteorology, magnetism, atmospheric science, and in the "mapping" of ionospheric phenomena. Arctic research escalated during the Second IPY. The International Geophysical Year (IGY) was held in 1957–1958 to celebrate the anniversaries of the First and Second IPYs, and it turned out to be a success. Among other achievements, the continental drift theory was confirmed, the world's first satellites were launched, and the first informed estimates of the total size of Antarctica's ice mass were yielded. The Kinnvika research station in Nordaustlandet, Svalbard, was originally built in cooperation between Sweden, Finland and Switzerland during the IGY. On 18 July 1957, the Finnish ship RV Aranda occupied Hydrographic Station No. 35 in Kinnvika, Murchisonfjorden during the first Finnish polar marine expedition.

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Finnish Antarctic research intensified about 20 years ago, when the Finnish research station Aboa was built on Basen nunatak in 1988–1989, simultaneously with the Swedish station Wasa. Finland had signed the Antarctic Treaty a few years earlier (1984). The early days of Finnish Antarctic research included intense cooperation in geophysics and meteorology with Argentineans at Marambion (1988) on the Antarctic Peninsula, and in glacial and quaternary geology with Australians at Davis station (1988–1989) in Princess Elizabeth Land. Since then, more than ten scientific expeditions have been carried out in the Antarctic. In 1991, for example, there was Antarctic marine research expedition in the Weddell Sea. The Finnish Antarctic Research Program (FINNARP) has been responsible for arranging these expeditions, maintaining Aboa research station, and coordinating international logistic cooperation. On the other side of the globe, Finnish research in the Arctic and northern regions emerged in the 1980s because of fossil fuel resource exploitation in cooperation with former Soviet Union. Also in the 1980s, Finnish researchers were involved in the Marginal Ice Zone Experiment –program and joined the Arctic Ocean Science Board. The Arctic Centre in Rovaniemi was established in 1989, and the Arctic Council was established in 1996 (http://www.arctic-council.org/). Environmental protection and enhanced sustainable development, climate change, and natural resource exploitation have been the main objectives of Finnish activities in the Arctic and northern regions.

The IPY 2007–2008 was, once again, an international effort to coordinate and promote scientific research on the polar regions (http://www.ipy.org). Thousands of researchers from more than 60 countries and from a wide range of disciplines studied the Arctic and Antarctic, aiming to expand our current understanding of environmental and climate change and their global significance. So far, the IPY has highlighted the global importance of polar processes and the urgent need to understand and track the extremely rapid changes occurring at high latitudes. An additional and important mission of the latest IPY was an active promotion of science education and outreach. Finland's IPY 2007–2008 activities (http://www.ipy-finland.fi) included a variety of multinational collaborations, such as the Kinnvika (http://www.kinnvika.net/), DAMOCLES (http://www.damocles-eu.org/) and ICESTAR (http://www.sos.siena.edu/~aweatherwax/icestar/) projects.

The research papers presented here are based on presentations given at the Congress of the International Polar Year (IPY) 2007/08, held at the Geological Survey of Finland from 12–13 November 2008. The congress covered a wide range natural sciences, including geology, geophysics, hydrology, atmospheric sciences, geography, marine research, geodesy, glaciology, and arctic geotechnics. It was organised by the Geological Survey of Finland, the Geological Society of Finland, the Geophysical Society of Finland, the Finnish National Committee of Quaternary Research (INQUA), and the Finnish National Committee on Arctic and Antarctic Research. The outcome of the conference was somewhat comforting, as the situation facing the continental glaciers in Greenland, Antarctica and the northern tundra in Siberia seems to be less dramatic than is often presented in the media. However, the climate and environment is changing, and there are many open questions and challenges concerning the behaviour and

responses of polar systems. Young scientists are urged to pack their rucksacks and travel to the remote Arctic frontiers to seek scientific facts, to face nature and our mother Earth and to gain some extraordinary experiences.

This publication contains 13 peer-reviewed papers that are based on presentations given at the Congress. The first paper by *Vihma et al*. introduces highlights of atmospheric surface layer research in the Finnish Antarctic programme during the last 20 years. A paper by *Sutinen et al*. suggest that snowmelt infiltration contributes significantly to ground water reserves. *Pirazzini* and *Meinander et al*. then discuss about challenges related to of snow and ice albedo measurements and parametrization. *Ruotoistenmäki and Lehtimäki* and *Korhonen et al*., as well as *Vanhala et al*., present the applicability of geophysical measurements in permafrost related studies. *Immonen et al*. and *Valppu et al*. discuss about interglacial-glacial climate change based on marine sediment records from Antarctic and Arctic sites. *Paatero et al*. presents results from recent ARCOS expedition, and *Virkkula et al*. introduces a review of aerosol research at the Finnish Antarctic research station Aboa. Finally, *Marnela et al*. and *Rudels et al*. present results from studies of circulation and water mass transformation and double-diffusive convection of the Arctic Ocean, respectively.

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