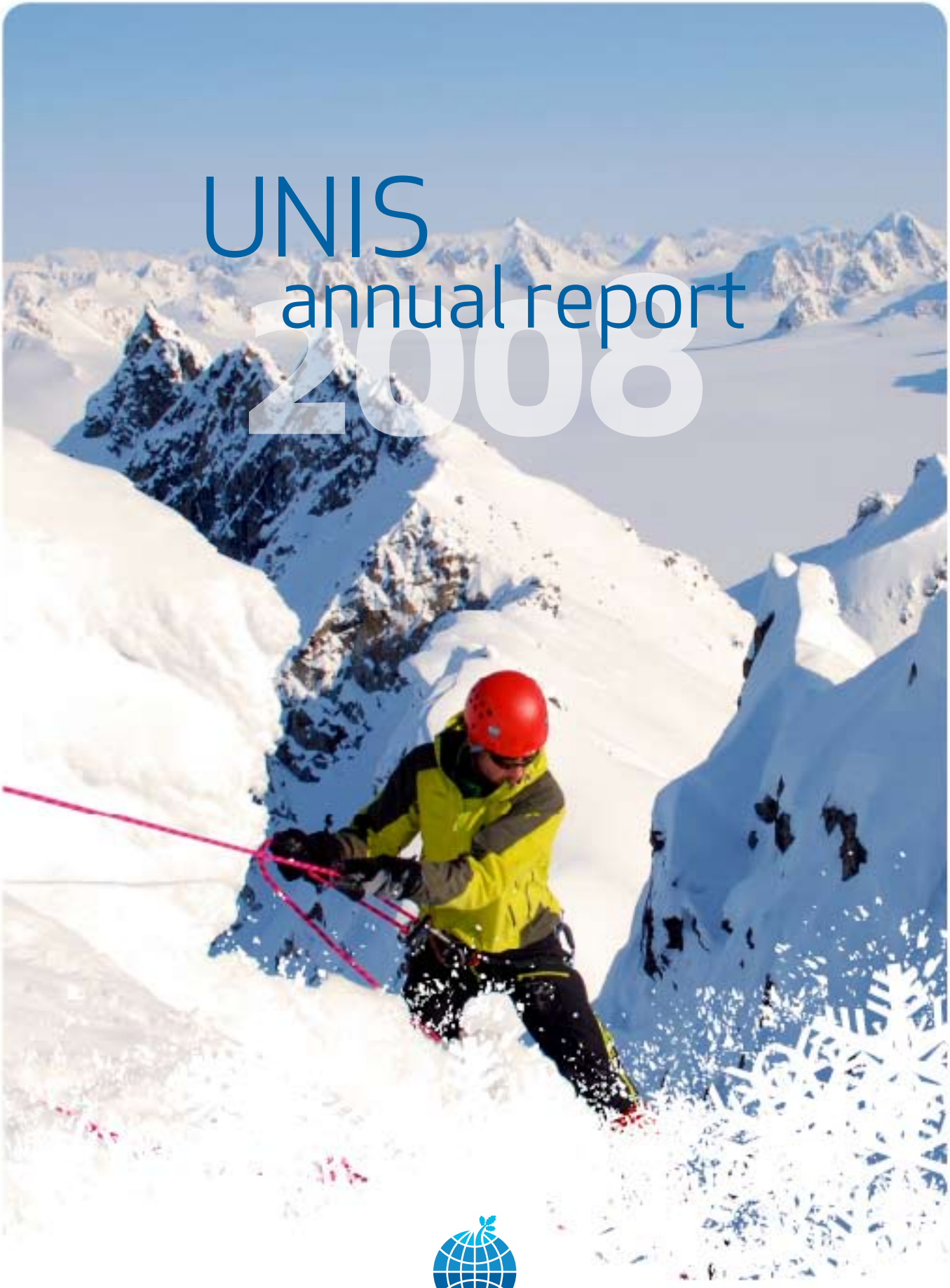
UNIS annual report 2008



UNIS

The University Centre in Svalbard

Front cover: UNIS Ph.D. student Endre Før Gjermundsen doing fieldwork in Losvikfjella east of Magdalenefjorden for the ICEBOUND project in April 2008.

Photo: Anne Hormes

map over svalbard

contents

from the director

It's been a cold winter in Longyearbyen, with temperatures between 20 and 30 degrees Celsius below zero for long periods of time. The sea ice has returned to the Svalbard fjords, more than we have seen the last years, and as a consequence we see more polar bears.

A winter like this is a reminder of the fact that climate change is a complex issue. We live in a time of global warming and the UN Intergovernmental Panel for Climate Change states that it is man made. At the same time, natural variations make quite a difference from one year to the other.

The University Centre in Svalbard is perfectly located to study climate change. Global warming is expected to arrive first and hit hardest in the high Arctic. At the same time, natural variations are relatively higher up here. It is a challenge for researchers to understand the interaction of natural changes and man made changes. It is also a challenge to keep them apart.

In December 2008 the Svalbard Integrated Arctic Earth Observing System (SIOS) was formally accepted as part of the European Road Map for Research Infrastructure. Researchers from many countries will come together to create a complete observation system for monitoring environmental and climate change. The knowledge center which will be the heart and mind of SIOS will be located next to UNIS in Longyearbyen.

The goal of UNIS research is to contribute to a better understanding of Arctic life, processes and effects, as well as its global impact. The goal of our teaching is to educate the Arctic experts of tomorrow; making UNIS THE place to be for young people who want to make a career through understanding environmental and climate change. We see many aspiring researchers among our students. We see some future policy makers also.

Longyearbyen April 2009

Gunnar Sand
Managing director of UNIS

excerpts from the report of directors 2008

From an academic perspective, 2008 was a good year for the University Centre in Svalbard (UNIS). Application figures reached a new record, the portfolio of externally financed research continued to grow and the publication rate is at the same level as the universities on the mainland. However, from a financial perspective, the situation is tougher. The accumulated increase in costs relating to housing and field operations has worsened. Consequently, the Board of Directors has decided to reduce the production of student-labour years from autumn 2009.

The University Centre in Svalbard AS (UNIS) was established as a state-owned limited corporation on November 29, 2002, replacing the original institution established in 1994 by the Norwegian University of Science and Technology and the Universities of Oslo, Bergen and Tromsø.

The institution's objective is to provide tuition and engage in research based on Svalbard's geographic location in the High Arctic and the special advantages this offers. The tuition shall act as a supplement to the tuition offered at the universities in mainland Norway and culminate with examinations at Bachelor, Master or PhD level. Studies at UNIS shall have an international profile, and all tuition is given in English.

The relationship with the founders is preserved through board representation and teaching committees, as well as direct relations with the academic environments. Similar relationships are now being developed with Stavanger and Ås, but without board representation. The first collaboration agreements with overseas universities have also seen the light of day. We expect more to follow, particularly from Russia and Canada, without this altering the place of the Norwegian mainland universities as the main collaborative partners.

Education
In 2008, UNIS offered four fields of study: Arctic Biology, Arctic Geology, Arctic Geophysics and Arctic Technology. A total of 46 courses were offered, of which 26 were at Master's or PhD level. A total of 384 students from 26 different countries took courses or worked on their Master or PhD theses. This equates to 122 student-labour years. One student-labour year is the equivalent of 60 credits (ECTS).

Bachelor and Master's students are included in the student production figure. At the start of 2009, applications outweighed available places two to one. In comparison, UNIS produced 95 student-labour years in 2006 by admitting all qualified applicants.

The proportion of Norwegian students in 2008 was 49 percent, of which 55 students were from NTNU, 36 from UiO, 33 from UiB and a total of 40 from UiT, Ås and Stavanger. Ten percent of the students came from other Nordic countries, while eight percent were from Germany and seven percent from the United Kingdom. The proportion of Russian and Polish students is growing and has now reached four and three percent respectively. Grants from the Ministry of Foreign Affairs (UD) and the Norwegian Centre for International Co-operation in Higher Education (SIU) have contributed to the development through scholarship programmes for Russian students.

Research
During 2008, the Department of Arctic Technology at UNIS carried out studies of hydrological conditions and the impact of ice on constructions at port facilities at Kapp Amsterdam near Svea in the Van Mijen Fjord. Studies of ice drift have also been carried out in the Barents Sea and in the waters near Hopen with a view to the future off-shore petroleum activity.

In the summer of 2008, 20 scientists and students from UNIS worked to collect more than half a million seeds for the Svalbard Global Seed Vault. The collection covers 88 species from Svalbard's flora, 10 of which are on the endangered species list. The goal is to store seeds from as many as possible of Svalbard's 165 vascular plants and in doing so secure Norway's Arctic flora and genetic diversity for the future.

In 2008, the Department of Arctic Geology arranged a course in which 10 students and two UNIS professors compared the temperature, ice content and other physical characteristics of permafrost on Svalbard and North-east Greenland. Sediment samples were taken from the uppermost two metres of the permafrost and temperature strings were installed to enable continual measurements.
The Kjell Henriksen Observatory (KHO), which was officially opened by the Minister of Research and Higher Education Tora Aasland in February 2008, has completed its first observation season. A total of 15 institutions from nine countries have moved in with their instruments and more will follow. During the year, UNIS also took over the SPEAR (Space Plasma Exploration by Active Radar) installation from the University of Leicester.

The UNIS-led project to qualify the "Svalbard Integrated Arctic Earth Observing System" (SIOS) on the European Roadmap for Research Infrastructure (ESFRI) was crowned with success.

The project aims to establish a complete system for environmental and climate monitoring on and around Svalbard. It is now entering a phase of detailing work packages and recruiting international partners. The project's main knowledge centre will be situated in Longyearbyen.

Several UNIS scientists have in the course of 2008 participated in the Arctic Council's Cryosphere Project "Climate Change and the Cryosphere: Snow, Water, Ice and Permafrost in the Arctic" (SWIPA).
The strategic plan places considerable emphasis on the building of alliances and partnerships. In 2008, UNIS entered into collaboration agreements with Eiscat, Akvaplan-niva and the Scott Polar Research Institute in the United Kingdom.

In 2008, scientists at UNIS published 52 articles in international refereed journals, of which 24 were at the highest level. In addition, there were nine chapters in books. Corresponding figures for 2007 were 57 articles, of which 15 were at the highest level, six chapters and one book.

Dissemination
Coverage in the Norwegian and international media has contributed to high visibility, particularly in relation to the opening of KHO and the Svalbard Global Seed Vault. Collaboration with NRK has resulted in four programmes in the TV series Schrödingers Katt. Our new website has been successful and the production of news articles has increased significantly. During IPY, UNIS has hosted nearly 250 guest delegations. Locally, the Svalbard Seminars, open days and other lectures for the local population have been well attended. There is often a full house at the science park when UNIS invites the local community to lectures. The Board of Directors is extremely satisfied with the dissemination activities.

Social responsibility
Right from the start, UNIS has been clear that the institution shall be a resource for the local community in Longyearbyen. This applies to the staff, students and the knowledge we possess. The staff shall live and work in Longyearbyen and contribute to the development of both the institution and the community. Neither staff nor students have the possibility of starting their own clubs or societies, but instead engage themselves in the community's social and cultural life. In 2008, the Board of Directors decided to switch to permanent positions, which means UNIS becomes an even more stable institution for the local community, while permanent positions will also secure stable quality in research and education.

Forty-five percent of goods and services were purchased locally in Longyearbyen, according to the annual accounts for 2008.

In the latest version of the strategic plan, UNIS has expanded the mission statement from being a resource for Longyearbyen to being a resource for the communities of Svalbard, including Barentsburg. The relationship with the Russians is developing through a desire to collaborate with Russian scientists and a growing number of Russian students and staff at UNIS.

UNIS collaborates with the travel and tourism industry in Svalbard and Finnmark University College about the training of guides, with Bydrift Longyearbyen about environmentally-friendly solutions for power production and with Store Norske about Carbon capture and storage (CCS) and environmental analyses. Several Master's and PhD theses are directed towards issues of relevance to Longyearbyen, Svea and Barentsburg.

Staff
As of December 31, 2008, the scientific staff at UNIS comprised seven professors, after five have been promoted in the past two years. This development shows UNIS has become attractive for established scientists, as opposed to the early years when UNIS mostly comprised young scientists starting their careers. As of December 31, 2008, the scientific staff comprised seven professors, 12 associate professors, four post docs, 18 Research Fellows, three project co-ordinating positions and 28 with adjunct professor/associate professor attachments. There was a technical staff of 12 and an administrative staff of 15. Women accounted for 54 percent of the technical and administrative positions, 44 percent of the scientific positions and 48 percent of the students. Four of the seven members of the Board of Directors were women.

The following positions are externally funded: four post docs (one ConocoPhillips and three RCN), five PhD (one Total, one Statoil and three RCN) and five professor/adjunct associate professorships (two by Akvaplan-niva and one each by ARS/NAROM, NERSC and NGU). In addition, three adjunct professor/associate professorships are part-financed by the Norwegian Polar Institute, and two vacant scientific positions have external funding from Store Norske and Statkraft. The Board of Directors would like to thank these institutions for their contribution to UNIS.

Health, Safety and Environment
Absence due to sickness at UNIS in 2008 was 2.05 percent. The institution has an agreement with Longyearbyen Hospital concerning occupational health services and is certified as an IA enterprise. There were no injuries or reports of serious occupational accidents or calamities resulting in serious material damage or personal injury.

Fieldwork in the Arctic can endanger the health and lives of the participants, as well as posing threats to the environment. UNIS has therefore established a comprehensive set of regulations to ensure that fieldwork is implemented in a safe manner. All students and staff must complete the mandatory Arctic Survival and Safety Course. Field and laboratory work is quality assured through risk analysis and is covered by strict reporting routines, including for any undesired incidents.

Safety instructions and control routines at UNIS cover the provisions of the Svalbard Environment Act, which states that in any conflict between activity and the environment priority must be given to environmental considerations. When carrying out its activities, UNIS focuses on sustainability and aims for the least possible negative impact on the natural environment.

UNIS is unaware of contamination of the wider environment to any significant degree as a result of the institution's operations. UNIS is working continually to limit the environmental impact of its activities.

Economic development
Funds for operation and investment at UNIS are appropriated over the budget of the Ministry of Education and Research. In the period from 2001 to 2006, UNIS has had an average annual increase in operational appropriations of 10 percent. This figure dropped to three percent in the period from 2006 to 2009.

The UNIS Board of Directors gathered in Trondheim. Rear row from left: Frank Eggenfellner (staff deputy representative), Hanne H. Christiansen (staff representative), Geir Anton Johansen, Borgar Aamaas (student representative), and Juni Vaardal-Lunde (student deputy representative). Front row from left: Berit Kjeldstad, Viva Mørk Kvello, director Gunnar Sand, Annik Myhre and Chariman Tore Vorren.

Photo: UNIS

In 2008, appropriations to UNIS from the Ministry totalled NOK 78,719,000, of which NOK 62,796,000 constituted base funding and NOK 15,923,000 rent for the science park and KHO. Income over and above the appropriations from the Ministry of NOK 32 million comprises NOK 26.2 million from external project income for research and NOK 5.8 million in income from consultancy services and rentals. UNIS has experienced an increase in external funding for research from 8 percent of its gross income in 2001 to 24 percent in 2008.

The annual accounts for 2008 show an operational deficit of NOK 2,937,022. Implementation of a new accounting policy for depreciation of apartments constitutes NOK 1,195,362 of the deficit, while the purchase of inventory to 10 apartments, earlier resolved to be covered by shareholder capital, accounted for a further NOK 882,286 in minus. Under financial costs, interest on the housing loan was NOK 534,252 higher than budgeted. As such, the annual accounts for 2008 show a total deficit of NOK 3,449,740 including financial items.

The institution's total assets at year-end 2008 were NOK 82,881,547, comprising NOK 50,492,658 of institutional buildings and NOK 8,059,901 of shareholder capital and other equity.

In 2008, a salary of NOK 863,425 was paid to the Managing Director. The Chairman of the Board of Directors received a fee of NOK 35,000 and the other members of the Board of Directors each received a fee of NOK 20,000.

The institution's accounts were audited by PriceWaterhouse Coopers A/S.

Infrastructure and housing
In 2008, UNIS took ownership of 10 new apartments and at year-end 2008 owned a total of 52 apartments. In addition, UNIS rents 25 studio apartments for Research Fellows and a further 20 for guest lecturers. At year-end 2008, UNIS' combined housing loans total NOK 40.9 million. Interest and instalments on the loan as well as inventory for the apartments must be financed from the operational budget.

The Student Welfare Organisation in Tromsø offers a total of 144 studio apartments to students. It is decisive for UNIS that the students have satisfactory living conditions, and the Board of Directors emphasises pursuing the good co-operation with the Student Welfare Organisation in Tromsø.

Liquidity and shareholder capital
At the Annual General Meeting on 30.04.07, the Ministry asked that an assessment of the level of shareholder capital be undertaken based on the risk and strategic requirements. Point 5 of the State's principles for good ownership states: "The capital structure in the company shall be adjusted for the purpose of the ownership and the company's situation." At year-end 2008, shareholder capital at UNIS comprises NOK 8 million, which gives a shareholder capital percentage of 9.6. In order to service the loan instalments without impacting the daily operation, UNIS requires a strengthening of shareholder capital or alternatively compensation from the Ministry to service the loans.

Board of Directors and Annual General Meeting
The UNIS Board of Directors held four meetings in 2008, two of which were in Longyearbyen. Sixty-eight matters were officially discussed. The Annual General Meeting was held in Oslo on April 23, 2008.

Continued operation
The institution's annual accounts are presented on the assumption of continued operation. The reasoning for the assumption is in the budget for 2009, which outlines the measures that have been implemented.

The path forward
Investments in housing and field equipment are necessary costs for UNIS in Longyearbyen. When these must be covered from the operating budget, it means that a desired proportion of the basic funding is used for purposes other than education and research. The institution's working capital (current assets minus short-term debt) has in the space of 2008 gone from positive to negative, which means there will be periods when liquidity is severely stretched. In the space of a few years, down payment of loans will drain UNIS's liquidity reserves unless fresh shareholder capital is added or acquired.

Given this situation, the Board of Directors wishes to emphasise that UNIS has a potential for education and research that far exceeds what the institution currently is financially capable of. UNIS delivers good results in all aspects in which universities are measured and it has shown a great ability to handle challenges at a high level. The production in the spring semester of 2009 shows that UNIS has attractive courses that draw good students, and that both technically and administratively the institution has the ability to handle a larger portfolio. At the same time, UNIS is acting in a sustainable and responsible manner in relation to the environment.

From a development perspective, we see that UNIS is attractive for ambitious scientists and is in the process of building a solid academic staff, of which the proportion employed in professorships is increasing. UNIS is playing a central role in the continuation of the Norwegian polar research tradition, in the development of Svalbard as a research platform and in representing and securing Norwegian interests in the Arctic. The polar focus of climate research, the government's initiatives in the High North and the industry's interests in the north all serve to emphasise this fact.

It is the Board of Directors' view that UNIS has every opportunity of fulfilling its overall goal of being a leading international centre for Arctic studies. However, this implies more vigorous funding than UNIS currently receives, which the Board of Directors wants to work towards. The Board of Directors looks forward to working in close collaboration with the Ministry to realise the institution's potential.

The Board of Directors would like to thank all staff at UNIS for the good contribution they have made in 2008!

Trondheim 19. mars 2009

Tore Vorren | leder

Annik M. Myhre

Berit Kjeldstad

Geir Anton Johansen

Viva Mørk Kvello

Borger Aamaas

Hanne Christiansen

Gunnar Sand | director

UNIS leader group 01.01.09

- Gunnar Sand, Director
- Helen Flå, Assistant director
- Ole-Jørgen Lønne, Department leader, Arctic Biology
- Alvar Braathen, Department leader, Arctic Geology
- Carl Egede Bøggild, Department leader, Arctic Geophysics
- Aleksey Marchenko, Department leader, Arctic Technology
- Fred Skanche Hansen, Head of Logistics and Safety
- Andrea Schmidt, Student Council leader
- Eva Therese Jenssen, Information Advisor

the brown bag lunch seminar

Every Wednesday at noon UNIS becomes the interdisciplinary learning platform of the Svalbard Science Centre. The Lunch Seminar provides short (15-20 min.) presentations about scientific research that goes on at UNIS and other research organizations, while the audience can enjoy their brown bag lunch.

In 2008, the Brown Bag Lunch Seminar hosted 34 speakers from 18 different universities and institutes around the world and got the appearance of Pierre Taberlet, Recipient of the Molecular Ecology Prize 2007.

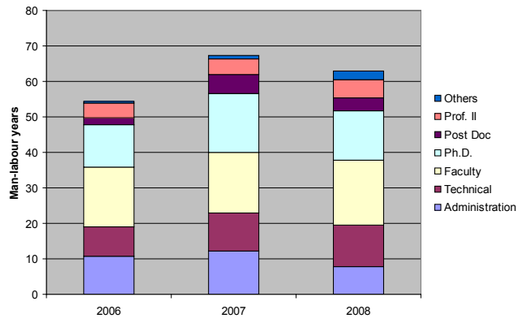
The UNIS web portal offers detailed information about the seminars and speakers and the possibility to download some of the given presentations: **www.unis.no/lunchseminar**

October 2008: UNIS celebrated its 15th year anniversary and invited all students and staff to birthday cake and coffee in the cafeteria.

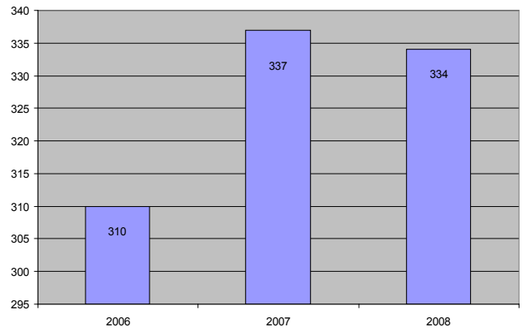
Photo: Eva Therese Jenssen

statistics

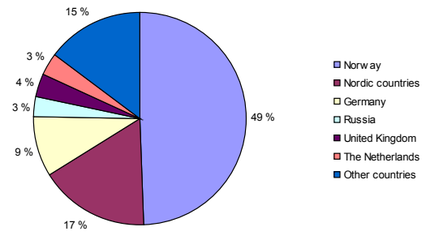
Work force in man-labour years according to category at UNIS 2006 - 2008



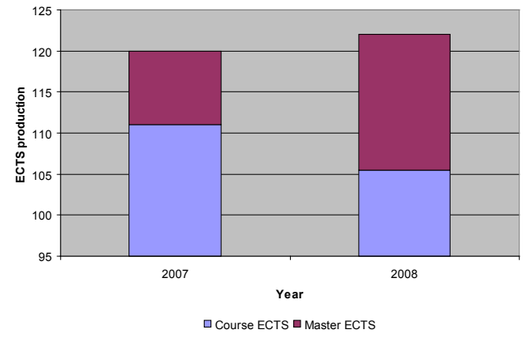
Number of students completing UNIS courses 2006-2008



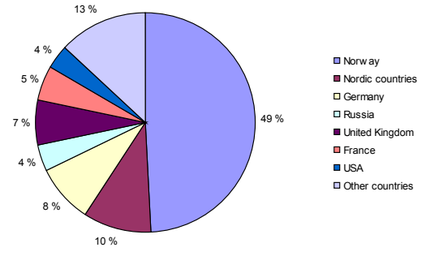
UNIS students' nationality 2007



Production in student-labour years (1 year = 60 ECTS credits)



UNIS students' nationality 2008



Note: In accordance with mainland universities practice, UNIS now registers ECTS by 1) course production and 2) master students attendance at UNIS

resultatregnskap 2008

	2008	2007
Tilskudd fra KD	78 719 000	75 474 000
Avsatt til investeringstilskudd	-2 316 325	-1 448 112
Årets driftstilskudd fra KD	76 402 675	74 025 888
Eksterne prosjektinntekter	26 279 700	21 420 379
Øvrige inntekter	5 750 808	4 873 065
Brutto driftsinntekter	108 433 182	100 319 332
Direkte prosjektkostnader	23 630 656	20 183 640
Netto driftsinntekter	84 802 526	80 135 692
Lønn og sosiale kostnader	39 788 631	34 598 941
Felt- og toktkostnader	6 328 478	7 132 534
Kostnader lokaler	23 895 917	20 126 919
Øvrige driftskostnader	16 531 161	18 035 072
Avskrivninger	1 195 362	
Sum driftskostnader	87 739 548	79 893 466
Driftsunderskudd	-2 937 022	242 226
Finansinntekter og finanskostnader		
Finansinntekter	1 377 884	626 098
Finanskostnader	1 890 603	1 213 844
Netto finansinntekter	-512 719	-587 746
Resultat før ekstraordinære poster	-3 449 740	-345 522
Disponeringer:		
Fra annen egenkapital	3 449 740	345 522

balanse pr. 31.12.2008

	2008	2007
EIENDELER		
Anleggsmidler:		
Bygninger	50 492 658	28 431 300
Andeler Svalbardhallen	1	1
Sum anleggsmidler	50 492 659	28 431 301
Omløpsmidler:		
Varebeholdning	2 202 766	1 599 217
Debitorer	6 789 100	5 857 230
Andre kortsiktige fordringer	7 605 655	8 394 706
Betalingsmidler	15 791 366	13 288 112
Sum omløpsmidler	32 388 888	29 139 566
SUM EIENDELER	82 881 547	57 570 566
GJELD OG EGENKAPITAL		
Innskutt egenkapital	2 054 025	2 054 025
Opptjent egenkapital	6 005 876	9 455 616
Sum egenkapital	8 059 901	11 509 641
Avsetninger for forpliktelse		
Utsatt innt.føring tilskudd Nodlysstasjonen	50 000	229 227
Sum avsetninger for forpliktelser	50 000	229 227
Langsiktig gjeld:		
Boliglån SparebankEN	40 976 690	19 137 052
Sum langsiktig gjeld	40 976 690	19 137 052
Kortsiktig gjeld:		
Leverandørgjeld	10 395 482	10 567 326
Skyldige off.trekk og avgifter	6 331 702	3 953 209
Annen kortsiktig gjeld	17 067 771	12 174 111
Sum kortsiktig gjeld	33 794 956	26 694 646
SUM GJELD OG EGENKAPITAL	82 881 547	57 570 566

April 2008: Arctic marine biology students sample zooplankton in Billefjorden.

Photo: Malin Daase

arctic biology

By Ole Jørgen Lønne

The department conducts research in arctic biology and ecology and provides a full one-year curriculum of undergraduate studies and eight Ph.D./Master's level courses. The department pursue the strategy to develop two research groups, one in marine arctic ecology and one in terrestrial arctic ecology. The two strategies are, however, linked in several areas. The common use of DNA methods and the common development of the DNA lab is one such area. At the end of 2008 the department consisted of one full professor, five associate professors, five adjunct professors, two postdoctoral research fellows and four Ph.D. students. A sixth adjunct professor position has been kept open during 2008, and part of 2009, as part of UNIS need to reduce costs.

Compared to last year, 2008 was a period of increased stability and completion of changes seen i 2007. Dr. Pernille Bronken Eidesen was engaged on a one year contract for 2008, and will join the permanent staff in early 2009. Dr. Gabrielsen had her start date in early 2008, when she became a member of the permanent staff and of the marine group. Dr. Ole Jørgen Lønne joined as associate professor in August, and took over as department head from Steve Coulson in October. Dr. Jørgen Berge was awarded full professorship in June, and became the first within the department to do so. Our two postdoctoral research fellows, Dr. Janne E. Søreide and Dr. Øystein Varpe and our three research fellows María Luisa Ávila Jiménez, Eike Müller and Henrik Nygård are all in their second year and doing good progress within their fields of research. Our fourth research fellow, Daniel L. Vogedes will in 2009 enter the final phase of his PhD project.

Emma Johansson-Karlsson was hired as a division engineer this year to cover the increasing demands in the DNA lab. Her services are shared between our department and the Department of Arctic technology. Finally our staff of adjunct professors had two new members this year. Thanks to cooperation with the ARCTOS research network and financial support from Akvaplan-niva Drs. Lionel Camus and Paul Renauld were engaged as adjunct associate professors at UNIS. They have together with the other adjunct professors; Jon Aars, Bjørn Gulliksen, Geir Johnsen, Kit Kovacs and Geir W. Gabrielsen, been vital in our efforts in delivering the best quality possible in the teaching we offer.

Terrestrial Ecology Research Group

By the end of the year, the terrestrial group consisted of three associate professors and two Ph.D. students. The Ph.D. students, María Luisa Ávila Jiménez and Eike Müller, are in their second year of investigating the dispersal to and colonisation of Svalbard by the flora and terrestrial invertebrate fauna; Ávila Jiménez on the project "High Arctic invertebrate biogeography: dispersal, establishment and survival" and Müller on "Plant dispersal and establishment in the Arctic". Jiménez have, through cooperation with Dr. David Pearse, strengthened the links between British Antarctic Survey (BAS) and UNIS through a study of gut microbe flora of Arctic Collembola. Research specialities of the group have been gradually focussed to concentrate on the biogeography of the flora and invertebrate fauna, but also include plant ecology, population dynamics and ecophysiology.

October 2008: UNIS botanists Inger Greve Alsos and Pernille Eidesen (with boxes) have together with staff, students and volunteers collected seeds from Svalbard's flora for preservation in the Global Seed Vault. The project was partly sponsored by the Svalbard Environmental Protection Fund and more than half a million seeds from 88 of the total of 165 plant species were delivered to the seed vault in autumn 2008. Photo: Frank Eggenfellner

The SPIDER (Svalbard Pictographic Invertebrate Database and Educational Resource) project got funded through the Svalbard Environmental Protection Fund and got its web site established this year with the aim to have a first operational version out by summer 2009 (**http://svalbardinsects.net/**).
The site will contain information concerning the terrestrial and freshwater invertebrate fauna of Svalbard. Some 1,200 species are recorded from the archipelago. It is hoped these pages will be of interest to both locals and visitors to Svalbard.

National and international co-operation with taxonomic experts have resulted in the identification of species new to Svalbard and the Arctic region. A co-operation with Dariusz Gwiazdowicz (University of Poznan) resulted in the description of mites new to the area. These findings will be followed up by a larger field study in June/July 2009. A UNIS workshop on Collembola have also resulted in publication of new species to Svalbard in 2008.

Of great significance to the terrestrial and the marine group is the new DNA laboratory which will be of key importance to the development of research in the department as a whole. The laboratory became operational in 2007, and has seen a high increase in the activities throughout 2008.

Both our terrestrial and marine research groups use the DNA laboratory, and the facilities available allow us to work with highly different questions such as the identification of plant individuals by genetic fingerprinting, the assessment of the biodiversity of marine microorganisms, and the identification of prey in marine zooplankton.

The use of the same laboratory and similar molecular tools by both the marine and terrestrial research groups strengthens the internal collaboration at the department. The DNA laboratory was also used in student projects for our two autumn courses at bachelor level, AB-201 and AB-202.

Marine Ecology Research Group

In 2008 one professor, two associate professors, two post doctoral research fellows and two Ph.D. students pursued research in Arctic Marine Biology. The International Polar Year (IPY) related field activities have made this an active year.

The three research fellows have continued their work on the large externally funded projects; "Climate effects on planktonic food quality and trophic transfer in the Arctic Marginal Ice zones" (CLEOPATRA), "The Arctic sea in wintertime: ecosystem structuring due to environmental variability during the polar night" (ArcWin), and the Statoil funded "Ice Edge" programme.

Winter ecology is a main research field in the department and 2008 saw the start of an extensive field campaign as part of the ArcWin project, where zooplankton were sampled at regular intervals for a whole winter season.

This is logistically challenging fieldwork, conducted by boat when open water, or by snow mobiles and sampling through the ice during winter. We use Bille-fjorden as our field location, and the sampling has been very successful. The data are promising and will be used to answer quest-ions regarding the seasonal and diel vertical migrations of zooplankton, their life cycle and energy storage strategies, and the possible predator-prey interactions in the system.

ArcWin has also seen good progress on the benthos ecology component of the project, with publication of a comparison of current versus past community structure in Isfjorden. Our new vessel, the Viking Explorer, has proved to be a very useful platform in these activities. We are also pleased to see that a flexible solution to bring the boat in- and out- of water has been established. This will strengthen our possibilities to expand on our winter ecology activities in times with variable ice conditions.

The CLEOPATRA-project is funded by the Research Council of Norway (Norklima program) and is IPY accredited. The project runs over three years (2007-2009) and investigate how increased light intensities, due to reduced ice concentrations and ice extent, affect timing, quantity and quality of primary and secondary production in the Arctic marginal ice zone (MIZ).

The MIZ is the key productive area of Arctic shelf seas. The ongoing warming of Arctic regions will lead to a northward retreat of the MIZ and to an earlier opening of huge areas in spring. This may result in a temporal mismatch between the phytoplankton spring bloom and zooplankton reproduction. Less ice will also reduce the ice algae production that may be an important food source for spawning zooplankton prior to the spring phytoplankton bloom.

Quantity and quality of primary production in seasonally ice-covered seas is primarily regulated by light and nutrients. Excess light, however, is potentially detrimental for algae and can reduce algal food quality. A decrease in the relative amount of essential polyunsaturated fatty acids (PUFAs) in algae due to excess light may affect the reproductive success and growth of zooplankton, and thereby the transport of energy to higher trophic levels, such as fish, birds, and mammals.

The CLEOPATRA-project has run a number of experiments throughout the year. According to the project plan, the most extensive field campaigns were carried out in 2007, whereas in 2008 completed most of the planned experiments.

July 2008: Master student Chris Ware collects soil from visitors' boots at Longyearbyen airport. The tourists can carry with them foreign seeds by their footwear, which might threaten the delicate balance of the Svalbard flora.

Photo: Eva Therese Jenssen

These included one extensive campaign in Ny-Ålesund as well as long-term experiments carried out on zooplankton development at UNIS.

In Ny-Ålesund, the CLEOPATRA-project followed the development in biomass and food quality of ice algae, phytoplankton and secondary production before, under different light and nutritional levels. At UNIS, the copepod Calanus glacialis, the key herbivore in Arctic shelf seas, was used as target species for developmental and secondary production experiments.

GRADUATES 2008:

Ph.D. degree:
Malin Daase: Mesozooplankton distribution in Svalbard waters: Calanus spp. and its relationship to hydrographic variability

Master degree:
Anna Solvang Båtnes: Trophic interaction between little auks and their zooplankton prey in a high Arctic fjord based on lipid analyses

Ragnhildur Gudmundsdottir: Pseudocalanus in Svalbard waters and beyond: new insight in the ecological niches of two sibling copepod species

Inkeri Markkula: Copepod community sturcture and stable isotopes composition of Calanus glacialis, Acartia longiremis and Pseudocalanus spp. in arctic saline lake and sill fjord, in Western Svalbard

Sanna Markkula: Community structure of Copepods in high Arctic saline lake compared to sill fjord, in Western Svalbard : with emphasis on Calanus spp. and Pseudocalanus spp.

Ditte Ejersbo Strebel: Carbon efflux and turnover in a High-Arctic ecosystem in response to goose grazing and warming

Mikko Vihtakari: Life history of an Arctic crustacean Onisimus caricus (Amphipoda: Lysianassidae) as deduced from baited trap samples taken from Adventfjorden, Svalbard

Jago Wallenschus: Life cycle and energy budget of the Arctic amphipod Onisimus litoralis: a case study from Adventfjorden (Svalbard)

August 2008: Pilot Bjørn F. Amundsen helps Ph.D. student Monica Sund drill through the thick snow layer on top of Kroppbreen. Kroppbreen is in a partial surge stage and Sund's project aims at monitoring the surge from start to finish.

Photo: Elise Strømseng

arctic geology

By Alvar Braathen

In 2008, research in the Arctic Geology Department covered six subjects in Earth Science; marine geology, Quaternary geology, permafrost and periglacial geomorphology, glaciology, sedimentology, and structural geology. The research vision of the department focuses on Svalbard, its fjords and adjacent shelf that together offer an excellent opportunity to study a wide range of landforms, processes, sediments and structures related to the development of the Barents Shelf and infill of sedimentary basins. As an area of terrestrial outcrop on the Barents Shelf, Svalbard provides excellent access to a vast range of basin settings, from the low-latitude infill of the Devonian basins, to the present glacial and periglacial erosion and infill of valleys and fjords.

By the end of 2008, the staff consisted of six full-time faculty, professors Benn, Braathen and Christensen, and associate professors Hormes, Jensen and Noormets. The department also has six adjunct professors; Helland-Hansen, Humlum, Ingólfsson, Thiede, Olausson and Osmundsen.
In addition, there is one post doc; Juliussen, four UNIS based Ph.D. students; Bælum, Gjermundsen, Sund, and Eckerstorfer, four external Ph.D. students, and one research assistant; Neumann. In 2009, the department will recruit a seventh full-time staff position in petroleum geology.

The Geology Department had a very productive year in 2008. One Ph.D. student (Lüthje) and two Master students finished their work. The department also performed a time-high record in course ECTS production, totalling 1820 ECTS, up from 1805 ECTS in 2007.

The department offered five new courses that were well attended, fulfilling the department's course portfolio of 190 ECTS. In research there is a significant positive development, as shown by the fact that the staff of the department published 18 papers in peer-review journals, and presented 34 papers on international conferences.

The permafrost and periglacial geomorphology research group in 2008 consisted of Hanne Christiansen, Håvard Juliussen, Lene Kristensen, Ullrich Neumann, Ole Humlum, Herman Farbrot and Markus Eckerstorfer. They had large activity, drilling 12 boreholes into different permafrost landforms here in central Svalbard, totaling 173 m. These holes now have ground thermal monitoring. This is a key part of the establishment of the Nordenskioldland Permafrost Observatory in the IPY Permafrost Observatory Project: A Contribution to the Thermal State of Permafrost in Norway and Svalbard (TSP Norway). A key UNIS and TSP Norway education activity partly funded also by the Nordic Council of Ministers Arctic Collaboration program, was to the course AG-333 'The International University Course on High Arctic Permafrost Landscape Dynamics in Svalbard and Greenland'. In this course 10 students and Hanne
Christiansen and Bo Elberling (UNIS lecturer) compared permafrost temperatures, ice content and physical conditions in Adventdalen and at Kapp Linné in Svalbard with conditions in NE Greenland at research station Zackenberg. The course also included a data workshop at University of Reykjavik to ensure the systematical organization of all the collected data. See **www.tspnorway.com** for more details on the TSP Norway project.

In the "Climate change effects on high arctic mountain slope processes and their impact on traffic in Svalbard" (CRYOSLOPE Svalbard) Norklima research project, Markus Eckerstorfer worked as a volunteer for most of 2008 assisting with the field observations and chartographical products from the project. The CRYOSLOPE Svalbard fieldwork office, consisting of Ulli Neumann and Eckerstorfer, spent 60 fieldwork days in snow avalanche terrain in 2008 without any hazardous situation. Until the summer of 2008 the project has registered 332 avalanches in the 70 km long commonly used snow mobile tracks that form the observation round around Longyearbyen. 53% of all the recorded avalanches stopped in the mountain sides with between 20 deg. and 30 deg. inclination, 30 % made it down to between 10 and 20 deg. inclination, while 10% made it down to less than 10 deg. inclination, putting the snow mobile routes at risk. Two meteorological stations were operated in snow avalanche terrain in 2008 for detailed meteorological studies enabling more information on physical exchange processes between the snow and the atmosphere. Detailed geomorphological mapping were carried out in the Todalen area mainly by our NGU CRYOSLOPE Svalbard partner in summer 2008. See **www.skred-svalbard.no** for more details and updates on the CRYOSLOPE Svalbard project.

Towards the end of 2008 we have finished our operation of the International Permafrost Association (IPA) Secretariat, which Herman Farbrot coordinated until August 2008. However, Hanne Christiansen is now one of the Vice Presidents of the IPA.

As part of the IPY extra ordinary activities we organized the AG-212 "Holocene and Modern Climate Change in the High Arctic - Svalbard REU" in close collaboration with US colleagues, who were the main responsible for this course. This allowed 3 UNIS undergraduate students to spend one month in the field at Kapp Linné and write a synthesis report in the following semester.

Doug Benn continued to pursue his research into the dynamics of calving glaciers with UNIS Ph.D. student Monica Sund, as part of the IPY Project GLACIODYN ("Dynamic Response of Arctic Glaciers to Climate Change"). He also continued researching into glacial drainage systems with University of Florida - UNIS Ph.D. student Jason Gulley. Ice caving fieldwork was carried out in Paulabreen-Bakaninbreen in the spring and autumn seasons, and in Hansbreen in the autumn. The latter work forms part of the ongoing collaboration with Polish researchers based at Hornsund. In addition, ice caves in Longyearbreen and Scott Turnerbreen were studied by master students Maria Temminghof and Katleen Van Hoof.

On the teaching side, AG-325 "Glaciology" continues to be popular, attracting 25 students in spring 2008. Benn attended several conferences and meetings in 2008. He was an invited speaker at the International Geological Congress in Oslo, and at the Workshop on Progress in Polar Research: "Nature of response of Arctic glaciers to climate warming" in Warsaw. In addition, he presented papers at the European Geosciences Union conference in Vienna and the International Glaciological Society symposium on Glacier Dynamics in Limerick, Ireland.

Ph.D. student Monica Sund continued her work on the GLACIODYN project. During 2008 field measurements were on several glaciers. On Kronebreen calving and velocity measurements are collected from terrestric photogrammetry, while on the surging Kroppbreen both GNSS and GPR were carried out. In spring also a new surge was found on Comfortlessbreen and cameras were put out to monitor the development. Additional 50 previously not described surges were found from DTM comparison and remote sensing.

Anne Hormes and the Quaternary geology group continued their multi-disciplinary research in the field of paleoglaciology, paleoclimatology, remote sensing, landscape and environmental reconstruction. Anne Hormes organized a dedicated session at the American Geophysical Union meeting in December 2008 "Progress in Quaternary Geochronology in Polar Regions" in collaboration with Meredith Kelly, Lamont-Doherty Earth Observatory of Columbia University, and Claire Todd, Pacific Lutheran University. The session was a success with 8 cutting-edge oral presentations given by leading geochronologists and 18 poster presentations. Ice sheet reconstructions from Nordaustlandet during the last ice age were presented during the session. Cosmogenic nuclide dating offers new avenues to reinvent the hypothesis of the maximum ice coverage on Svalbard and the adjacent Barents Sea. Most likely the ice coverage was more extensive during Mid-Weichselian than during Late Weichselian on northern and western Nordaustlandet.

The results of a collaboration project with Dave Beilman, Paula Reimer and Maarten Blaauw (^{14}Chrono Centre for Climate, Environment and Chronology at Queen's University Belfast) were presented as well. Peat deposits from Svalbard can be used as high-resolution archives for carbon accumulation and regional temperature. Svalbard has experienced highly dynamic changes of carbon storage over the last 6000 years including multi-millennial periods of shutdown in carbon accumulation.

Ph.D. student Endre Før Gjermundsen conducted successful field campaigns in Atomfjellet and in NW Spitsbergen. In Atomfjellet 20 erratic boulders, tors and bedrock sites along the east side of Austfjorden were sampled. In Northwest Spitsbergen 26 samples from below and above recognized trimlines and 9 samples from glacially transported boulders were taken. ASTER satellite images were used successfully during the field campaigns in order to find potential trimline sites. Preliminary cosmogenic nuclide dating results are awaited for spring 2009. Progression of his Ph.D. project is published on **www.icebound.no**.

Master student Willem van der Bilt (Utrecht University and UNIS) has made extensive progression with his work on post little Ice Age environmental change documented in lake sediments from Kongressvatnet, Spitsbergen. His work focuses on biological, sedimentological and geochemical data in order to assess recent regional environmental change in Western Spitsbergen.
In spring 2008 the two longest lake sediment cores ever on Svalbard were retrieved from Kongressvatnet in a collaborative effort of Al Werner (Mount Holyoke College, USA), van der Bilt, Jørgen Haagensli (UNIS logistics) and Anne Hormes.
Willem works mainly on two short cores that were retrieved from Kongressvatnet and his investigation concentrates on diatom analysis.

In autumn 2008 the Marie Curie Training Network "NSINK – Training in sources, sinks and impacts of atmospheric nitrogen deposition in the Arctic" was funded by the European Framework programme 7.
This project is lead by University of Sheffield and will study the enrichment of Arctic terrestrial and aquatic ecosystems by reactive atmospheric nitrogen. In December 2008 Trine Marianne Holm started her Ph.D. within NSINK at the Institute of Ecology, University of Innsbruck with supervisor Karin Koinig and as external UNIS Ph.D. student under supervision of Anne Hormes. Trine will constrain history and drivers of physico-chemical conditions throughout the late Holocene by examining the Kongressvatnet lake sediments, Trauvatnet lake sediments that were recovered in 2007, and additional lake sediment cores from the surrounding of Ny-Ålesund. Collaboration with other scientists that study lake sediments on Svalbard has been established: Sofia Holmgren, Göteborg University; Ólafur Ingólfsson, UNIS and University of Iceland; and Alex Wolfe, University of Alberta, Canada.

Riko Noormets started as a marine geologist at UNIS in April 2008. In 2008, he organized and/or participated in two marine geological/geophysical cruises to the continental margin and the fjords of West Spitsbergen. His research interests are in the reconstruction of past ice sheet configuration and ice stream activity with the focus on the marine-based ice sheets, which are/were a considerably more unstable component of the climate system than their land-based counterparts.

In 2008, his work was focused on the three major ice-streams that drained the West Antarctic and Antarctic Peninsula Ice Sheets across the western shelf of Antarctic Peninsula - the Marguerite, Belgica and Pine Island Bay Ice Streams. Riko and co-workers studied the submarine landforms and sedimentary processes at the shelf edge through glacial-interglacial periods, and the significance of subglacial meltwater on the streaming ice using marine geological/geophysical data, including unique datasets obtained by the British ROV Isis in 2007. These activities are part of the ongoing collaborative efforts with colleagues from the UK (Universities of Cambridge, Loughborough and Durham, and the British Antarctic Survey).

First results based on a 2006 cruise on the ship James Clark Ross to the eastern and northern Svalbard margins suggest considerably different dynamics of the former Svalbard-Barents Sea Ice Sheet east of Spitsbergen than previously thought. Discussions on the planning of follow-up investigations in the northern part of the Barents Sea have been initiated with colleagues at the universities in the UK and Norway. Riko also has an interest in the modern morphodynamics and sediment transport processes, focusing on the Iberian shelf of the Spanish Atlantic continental margin. This work is conducted together with colleagues from the University of Granada in Spain.

Maria Jensen started as a sedimentologist at UNIS in June 2008. In 2008, she was teaching AG-209 and participated in field work both on Spitsbergen and in Northern Russia. Her research interests are in the sedimentary arrangement of shallow marine to tidally influenced fluvial deposits, both in front of past ice sheets as well as in modern and past systems.

Alvar Braathen focused on three projects in 2008; Longyearbyen CO2 lab, Palaeokarst in Billefjorden, and the Mediumfjellet fold-thrust stack. The "Palaeokarst in Billefjorden" project is currently creating a 3D reservoir-analogue model from superbly-exposed kilometer-scale stratiform and cross-cutting collapse-breccias, and backed by a high-resolution digital elevation model from helicopter laser scanning. The work is conducted within a large network of collaborating institutions and researchers, with the Centre for Integrated Petroleum Research (CIPR) at the University of Bergen in the leading role and UNIS handling the logistics. In 2008, more than 20 researchers and students performed outcrop and geophysical studies in the inner Billefjorden area. One major activity was the helicopter-based laser scanning of the area, which was performed in August 2007. These data are compiled into a high-resolution digital elevation model (DEM).

The "Mediumfjellet fold-thrust stack" project study the different structural styles and the processes responsible for uplift of Svalbard in the Early Cenozoic. The project is testing structural timing, kinematics and processes of fold-thrust belt development as a basis for analogue modeling and high-resolution strain modeling. Master student Tine Larsen of the University of Tromsø and UNIS continued her outcrop studies in the area.

The Longyearbyen CO2 lab project continued its high-profile activity aimed on identifying potential reservoirs near Longyearbyen. The longer perspective is to develop one or more of the reservoir(s) into a CO2 injection laboratory, with the ultimate aim to utilize it as a permanent CO2 storage site. During 2007 and 2008, three wells were drilled to 403 m, 500 m and 860 m, respectively. Drill cores and outcrop data have been compiled, and the cores have been carefully examined with respect to petrophysical properties. Some promising results have been encountered, and a forth drill hole in 2009 is aimed on the main reservoir at c. 900-1000 m depth. This drilling will be critical for the final assessment of a CO2 storage site.
See **http://co2-ccs.unis.no/** for details around the project.

August 2008: The AG-333 group enjoying life outside the Zackenberg Station in Northeastern Greenland. This is the first time a UNIS course has conducted field work in Greenland.

Photo: Hanne H. Christiansen

Ph.D. student Karoline Bælum has continued her involvement in several projects including the Palaeokarst in Billefjorden, and the Longyearbyen CO2 pilot study. The main focus has been on processing of seismic data in connection with the CO2 project, a regional study of the Billefjorden lineament, and processing and interpretation of radar and EM data. The majority of the field work was undertaken in connection with seismic acquisition for the CO2 project in April and the Palaeokarst project in Billefjorden in July/August.

Professor William Helland-Hansen was on sabbatical from the University of Bergen, spending the period between august 2007 and June 2008 at UNIS. His main aim was to write scientific papers: He succeeded, with 8 papers currently in press and 4 more in preparation stage. During his stay at UNIS, he supervised master student Stig Atle Kvinen Stene, and also started new field based master projects in Nordenskiold Land during the summer of 2008 (2 students). As part of his adjunct position at UNIS, William taught AG-323 "Sequences stratigraphy- a tool for basin analysis" in July and August 2008.

GRADUATES 2008:

Ph.D. degree:
Charlotta J. Lüthje: Transgressive Development of Coal-bearing Coastal Plain to Shallow Marine Setting in a Flexural Compressional basin, Paleocene, Svalbard, Arctic Norway.

Master degree:
Martin Machiedo: Crevasse-fill ridges as morphological legacy of a polythermal surge-type glacier.

Tatsuya Watanabe: Distribution and Structure of Ice and Soil Wedges in Svalbard, Sounded with the Ground-Penetrating Radar.

December 2008: The ICI-2 rocket sets off from its launch pad in Ny-Ålesund. The rocket's mission was to fly through the Aurora Borealis, and it reached a height of approximately 330 kilometers, before it landed in the ocean after a 10 minute flight.

Photo: Preben Hanssen

arctic geophysics

By Carl Egede Bøggild

The department have in total of seven full time faculty positions, and have established research within oceanography, meteorology, middle and upper polar atmosphere. The department also consisted of six adjunct professors, as well as one post doc (oceanography) and four Ph.D. research fellows (upper polar atmosphere, middle polar atmosphere, oceanography and meteorology).

One position in middle atmosphere is presently unfilled. Announcement for filling the position has been made and the department awaits a candidate to fill the position.

Teaching was conducted at both undergraduate and graduate level, with seven and five courses respectively. An important part of all courses is the field work, which allows the students to operate research equipment in the field. During 2008 the department has carried out several ship cruises and a glacier course with teaching of field methods. The data collected are then typically used in course reports, giving the students valuable experience in analysing and presenting scientific data in a coherent manner.

The year of 2008 has been a very busy time for the Arctic Geophysics department. After the official opening of the Kjell Henriksen Observatory (KHO) in February 2008 we have successfully completed the first observing season. Later UNIS signed a collaboration agreement with the EISCAT Scientific Association who operates the EISCAT Svalbard Radar (ESR). In 2008 UNIS also became the official owner of the Space Plasma Exploration by Active Radar (SPEAR) facility. This piece of advanced research infrastructure is also located on the mountain Breinosa (Mine 7), in the vicinity of both KHO and ESR. SPEAR was built in 2004 by the Radio and Space Plasma Physics group at the University of Leicester, UK. But recently Leicester decided to give SPEAR to UNIS. At the same time UNIS received all remaining funds that were put aside for decommissioning. To keep the momentum up, UNIS used these funds to run our first SPEAR campaign. It was successfully completed in October 2008. At the same time UNIS requested additional funding from the Research Council of Norway (RCN) to cover future SPEAR operations.

In December 2008 we were pleased to learn that our proposal "SPEAR - a high power ionospheric modification facility for Svalbard" will be funded via the RCN program FRINAT from July 2009 to June 2012. In addition to operation costs, that project will also cover a full post doc position and a 50% engineering position.

In 2008 the space physics group at UNIS were involved in two large successful sounding rocket campaigns. In January the NASA SCIFER-2 (Sounding of the Cusp Ion Fountain Energization Region -2) rocket was launched from Andøya rocket range and reached an apogee of 1460 km over Svalbard, with all instruments functioning nominally. In December the UiO initiated ICI-2 (Investigations of Cusp Irregularities-2) rocket was launched from Ny-Ålesund. Both sounding rockets met their science objectives, and data from both campaigns are now being analyzed. They were also both launched during solar minimum conditions, as we were in a low in the 11 year solar cycle. Less activity on the Sun, means less auroral activity, and provided an extra challenge to meet the expected launch conditions. A new Ph.D. student, Åsmund Skjæveland, co-funded by the PROEM project (Norwegian Research Council project) and by UNIS and UiO, joined us in 2008. He will work on problems related to electron precipitation, Joule heating and heat flow thru plasma species.

In physical oceanography, main focus has been on field work related to ongoing Norwegian IPY projects. Associate professor Frank Nilsen is PI in the two largest Norwegian IPY projects, IPY iAOOS-Norway and IPY BIAC. New instruments and subsurface moorings were deployed around Svalbard in September-October 2007 and retrieved in September 2008. The retrieved data will be used to study the dynamic of the West Spitsbergen Current and its effect on the water mass and sea ice distribution in the Arctic Ocean (iAOOS), and to study ice production and deep-water formation in the Barents Sea and its effect on the thermohaline circulation (BIAC). These projects also fund a post doc position in physical oceanography.

In 2008, a paper have been published on the dynamics of dense water formation in Storfjorden based on winter campaigns lead by UNIS. In another paper, based on the air-ice-ocean data collected in the fjords around Svalbard, an ice growth and ablation model was tested. Properly describing heat and salt flux at the ice/ocean interface is essential for understanding and modelling the energy and mass balance of drifting sea ice.
A description of the physical oceanographic conditions in Isfjorden and the adjacent continental shelf were published in another paper. Here we show that the ice production in Isfjorden controls the year to year variation in the water mass exchange with the continental shelf areas. This controls the amount of warm and salt Atlantic water in Isfjorden, which again determines the biological diversity during summer/autumn and the fast ice cover in Isfjorden during winter. Sigurd Henrik Teigen, a Ph.D. student at UNIS, has developed an model explaining the mechanisms for transporting warm and salt Atlantic water from the West Spitsbergen Current further west and onto the continental shelf.

One of the focus areas in meteorology is air-ice-sea interaction and in January 2008, instruments for long-term measurements of momentum and heat fluxes were installed in a 30 m mast at the shoreline of Isfjorden. The measurements from this site will contribute to a better understanding of the exchange processes between the sea and the air, with and without sea ice, something which is crucial for improving weather and climate models in the Arctic. As part of this focus area, Eeva Mäkiranta completed her master thesis, in which she studied the atmospheric boundary layer over sea ice in Wallenbergfjorden in northern Svalbard.
The project "Climate change effects on high arctic mountain slope processes and their impact on traffic in Svalbard" (CRYOSLOPE Svalbard), is a three year project (2007-2009) funded by the Norwegian research council (Norklima). The meteorology group's focus is on meteorological monitoring and surface exchange processes with the aim to better understand the connection between avalanches and weather.

The meteorology group also works with what controls the climate on a local scale with varying topography and surfaces such as tundra, snow, ice etc. In the field of snow- and ice processes research activities has concentrated on two focus areas, namely melt water refreezing in snow and ice and the effect of micro particles from aerosols on darkening and hence melt rates of glaciers. Detailed field measurements have been carried out during the summer of 2007 in collaboration with Norwegian Computing Centre and university of Sheffield on the way particles flocculate on ice. Preliminarily results show that flocculation is by microorganisms that cause the glacier albedo to increase.

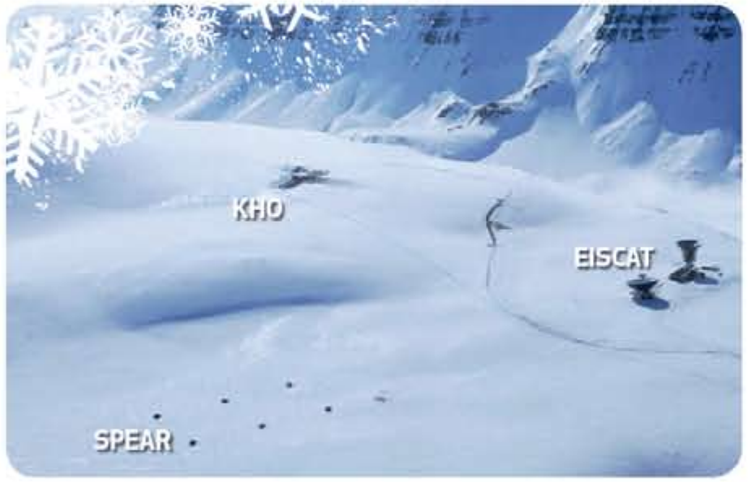
A research project in collaboration with several international research institutions focus on the fresh water discharge from the Greenland ice sheet. The research project FreshLink funded by the Danish Research Councils and the Danish Ministry of Climate focus on that linkage between fresh water discharge from the ice sheet and marine circulation in the fjord. Presently research institutions from Norway, Denmark, Greenland and United States are involved.
The components of the research projects are fjord oceanography, land hydrology, ice sheet research, marine geology, and geodetics.
The running hypotheses of the project is that more fresh water will enhance fjord circulation and hence result in increased marine production, i.e. climate change marine resources are likely to increase.

GRADUATES 2008:

Master degree:
Ragnhild Lundmark Daae: Long periodic vorticity waves in Kongsfjorden

Eeva Mäkiranta: Observations of Atmospheric Boundary Layer over Sea Ice in a Svalbard Fjord.

Dorothea Schulze: Transport pathways for atmospheric pollutants into the Arctic



October 2008: The Mine 7 Mountain is the home of impressive research facilities like the Kjell Henriksen Observatory, SPEAR and Eiscat. They offer a unique opportunity to study the upper and middle atmosphere and its role in a changing climate. The facilities on Mine 7 Mountain are a major building block in SIOS.

Photo: Anja Strømme

April 2008: Arctic Geophysics students set up a weather mast on the sea ice in Van Mijen fjorden.

Photo: Kjersti Lundmark Daae

May 2008: Arctic Technology staff and students prepare for an oil experiment on the sea ice.

Photo: Lucie Strub-Klein

arctic technology

By Aleksey Marchenko

The Arctic Technology department offers state-of-the- art education and research opportunities in Arctic Engineering as well as in Arctic Environmental Technology and Chemistry. Arctic Engineering concentrates on engineering problems to be tackled when setting in the Arctic Environment: living and building on frozen ground that may be subject to landslides and avalanches (Geotechnics), Arctic offshore oil and gas exploitation (Ice Mechanics, Geotechnics), and potable water supply (Hydrology). Arctic Environmental Technology and Chemistry concentrates on current and potential pollution problems, environmental impacts and feasible remediation techniques in Arctic areas.

The technological challenges deriving from increased human activity in the northern marine environments, as well as locally here on Svalbard, continue to be our main focus. This research priority is also including climate change related topics in education and science. The faculty staff continued to work on established relevant research programs at UNIS and new studies were initiated.

Arctic Engineering

The key topics within Arctic Engineering are permafrost and ice. We perform field studies, mathematical modeling and numerical simulations of thermo-mechanical response in relation to onshore, coastal and offshore infrastructure. The main sites of our investigations are Longyearbyen, the Van Mijen fjorden, Svea and North-West Barents Sea. These research directions also include climate change related aspects. In this context, UNIS Arctic Engineering scientists monitor ground temperatures when the permafrost is influenced by human activities and investigate how the temperature changes influences the strength and stiffness of the soil material.

In addition they seek improved solutions for foundations, road structures and routes, i.e. generally try to find ways to minimize the problems the frozen ground poses to engineering activities when establishing infrastructure in cold regions. Students joining the courses and research activities in frozen ground engineering may involve themselves into engineering problems related to frozen ground and the utilization of this ground for infrastructure like foundations for building, roads, quays, pipelines, transmission lines etc. Recent activities are development and monitoring of environmental friendly quays and constructions for preventing coastal erosion, monitoring the actual condition of different foundations of buildings, collecting information from fragmentary site investigations, judging threats from snow avalanches and slow or faster soil movements in the form of landslides or severe creep of slopes and investigating the conditions of the dikes holding the water supplies for Longyearbyen.

The development of mines as well as community related infrastructure and harbour facilities in Longyearbyen, as indeed in the Svea community, poses important scientific and engineering tests for our staff and students. The ice coverage in the Van Mijen fjorden is usually stable through the season, allowing us to perform seasonal studies on sea ice without risks. Several unique medium- as well as large scale experiments have been performed on the ice, close to the Svea community, over the past years during a set of international co-operation projects. These experiments brought together a unique combination of real sea ice measurements and load determinants. Hydrological and ice conditions on the Van Mijen fjorden were monitored and in-situ ice stresses were investigated. The main focus within this topic was to investigate how environmental variables (meteorological and hydrological) determine ice conditions in natural environment and near industrial objects (coal quay Kapp Amsterdam). In the Barents Sea we performed our annual field studies and measurements of sea ice ridges, icebergs, sea currents, temperature and salinity of the water in ice adjacent layers and inside ridge keels. We also deployed ice tracking buoys to monitor ice drift in the Western Barents Sea with high spatial and temporal resolution. Ice samples collected during field work were tested for the strength properties and structure in the UNIS cold laboratory. Laboratory experiments were used also to study the friction between ice and rough steel surfaces and to study freeze bonds formation between submerged solid ice blocks. This activity is a part of a combined scientific and educational program were students participate in state-of-the-science research activities as part of their project work.

Researcher Nataly Marchenko is working for the collection of ice pilot experience from sealers for the construction of data base of incidents with ships in ice conditions in the Russian Arctic. The work is supported by PetroArctic project. She also administrates two RCN projects supporting scientific exchange of students (Ph.D. and M.Sc. level) as well as scientific personnel between Russian and Norwegian academic institutions involved in research in the European High North.

Several Ph.D. projects are related to the research of ice influence on shore line and elements of quay structure in Van Mijen fjorden. As an example, Fabrice Caline is studying the design of environmentally friendly shore protection structures.
The project is supported by the coal mining company Store Norske (SNSG) and RCN. Field work for this Ph.D. project was finished in 2008.

Sebastien Barrault's Ph.D. project is focused on the study of mechanical deformations of land fast ice due to temperature variations and tides. Special membrane sensors were frozen in the ice in different locations of Van Mijen fjord and in Austfjorden for the measurements of internal stresses in the ice. Barrault also used the same sensors to study the relaxation of stresses inside the ice created by borehole jack. The experiments have been carried out on the ice in the Barents Sea. In parallel ice temperature, salinity and density are measured as state parameters of sea ice. This project, supported by Total Norge, will finish by the end of 2009.

The Ph.D. project of Lucie Strub-Klein is related to the study of physico-mechanical properties of sea ice ridges. Samples from several ice ridges in the Barents Sea and Fram Strait were tested for the uniaxial compressive strength. Porosity of these ice ridges was reconstructed by the drilling profiles. Thermistors strings were used to measure long term evolution of temperature profiles in ice ridges in Van Mijen fjorden. The project is supported by the PetroArctic program.

Ph.D. student Louis Delmas is studying the geotechnical and climate related mechanisms leading to increased snow avalanches releases under the special Arctic conditions. The effect of permafrost on the temperature gradient in the snow pack is studied in the field around Longyearbyen. Special equipment for the measuring of shear stresses in snow is constructed and tested in the field. Compressive strength of snow samples is measured in bi-axial tests in the UNIS cold laboratory.

The Ph.D. project of Aleksey Shestov is supported by SIU and UNIS and has started in September 2008. The project is focused on field studies and mathematical modeling of sea ice growth and ice influence on seabed and quay constructions. Filed works carried out in 2008 included measurements of sea currents and temperature in ice adjacent layers in the Barents Sea and in Van Mijen fjorden with using of Acoustic Doppler Velocimeter ADV SonTek and Sea-Bird temperature and pressure recorders.

Environmental Technology and Chemistry

Key topics within Environmental Technology include: The fate of oil spills in an Arctic environment and possible countermeasure and mitigation strategies as well as development of sustainable remediation techniques; levels and spreading of persistent organic pollutants and their behaviour in the Arctic environment (Polychlorinated biphenyls, current used pesticides and organochlorine pesticides in Arctic biota, sea water, ice and snow as well as lake sediment and sea weed); and the spreading and effects of pollution from local mining industry. Oil spills in a High Arctic environment can be expected to behave significantly differently than oil spills in warmer waters, like the North Sea. The differences in spreading, evaporative loss, emulsification, dispersion and other factors add up to important modifications in operational oil spill contingency planning. There is a range of potential sources of oil spills in and around Svalbard, including fishing boats and freighters, tourist vessels, and leakage or seepage from oil depots on land.

The Arctic technology department (Environmental Technology) is involved in a new EU-initiative (7th Frame work programme) on fate and behaviour of persistent organic pollutants (POPs) in the Arctic under changing climate conditions (ArcRisk). The initiative will start in May 2009 An UNIS Ph.D. position is integrated into this research project. The PhD student is expected to start the research work already during May 2009.

As a part of her Ph.D. project, Monika Trümper performed combined laboratory and field experiments on photochemical transformation processes of persistent organic pollutants on ice and snow surfaces under Arctic conditions. In addition, the Environmental Technology division has conducted comprehensive experimental work within two research project financed through the research Council of Norway (RCN) for the investigation of pharmaceutical residues in sewage treatment processes under different Climate conditions and the environmental behaviour of perfluorinated flame retardants in off-shore fire fighting foams (AFFF), respectively.

Another research topic in Environmental Technology includes the environmental control of acids and metals being released (known as acid mine drainage) from mine waste rock dumps and the impact of metals as these accumulate in soil, disperse within the hydrological system or taken up by plants. As an extension of this program, a Ph.D. study on self incineration processes in waste dumps from coal mining activities is now underway with close co-operation with Russian (Barentsburg) and SNSK (Svea) co-operation partners. The project is conducted by Jørgen Hollesen (University of Copenhagen, Denmark).

Project co-operation

In 2008, the Arctic technology department continued with two RCN projects supporting scientific exchange of students (Ph.D. and M.Sc. level) as well as scientific personnel between Russian and Norwegian academic institutions involved in research in the European High North. The projects "NorthPOP" and "Safe loading and transport of hydrocarbons from the Barents sea" (see detailed information on the UNIS webpage) are currently co-ordinated through the UNIS Arctic Technology department. In 2008, two workshops (St. Petersburg, MS-seminar in Tromsø) were organised through the NorthPOP initiative, and one workshop (St. Petersburg) was organized through SafeLOT initiative. In co-operation with Carl E. Bøggild (Geophysical department), Environmental Technology is involved in the FreshLink initiative, to establish freshwater inflow budgets into East Greenland Fjord system. From 2008 the Arctic technology department is involved in the project "Marine Safety Management in the High North" together with total 18 participating companies including the Norwegian Research Council, represented by the MarOff program.

GRADUATES 2008

Ph.D. degree:

Liv-Guri Faksness: Weathering of oil under Arctic conditions. Distribution and toxicity of water soluble oil components dissolving in seawater and migrating through sea ice. A combined laboratory and field study

Jens Søndergaard: Contamination from Arctic coal mining

Master degree:

Dag Theodor R. Andreassen: Geosynthetic bags used for erosion protection of a quay at Kapp Amsterdam

Ole-Christian Ekeberg: Sea ice creep – laboratory tests on creep

Tone Grangård Helland: Selected pharmaceutical residues in Norwegian sewage effluent and the adjacent aqueous environment

Øyvind Skeie Hellum: Ny veg til Gruve 7: snødrift og skredsikring

Thue Weel Jenssen: Snow surface exchange processes for persistent organic pollutants (POP's) and currently used pesticides (CUP's) in theArctic cryosphere: a comparative study on pollutant exchange processes at Summit (Greenland) and Ny-Ålesund (Svalbard)

Marit Bratland Pedersen: Ny vei til Gruve 7: veibygging på permafrost

Aleksey Shestov: Physical and mechanical properties of fast ice depending on under ice current properties

Magne Wold: Efficient soil investigative methods on permafrost: method testing

student council

By Nial Peters (SC leader autumn 2008) and Andrea Schmidt (SC leader spring 2009)

As with all universities, the welfare of the students at UNIS plays a crucial role in its success. However, the unique location of UNIS brings with it a large number of welfare issues not encountered at other institutions. Tackling these issues requires a close bond between staff, students and the local community of Longyearbyen. As such, the student council at UNIS strives to promote communication between these three parties, connecting students with the relevant people or, where appropriate, acting on their behalf.

Internal links to UNIS are maintained by representatives in both the UNIS board, and in the leader group at UNIS. These representatives are the students voice in the organization and have a say in all matters that concern both students and UNIS as an institution.

Whilst no 'hard' links to the community outside of UNIS exist, the Student Council strive to promote student participation in community events such as "Ta Sjansen" and the local sports club "Svalbard Turn". Participation encourages students to socialise with local people and aids integration into the community.

In addition, the Student Council gathers all students together to allocate some responsibilities of a more practical nature.

The budget allocated by UNIS for student welfare is used to provide and maintain many facilities for students' use. These include outdoor equipment such as skis, sledges, camping gear, safety equipment, kitchen utensils, and two student cabins. These facilities are used extensively by the students at UNIS, and being responsible for these services is perhaps the student council's most important role.

This year, the Student Council has also been active in motivating UNIS to take over the student housing responsibilities from Studentsamskipnaden in Tromsø. Accomplishing this would help localize student welfare issues to the already tightly knit UNIS community and would ease communication between student and housing provider.

With such a high turnover of students at UNIS, the student council must be dynamic, constantly changing its services to meet the demands of the new students and address their needs.

This is no easy task, and is perhaps the biggest challenge that faces the new Student Council team as it begins office every semester.

Some student representatives in 2008:

Spring:
SC leader: Daniels Karin Amby
SC vice leader: Nial Peters
SC treasurer: Louise Hutchinson
Board representative: Ragnhild Lundmark Daae

Autumn:
SC leader: Nial Peters
SC vice leader: Lars Koens
SC treasurer: Yann Rashid
Board representative: Borgar Aamaas

May 2008: Arctic Technology students take the plunge while on a field cruise in the Barents Sea.

Photo: Lucie Strub-Klein

scientific publications 2008

Scientific journal articles and chapters in books published with UNIS as author address in journals accepted by the Norwegian Association of Higher Education Institutions (UHR).

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Prevalence of *Yersinia* species in healthy free-ranging red deer (*Cervus elaphus*) in Norway.
The Veterinary Record 163 (1): 27-28

Askaer, L., Bjerre Schmidt, L., **Elberling, B.**, Asmund, G. & Jónsdóttir, I.S.
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Water, Air and Soil Pollution 195 (1-4): 99-114
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First record of *Folsomia bisetosella* Fjellberg, 2005 (Hexapoda, Collembola) from High Arctic islands.
Norwegian Journal of Entomology 55 (2): 129–130

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Polar Biology 31 (8): 913-924
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Deep Sea Research Part II: Topical Studies in Oceanography 55 (20-21): 2210-2224
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guest lecturers 2008

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August 2008: Aerial view of part of Longyearbyen and the Longyear valley, with UNIS located in the bottom of the picture.

Photo: Elise Strømseng

UNIS annual report 2008

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