UNIS

The University Centre in Svalbard

ANNUAL REPORT 2018

Front page | April 2018: AGF-211 students on their way over the sea ice in St. Jonsfjorden. Photo: Lars Henrik Smedsrud/UNIS.
Editor | Eva Therese Jenssen/UNIS.

Photo: Aleksey Shestov/UNIS.

FROM THE DIRECTOR

In 2018, UNIS delivered according to expectations of student-year production and share of students from Norwegian institutions. 772 students from 43 nations followed our teaching and 59 master students worked on their assignments. Overall, it corresponds to 218 student-years. A significant part of the deviation from the target number of 220 student man-years was due to a lack of student housing which meant that we could not fill up certain courses with qualified students who were on the waiting list. 51 % of the students came from a study program at a Norwegian university. 30 postdoctoral fellows and PhD students stayed at UNIS in 2018 and five dissertations were held.

2018 was also a demanding year financially, but the positive trend from 2017 was continued so that the results were somewhat better than budgeted. The year was characterized by strict financial management and further efficiency measures without impairing the quality and production of teaching. We still have a backlog in terms of maintenance and investment in building and operating equipment, which means there will be a demanding economic situation in the coming years as well.

An increasing student mass combined with limited student housing capacity has given the organization great challenges. The Arctic Student Welfare Organisation's plans for building new student housing in central Longyearbyen have faced a number of obstacles, but now seem to be approaching realization. The goal is that UNIS will no longer have students living in the avalanche exposed Nybyen.

UNIS had a great deal of research activity in 2018. The Svalbard Integrated Arctic Earth Observing System (SIOS) had its first year as an independent organization, and the Arctic Safety Center has developed according to the milestone plan both in terms of cost and progress. UNIS is also involved in the national project *Nansen Legacy*, which was granted funding from the Norwegian Research Council from 2018 to 2023. The partners here contribute with 50 % self-financing of a total budget of NOK 740 million. Furthermore, employees at UNIS were granted among many other two FRIPRO projects with funding from the Norwegian Research Council, one project in space physics and one in Arctic geology.

Harald Ellingsen is managing director at UNIS. Photo: Eirik Berger.

That UNIS projects win through in such a competition-oriented arena is very gratifying.

UNIS can further report on yet another high publication rate. A total of 171 publications in authorized publication channels and peer-reviewed journals have been registered in 2018.

UNIS will be a resource for the local communities in Svalbard. It includes employees, students and the knowledge they possess. Employees will live and work in Longyearbyen and contribute to the development of the institution and the society. As an educational institution, UNIS offer research-based and field-based teaching at a high level to young people from many countries, and through this helps to ensure the recruitment of competent labour for research, management and business development in and for Arctic areas. UNIS employees are also significant resource persons in connection with the evaluation of the avalanche danger in and around Longyearbyen, as well as contributing actively to local events such as Polarjazz, Svalbard seminar, Svalbard Ski Marathon, etc. These are tasks that UNIS will continue to take seriously in the years forward.

Harald Ellingsen
Managing director

EXCERPT FROM THE REPORT OF THE BOARD OF DIRECTORS FOR 2018

The University Centre in Svalbard AS (UNIS) was established as a state-owned limited corporation in 2002, wholly owned by the Ministry of Education and Research. This company replaced the original foundation established in 1994 by the Norwegian University of Science and Technology (NTNU), the University of Bergen (UiB), University of Oslo (UiO) and University of Tromsø (UiT).

Since 2011, UNIS AS has had an identical collaboration agreement with the eight universities on the Norwegian mainland. The enterprise's objective is to provide tuition and engage in research of a high international standard based on Svalbard's geographic location in the High Arctic and the special advantages this offers. The educational provision shall act as a supplement to the tuition offered at the universities and form part of the ordinary programmes of study culminating in degrees at Bachelor, Master and PhD level. The educational provision shall have an international profile, and all tuition shall be given in English. There shall be a balance between Norwegian and international students.

As the positive developments in 2017 continued in 2018, UNIS has now had two consecutive years with positive financial results. The student production at UNIS has levelled off and reached a total of 218 student-labour years, which represents a small decrease from 2017 when the institution produced 223 student-labour years. At the same time, balance was achieved between students from Norwegian and international study programmes. Some of the decrease may be attributed to a shortage of student accommodation during a critical period, which led to some courses not being filled.

The provision of student accommodation, which is managed by the Arctic Student Welfare Organisation, no longer meets the requirements during the most intense seasons. Furthermore, there is still concern that, according to the avalanche hazard report by the Norwegian Water Resources and Energy Directorate (NVE) in December 2016, the student housing in Nybyen is in an area prone to avalanches. The Arctic Student Welfare Organisation is now working on building new student housing in the centre of Longyearbyen and it is important for UNIS that this project is not delayed.

Collaboration with the Norwegian universities, which is based on collaboration agreements from 2011 and appurtenant plans of action, remains a high priority. As part of this collaboration, UNIS is working to develop the teaching into educational provisions that last a full semester to enable students to spend a full semester or year at the institution. The Board of Directors has high

October 2018: PhD student Siiri Wickström demonstrates how a weather balloon is operated to the children at Open Day in connection with the 25th anniversary celebrations. Both photos: Børge Damsgård/UNIS.

Young scientist in the making at Open day.

expectations for this process and believes it will be a win-win situation for all parties.

The teaching at UNIS shall be research-based, and UNIS wishes to strengthen its position as a strong international actor within in Arctic research. UNIS will continue its efforts in the research centres and major research projects in which it participates and seek to participate in new projects. Moreover, UNIS wishes to strengthen the externally funded component of its research.

UNIS will maintain focus on high-quality research and education in the Arctic. UNIS has developed a new educational provision through the *Arctic Safety Centre* project and wishes to further develop its role of supporting the local community in Longyearbyen.

The available space at Svalbard Science Centre is fully utilized. Several of the tenants require more space based on their current level of activity, and some wish to expand their activities. Furthermore, there is a strong level of interest from many academic environments and institutions in Norway and overseas concerning access to offices and logistics facilities. In 2018, UNIS in collaboration with the other tenants and key institutions in Longyearbyen, compiled a document outlining the requirements for increased activity within an expanded Svalbard Science Centre.

It is the Board of Directors' view that UNIS has taken new steps towards achieving its overall goal of being a leading international centre for Arctic studies and Arctic research.

EDUCATION AND STUDENT STATISTICS

UNIS' commission from the Ministry of Education and Research for 2018 was to "develop an educational provision that represents approximately 220 student-labour years". UNIS offered 98 different courses in 2018, which equated to an educational provision of 233 student-labour years, a reduction of 11 student-labour years from 2017 (244 student-labour years).

In 2018, 772 students from 43 nations spent shorter or longer periods at UNIS, including both course students and guest master's students. Of these, 51% came from programmes of study at Norwegian universities (Norwegian degree students), while the remaining 49% came from international universities. The gender distribution shows that 53% of the students were women. UiT – The Arctic University of Norway is the Norwegian university that sends the most students to UNIS.

A total of 218 student-labour years was produced at UNIS in 2018, of which 195 student-labour years were linked to credits (ECTS) from competed courses and 23 student-labour years linked to presence by guest master's students. This represents a decrease of 4.5 student-labour years from 2017. The decrease in production applies to student-labour years from completed courses. The Department of Arctic Geology experienced the largest decrease in terms of both educational provision and production, but despite this still has the largest educational provision and the highest credit production at UNIS. The Department of Arctic Geophysics experienced the largest increase in production since 2017. The results from the final assessment of the courses have been above average, with B as the average grade. The failure percentage has been low (1%), while the drop-out rate is relatively low; 6.5% of the students at UNIS dropped out or failed to attend the final assessment in the courses.

UNIS had 27 PhD candidates in 2018, and five public defences were held.

RESEARCH AND ACADEMIC INITIATIVES – EXTERNAL FUNDING

UNIS has ambitious goals for its research and participates in numerous initiatives aimed at establishing national and international centres and larger projects. Among other examples, the Department of Arctic Biology, together with the Norwegian Polar Institute, the Institute of Marine Research and several Norwegian and overseas universities, has submitted an application for a major research project to the EU's Horizon 2020 programme. From a purely research strategy perspective, the institution wants to be involved in larger scale and longer projects that give UNIS more maneuvering space. However, this also places new demands on the organisation. Consequently, the institution's Research Committee (RCom) is in the process of laying the foundations for ensuring the quality of applications and project implementation. UNIS is now introducing a registration system for all new applications, among other things. This system will ensure that applications are handled in the correct way and that from next year we can quantify the application activity.

UNIS wishes to ensure a robust research environment of high quality and contribute to the knowledge front on Arctic issues, generate innovations and business development both locally and nationally. The institution's research shall also support the research-based teaching. These are high ambitions for a small institution, but analyses of research indicators show that UNIS can deliver results. Collaboration with strong national and international academic environments through participation in research projects is an important tool for our own research, and it is only through such collaboration that we can further develop the institution.

The turnover from external activities at UNIS in 2018 was nearly NOK 43 million. This was spread over 62 projects of various sizes. *The Nansen Legacy* is now the largest project at UNIS and involves a lot of field activity and positions at the departments of Arctic Geophysics and Arctic Biology. We now confirmed several new, large-scale projects, including a new space research project for the Department of Arctic Geophysics, a project

August 2018: Managing director Harald Ellingsen welcomes their Majesties King Harald and Queen Sonja of Norway. Photo: Petter W. Sele/UNIS.

October 2018: Jan Tore Sanner, Minister of Education and Integration, enjoyed brunch together with UNIS students in Sjøskrenten.

Minister Sanner gets insight in the UNIS oceanographic research field by professor Frank Nilsen. Both photos: Eva Therese Jenssen/UNIS.

for the Department of Arctic Biology, a FRIPRO project and a climate gas project from the Research Council of Norway for the Department of Arctic Geology, and a two-year financial support for the Svalbard Rock Vault from 2019. UNIS has close organisational and administrative collaboration with Svalbard Integrated Arctic Earth Observing System (SIOS), which is now well underway and has participated in an InfraNOR project concerning oceanography and permafrost from 2018.

DISSEMINATION AND VISITS

UNIS receives considerable attention in the form of visits to the institution and media coverage. Around 1,000 people from Norway and overseas visited UNIS in 2018. Delegations to visit in 2018 included the Norwegian parliament's Arctic delegation and *Standing Committee on Education and Research*, the Italian Ambassador to Norway, The Royal Swedish Academy of Sciences, the Polar Research Institute of China, the *European Parliament's Committee on Foreign Affairs* and, not least, the Norwegian Royal Family, who visited UNIS in August in connection with our 25th anniversary celebrations.

The royal visit generated wide coverage in Norwegian and international media, but our students and staff also led to more than 200 media reports worldwide in 2018.

The actual 25th anniversary was celebrated over two days in October with seminars and an open day at the Svalbard Science Centre. These events were attended by the Minister of Education and Integration, Jan Tore Sanner, representatives from the Norwegian universities and university colleges and international guests.

August 2018: Her Majesty Queen Sonja presented the Royal anniversary gift to UNIS: A graphic print produced by the Queen herself. In the back (from left): UNIS director Harald Ellingsen, His Majesty King Harald and Longyearbyen Mayor Arild Olsen. Photo: Eva Therese Jenssen/UNIS.

In January, UNIS organised the annual Svalbard Seminars in collaboration with the Norwegian Polar Institute and the Governor of Svalbard. These popular science lectures attracted around 100 people to each of the five evenings the seminar took place. Svalbardkurset and Studietur Nord in the summer both received positive feedback.

STAFF

As of 31 December 2018, the academic staff at UNIS comprised of 13 professors, 15 associate professors, three researchers, two researchers, four post docs, 13 PhD candidates and 39 staff with adjunct professor/ associate professor attachments. The technical and administrative staff comprised 43 full-time equivalent work years. Women accounted for 50% of the technical and administrative positions, 49% of the academic positions and 53% of the students. Four of the 11 members of the Board of Directors were women. The Board of Directors is not aware of discrimination of any form at UNIS.

ORGANISATIONAL AND STRATEGIC DEVELOPMENT

Longyearbyen and Svalbard are undergoing a major transformation. A century of mining operations is about to end, meaning that Longyearbyen as an industrial society will soon be history. In time, many jobs will need to be replaced to secure the future family community. This coincides with the ongoing climate and environmental changes, which are creating major challenges as well as opportunities. Consequently, the Board of Directors has initiated a process aimed at achieving a revised overall strategy for UNIS in the course of 2019. A preliminary result of the strategic work is the establishment of two new positions at UNIS, a Vice-Dean for education and another for research.

STAFF HOUSING AND STUDENT FLATS

At year-end UNIS owned a total of 54 housing units. To cover the remaining needs, UNIS rents 32 housing units for staff from various actors in Longyearbyen. In addition, UNIS leases UNIS Guest House for guest lecturers and guest researchers.

The Arctic Student Welfare Organisation had 208 studio flats for students in 2018. These were used by both UNIS students and Arctic nature guide students from UiT – The Arctic University of Norway. This student housing is in Nybyen and adjacent to UNIS in Sjøskrenten. The landslide risk survey shows that student housing in Nybyen is in a landslide prone area. The Arctic Student Welfare Organisation has acquired land at Elvesletta and is planning a major construction project. A coordinated effort is underway concerning the subdivision work and building application.

It is essential for UNIS that the students have satisfactory living conditions, and the Board of Directors emphasizes a continuation of the good cooperation with the Arctic Student Welfare Organisation to ensure new safe student housing is realised as quickly as possible.

September 2018: Hanne Christiansen is appointed Vice Dean of Education and Børge Damsgård is appointed Vice Dean of Research. Photo: Eva Therese Jenssen/UNIS.

SOCIAL RESPONSIBILITY

UNIS shall be a resource for the local communities in Svalbard. 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 the institution and the community. Everyone shall engage themselves in the community's social and cultural life rather than starting their own clubs or societies. The staff at UNIS are important resources for the local community, including in connection with evaluating the avalanche risk in and around Longyearbyen and assisting with local events such as Polarjazz and the Svalbard Ski Marathon.

HEALTH, SAFETY AND ENVIRONMENT (HSE)

Absence due to illness at UNIS in 2017 was 2.7%. HSE has high priority, and the safety of our students, staff and visitors is an overarching consideration for the implementation of all activities at UNIS. We have special focus on the safe implementation of fieldwork and cruise activities in Arctic areas. In 2018, 84 field safety courses of various duration were attended by 1,288 people.

UNIS' location in the High Arctic provides special challenges in the entire HSE spectrum. It is especially important to take a proactive approach in our responsibility for the safety of our students and staff when travelling in the Svalbard nature. Quality assurance of the planning and implementation of field-based projects is implemented in a structured manner with strict requirements for work procedures and methods. Work at UNIS' laboratories is subject to the same quality assurance as work in the field.

UNIS cooperates closely with the local administration at the Governor of Svalbard and Longyearbyen Community Council to find good solutions, particularly in connection with UNIS' activity in the field. During 2018, UNIS has been responsible for supplying the snow data used to prepare local avalanche forecasts for Longyeardalen and Nordenskiöldland.

UNIS' internal regulations are based on the formulation of objectives from the Svalbard Environmental Protection Act, which states that in the event of conflict between the activity and the environment priority must be given to environmental considerations. UNIS works in a purposeful manner to ensure that the safety aspects associated with laboratory and field activities shall be governing for all activities.

UNIS is unaware of contamination of the wider environment to any significant degree due to the company's operations. UNIS works continually to limit the environmental impact of its activities.

ECONOMIC DEVELOPMENT

Funds for operation and investments at UNIS are appropriated in the budget of the Ministry of Education and Research. In 2018, the appropriations from the Ministry totalled NOK 132,349,000, of which NOK 101,473,818 constituted of base funding, NOK 6,269,242 of investments in equipment and NOK 24,605,940 rent/ operation of the Svalbard Science Centre and Kjell Henriksen Observatory (KHO).

Moreover, we received an additional allocation of NOK 6 million from the Ministry of Education and Research to upgrade equipment. This amount has been received but was not included as income in 2018. An equivalent amount is included in "other short-term liabilities" and will be included as income in full and spent in 2019.

Income over and above the appropriations from the Ministry of NOK 59,909,240 comprises NOK 42,753,470 in external research project income and NOK 17,155,770 in consultancy services and rentals.

The accounts for 2018 show an operating surplus of NOK 4,414,639. It is proposed that this be transferred to shareholder equity.

External net income has increased, and a satisfactory budgetary control has been established. However, there is still an uncovered need for maintenance associated with buildings.

BOARD OF DIRECTORS AND ANNUAL GENERAL MEETING

The Board of Directors held four meetings in 2018, including two meetings in Longyearbyen. A total of 60 items were officially discussed. The Annual General Meeting was held in Oslo on 14 June 2018.

TRONDHEIM, 13 MARCH 2019:

Chair Morten Hald (University of Tromsø), deputy chair Nina Frisak, Robert Bjerknes (University of Bergen), Kristin Vinje (University of Oslo), Øyvind Weiby Gregersen (NTNU), Siri Kalvig, Arild Olsen (Longyearbyen Community Council), Pernille Bronken Eidesen and Petter Sele (staff representatives).

BIOCEED

TEXT BY TINA DAHL, BIOCEED ADVISER

ABOUT BIOCEE D:
bioCEED has been a Centre for Excellence in Biology Education since 2014. bioCEED develops biology educations that fill future needs in science and society. This is achieved by connecting scientific knowledge, practical skills and societal applications throughout the biology education, and by bringing the strengths of the research culture into the educational practice.

bioCEED is a collaboration between biology programs at UIB (Department of Biology) and UNIS (Department of Arctic Biology), education science (Department of Education, UiB) and practical training (represented by The Institute for Marine Research, but including a range of private and public research, industry, and environmental management institutions), as well as our partners at home and abroad.

BIOCEED IN 2018

bioCEED works on several platforms and levels, and tries to interact with both students, teachers and higher administrative levels to improve both the way we teach, and the teaching framework and environment.

bioCEED has emphasized developing a **Scholarship of Teaching and Learning** (SOTL) culture and practice among our teaching staff. Focus is on sharing good practice, knowledge and communication around teaching and learning. bioCEED created a range of formal meeting places at UNIS, where staff can collaboratively develop their pedagogical knowledge, skills, and discuss their experience. Meeting places are seminar series, workshops and sharing sessions as well as the yearly Learning Forum. Both external invited speakers and in-house teaching staff contribute at those occasions through educating, sharing, discussing and receiving feedback from colleagues on some teaching ideas. A wide range of themes was discussed, including student-active assessment, process evaluation, use of students as field teachers, internship courses, practical teaching in lab and opportunities to apply for support for fields and research-based teaching. bioCEED has contributed to a cultural shift in the way staff approaches teaching. We are now talking and debating teaching and learning more and we also do this at more informal settings.

The SOTL culture also focuses on using scientific methods to analyse the effect different ways of teaching has on students' learning progress. THE big event for bioCEED in 2018 was to host the International Society for the Scholarship of Teaching and Learning (ISSOTL) conference in Bergen. The ISSOTL is one of the major international SOTL societies, and the society's 2018 annual conference brought 680 researchers and students from around the world together, including a record of 160 Norwegian participants. The theme was "A Learning Culture". Staff from UNIS was involved in both organizing, hosting and contributing with posters, talks and in workshops throughout the event.

bioCEED works on strengthening educational leadership and build organisational structures that support a scholarly teaching culture, and provides visibility and recognition to quality teaching - both locally, nationally, and internationally. At the institutional level, the implementation of University of Bergen's reward system for Excellent Teaching Practitioners (ETP) at UNIS made it possible for full time UNIS staff to apply for ETP status in 2018.

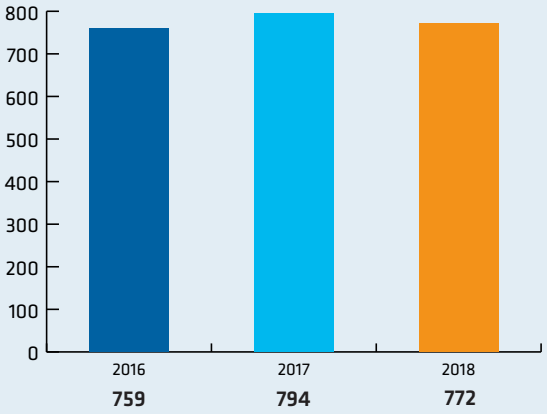
bioCEED has initiated and run the National Forum for Educational Leadership in Biology in close collaboration with Biofagrådet. It is an area for exchange of leadership ideas and experiences on current practices and trends in educational leadership relevant to all biology departments at Norwegian universities. The annual meeting took place in early spring 2018 at UNIS. The forum-topic this year was on pedagogical training and development for staff and the role of leaders to motivate, provide opportunities, and create a collegial culture for continuous development, sharing and exchange.

Students are actively involved in bioCEED, and the bioCEED student representatives at UNIS continued to develop a student-driven and NOKUT-funded project, *bioBreakfast*. It is a meeting place for bachelor-, master- and PhD students, where biology students can exchange knowledge and experiences related to education and further working life. In 2018, students from the other three departments were included in bioBreakfast with great success and this has contributed to the exchange of experience between students across the departments. The student representatives in bioCEED also arranged a number of student seminars with topics within statistics, research dissemination, oral presentation techniques, and invited resource persons at various relevant workplaces to provide a brief introduction to the workplace and work tasks and which qualifications employers look for when hiring biologists.

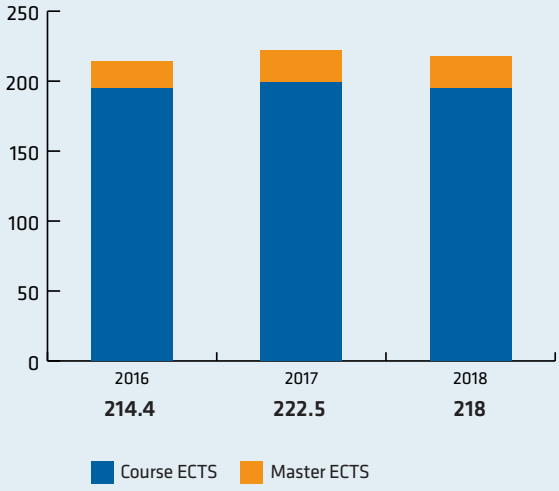
Want to know more about bioCEED? Check out the monthly newsletter that is distributed to all employees at UNIS or the bioCEED web-page (https://bioceed.w.uib.no/).

STATISTICS

TOTAL NUMBERS OF STUDENTS

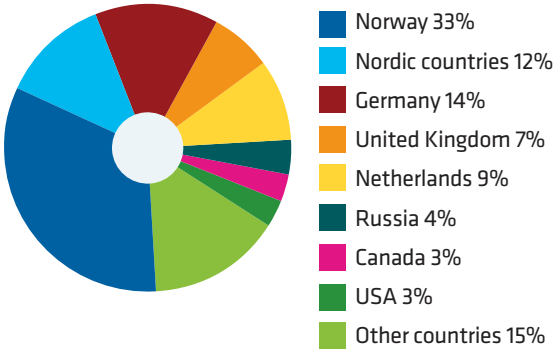


PRODUCTION IN STUDENT-LABOUR YEARS (1 YEAR = 60 ECTS CREDITS)

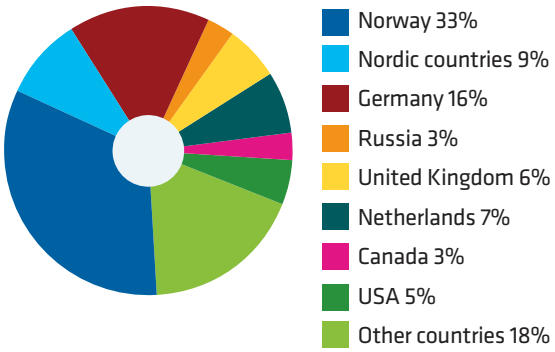


Note: UNIS registers ECTS by 1) course production and 2) master students attendance

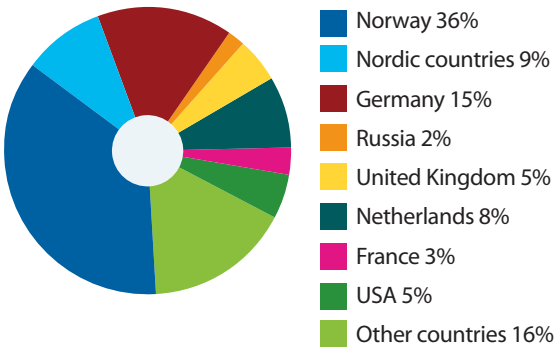
STUDENT NATIONALITY 2016



STUDENT NATIONALITY 2017



STUDENT NATIONALITY 2018



PROFIT AND LOSS ACCOUNT 2018

GROUP*			University Centre in Svalbard AS	
2018	2017		2018	2017
NOK	**NOK**	**OPERATING INCOME**	**NOK**	**NOK**
132 349 000	128 870 000	Operating grant from the Ministry	132 349 000	128 870 000
2 743 533	75 000	Other grants	2 743 533	75 000
-6 269 242	-1 007 128	Appropriation for investments	-6 269 242	-1 007 128
128 823 291	**127 937 872**	**Operating grant from the Ministry**	**128 823 291**	**127 937 872**
48 304 497	43 734 377	External project income	37 269 836	43 740 259
0	0	Operating grant from sponsors	0	0
21 595 085	13 962 633	Other incomes	22 639 404	13 962 633
198 722 873	**185 634 882**	**Gross operating income**	**185 988 998**	**185 640 764**
48 304 497	37 289 733	Direct project expenses	37 269 836	37 289 733
150 418 376	**148 345 149**	**Net operating income**	**148 719 162**	**148 351 031**
		OPERATING EXPENSES		
77 776 277	75 688 322	Salary and related expenses	76 360 834	75 688 322
9 990 686	9 273 395	Fieldwork and cruise	9 990 686	9 273 395
0	143 253	Consultancy services	0	0
35 738 835	35 091 670	Buildings	35 738 835	35 091 670
20 965 849	25 391 803	Other operating expenses	20 669 354	25 386 530
1 800 000	1 775 000	Depreciation	1 800 000	1 775 000
146 271 647	**147 363 443**	**Sum operating expenses**	**144 559 709**	**147 214 917**
4 146 729	**981 706**	**OPERATING SURPLUS**	**4 159 453**	**1 136 114**
		FINANCIAL INCOME AND EXPENSES		
878 187	634 722	Financial income	876 246	634 600
622 439	709 230	Financial expenses	621 060	709 230
255 748	-74 508	Net financial items	255 186	-74 630
4 402 477	**907 198**	**Net profit for the year**	**4 414 639**	**1 061 485**
		Information about appropriations to:		
		Transferred from/to other equity	4 414 639	1 061 485
		Sum transfers	**4 414 639**	**1 061 485**

* The UNIS group consists of the University in Svalbard AS and the subsidiary companies UNIS CO_2 lab and Svalbard Integrated Arctic Earth Observing System (SIOS)

BALANCE SHEET 31.12.2018

GROUP*			University Centre in Svalbard AS	
2018	2017		2018	2017
NOK	**NOK**	**FIXED ASSETS**	**NOK**	**NOK**
		Fixed assets (tangible)		
31 066 208	32 866 208	Buildings	31 066 208	32 866 208
31 066 208	**32 866 208**	**Sum tangible fixed assets**	**31 066 208**	**32 866 208**
		Fixed assets (financial)		
0	0	Investments in subsidiary company	175 000	100 000
0	0	Sum financial fixed assets	175 000	100 000
31 066 208	**32 866 208**	**Sum fixed assets**	**31 241 208**	**33 041 208**
		CURRENT ASSETS		
17 689 387	10 203 432	Accounts receivable	10 950 421	10 203 432
3 817 300	4 858 531	Other short-term receivables	3 817 300	4 858 531
42 455 280	27 136 326	Cash and bank deposits	40 691 343	27 048 456
63 961 967	**42 198 289**	**Sum current assets**	**55 459 064**	**42 110 419**
95 028 176	**75 064 498**	**SUM ASSETS**	**86 700 272**	**75 151 627**
		EQUITY		
		Accumulated equity		
100 000	100 000	Share capital	100 000	100 000
1 954 025	1 954 025	Other accumulated equity	1 954 025	1 954 025
2 054 025	**2 054 025**	**Sum accumulated equity**	**2 054 025**	**2 054 025**
		Retained equity		
13 614 654	9 212 177	Other equity	13 719 946	9 305 307
13 614 654	**9 212 177**	**Sum retained equity**	**13 719 946**	**9 305 307**
15 668 679	**11 266 202**	**Sum equity**	**15 773 971**	**11 359 332**
		LIABILITIES		
		Allowances for liabilities		
3 400 000	3 400 000	Provisions for liabilities	3 400 000	3 400 000
3 400 000	**3 400 000**	**Sum allowances for liabilities**	**3 400 000**	**3 400 000**
		Other long-term liabilities		
14 520 449	16 593 692	Housing loan	14 520 449	16 593 692
14 520 449	**16 593 692**	**Sum other long-term liabilities**	**14 520 449**	**16 593 692**
		Short-term liabilities		
15 346 753	1 685 079	Accounts payable	9 650 294	1 679 079
2 887 935	2 310 126	Public fees and duties	2 811 433	2 310 126
43 204 360	39 809 399	Other short-term liabilities	40 544 126	39 809 399
61 439 048	**43 804 604**	**Sum short-term liabilities**	**53 005 853**	**43 798 604**
79 359 497	**63 798 296**	**Sum liabilities**	**70 926 302**	**63 792 296**
95 028 176	**75 064 498**	**SUM EQUITY AND LIABILITIES**	**86 700 273**	**75 151 627**

* The UNIS group consists of the University in Svalbard AS and the subsidiary companies UNIS CO_2 lab and Svalbard Integrated Arctic Earth Observing System (SIOS)

ARCTIC BIOLOGY

March 2018: Biology students measure the snow characteristics in Adventdalen. Photo: Børge Damsgård/UNIS.

BY PROF. BØRGE DAMSGÅRD, HEAD OF DEPARTMENT

Arctic Biology (AB) provides a full one-year curriculum of undergraduate studies, including a summer course on identification of Arctic species, as well as a range of Master- and PhD level courses in biology. The department conducts research in biological climate effects, seasonality, and dynamics of species and ecosystems in space and time. Our strategy will strengthen our local, national and international scientific role, founded upon curiosity driven, high scientific competence and year-round presence in Svalbard.

PEOPLE

At the end of 2018, the AB department consisted of three professors, five associate professors, five PhD students and eight adjunct professors. Ingibjörg Svala Jónsdóttir ended her two-year contract as adjunct professor in December 2018, and Simone Lang was appointed associated professor with effect from July 2018. Tove Gabrielsen was appointed full professor at UNIS in spring 2018, and ended her work as faculty staff in June, when she started as professor at the University in Agder. She is currently adjunct professor at UNIS. Pål Ellingsen started in August as head engineer funded by the Nansen Legacy project. His work focuses on data management for the project, specifically handling all data on board the ice-class research vessel FF Kronprins Haakon.

EDUCATION

Our aim is to be the preferred study site for learning high Arctic biology through authentic experiences. Education at AB is research-based both in knowledge content and how we teach. Knowledge and skills are best mediated through student centred active learning, and authentic research settings and active involvement may create more motivated students and aid deeper learning. Based on this background AB has now developed both a bachelor research project course (AB-207) and a bachelor internship course (AB-208). The courses give insight into research at AB and external institutions that provide job opportunities after the students finishes their education. This will give the students more practical experience and generic skills that might improve learning outcomes in other courses, and also prepare them for their later job careers. The educational development in the AB department is to a large extent linked to the project bioCEED, the Centre for Excellence in Education (see separate chapter).

RESEARCH

The AB department continued to develop our research strategy. The overall aim is to become a leading institution in high Arctic biological research with cutting edge methodology and infrastructure. Our goals embrace advancing fundamental knowledge on the ecology and evolution of Arctic species, formed by the seasonal as well as long-term interactions with the biotic and abiotic components characteristic of the Arctic environment, including human impact. Our research covers three over-arching themes: *Climate change biology, Seasonal ecology* and *Spatio-temporal dynamics of species and systems.*

Marine biology

The department contributed in a number of projects, including largescale projects embracing several research aspects of many faculty staff members. On the marine side the Nansen Legacy project (see separate chapter) increased the department's activities in 2018 with involvement in several cruises. The project will lead to several new external positions at AB in the years to come. During 2018 the department initiated BIG (*Bjørndalen Integrated Gradient*), which is a supersite concept that includes all faculty staff and all habitats along an axis from the terrestrial site in Bjørndalen outside Longyearbyen, to the nearby shore areas and the Isfjorden Adventfjorden (IsA) station.

The IsA high-resolution marine time series station was established in 2011 and is now in its eight year. The station, set up to determine temporal drivers of microbial communities and to disentangle natural variation from changes induced by climate change, provides weekly to monthly data on hydrography as well as diversity and community composition of microbial eukaryotes and larger plankton. Analyses of biological data from multiple years show both recurring annual patterns of biodiversity and species composition, as well as large interannual variation linked to inflow of "warm" Atlantic water. AB is currently expanding these findings by investigating seasonal variations in community function by metatranscriptomics. By determining how the gene activities of protists change throughout the year, we aim to improve our understanding of how this important ecosystem component at the bottom of the marine food chain responds to the extreme differences in light that characterizes the Arctic.

The BIG and Nansen Legacy projects are complementary, and both are attempts to increase cross-disciplinary collaboration within the department. In addition, BIG includes both educational and research approaches, including research on didactic topics such as field education.

Furthermore, the AB department was also included in other large scale projects in 2018:

The NIVA-led project TerrACE: *Where land meets sea: effects of terrestrial inputs on contaminant dynamics in Arctic coastal ecosystems* (2017-2020), and the FAABulous project: *Future Arctic Algae Blooms – and their role in the context of climate change*; (2015-2019). The FAABulous project aims to study the combined effects of altered light conditions, ocean acidification and invasion of temperate species on Arctic pelagic and sympagic algal blooms.

In 2018, AB took more than 300 marine samples on the west and east coast of Svalbard during the summer months, using Hurtigruten's expedition ships. This was a part of a citizen science projects funded by the Svalbard Environmental Fund, where participants from AB gave lectures and demonstrations for the tourists on board, in addition to our own sampling program to collect marine biological data.

Terrestrial biology

Studies on the effects of climate change on the Arctic species and their systems form a central part of the research at AB. The large-scale atmospheric system Arctic Oscillation (AO) as well as retreating Arctic sea ice link the effects of climate changes across the Arctic. For example, using comprehensive spatio-temporal growth data from three different species of willow and birch, the retreating Arctic sea ice was found to significantly impact annual growth of individuals across Greenland to central Svalbard. Also, the AO was found, through annual changes in snow cover, to affect the abundance of herbivores differently. Whereas muskoxen were affected through changes in plant phenology, lemmings were directly affected by the protection increased snow cover provides.

Our terrestrial research platform *Adventdalen Integrated Research Operations* (ANCHOR) has increased its activity through collaboration with *Climate-Ecological Observatory for Arctic Tundra* (COAT), which is a research-based observation system to enable real time detection, documentation and understanding of climate impacts on arctic tundra ecosystems from the low-Arctic Norway (70°N) to the high-Arctic Svalbard (79°N). The long-term study of reindeer in Reindalen (TRACT) was continued in 2018. The individual-based database provides a unique knowledge of the life history of female reindeer and how density-independent and density-dependent climate factors form the life of Svalbard reindeer.

AB continued to solve biological puzzles related to drivers of spatial and temporal variation of terrestrial biodiversity and speciation. In 2018, our investigations in the inner fjord areas of Wijdefjorden revealed that the Flatøyrdalen-Ringhorndalen area holds the highest number of vascular plant species in Svalbard and we managed to reconstruct the vegetation history of this area. With support from Svalbard Environmental Fund and in cooperation with colleagues from UiT and the Arctic Geology department at UNIS, we reconstructed vegetation composition based on ancient DNA in a sediment core from the Ringhorndalen area, dating back approx. 12.000 years. Our investigations revealed

August 2018: Professor Mads Forchhammer teach the AB-201 Terrestrial Arctic Biology students in Bjørnfjorden, with the Smeerenburgbreen in the background. Both photos: Tina Dahl/UNIS.

August 2018: The AB-201 students take a well-deserved break in Ringhorndalen in Wijdefjorden.

March 2018: Biology students on a steep slope in Adventdalen. Photo: Børge Damsgård/UNIS.

the oldest known established vegetation after the last glaciation in Svalbard, showing that the vegetation found in the area today is the relict remains of former, more widespread thermophilious vegetation. Polyploidy is an important evolutionary driver of plant evolution, in particular in the Arctic. During summer 2018, a model system for autopolyploidy-research was established in Adventdalen. Using *Saxifraga oppositifolia* as model species, the aim is to understand the evolutionary consequences of autopolyploidy.

GRADUATES 2018

MASTER DEGREE:

AMALIA KECK
Recolonization and succession of a subtidal hard-bottom epibenthic community in Smeerenburgfjorden, NW Svalbard. *(The Arctic University of Norway and UNIS).*

ELINOR TESSIN
Drivers of spatial variability in spring bloom onset and magnitude along a latitudinal gradient in the Nordic Seas. *(University of Bergen and UNIS).*

LINN MARGRETHE HØEG VOLDSTAD
The Holocene vegetation history of an isolated, high-arctic plant diversity hot spot. *(NMBU – Norwegian University of Life Sciences and UNIS).*

ELLA WEISSENBERG
Spatial structures of a high-Arctic macrozooplankton community. *(University of Helsinki and UNIS).*

COLLABORATION WITH THE BARENTSBURG RESEARCH STATION

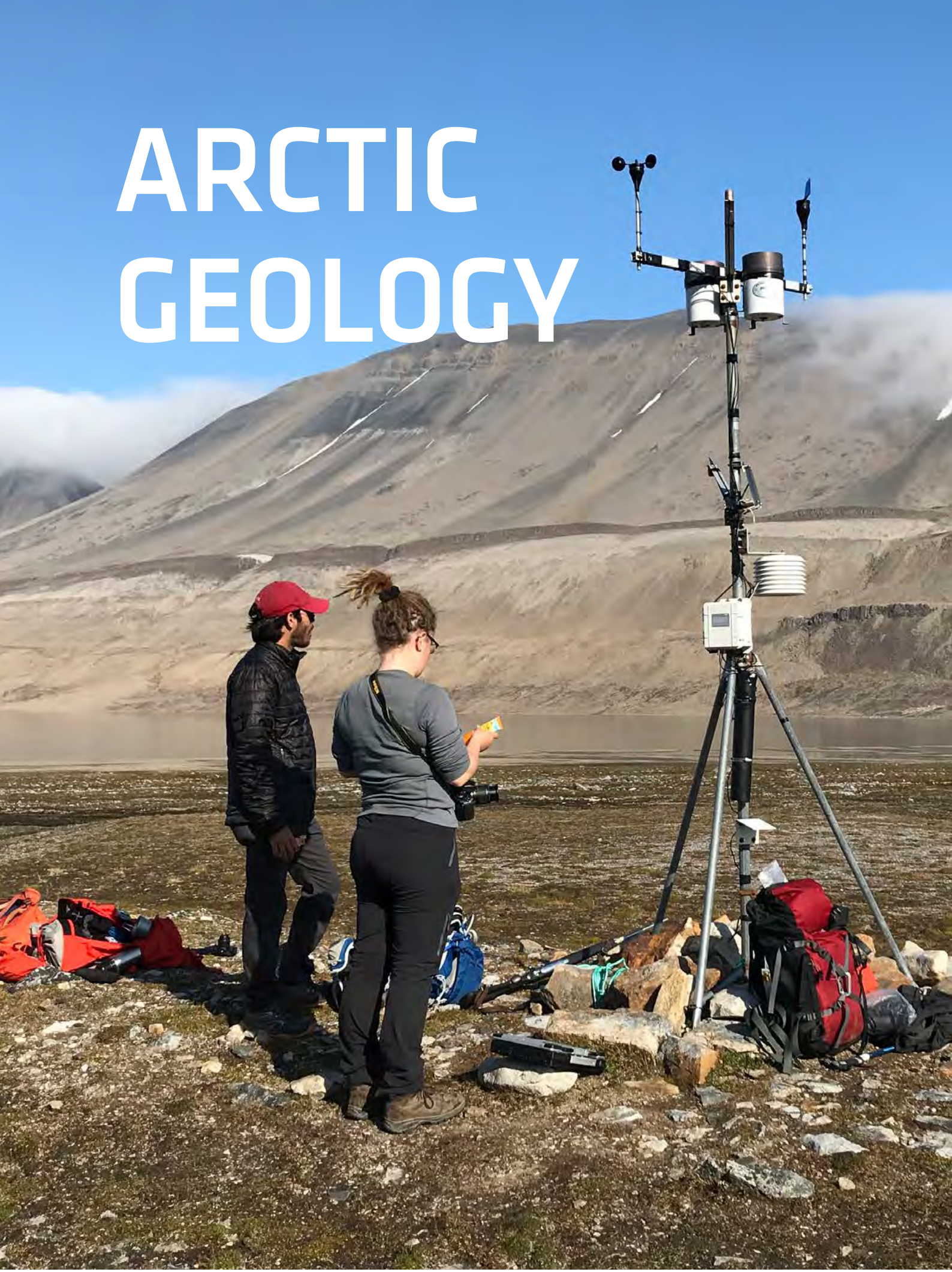
May 2018: Students and teachers of AT-324/824 after field work in front of the AARI Research station. Photo: Anna Nikulina/AARI.

TEXT BY ROLAND KALLENBORN, ADJUNCT PROFESSOR

The collaboration in environmental chemistry with the Barentsburg research station is built upon an already long-lasting research collaboration (since 2005) between UNIS, the Arctic and Antarctic Research institute (AARI, St. Petersburg) and Typhoon North Western Branch (St. Petersburg) in the frame of the continuous pollutant monitoring of the Arctic Monitoring and Assessment Programme (AMAP).

As a part of this collaboration, a new environmental chemistry laboratory was established in Barentsburg (2014-2016) with modern trace analytical equipment for the local environmental pollutant monitoring. For coordinating and supporting the here established research program in organic environmental pollutant research and monitoring, a joint Russian-Norwegian research project was established in 2016 aiming at coordinating research and educational activities between the Barentsburg environmental Chemistry laboratory (AARI), the AT department and other Norwegian partners. The BARELAB project (Integration of the New Lab Facility for Chemical Analyses in Barentsburg into International Cooperation in the Arctic) was funded by the Research Council of Norway as a collaboration between AARI, North-Western branch of Typhoon (Russia), the Norwegian Institute for Air Research (NILU), the Norwegian University of Life Sciences (NMBU) and UNIS. The BARELAB research program included joint experimental work (PhD level field work), intercalibration exercises, technology transfer but also integrated educational activity and training. The Barentsburg chemistry laboratory has served as field work platform for the UNIS course AT-324/824 “Techniques for the Detection of Organo-Chemical Pollutants in the Arctic Environment” since 2017. More than 35 Master and PhD students found an ideal working platform and enjoyed the open and constructive academic collaboration with our Russian colleagues in Barentsburg. The Educational collaborations is considered a great success from both the Norwegian and the Russian partners. In mutual understanding, both UNIS and AARI have therefore decided to continue the successful educational collaboration also after the official end of the Barelab collaboration.

ARCTIC GEOLOGY



August 2018: Students in the AG-220 Environmental Change in the High Arctic Landscape of Svalbard course on fieldwork by Linnévatnet. Photo: Mike Retelle/UNIS.

The Arctic Geology (AG) department's research and education is focused on the geological evolution of Svalbard as recorded in spectacular geological sequences spanning the Precambrian to the Cenozoic, and overlain by Quaternary glacial and interglacial deposits. Easily accessible outcrops make it possible to do research in the interplay of continental drift with tectonic, glacial, periglacial, coastal, fluvial and marine sedimentary processes. The close proximity of present-day geological, glacial, periglacial, marine and terrestrial processes provides an exciting field laboratory as the basis for our research and education within three main areas: Arctic Basins, the Quaternary and the cryosphere.

PEOPLE

During 2018 the department had nine full time faculty positions, which were filled by four professors and four associate professors. Mark Furze started as our new Quaternary geologist in July. Olafur Ingolfsson ended his adjunct contract by the end of the year. Aga Nowak was hired to replace teaching capacity during parts of the spring and the autumn semester. Graham Gilbert started in an adjunct position. Hanne H. Christiansen was appointed Vice Dean of Education at UNIS in August, and was still the Head of Department as well.

EDUCATION

Eight bachelor courses, eight combined master- and PhD courses were taught in our department in 2018. The department was responsible for 29% of all student production at UNIS in 2018. Our courses were on average filled only filled to 85%. In total 65.8 student years were produced in our department, of which 8.6 were from master thesis studies.

The spring semester of 2018 marked the first time a full-semester geology 30 ECTS course package was offered targeting bachelor students. The existing AG-209 course "The Tectonic and Sedimentary History of Svalbard" was complemented by the new AG-222 "Integrated Geological Methods: From outcrop to geomodel". The courses run in parallel from January to early June and offered the students an active learning environment fully utilizing the geological field laboratory that Svalbard has to offer. The students experienced a broad range of geological

settings. Amongst others we investigated the tectonic and stratigraphic evolution of the Paleogene Central Tertiary Basin, whose coal-bearing succession is the main reason for the existence of permanent settlements on Svalbard. Furthermore we studied the Billefjorden Trough in the vicinity of the Pyramiden settlement, piecing together the tectonic and depositional evolution of this world-class half graben. The students learned to integrate various geological and geophysical techniques across a range of scales to characterize the basins, outcrops and drill cores.

The autumn semester saw the introduction of the new physical geography programme, which consisted of two integrated courses: AG-204 "The Physical Geography of Svalbard", a largely theory-based introduction, and AG-221 "Arctic Physical Geography Field Techniques", a techniques course that covered core skills in geomorphological field mapping combined with various monitoring and sampling techniques. Outdoor training in field techniques in AG-221 followed shortly after lectures in AG-204. Particular emphasis was also given to the local environment; students participated in glacier mass balance surveys on Foxfonna, snow avalanche hazard assessment in the Longyearbyen area, permafrost studies in Adventdalen and water quality monitoring in the Isdammen watershed. The separation of theory and skills teaching into two courses was clearly successful and their application to problems faced by the Longyearbyen community proved popular among the students.

For us to evaluate and further develop our strong focus on field education, we ran a field teaching evaluation based on student administered interviews for all the AG autumn semester bachelor courses. A total of four AG bachelor students were hired, as part of our iEarth activities, to be responsible for evaluating all field components in the four autumn semester AG bachelor courses AG-210, AG-211, AG-204 and AG-221. Each student was responsible for one course and coordinated a three step evaluation; 1) coordinate a written evaluation carried out by all class mates, 2) be responsible for interviews with 5-6 fellow class mates, 3) write an evaluation report. These evaluations provided us with the student perspective on the field teaching.

The DIKU funded project "A Digital Learning Environment for field based geoscience teaching" led by Maria Jensen started in 2018. The project explores the use of digital platforms in geology education and focus on integrating classroom and field teaching in a seamless way through using ipads and an in-classroom Smartboard. The digital setup allows students to bring material and datasets worked on in advance into the field and to work directly on field data in the classroom afterwards. The idea is that this integration will allow for better alignment between field- and classroom activities, better assessment of the entire course content, more student directed learning in the field and a better chance to catch misunderstanding or problems from fieldwork in classroom discussions.

We have been active in the national consortium called iEarth "Centre for integrated Earth System education" planning a Center for Excellence in Education application. We attended national meetings and the iEarth Teachers retreat, and have been developing the UNIS led focus on field teaching in iEarth in the department and with other UNIS colleagues.

RESEARCH

The department has three specialised research groups, presented below with their different main activities. However, also cross departmental research is going on and are being planned.

Arctic basins

The Research Centre for Arctic Petroleum Exploration, ARCEx, successfully passed its mid-way evaluation in 2017 and this was marked with a period of intense activity and scientific output in 2018. UNIS is an active partner in ARCEX, with Kim Senger co-leading the geology work package together with Sten-Andreas Grundvåg (UiT), and UNIS adjunct Professor Tor Arne Johansen leading the Eco-safe exploration work package. The geology work package strives to provide a better basis to assess the petroleum potential in the northern Barents Sea by systematically working to reduce the geological risk factors including presence and quality of reservoirs, source rocks and traps. The systematic data mining of the eighteen petroleum exploration boreholes drilled in Svalbard from 1961 to 1994 is an important foundation to synthesize Svalbard's stratigraphic framework, as well as link the geophysical data in and around Svalbard with its world-class outcrops.

UNIS and the coal-mining company SNSK joined forces to safeguard physical and digital material collected during various geological campaigns in Svalbard in the project "Svalbard Rock Vault", funded by the Svalbard Science Forum. There is major concern that unique drill core material will be lost, as has happened many times before. A kick-off meeting was held in Longyearbyen in September 2018 with representatives from most of the relevant institutions, including the Norwegian Polar Institute, the Geological Survey of Norway and the Mining Commissioner in Svalbard. The key outcome of the workshop was that everyone was positive to such an initiative. A follow-up project, also financed through a Svalbard strategic grant, will investigate options for organizational structure, financing models and location, during 2019-2020.

The project "Coal - the ice core of the warm past: using the natural coal archive on Svalbard to initiate a flagship for palaeoclimate research" was funded by a Svalbard strategic grant. Maria Jensen and Malte Jochmann are leading this project aiming at obtaining high resolution palaeoclimatic records from coal. A pilot study from Mine 7 was previously carried out and had proven the potential of using the Svalbard coal seams for palaeoclimatic research. This study will use more proxies and do a new analysis of the coal from Mine 7, in addition

to sample continuous coal successions from the soon-to-be closed coal mines Lunckefjell and Svea Nord. An aim of the project is also to learn from existing coal laboratories, while they still exist, and transfer knowledge to UNIS that allows exploiting the full research potential of the Svalbard coal seams, when the active large-scale coal mining era in Svalbard will end.

Foreland basins or sag basins studies became an important task among the Arctic Basin group staff in cooperation with national and international universities. These involve studies in:

- Triassic Foreland Basin in the Barents Sea - linked to the Uralian Orogeny.
- Lower Jurassic Foreland Basin in the Barents Sea and Svalbard - linked to the onset of the Novaya Zemlya Fold and Thrust Belt.
- Upper Jurassic to Lower Cretaceous sag basins and volcanism in the Arctic - linked to the opening of the Amerasian basin in north.
- Cenozoic foreland basin; the Central Tertiary Basin and West Spitsbergen Fold and Thrust Belt and basins North Greenland - linked to the Eurekan Orogeny.

In cooperation with Copenhagen University several projects are ongoing to improve the understanding of the carbonate deposits in the Upper Palaeozoic. Special tasks are to better record and date the climate change from humid tropical to warm arid semi-arid climate in the Early to Late Carboniferous and from tropical warm water to cold water carbonates in the middle Permian.

In cooperation with the universities in Bergen and Oslo, studies were conducted to investigate the timing and magnitude of the transition from semi-arid to humid climate in latest Triassic in Svalbard and the Barents Sea. Preliminary results suggest similar timing as in northern Europe and Greenland, supporting abrupt climate change. It also supports the hypothesis that the Triassic to be the most arid period in the Phanerozoic.

Quaternary geology

Mark Furze continued to work on projects stemming from his prior work in Arctic Canada on the deglaciation of the Northwest Passage and palaeo ice shelf development and collapse in collaboration with colleagues in Canada (Geological Survey of Canada, University of Alberta, Université du Québec à Rimouski and MacEwan University), the UK (Keele University and Exeter University), and Norway (NGU, NTNU, NPI). This has included the successful application to ArcticNet (Canada) for continued Quaternary research in the region. Furze started developing a Svalbard research programme aimed at exploring linked marine and terrestrial records of deglaciation and ice shelf history around the archipelago.

Riko Noormets continued his research into glacial and paleoenvironmental reconstruction of the Svalbard fjords and the northern Barents Sea using a variety of seafloor and subsurface mapping methods. For the first time, autonomous surface vessels were deployed to map a lake of Isvatnet on the remote islands of Sjuøyane in Svalbard. Noormets was also involved in two successful proposals in 2018, a FORMAS-funded “Ocean-induced changes at calving glacier margins: data, uncertainty, and simulation” together with colleagues from Stockholm and Uppsala universities, and the EU NPA project “Adaption and Resilience tools for monitoring ClimaTe change Impacts in NPA Communities (ARCTIC)” together with partners from UK, Ireland and Sweden.

Lena Håkansson has continued the work on the project Holocene Precipitation Seasonality in Svalbard with the purpose to reconstruct Holocene hydroclimate by analyzing leaf wax hydrogen isotopes in lake sediment cores. She and Wesley Farnsworth have been working with Arctic Biology colleague Pernille B. Eidesen on a project using ancient DNA to reconstruct vegetation at an isolated plant diversity hotspot in Wijdefjorden. In 2018 she was involved in a successful KLIMAFORSK proposal funded by the Norwegian Research Council to the project “PolarCH4ives” led by University of Tromsø, and with collaborators in Copenhagen. This project will use ancient environmental DNA in lake sediment archives to characterise CH_4 exchange in Arctic catchments during periods of major climatic change since the last glaciation.

Martin Jakobsson is the vice chair of GEBCO and a co-leader of the North Pacific and Arctic Ocean regional center of the Nippon Foundation-GEBCO Seabed 2030 Project (https://seabed2030.gebco.net), which in 2018 established new Regional Mapping Board for the Arctic, where both Jakobsson and Noormets are members.

Mike Retelle started a new three-year research project entitled “Holocene hydroclimate reconstruction in Nordenskioldland”, supported by US NSF Polar Programs with colleague Ray Bradley, University of Massachusetts, USA. This project seeks to reconstruct Holocene seasonal hydrology and extreme hydrologic events from annually laminated lake sediments in Linnèvatnet and other glacier-fed lakes in Nordenskiöldland. The project is funded by the U.S. National Science Foundation and supports a post doc, masters students at UNIS and bachelors students.

Wesley Farnsworth completed his PhD studies by defending his thesis entitled ‘Holocene glacial history of Svalbard: Retracing the style of (de-)glaciation’. Farnsworth´s PhD thesis comprised five papers and compiled a suite terrestrial and marine mapping as well as a geochronological database for the Svalbard region over the last 12,000 years. He obtained funding from the Svalbard Science Forum of the Norwegian Research Council to host a workshop focusing on coordination of scientific and logistical collaboration on the Holocene in Svalbard, SVALHOLA.

The cryosphere

The year saw the end of the multi-partner LowPerm project led by Andy Hodson and involving Hanne H. Christiansen, Graham Gilbert and Aga Nowak from the department. The research documented the influence of the valley infill sediments in Adventdalen upon the biogeochemistry of key nutrients and methane, giving a particular emphasis to processes in the active layer and upper permafrost. The project also provided data in support of a successful application by the group to the KLIMAFORSK call from the Research Council of Norway (RCN). This project, CLIMAGAS will examine methane production, removal and escape in Adventdalen: this time giving emphasis to deeper sources of the gas. Andy Hodson led a further successful application to the RCN for funding related to the survival of microbes in glacier ice, BIOICE. This includes partners from two UK universities in Aberystwyth and Northumberland, as well as the NPI. BIOICE will also undertake an Arctic-Antarctic comparison by comparing Svalbard with sites in the vicinity of the Troll Station, Dronning Maud Land. Both BIOICE and CLIMAGAS will run from 2019 until 2022.

The Svalbard Integrated Arctic Earth Observing System (SIOS) - Infrastructure development of the Norwegian node, InfraNOR, started in 2018, and will be ongoing for a decade. UNIS is responsible for the upgrading of the permafrost observation infrastructure in this project around Longyearbyen and in the Kapp Linnè areas, with Hanne H. Christiansen as responsible. The focus is on extending and upgrading the permafrost boreholes drilled and instrumented during the IPY (2007-2008), and on improving our permafrost drill rig to be able to core the different types of sediment existing in Svalbard. This is done in close collaboration with the Norwegian Meteorological Institute, who is responsible for establishing permafrost boreholes in more remote parts of Svalbard.

As part of the SIOS activities Hanne H. Christiansen led the project "Permafrost thermal state in Svalbard 2016-2017" (PermaSval), funded by SIOS. The aim was to develop and write the first regional permafrost thermal state analysis for existing permafrost observations in Svalbard for the period 2016-2017 to be part of the first State of the Environmental Science in Svalbard (SESS) report. Partners from Italy, Russia, Poland, Germany and Norway all with permafrost observation infrastructure in Svalbard participated, which had a kick-off workshop at UNIS in March 2018. Graham Gilbert was hired to do data analyses and coordinate the reporting. The project managed to integrate and analyse permafrost temperatures and active layer thickness data from the Longyearbyen, Kapp Linnè, Barentsburg, Ny-Ålesund and Hornsund areas.

The INTPART project "Landscape & infrastructure dynamics of frozen environments undergoing climate change in Canada, Norway and Svalbard" funded by the RCN and led by Hanne H. Christiansen, had its kick-off meeting at UNIS in October. The aim is to develop a joint research-based educational field-based programme, combining geoscience and engineering to address perennially and seasonally frozen ground undergoing climate change, using innovative educational knowledge from both the Norwegian (UNIS & NTNU) and Canadian (Laval, Carleton and Yukon College) university partners. The UNIS AT department is also involved. Three interdisciplinary and complementary master level field-based courses will be developed and run in the project.

Research administration

Maria Jensen participates in the Kongsfjorden flagship group under NySMAC, and was involved in developing a pilot project for collaboration between terrestrial and marine biologists, geophysicists and onshore geoscientists to study land-sea transects in Kongsfjorden and the influence of long- and short-term sediment dynamics on ecosystems.

The International Permafrost Association (IPA) Secretariat had its second full year operating at UNIS, with Hanne H. Christiansen acting as President of the IPA both funded by the RCN. The 5th European Conference on Permafrost was a major event for the IPA in 2018; the conference had over 460 participants and included meetings of the IPA Council and elections of the IPA Executive Committee, largely organized by the IPA Secretariat.

OUTREACH

Maria Jensen and Malte Jochmann collaborated with the Longyearbyen School on their annual project on fossil collection from the Longyearbreen moraine. They visited the school, participated in the day field trip and provided identification material for fossil leaves and how the fossils link to palaeoclimate. The work of the school children were shown as an exhibit at the Open Day of the UNIS 25 year anniversary in October 2018.

GRADUATES 2018

PHD DEGREE:

WESLEY R. FARNSWORTH
Holocene glacial history of Svalbard: Retracing the style of de-glaciation. *(UNIS and The Arctic University of Norway).*

OSCAR FRANSNER
Late Weichselian ice-sheet dynamics and deglaciation history of the northern Svalbard margin. *(UNIS and University of Bergen)*.

GRAHAM L. GILBERT
Cryostratigraphy and sedimentology of high-Arctic fjord-valleys. *(UNIS and University of Bergen)*.

MARK MULROONEY
Faults affecting the Triassic Barents Shelf. Syn-kinematic, deposition, deformation mechanisms and driving forces. *(UNIS and University of Oslo)*.

MASTER DEGREE:

TOR KRISTIAN BERG
Sedimentology of the Grønfjorden Bed, Grønfjorden, Svalbard. *(University of Bergen and UNIS)*.

PETER BETLEM
3D Thermobaric Modelling of Central Spitsbergen: Implications for Gas Hydrate Occurrence. *(University of Iceland and UNIS)*.

THEA MARIE ENGEN
A sedimentological study of the Lower Cretaceous Glitrefjellet Member, Svalbard. *(The Arctic University of Norway and UNIS)*.

ØYSTEIN GRASDAL
Sedimentary architecture of sand bodies in the Paleocene Firkanten Fm, Svalbard. *(University of Bergen and UNIS)*.

INGRID NISING HOEL
Sedimentology and facies distribution in the Lower Triassic Vardebukta Formation on Oscar II Land, Svalbard. *(NTNU and UNIS)*.

MAX HOLTHUIS
Sedimentation processes in the Arctic: A comparison between a glaciated and non-glaciated fjord on Spitsbergen. *(Vrije Universiteit Amsterdam and UNIS)*.

KRISTINE KIRKEBØEN
Glacial history and forefield development of Aldegondabreen since the Little Ice Age maximum extent. (*The Arctic University of Norway and UNIS*).

MARIA HUSE KVAM
Sedimentological development of the tidal flat in inner Dicksonfjorden. (*The Arctic University of Norway and UNIS*).

KRISTINE LARSSEN
Integrated characterization of the Upper Permian Kapp Starostin Formation in central Spitsbergen, Svalbard. (*The Arctic University of Norway and UNIS*).

JULIANE LEISTER
Holocene Glacial Dynamics of the Barentsøya ice cap, Svalbard. *(The Arctic University of Norway and UNIS)*.

CHRISTINE PATRICIA MCCABE
Sedimentology and diagenesis of the Late Triassic De Geerdalen Formation in Oscar II Land, Spitsbergen, Svalbard. *(NTNU and UNIS)*.

LOUISE KRISTIANSEN POOLE
Sedimentology of the Paleogene succession at Renardodden, Svalbard. *(University of Bergen and UNIS)*.

NIKLAS WILKO SCHAAF
Tectono-sedimentary history of the Forlandsundet Graben: New insights from Sarsøyra, Western Spitsbergen. *(University of Oslo and UNIS)*.

OLE-MARIUS SOLVANG
Sedimentological and petrographical investigations of the Early Triassic Vardebukta Formation on western Spitsbergen. *(University of Bergen and UNIS)*.

MATILDA SVENSSON
Sedimentology and catchment processes of Lake Bolterskaret, Svalbard. *(Uppsala University and UNIS)*.

SARAH SAPPER
Proglacial icing Rieperbreen: tracking the source of water with natural and artificial tracers. *(University of Vienna and UNIS)*.

INGRID TENNVASSÅS
Characterisation of palaeosols in the Lower Cretaceous Helvetiafjellet Formation, Svalbard. *(The Arctic University of Norway and UNIS)*.

CAMILLA LOUISE WÜRTZEN
Facies Analysis of the uppermost Devonian to Lower Carboniferous Billefjorden Group of Central. *(University of Copenhagen and UNIS)*.

In spring 2018 UNIS announced a photo competition for our students as part of the celebration of UNIS' 25th anniversary. We got an impressive 180 entries in total, spread in the three categories fieldwork, nature and social life. Here we present the winners of the three categories:

CATEGORY: FIELDWORK

Winner: Yannick Rouven Kern.
Runner-up: Magnus Heide Andreasen.
Runner-up: Ingeborg Høiaas.

CATEGORY: NATURE

Winner: Anna Ejsmond.
Runner-up: Lauritz Schönfeld.
Runner-up: Lauritz Schönfeld.

CATEGORY: SOCIAL LIFE

Winner: Samuel Eide.
Runner-up: Joshua Dreyer.
Runner-up: Peter Betlem.

THE NANSEN LEGACY

September 2018: R/V «Kronprins Haakon» on a scientific cruise north of Svalbard. Photo: Ann Kristin Balto/Norwegian Polar Institute.

THE LEGACY
The Nansen Legacy is a collaborative project between ten Norwegian research institutions with Arctic marine expertise, and with competence and perspectives including education, management and contact with different user groups.

Project period: 2018-2023

Budget: 740 million NOK

Research group: More than 130 scientists from 10 institutions, about 50 recruitment positions (PhD and post docs), associated members, international collaborators.

Website: http://www.nansenlegacy.org

TEXT BY PROFESSOR FRANK NILSEN

– A scientific journey to reveal the secrets of the new emerging Arctic

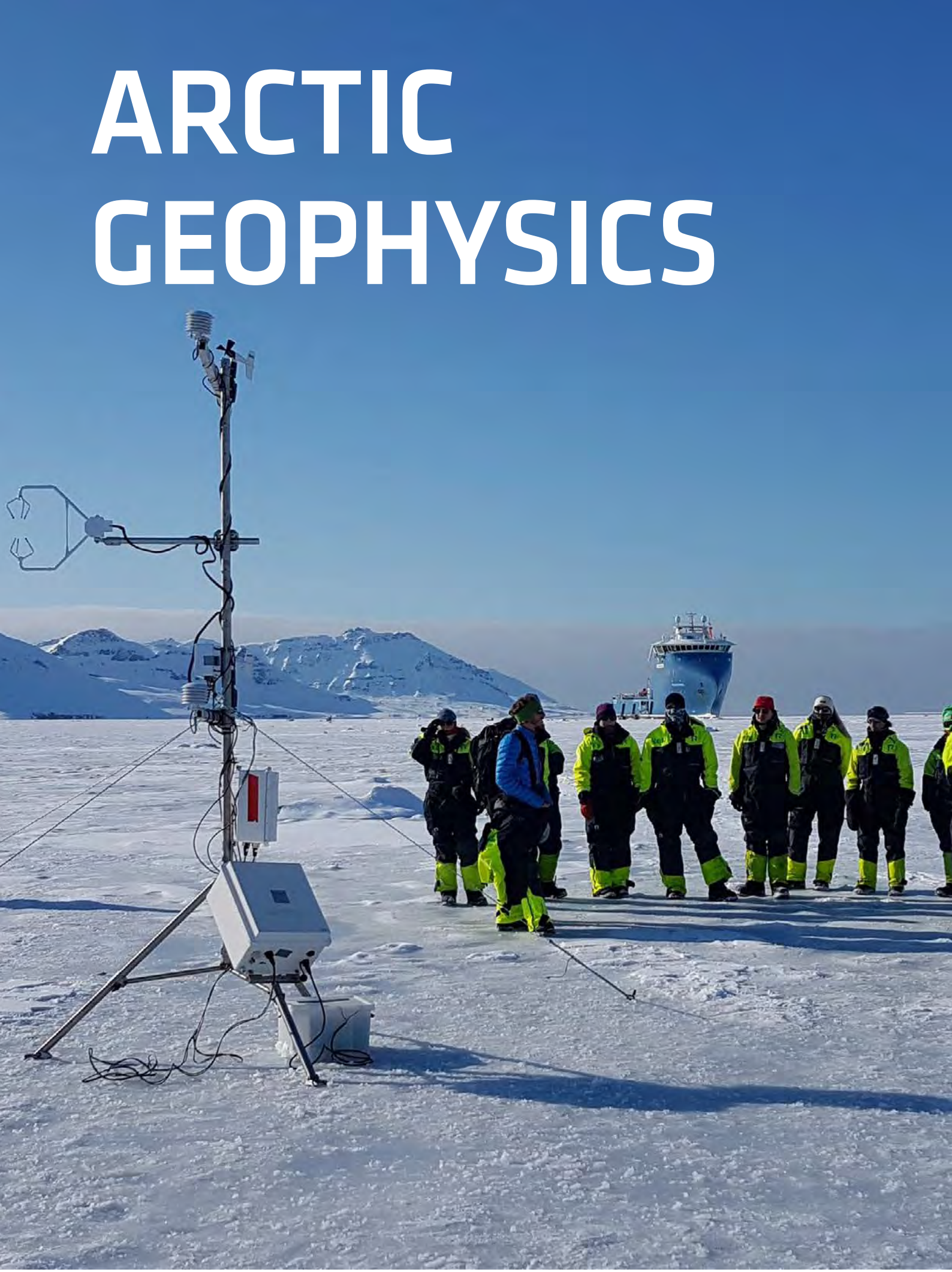
The Nansen Legacy is the collective answer of the Norwegian research community to the outstanding changes witnessed in the Barents Sea and the Arctic as a whole.

The Nansen Legacy is the Norwegian Arctic research community's joint effort to establish a holistic understanding of a changing marine Arctic climate and ecosystem. It is a collaborative project between ten Norwegian research institutions and will run from 2018-2023. The oceanography group's main delivery into The Nansen Legacy project is to provide data sets from year-long moored instruments and process cruises around Svalbard, and to study the processes contributing to the ocean heat budget of the region north of Svalbard.

UNIS was co-leading two Nansen Legacy cruises in 2018, June/July with R/V "Kristine Bonnevie" and September with R/V "Kronprins Haakon", in the area north of Svalbard, which recently has experienced the largest winter sea ice loss in the Arctic. The UNIS oceanography team is working on mapping the distribution of Arctic Water (ArW) and Atlantic Water (AW) with an emphasis on describing the thermohaline polar front between them, understanding the processes that control the front position and variability, and hence, the effects on volume, heat and salt exchange across the front.

UNIS is heading the important research activity task RA-B "Data management and synthesis". In many ways this can be seen as, and become, the legacy of the Nansen Legacy project since it is vital for the collaborative project to leave behind an accessible and comprehensive data set that will be valuable for scientists in the future that pursue new knowledge, long after the project has ended. To be able to collect more data with new and smarter methods and instrumentation, UNIS is also co-leading the innovative research activity RA-C "Technology and method development". Here, the main objective is to study and develop reliable and robust autonomous platform solutions, both in the ocean (AUV/glider/USV) and in the atmosphere (Drones/RPAS/UAV). Moreover, new sensor are tested and developed on these smart and self-going vessels. The vessels will be able to take mission decisions based on ongoing measurements being continuously fed to the vessels. Hence, smarter measurements and sampling for detection and analysis of ocean- and atmospheric processes will improve modeling capability and the understanding of the ecosystem in the Barents Sea

ARCTIC GEOPHYSICS



April 2018: The students in the course AGF-211 Air–Ice–Sea Interaction has put up a weather mast in St. Jonsfjorden. Photo: Lars Henrik Smedsrud/UNIS.

BY DAG A. LORENTZEN, HEAD OF DEPARTMENT

The Arctic Geophysics department provides courses and conducts research within the fields of oceanography, the cryosphere, meteorology and the middle- and upper atmosphere. These fields of study constitute two research groups within the department; the *Air-Cryosphere-Sea Interaction* (ACSI) group and the *Space Physics* group.

PEOPLE

At the end of 2018 the department consisted of nine full time faculty, three post docs, ten adjuncts and six PhDs. In addition two engineers are working in the department.

EDUCATION

Bachelor and master/PhD courses are offered within all research fields in the department. In 2018 the department ran six bachelor courses, one master course and seven combined master/PhD courses. All courses include field work in and around Svalbard, using external research facilities, scientific boat cruises or other locations out in the field. In addition, the department also offers two cross-disciplinary bachelor courses – *The Stormy Sun and the Northern Lights*, and *Shipping in the Arctic*. The new bachelor course in *Remote Sensing and Space Instrumentation* was run for the first time in the autumn semester with 9 students. This means that we have a full semester bachelor package in upper/ middle atmospheric physics. We now have a dedicated departmental member of the Education Committee (ECOM), which meets once a month to discuss educational matters at UNIS. Through the department, UNIS was host to the ASTRA (Arctic Space Training) Summer School, organized by the University of Oslo. This involved 15 students from Russia and Norway taking part in an intensive workshop focused around radar and satellite studies of the arctic ionosphere. In addition, the European Space Agency arranged a cryosphere remote sensing training course through the department in June 2018.

RESEARCH

The Air-Cryosphere-Sea Interaction (ACSI) Group

The Nansen Legacy (http://nansenlegacy.org) is the Norwegian Arctic research community's joint effort to establish a holistic understanding of a changing marine Arctic climate and ecosystem. It is a collaborative project between ten Norwegian research institutions and will run from 2018-2023. The oceanography group's main delivery into project is described in an own chapter.

The UNIS-led project "Remote Sensing of Ocean Circulation and Environmental Mass Change" (REOCIRC) ended in December 2018 with an interesting data set

from a three years monitoring program on the Atlantic Water flow across the Yermak Plateau and into the Arctic Ocean. Important results on tidal- and vorticity dynamics and heat transport are obtained, revealing new current structures on the Yermak Plateau. These results will be beneficial for future tidal modelling and remote sensed data collection in the area. Moreover, collaboration with visiting scientists from the USA (Polar Science Center, University of Washington), and cross discipline collaboration with Norwegian glaciologists (University of Oslo) has resulted in a breakthrough in monitoring mass changes, both in the ocean and on land, when ocean data are combined with remote sensed data.

A glider campaign in Isfjorden during field work in the master/PhD course "Air-Ice-Sea Interaction II" (AGF-311/811) in collaboration with the Norwegian National Facility for Ocean Gliders (NorGliders) has led to published work. The gliders measured the hydrographical properties and depth-averaged currents in the region and marked the first time gliders have been used inside an Arctic fjord. Flow patterns were observed and a heat flux into the fjord was calculated. The combination of hydrography and high-resolution velocity data from throughout the Isfjorden region provided new insights into the circulation here, suggesting that this approach will be useful for studying high-latitude fjords in the future.

Other research activities in Isfjorden during 2018 were two moorings at the fjord mouth designed to measure exchange flow between the shelf and fjord, and are both part of the field work in the bachelor course "Polar Ocean Climate" (AGF-214). The southern mooring has delivered valuable data sets of hydrography and current since 2005 (with a few missing years), while the northern mooring will be used further in different positions inside Isfjorden. In addition, standard hydrographic sections were obtained in April and September during the bachelor courses "Air-Ice Sea Interaction I" (AGF-211) and AGF-214, which have been done almost regularly since 1999. During this time period Isfjorden has experienced a dramatic climatic change with less sea ice cover and more inflow of warm Atlantic Water both in winter and summer. This collection of UNIS data is now an important part of an ongoing study of the variability and trends in the fjord's climate and circulation.

The chemical oceanography group has sampled the IsA Station in the mouth of Adventfjorden once a month since November 2015 to investigate the carbon cycle at this location. This has led to published work with emphasis on physical and biogeochemical drivers. This is one of the first time series of pCO_2 that covers all seasons in an Arctic marine environment. The IsA Station was under-saturated in CO_2 during the whole time period, resulting in an annual uptake rate of 31-36 g C m^{-2} $year^{-1}$. The fluxes were significantly higher in Arctic origin waters compared to fluxes of Atlantic origin waters. The main drivers for the observed pCO2 variability were biological processes and changes in temperature.

The meteorology section has co-lead on the four-year RCN funded project "Advanced models and weather prediction in the Arctic: Enhanced capacity from observations and polar process representations (ALERTNESS)". The main aim of the project is an improved weather prediction capability for the Arctic, benefiting amongst others increased high-latitude activities related to e.g. shipping, fishery, transportation and tourism.

The Space Physics Group

The space physics group is a part of a centre of excellence, the Birkeland Centre for Space Science (BCSS), which is based at the University of Bergen.

The group own and operates the Svalbard SuperDARN radar. The radar was inaugurated late autumn 2016, and has been providing an extensive amount of good quality data with 24 hours/day coverage up to October 2018. The radar is part of a global network of similar radars, where one of the main products is global convection maps of the ionosphere. On the 23rd of October an unfortunate incident occurred where all masts in both the main and interferometer array broke down due to high winds and ice loading. The actual radar electronics located in a custom made shipping container appears to be undamaged. The space physics group will rebuild the antenna system with a new design, based on wind and ice load calculations/modelling conducted by an external company.

The space physics group also owns and operates the Kjell Henriksen Observatory (KHO), one of the world's largest observatories for studies of the aurora using optical instrumentation. During the auroral winter season the instruments operate 24 hours/day. There are 26 optical instruments (cameras, photometers, spectrometers, etc.) and 17 non-optical instruments (magnetometers and passive radio instruments). 24 institutions from 14 nations have their instruments at KHO. The observatory also serves as the main field laboratory for several space physics courses. KHO has been used as ground support for four sounding rockets in 2018 that was part of the Grand Challenge Initiative campaign. As part of this initiative were two NASA campaigns, VISIONS-2 and TRICE-2, that launched four rockets in December 2018. The first two rockets were launched from Ny-Ålesund on the 7th December 2018, and the two last rockets where launched from Andøya Space Centre the 8th December 2018. Each pair of rockets was launched within minutes of each other, and studied ion outflow and cusp electrodynamics.

The ionosphere/magnetosphere section of the space physics group has been continuing their research into mesoscale dynamics of the polar ionosphere. An algorithm has been developed which will allow identification of narrow flow channels as observed by the SuperDARN radars. This will be the first time these flow channels have been looked at in a statistical, automated manner and will increase our knowledge regarding the

September 2018: The first joint cruise in the Nansen Legacy project with R/V "Kronprins Haakon". Photo: Pål Gunnar Ellingsen/UNIS.

October 2018: The students in AGF-223 Remote Sensing and Space Instrumentation up at the Kjell Henriksen Observatory with their own "cansats". Photo: Mikko Syrjäsuo/UNIS.

October 2018: The SuperDARN radar broke down after all masts in both the main and interferometer array broke down due to high winds and ice loading. The antennae will be rebuild. Photo: Dag Lorentzen/UNIS.

flow of plasma across the polar cap. Members of the Space Physics group were also part of the EISCAT radar team during the Grand Challenge Campaign in December 2018.

The ongoing RCN PolarProg project (which is a collaborative project between scientists at UNIS and in Russia) organized a session at the 2018 EGU meeting in Vienna (Session ST3.6 ULF waves and turbulence in the auroral oval and polar cap regions: New horizons in multi-instrument observations). The project, which was due to finish in 2018, has been granted a one year extension from the research council.

The middle atmosphere team of the AGF space physics group focuses on detection and characterisation of particle precipitation, and studies of the effects of high-energy particle precipitation on the Earth's atmosphere. A four-year research project titled "Which types of particle precipitation matter in the middle atmosphere?" received a positive funding decision from the RCN. It will use the proton effects on the atmosphere as a reference to assess the importance of different types of electron precipitation. Another highlight of 2018 is the detection of energetic particle precipitation in the SuperDARN radar data. According to a newly published study, the atmospheric noise recorded by these ionospheric radars can be used to detect high-energy particles meeting the atmosphere. The noise, as well as the received echo power, is being attenuated by the excess ionisation due to precipitating particles reaching the mesosphere -- lower thermosphere region. This method gives a clear indication of high-energy particles and allows the spatial extent of the particle precipitation region to be monitored.

The space physics group is also involved in instrument design, development and construction. In cooperation with the Centre for Autonomous Marine Operations and Systems (AMOS) at NTNU, a Norwegian Centre of Excellence, small, lightweight, push-broom Hyper Spectral Imager (HSI) prototypes have been constructed for drone and satellite operations. The next steps are to test and space-qualify the instruments for a CubeSat satellite aimed at detecting various oceanic targets.

GRADUATES 2018

MASTER DEGREE:

CRISTINA GERLI
Assessment of the influence of structural features on rift propagation in the Larsen C ice shelf prior its calving event. *(Stockholm University and UNIS)*.

MAGNUS JOHAN ISAKSEN
Dynamical processes in the mesopause region from OH-airglow and meteor echoes above Longyearbyen. *(University of Oslo and UNIS)*.

MATHIAS TOLLINGER
Unravelling the March 1972 northwest Greenland windstorm. *(University of Innsbruck and UNIS)*.

January 2018: Lunar eclipse in Svalbard. Photo: Emma Bland/UNIS.

ARCTIC TECHNOLOGY

April 2018: Arctic technology scientists work on the sea ice. Photo: Sebastian Sikora/UNIS.

BY ARNE AALBERG, HEAD OF DEPARTMENT

The Arctic Technology (AT) department offers courses and performs research within two main fields: *Arctic Engineering* concentrates on engineering problems related to settlements, structures and operations in the Arctic environment: foundations and structures in the frozen ground, loads from the natural environment, like wind, wave and ice forces, material behaviours and landslides and avalanches, Arctic offshore oil and gas exploitation and potable water supply. *Arctic Environmental Technology* concentrates on current and potential pollution problems, environmental impacts and feasible remediation techniques in Arctic areas.

PEOPLE

In 2018, the department had two professors, one associate professor, two research associates, two PhD candidates, one staff engineer, and an adjunct staff with six professors.

EDUCATION

The research activities support and motivates the education in department's courses at all levels, by generating research materials and data, as measurements series on physical and mechanical properties, time dependencies and failure modes of materials as soil and ice, as well as pollution contaminants and concentrations onshore and offshore. This gives students the opportunity to study both the theoretical and practical aspects of Arctic technology, engineering and environmental technology, and further to benchmark analytical and numerical models and simulations for such, in order to provide better assessments and predictions for Arctic infrastructure and contribute to a sustainable environment. In 2018, the department offered altogether 23 courses at the bachelor-, master- and PhD level. Environmental toxicology teaching included some new and popular topics such as plastics in the marine environment. Investigations and testing by the department were performed in and around Longyearbyen and Svea, the Russian settlements Barentsburg and Pyramiden, and on ice in the sea east of Svalbard.

RESEARCH

The Arctic Technology Department conducted research in a wide field in 2018, within ice mechanics and offshore engineering, geotechnics, environmental chemistry and toxicology, and marine technology.

Ice mechanics and offshore engineering

The research group consisted of one full time professor and two adjunct professors, whereas one research associate and one postdoc were part of the group through external projects.

The group conducted fieldwork and data collection at various sites around Svalbard; Van Mijenfjorden (Sveabukta) and in the Barents Sea Opening, focusing on ice strength properties, ice drift patterns, drag forces and energy flux to drift ice, ice rubble structure, and iceberg studies. Field studies of internal waves and wave damping by land fast ice were performed together with a group from the University of Oslo, to inform a model of wave damping in the marginal ice zone of drift ice.

Adjunct professor Sveinung Løset (NTNU/UNIS) is the director of the Centre for Research-Based Innovation *Sustainable Arctic Marine and Coastal Technology* (SAMCoT). Professor Aleksey Marchenko is leader of work package 1 (WP1), while postdoc Aleksey Shestov is deputy leader. The research and education projects in the group comprised:

The SAMCoT WP1 (Data Collection and Process Modelling) performed full-scale tests on compression, indentation and flexural strength of floating sea ice with original equipment designed at UNIS for the project works. Two types of compression strength tests were performed, the first using a cantilever beam and compression along the beam axis, the second with a beam with fixed ends and loaded by a perpendicular force at the beam midspan. It was discovered that compression strength of ice was higher in the tests of the second type, and analyses of ice granular structure showed decreased grain sizes in the compression zone. Brittle failure of cantilever beams did not influence the granular structure of ice in the first type tests. Full-scale indentation tests were performed with and without vibrations, where the vibrations were introduced by means of a vibrating-plate standing on the ice. Vibrations increased indentation rate in the tests in comparison with the same tests performed without vibrations. Results of more than 70 full-scale flexural-strength tests performed in Spitsbergen fjords and on the drift ice of the Barents Sea were analyzed and approximation formulas describing the dependence of sea ice flexural-strength and effective elastic modulus from ice temperature and salinity were constructed. Results of the full-scale tests were used for the verification of models describing ice deformation and failure, and models for ice-structure interaction.

Field investigation of sea ice morphology and drift were performed in the region of Bear Island. It was discovered that floes with thickness up to 5 m and relatively small diameters about 30 m and smaller are typical features of sea ice in the region. Drilling studies showed that these floes are completely consolidated and have salinity of about 5 ppt, i.e. they represent first year ice ridges consolidated on the way of their drift from northern regions of the Barents Sea. Measurements of water characteristics and turbulence in under ice boundary layer were performed from drifting ice. Collected data were used for the parametrization of ocean heat flux and effective eddy viscosity. These characteristics were used for the modeling of thermodynamic consolidation of ice ridges and wave damping in marginal ice zone. Thermodynamic modeling demonstrated that drifting ice ridges melting and consolidating at the same time under the influence of ocean heat flux can transform during 2-3 months into the floes which are similar to observed floes. Ice drift velocities were registered with ice trackers deployed on several floes. Maximal drift velocities exceed 1 m/s in the region. Ice trackers equipped with accelerometers were deployed on drift ice to investigate wave damping effects in ice conditions. Performed investigations are useful for offshore development and navigation.

Other projects:

IntPart: "Arctic off shore and coastal engineering in changing climate" (2018-2020). UNIS is the project responsible, and cooperates in research and education with NTNU and UiO (Norway), and with Memorial University of Newfoundland (Canada), Dartmouth College and University Alaska Fairbanks (USA), Lomonosov Moscow State University and Moscow Institute of Physics and Technology, State University (Russia).

Hydralab: "Investigation of bending rheology of floating saline ice and physical mechanisms of wave damping". This project involves experiments in Hamburg Ship Model Basin, Germany (January, 2018). Participants: UNIS, UiO, University College of London and Advanced Optic Solutions.

Petromaks 2: "Dynamics of floating ice" (NRC, with UiO as project responsible)

SITRA: "Safety of Industrial Development and Transportation Routes in the Arctic" (2016-2019). UNIS is the project leader and the focus is on cooperation in education and research with Memorial University of Newfoundland (Canada), together with Norwegian and Russian partners.

UNIS master student Maren Kallelid, supervised by Ass. Prof Torodd Nord (NTNU/UNIS) was in Antarctica carrying out here master thesis with a novel borehole jack to characterize ice strength of the air strip close the Troll station.

Geotechnics

This research group consisted of one full time professor, one adjunct professor, one PhD student, and one researcher.

March 2018: Arctic technology scientists work on the sea ice in Svea. Photo: Sebastian Sikora/UNIS.

A major part of the group's research was connected to the finalization of the *Norwegian Geo Test Site -Permafrost site* in Adventdalen (NGTS), https://www.ngi.no/Prosjekter/NGTS-Nasjonale-Geoforsoeksfelt), comprising installation of on-line instrumentation in the site, determination of the soil's thermal regime, frozen soil sampling and conduct of extensive laboratory test programmes for material characterization and testing of mechanical and thermal properties of saline frozen soil. PhD Graham Gilbert was engaged full time for this work, assisted by professors Arne Aalberg and Arne Instanes. The permafrost test site comprises two test fields in the vicinity of Longyearbyen for long term geotechnical testing and future investigations of field test methods for frozen soil. The NGTS project has enabled building up valuable scientific infrastructure for research and education at UNIS, comprising the test site instrumentation, instruments for soil mechanical and thermal analyses, acquisition of a geotechnical test rig and temperature controlled storage containers, etc.

The RCN supported 3-year project *Monitoring of Arctic Infrastructures* (MONARC) continued with repeated series of building survey and foundation levelling to observe settlements on building foundation in Pyramiden, Barentsburg, Svea and Longyearbyen. The project investigates effects of warming climate on structures and foundations in Svalbard. Participants are Sintef, UNIS, Moscow State University, Trust Arcticugol (Barentsburg/Moscow) and Store Norske Spitsbergen Grubekompani (SNSK). Preliminary results were presented in conference papers.

The Horizon 2020 Project "Nunataryuk" (https://www.nunataryuk.org/) started late 2017 and NTNU, DTU and UNIS are responsible for the Work Package on Coastal Structures. Field-tests are under establishment on the NGTS site in Adventdalen. Plate loading is one of the effective field tests to estimate creep behavior and degrading of permafrost. Three foundation plates are placed on the permafrost with the center distance of a few meters after digging the holes through active layer. Necessary insolation and lubrication are required to eliminate the effect of heat transfer through the loading plate and frost heave lifting. The continuous monitoring of vertical and horizontal displacement, temperature, earth, and fluid pressure will be recorded in the next two years.

Environmental chemistry and toxicology

The research group consisted of one full time associate professor, two adjunct professors and one PhD candidate. The group has participated in several projects, and has had activity in Longyearbyen, Ny-Ålesund and Barentsburg.

The Barentsburg chemistry laboratory has served as field work platform for research and education for the UNIS

April 2018: AT-324/824 students perform fieldwork in Barentsburg. Photo: Roland Kallenborn/UNIS.

course "Techniques for the Detection of Organo-Chemical Pollutants in the Arctic Environment" led by Professor Roland Kallenborn (NMBU/UNIS). More than 35 Master and PhD students have benefit the open and constructive academic collaboration with our Russian colleagues in Barentsburg, an activity that will be continued despite the official end of the Barelab collaboration project.

In the project "Reducing the impact of fluorinated compounds on the environment and human health", a PhD student conducted extensive fieldwork in Longyearbyen and Adventdalen autumn 2018, for identification of point sources for perfluoroalkyl substances (PFASs). All samples were prepared for analysis at the UNIS laboratory for subsequent analysis at NMBU.

In June, the Summer School on "Water Management in Cold Regions" was held at UNIS. In total 63 students from 16 countries participated in the course which was organized by UNIS, NMBU and the Harbin Institute of Technology (China). All lectures and exercises were recorded and are now organized as e-learning course as electronic learning tool for follow up courses.

PhD student Tatiana Drotikova conducted extensive fieldwork in Longyearbyen and Barentsburg vicinities, including exhaust sampling in chimneys of the both coal-fired power plant, for identification of profiles of local sources of polycyclic aromatic hydrocarbons (PAHs) and their nitrated (NPAHs) and oxygenated (OPAHs) toxic derivatives in Svalbard air (RIS-10964). Drotikova was also involved in the project "Strengthening of the cooperation within air pollution research in Svalbard". This project, which is supported by Svalbard Science Forum, is collaboration between The Arctic University of Norway and several international partners.

Comprehensive fieldwork has been performed to monitor pollution from cruise ships and transport vessels traffic in summer 2018 in Longyearbyen.

In the field of toxicology, the Environmental Waste Management (EWMA) project, with UNIS contributor Helena Reinardy, involved extensive analysis and writing, including publication of two peer-reviewed papers. The project "Sensitivity of polar cod early life stages to a changing Arctic: A study of the impact of petroleum and elevated temperature" (Sens2change), was initiated. Helena Reinardy led the workpackage on epigenetic analyses. The project "Incorporating pollutant availability and mobility in environmental risk assessment management tools" (PAMERA) was also initiated.

In March 2018, the AT department hosted the biannual Norwegian Environmental Toxicology Symposium (NETS 2018). Approximately 100 scientists and students attended the three day symposium, which focused on solutions for pollution in a warming Arctic.

In a RCN project effects of per- and polyfluorinated substances (PFAS) on glaucous gulls have been investigated. Adjunct professor Bjørn Munro Jenssen, one PhD fellow and one MSc student were involved in this project. In addition, in the project "Reducing the impact of fluorinated compounds on the environment and human health", one PhD fellow investigated levels and effects of PFAS originating from the use of aqueous fire-fighting foams (AFFF) at Svalbard airport. This RCN project is a collaboration between NGI, NTNU, NMBU and UNIS. Furthermore, based on sampling during the field course in course AT-330, the use of reindeer faeces as bioindicators of local and long-range pollution of toxic elements was investigated. The results showed that

February 2018: UNIS and NTNU master student Maren Kallelid was in Antarctica to characterize the ice strength of the air strip close the Troll station. Photo: Maren Salte Kallelid.

levels of toxic elements such as mercury, cadmium and lead were higher at Kapp Linné than in Adventdalen, most likely due to higher precipitation rates at Kapp Linné, indicating long-range atmospheric transport as the source. In Adventdalen, cadmium levels were inversely correlated with the distance to the coal power plant, indicating that atmospheric releases of Cd from coal combustion at the coal power plant is a local source of cadmium pollution. However, levels were in general low and the potential pollution does not appear to constitute any risk of adverse effects.

MARINE TECHNOLOGY

This group consisted of on adjunct professor position, shared by two persons. The group activity is closely linked to the Centre of Excellence AMOS at NTNU, and working with autonomous vehicles underwater, on the surface and in the air.

During the course AT-334 "Arctic Marine Measurements Techniques, Operations and Transport", AUVs were deployed in Billefjorden and Tempefjorden also providing data for the research project TerrACE. Water column data on salinity, temperature, oxygen and turbidity were collected providing information on layers of melting water and fjord water.

GRADUATES 2018

PHD DEGREE:

LIYUAN CHI
Shock Compression and Fractures in Laboratory Rock Blasting. *(NTNU and UNIS).*

MASTER DEGREE:

DITTE SECHER PALUDAN
Transcriptional study on endocrine disruption in female polar cod *(Boreogadus saida)* following a prolonged recovery to short-term exposure to oil spill residues. *(University of Copenhagen and UNIS).*

June 2018: The very first master course within the Arctic Safety Center was arranged in summer of 2018. Here the students in AS-301 Risk Assessment of Arctic Natural Hazards are at Rudmosepynten in Adolfbukta. Photo: Thorben Dunse/UNIS.

SCIENTIFIC PUBLICATIONS 2018

Scientific publications (NVI level 1 and 2) published with UNIS as author address in journals accepted by the Norwegian Association of Higher Education Institutions (UHR).

Abernethy, R., Ackerman, S. A., Adler, R., Albanil Encarnacion, A., Aldeco, L. S., Alfaro, E. J., Aliaga-Nestares, V., Allan, R. P., Allan, R., Alves, L. M., Amador, J. A., Anderson, J., Andreassen, L. M., Argüez, A., Armitage, C., Arndt, D. S., Avalos, G., Azorin-Molina, C., Báez, J., Bardin, M., Barichivich, J., Baringer, M. O., Barreira, S., Baxter, S., Beck, H., Becker, A., Bedka, K. M., Behe, C., Bell, G. D., Bellouin, N., Belmont, M., Benedetti, A., Bernhard, G., Berrisford, P., Berry, D. I., Bhatt, U., Bissolli, P., Bjerke, J. W., Blake, E. S., Blenkinsop, S., Blunden, J., Bolmgren, K., Bosilovich, M. G., Boucher, O., Bouchon, M., Box, J., Boyer, T., Braathen, G. O., Bromwich, D. H., Brown, R., Buehler, S., Bulygina, O. N., Burgess, D., Calderón, B., Camargo, S. J., Campbell, E. C., Campbell, J. D., Cappelen, J., Carrea, L., Carter, B. R., Castro, A., Chambers, D. P., Cheng, L., **Christiansen, H. H.**, Christy, J. R., Chung, E., Clem, K. R., Coelho, C. 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ARCTIC GEOLOGY

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Frauenfelder	Regula	Norwegian Geotechnical Institute
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Cassano	John	University of Colorado, USA
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Flier	Evert	Norwegian Mapping Authority
Gammelsrød	Tor	University of Bergen, Norway
Graversen	Rune	UiT The Arctic University of Norway
Groh	Andreas	Technische Universität Dresden, Germany
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Inall	Mark	Scottish Association for Marine Science
Isachsen	Pål Erik	University of Oslo, Norway
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