# ANNUAL REPORT 2017

UNIS
The University Centre in Svalbard

**Front page | May 2017:** AT-331/831 Arctic Environmental Pollution fieldwork in Mohnbukta, on the east coast of Spitsbergen. Photo: Richard Hann/UNIS.

**Editor** | Eva Therese Jenssen/UNIS.


Photo: Aleksey Shestov/UNIS.

# FROM THE DIRECTOR

UNIS continued to experience growth in 2017. In all, 794 students from 45 nations attended courses and 59 master's students worked on their theses. This equates to 222.5 student-labour years, which is a new record. Consequently, 2017 was the first year we achieved the target of 220 student-labour years. Moreover, 50% of the students came from programmes of study at Norwegian universities (Norwegian degree students). There were 31 post docs and PhD candidates at UNIS in 2017 and five public defences were held. In 2017, UNIS registered 153 publications in authorized publication channels and peer-reviewed journals.

It was a demanding year from a financial perspective, but we managed to turn a negative trend from the previous two years of significant deficits into a small surplus in 2017. This was achieved through strict cost saving measures without having a negative effect on the quality of the academic production. However, this has led to lagging behind when it comes to maintenance and investment in construction and working capital, which means the demanding financial situation will continue in the foreseeable future. The measures implemented were followed loyally by the entire organisation.

An increasing number of students combined with a limited capacity of student housing has created major challenges for the organisation. However, it is extremely positive that the Arctic Student Welfare Organisation has gained access to land for a major new student housing construction project in Longyearbyen. A coordinated effort is underway concerning the subdivision work and building application. The goal is that UNIS will no longer have students living in avalanche prone Nybyen.

There was a high level of activity on the research front in 2017. Svalbard Integrated Arctic Earth Observing System (SIOS) was by year-end in the process of becoming an independent organisation, and the Arctic Safety Centre has developed in accordance with the milestone plan in terms of both costs and progress. Moreover, UNIS is involved in The Nansen Legacy, which underwent an evaluation by a scientific panel under the auspices of the Research Council of Norway in 2017. The panel agreed on a very strong overall assessment.

During the year, UNIS was very involved in the process of preparing the basis for the government's strategy for research and higher education in Svalbard. The government is expected to make the new strategy public in the spring of 2018. Furthermore, the Board of Directors at UNIS has initiated a new strategic process for the institution. The background for this decision are the major transformations taking place in and around Longyearbyen and what role UNIS shall have in this picture. The strategic work will be concluded in 2018.

UNIS shall be a resource for the local communities in Svalbard. As an education institution, UNIS offers research-based and field-based teaching at a high level to young people from many countries and, in so doing, contributes to securing the recruitment of competent labour for research, administration and business development in and for Arctic regions. Staff at UNIS are important resources when it comes to evaluating the avalanche risk in and around Longyearbyen, as well as making a major contribution to local events such as Polarjazz, the Svalbard Seminars and the Svalbard Ski Marathon, etc. UNIS will continue to take such tasks seriously in the years ahead.

Photo: Eirik Berger

Harald Ellingsen
Managing director

# EXCERPT FROM THE BOARD OF DIRECTORS' REPORT 2017

**February 2017:** UNIS and the Svalbard Science Centre. Photo: Hanne H. Christiansen/UNIS.

The University Centre in Svalbard AS (UNIS) was established as a state-owned limited corporation on 29 November 2002. 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 high international quality 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.

The University Centre in Svalbard AS (UNIS) is wholly owned by the Ministry of Education and Research.

The annual accounts for 2015 and 2016 showed significant deficits. This has necessitated more stringent budgeting and financial management, which has characterized operations in 2017. The measures implemented were followed loyally by the entire organisation, which resulted in an operating surplus in 2017.

There is a positive trend in student production at UNIS. In 2017, the target of 220 student-labour years was achieved for the first time. At the same time, a balance was achieved between students from Norwegian and international programmes of study.

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, the avalanche hazard report by the Norwegian Water Resources and Energy Directorate (NVE) in December 2016 raises concern that 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 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 expectations for this process and believes it will be a win-win situation for all parties.

All teaching at UNIS should 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 research centres/projects. Moreover, UNIS wishes to strengthen the externally funded component of its research.

While UNIS will maintain focus on high-quality research and education in the Arctic, the institution is considering developing new areas such as "Safety in the High Arctic". UNIS also wishes to take on a greater role in supporting the local community. A pilot course on "Risk Assessment of Arctic Natural Hazards" will be tested in the summer of 2018.

Work on the further development of UNIS is an ongoing process, which will continue in 2018. Work is underway to strengthen the administrative apparatus for initiating and managing research activities to further realise the organisation's potential in Arctic research.

All available space at Svalbard Science Centre is fully utilized. Several of the tenants require more space based on their current level of activity, while 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 to enable them to cooperate more closely with the institutions present here. In 2017, UNIS in collaboration with the other tenants and key institutions in Longyearbyen, started to compile a document outlining the requirements for increased activity within an expanded Svalbard Science Centre.

In 2017, UNIS was very involved in the process of preparing the basis for the government's strategy for research and education in Svalbard. The Board of Directors anticipates that this strategy will be an important foundation for the further development of the institution in the years ahead.

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.

## EDUCATION AND STUDENT STATISTICS

Our commission from the Ministry of Education and Research for 2017 was to "develop an educational provision that represents approximately 220 student-labour years". A total of 222.5 student-labour years was produced in 2017, of which 199 student-labour years were linked to credits (ECTS) from completed courses and 23.5 student-labour years linked to presence by guest master's students.

In 2017, 794 students from 45 nations spent shorter or longer periods at UNIS. This included both course students and guest master's students. 50% of the students came from programmes of study at Norwegian universities (Norwegian degree students), which was an increase of 5% from 2016. The remaining 50% came from international universities. This indicates that the student group which has increased most is foreign citizens admitted to ordinary programmes of study at Norwegian universities. The gender distribution shows that 55% of the students were women, which is an increase of 5% since 2016. UiT – The Arctic University of Norway is the Norwegian university which sends the most students to UNIS.

The results from the final assessment of the courses has been above average, with B as the average grade. The failure percentage has been low (1%). The overall results show that although the course provision has remained stable, UNIS has experienced an increase in student-labour years; both higher percentages of places filled on courses and increased presence by guest master's student. The number of applicants has increased, and the results of the final assessment are good.

## RESEARCH AND ACADEMIC INITIATIVES – EXTERNAL FUNDING

UNIS has ambitious goals for its research and participates in several major initiatives aimed at establishing national and international centres. UNIS wishes to safeguard a robust research environment of high quality, contribute to the knowledge front on Arctic issues, generate innovations, business development both locally and nationally and support the research-based teaching. Collaboration with strong national and international academic environments through participation in research projects will be an important tool for the further development of the institution. To increase efforts to seek opportunities to participate in new projects, work is underway to strengthen the organisation in this area.

The turnover for external activities at UNIS in 2017 was more than NOK 37 million. This was spread over 51 registered projects. The key externally funded projects include:

- Svalbard Integrated Arctic Earth Observing System (SIOS) was by year-end 2017 in the process of becoming an independent organisation.
- Arctic Safety Centre is in accordance with the milestone plan in terms of both costs and progress.

- The Birkeland Centre for Space Science (a Centre of Excellence), which is managed by the University of Bergen, underwent a midway assessment in 2017 and achieved a very strong result.

- SAMCoT: "Sustainable Arctic Marine and Coastal Technology" (Centre for Research-based Innovation), is entering its final full year of operation in 2018. The project is managed from NTNU in Trondheim, with a work package (WP1) managed by and performed at UNIS.

- Norwegian Geo Test Site (NGTS) is part of an infrastructure project with financial support from the Research Council of Norway in which UNIS collaborates with SINTEF. The project is managed by the Norwegian Geotechnical Institute (NGI).

- The Nansen Legacy underwent an evaluation by a scientific panel under the auspices of the Research Council of Norway in 2017. The panel agreed on a very strong overall assessment with 6/A for all points.

- bioCEED (Centre of Excellence in Biology Education) is evaluated by NOKUT's expert committee. The project will be continued and financed for a further five-year period (2019 – 2023).

## DISSEMINATION AND VISITS

UNIS receives considerable attention in the Norwegian and international media. In 2017, there were nearly 300 media reports in Norwegian and international media including *The Telegraph, BBC, National Geographic* and *CNN.*

Around 700 people from Norway and overseas visited UNIS in 2017. These delegations included the Norwegian Inter-Ministerial Committee on the Polar Regions, the Danish Ministry of Education and Research, the Nordic Council of Ministers, the Italian Foreign Affairs committee, several standing committees from the Norwegian parliament and Norwegian MPs, ambassadors and the Chinese Minister of Research, as well as representatives from the Swedish national legislature, the US Congress and the British parliament.

Each winter UNIS, Norwegian Polar Institute and the Governor of Svalbard organise the Svalbard Seminars. Each seminar evening in 2017 attracted around 100 people. The Svalbard Course and Studietur Nord, which were held during the summer, both received positive feedback. In November, an open day was held at Svalbard Science Centre during which employees and students displayed research to interested children and adults.

## STAFF

As of 31 December 2017, the academic staff at UNIS comprised of 11 professors, 17 associate professors, three researchers, 12 post docs, 19 PhD candidates and 43 with adjunct professor/associate professor attachments. The technical and administrative staff comprised 44 full-time equivalent work years.

**September 2017:** The Chinese Minister of Science and Technology, Dr. Wan Gang (centre), visits UNIS. Photo: Inger Lise Næss/UNIS.

Women accounted for 55% of the technical and administrative positions, 52% of the academic positions and 55% of the students. Six 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 2018. It has already been decided to strengthen the organisation by creating a new position responsible for the initiation and follow-up of external activities at UNIS. This will be implemented in 2018.

## STAFF HOUSING AND STUDENT APARTMENTS

At year-end UNIS owned a total of 53 housing units. UNIS leases UNIS Guest House for guest lecturers and guest researchers (52 studio apartments). To cover the remaining needs, UNIS rents 29 housing units for staff from various actors in Longyearbyen.

UNIS has 21 housing units in areas prone to avalanches and landslides. Measures to secure the house in Lia against avalanches has begun. However, it remains unclear how many of our housing units this will include.

The Arctic Student Welfare Organisation had 208 studio apartments for students in 2017. These studio apartments are in Nybyen and at Sjøskrenten (adjacent

**May 2017:** UNIS director Harald Ellingsen and professor Henrik Skov from Aarhus University's Villum Research Station in Greenland, signed a collaboration agreement during the first SVALGREEN workshop. Photo: Eva Therese Jenssen/UNIS.

to UNIS). The landslide risk survey shows that student accommodation in Nybyen are in a landslide prone area. The Arctic Student Welfare Organisation has acquired land at Elvesletta and wants to move all student housing to Elvesletta. A coordinated effort is underway concerning the subdivision work and building application.

It is essential for UNIS that the students have satisfactory living conditions. 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.

## 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 evaluating the avalanche risk in and around Longyearbyen and assisting with local events such as Polarjazz and the Svalbard Ski Marathon. We expect that the downscaling of the mining activities in Svalbard will lead to an increased community building role for UNIS.

## HEALTH, SAFETY AND ENVIRONMENT (HSE)

Absence due to illness at UNIS in 2017 was 1.5%. 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 2017, more than 100 field safety courses of various duration were held for more than 1,200 people.

During 2017, UNIS has had special focus on quality assurance of passage at sea in small boats. Formal qualifications for boatmanship and routines for safe passage have been key aspects of this. Moreover, efforts have taken place during the year to revise HSE-related routines and regulations.

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.

UNIS cooperates closely with the local administration at the Office of the Governor of Svalbard and the Longyearbyen Community Council to find good solutions,

**January 2017:** A signal flare is shot during the AS-101 Arctic Survival and Safety practical outdoor group exercise. Photo: Børge Damsgård/UNIS.

particularly in connection with UNIS' activity in the field. 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 is unaware of contamination of the wider environment to any significant degree due to the company's operations. UNIS is working 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 2017 appropriations from the Ministry totalled NOK 128,870,000, of which NOK 103 million constituted of base funding, NOK 1 million of investments in equipment and NOK 24.9 million rent/operation of the Svalbard Science Centre and the Kjell Henriksen Observatory (KHO).

Income over and above the appropriations from the Ministry is NOK 57.8 million, of which NOK 43.7 million is external research project income and NOK 14.1 million in income from consultancy services and rentals.

In the two previous years UNIS had an operating deficit. In 2017, there has been major focus on achieving efficient operation and balancing the accounts and the annual accounts for 2017 show an operating surplus of NOK 1.1 million. However, this has led to lagging behind when it comes to maintenance and investment in construction and working capital, which means the demanding financial situation will continue in the coming years.

## BOARD OF DIRECTORS AND ANNUAL GENERAL MEETING

The Board of Directors held six meetings in 2017, including one by telephone conference and one Longyearbyen. A total of 71 items were officially discussed. The Annual General Meeting was held in Oslo on 23 June 2017.

## TROMSØ, 14 MARCH 2018:

Chair Berit Kjeldstad (NTNU); Deputy Chair Jarle Nygard (University of Oslo); Morten Hald (University of Tromsø); Lise Øvreås (University of Bergen); Eva Falleth (Norwegian University of Life Sciences); Nina Frisak; Arild Olsen (Longyearbyen Community Council); Pernille Bronken Eidesen, Petter Sele and Eli Anne Ersdal (staff representatives).

# EDUCATIONAL QUALITY

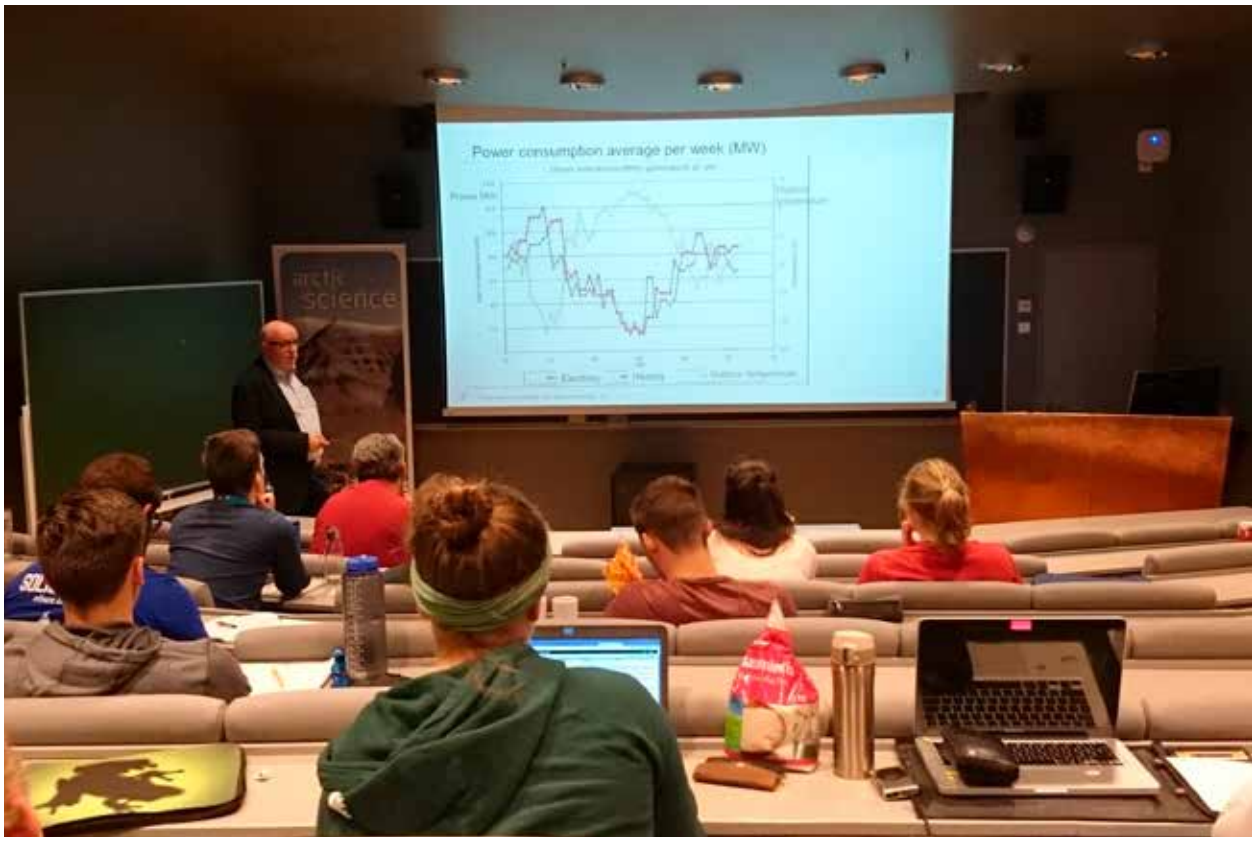
BY ANE H. BJØRSVIK, HEAD OF DEPARTMENT OF ACADEMIC AFFAIRS

The revised UNIS quality assurance system for educational activities was approved in February 2017. The quality system is built upon the basis of the quality systems at the Norwegian universities and shall secure high quality and continuous focus on improvements in all educational activities. The UNIS strategy emphasizes that UNIS shall offer research- and field-based courses of high quality where students are actively involved, where the learning environment has high standards and a close follow-up of students. The system has a clear definition of roles, responsibilities, tasks and processes that contribute to the fulfilment of these goals. The quality system also includes links to administrative routines and regulations at UNIS. In 2018, UNIS will focus on the revision of the course evaluations and an implementation of a formal notice system for students regarding learning environment.

The UNIS Education Committee (ECom) is responsible for the work on educational quality. This work shall focus on the quality in the education offered at UNIS and an increased educational quality for our students. The UNIS Board of Directors has the overall responsibility for education and educational quality at UNIS and receives an annual report on educational quality. The report mainly describes the quality work and status of UNIS education and is based on findings in student evaluations, input from different parts of UNIS which has direct influence on the education quality and the educational setting, as well as student statistics.

For 2017, both the level of admission and examination results of UNIS students were high, and the percentage of failed exams were lower than in 2016. The feedback UNIS receives from the students show that they to a high degree experience a good learning environment. However, they wish the curriculum lists are made available before the course starts, in addition to getting more course specific information and more field preparation. Also, the students expect UNIS to have a learning management system (LMS). For further information, please see the 2017 Report on Educational Quality available on our website (both in English and Norwegian).

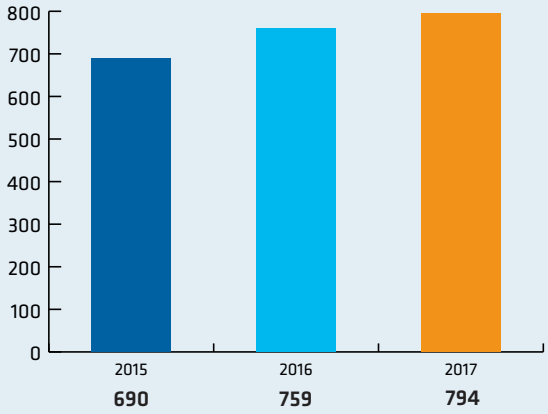
UNIS' participation in the Centre of excellence in education, bioCEED, continues to contribute to further strengthening of the educational quality focus. bioCEED has made available resources and competences in educational quality for our staff, and organizes together with ECom the annual UNIS Learning Forum.



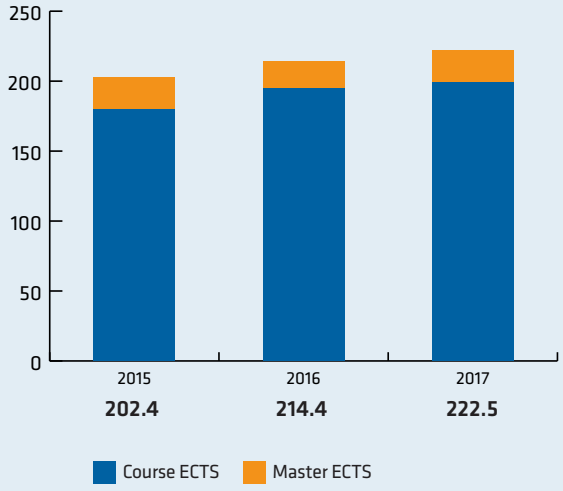

**June 2017:** AGF-353/853 Arctic Energy Exploration and Development lecture in Lassegrotta. Photo: Lars Henrik Smedsrud/UNIS.

# STATISTICS

## TOTAL NUMBERS OF STUDENTS

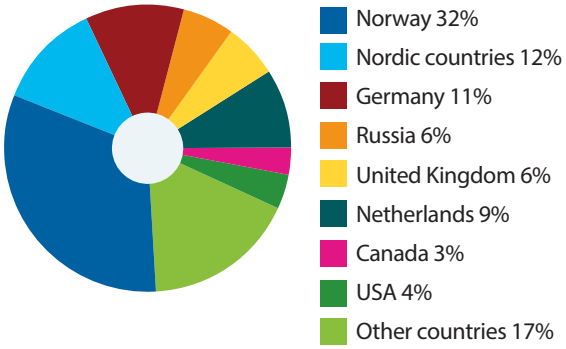



## PRODUCTION IN STUDENT-LABOUR YEARS (1 YEAR = 60 ECTS CREDITS)

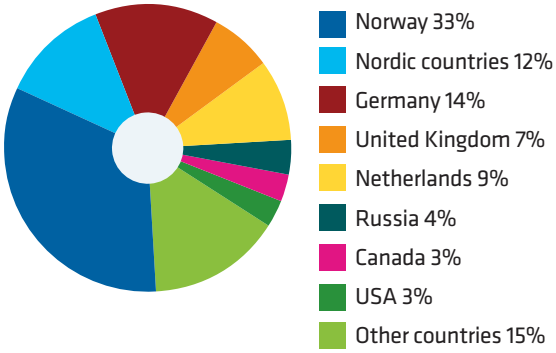



Note: UNIS registers ECTS by 1) course production and 2) master students attendance

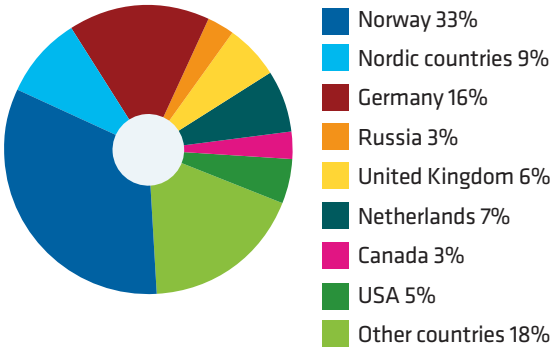
## STUDENT NATIONALITY 2015




## STUDENT NATIONALITY 2016




## STUDENT NATIONALITY 2017



# PROFIT AND LOSS ACCOUNT 2017

| GROUP* | | | University Centre in Svalbard AS | |
|---|---|---|---|---|
| 2017 | 2016 | | 2017 | 2016 |
| **NOK** | **NOK** | **OPERATING INCOME** | **NOK** | **NOK** |
| 128 870 000 | 125 360 000 | Operating grant from the Ministry | 128 870 000 | 125 360 000 |
| 75 000 | 0 | Other grants | 75 000 | |
| -1 007 128 | -2 611 902 | Appropriation for investments | -1 007 128 | -2 611 902 |
| **127 937 872** | **122 748 098** | **Operating grant from the Ministry** | **127 937 872** | **122 748 098** |
| 43 734 377 | 44 536 661 | External project income | 43 740 259 | 44 993 136 |
| 0 | 2 173 321 | Operating grant from sponsors | 0 | 0 |
| 13 962 633 | 14 515 617 | Other incomes | 13 962 633 | 15 515 617 |
| **185 634 882** | **183 973 697** | **Gross operating income** | **185 640 764** | **183 256 851** |
| 37 289 733 | 37 708 244 | Direct project expenses | 37 289 733 | 37 708 244 |
| **148 345 149** | **146 265 453** | **Net operating income** | **148 351 031** | **145 548 607** |
| | | **OPERATING EXPENSES** | | |
| 75 688 322 | 76 763 064 | Salary and related expenses | 75 688 322 | 76 763 064 |
| 9 273 395 | 10 421 626 | Fieldwork and cruise | 9 273 395 | 10 421 626 |
| 143 253 | 651 362 | Consultancy services | 0 | 0 |
| 35 091 670 | 33 901 623 | Buildings | 35 091 670 | 33 901 623 |
| 25 391 803 | 28 510 927 | Other operating expenses | 25 386 530 | 28 505 727 |
| 1 775 000 | 1 740 000 | Depreciation | 1 775 000 | 1 740 000 |
| **147 363 443** | **151 988 602** | **Sum operating expenses** | **147 214 917** | **151 332 040** |
| **981 706** | **-5 723 149** | **OPERATING SURPLUS** | **1 136 114** | **-5 783 433** |
| | | **FINANCIAL INCOME AND EXPENSES** | | |
| 634 722 | 756 669 | Financial income | 634 600 | 753 750 |
| 709 230 | 837 806 | Financial expenses | 709 230 | 835 758 |
| -74 508 | -81 137 | Net financial items | -74 630 | -82 008 |
| **907 198** | **-5 804 286** | **Net profit for the year** | **1 061 485** | **-5 865 441** |
| | | **Information about appropriations to:** | | |
| | | Transferred from/to other equity | 1 061 485 | -5 865 441 |
| | | **Sum transfers** | **1 061 485** | **-5 865 441** |

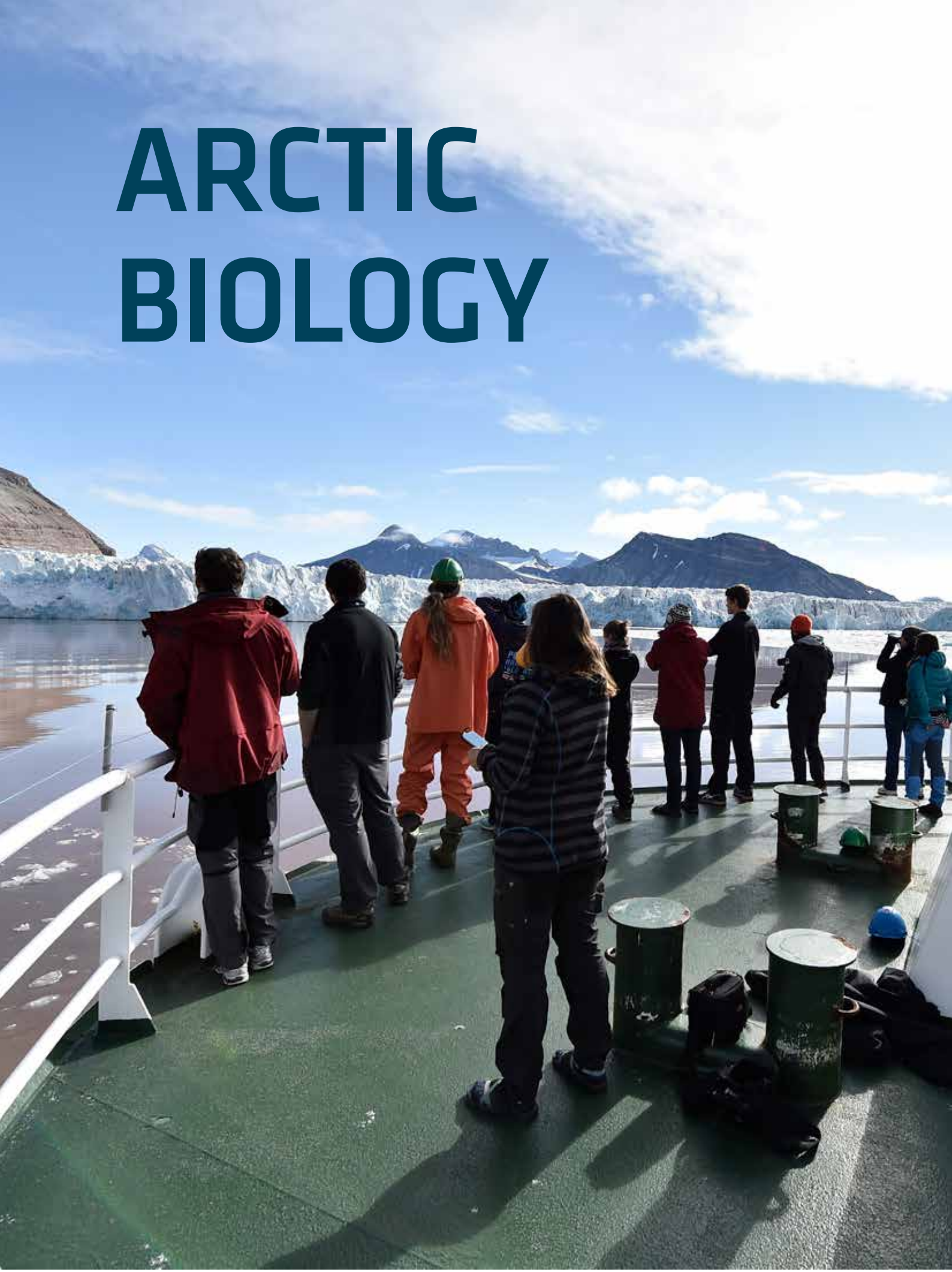
* The UNIS group consists of the University in Svalbard AS and the subsidiary company UNIS $CO_2$ lab.

# BALANCE SHEET 31.12.2017

| GROUP* | | | University Centre in Svalbard AS | |
|---|---|---|---|---|
| 2017 | 2016 | | 2017 | 2016 |
| **NOK** | **NOK** | **FIXED ASSETS** | **NOK** | **NOK** |
| | | **Fixed assets (tangible)** | | |
| 32 866 208 | 34 641 208 | Buildings | 32 866 208 | 34 641 208 |
| **32 866 208** | **34 641 208** | **Sum tangible fixed assets** | **32 866 208** | **34 641 208** |
| | | **Fixed assets (financial)** | | |
| 0 | 0 | Investments in subsidiary company | 175 000 | 100 000 |
| 0 | 0 | Sum financial fixed assets | 175 000 | 100 000 |
| **32 866 208** | **34 641 208** | **Sum fixed assets** | **33 041 208** | **34 741 208** |
| | | **CURRENT ASSETS** | | |
| 10 203 432 | 4 967 149 | Accounts receivable | 10 203 432 | 8 047 709 |
| 4 858 531 | 5 374 677 | Other short-term receivables | 4 858 531 | 5 374 677 |
| 27 136 326 | 15 278 672 | Cash and bank deposits | 27 048 456 | 12 036 956 |
| **42 198 289** | **25 620 498** | **Sum current assets** | **42 110 419** | **25 459 342** |
| **75 064 497** | **60 261 706** | **SUM ASSETS** | **75 151 627** | **60 200 550** |
| | | **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** | | |
| 9 212 177 | 8 304 978 | Other equity | 9 305 307 | 8 243 822 |
| **9 212 177** | **8 304 978** | **Sum retained equity** | **9 305 307** | **8 243 822** |
| **11 266 202** | **10 359 003** | **Sum equity** | **11 359 332** | **10 297 847** |
| | | **LIABILITIES** | | |
| | | **Allowances for liabilities** | | |
| 3 400 000 | 0 | Provisions for liabilities | 3 400 000 | 0 |
| **3 400 000** | **0** | **Sum allowances for liabilities** | **3 400 000** | **0** |
| | | **Other long-term liabilities** | | |
| 16 593 692 | 18 368 356 | Housing loan | 16 593 692 | 18 368 356 |
| **16 593 692** | **18 368 356** | **Sum other long-term liabilities** | **16 593 692** | **18 368 356** |
| | | **Short-term liabilities** | | |
| 1 685 079 | 3 761 672 | Accounts payable | 1 679 079 | 3 761 672 |
| 2 310 126 | 2 437 503 | Public fees and duties | 2 310 126 | 2 437 503 |
| 39 809 399 | 25 335 171 | Other short-term liabilities | 39 809 399 | 25 335 171 |
| **43 804 604** | **31 534 346** | **Sum short-term liabilities** | **43 798 604** | **31 534 346** |
| **63 798 296** | **49 902 702** | **Sum liabilities** | **63 792 296** | **49 902 702** |
| **75 064 498** | **60 261 705** | **SUM EQUITY AND LIABILITIES** | **75 151 628** | **60 261 705** |

* The UNIS group consists of the University in Svalbard AS and the subsidiary company UNIS $CO_2$ lab.

# ARCTIC BIOLOGY



**August 2017:** AB-321/821 Ecology of Arctic Marine Benthos course cruise in Kongsfjorden. Photo: Fredrik Broms/Akvaplan-niva.

**BY 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 climate change biology, seasonal ecology, and spatio-temporal dynamics of species and systems. 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 2017, the AB department consisted of three professors, five associate professors, two support positions, five PhD students and eight adjunct professors. Ingibjörg Svala Jónsdóttir started a two-year contract as adjunct professor from January 2017, and in March Øystein Varpe was appointed full professor, effective from September 2016.

## EDUCATION

The AB department aims to be the preferred study site for learning high Arctic biology through authentic experiences. Our education should be research-based both in knowledge content and how we teach. Knowledge and skills are best mediated through student centred learning and active learning, and authentic research settings and active involvement may create more motivated students and aid deeper learning. With this background a bachelor research project course (AB-207) was started in 2017. The course gives the students insight into AB research, and provides an opportunity to work on their own research project linked to ongoing projects in the department.

The educational development in the AB department is to a large extent linked to the project *bioCEED*, a Centre for Excellence in Biology Education. In 2017, bioCEED has been through a comprehensive evaluation process by an expert committee of the Norwegian Agency for Quality Assurance in Education (NOKUT), where the achieved results and plans for further development have been evaluated. A positive evaluation result led to five new years of funding until 2023.

In 2017 bioCEED provided several meeting arenas for staff and students at UNIS. bioCEED has offered seminars for all employees, e.g. field and research-based

**June 2017:** UNIS staff Chris Borstad (left), Mads Forchhammer and Tove M. Gabrielsen were awarded The Joanna Renc-Roe Award – for pushing the boundaries of SoTL at the EuroSoTL conference in Sweden. Photo: Børge Damsgård/UNIS.

education, sustainable education, pedagogical portfolio, and challenges related to PhD learning. bioCEED has run the teacher's course *Collegial Teaching and Learning in STEM Education* where four AB staff members have participated. Staff from the AB department participated in three major teaching conferences in 2017. At the EuroSOTL in Lund, Sweden, Tove Gabrielsen and Mads Forchhammer, together with their colleague Chris Borstad in the Arctic Geophysics department, received the Joanna Renc-Roe Award 2017 for "Pushing the boundaries of the scholarship of teaching and learning" (SoTL) with their contributing paper "Active learning and course alignment in thematically complex courses". bioCEED also facilitated the annual Learning Forum at UNIS in November 2017, focusing on field based teaching, student workload and active learning.

In 2017 two major pedagogical research projects were launched at the department; *Numerical competence and student active research* funded by the Thon Foundation, and the COPUS project *Classroom Observation Protocol for Undergraduate STEM.* The student representatives from bioCEED have developed *bioBreakfast*, funded by NOKUT. The breakfast is a meeting place for bachelor, master and PhD students, where the students can share experiences related to education and working life. Furthermore, the student representatives have arranged writing and reading seminars for UNIS students.

In order to disseminate knowledge from bioCEED, the National Forum for Educational Leadership in Biology is organized together with the national meetings in Biofagrådet. In 2017 the meeting in Bergen focused on pedagogical merit systems. The forum is organized by Øystein Varpe from the department.

## RESEARCH

In 2017 the AB department developed a new strategy for 2017-2021, and aims to become a leading institution in high Arctic biological research with cutting edge methodology and infrastructure. Our goals embrace advancing fundamental knowledge of 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 cover three overarching themes: *Climate change biology, Seasonal ecology and Spatio-temporal dynamics of species and systems.*

The Isfjorden-Adventfjorden (IsA) high-resolution marine time series station was established in 2011 and is now in its seventh year. The station, set up to determine temporal drivers of microbial communities, and to disentangle natural variations 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. Data from the station was used in several master theses in 2017, and 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. The AB department is currently expanding on these findings by investigating seasonal variations in community function. 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 synthesis-work of historical and new Isfjorden plankton data as part of the *Isfjorden Marine Observatory System, IMOS,* continued in 2017 with seasonal sampling in spring, summer, autumn and winter. The IMOS time series is the only plankton data series from the high-Arctic (>78 °N) with seasonal resolution. Such a long-term plankton time series is possible to maintain since samplings can be secured through regular student field campaigns, combined by the regular activity at the Murmansk Marine Biological Institute (MMBI) field station in Barentsburg. IMOS is financed by the Research Council of Norway (RCN).

The large calanoid copepods of the genus *Calanus* are key components of the Arctic marine food web. Three co-occurring species exist in our part of the Arctic: the sub-Arctic *Calanus finmarchicus*, the Arctic shelf species *C. glacialis* and the true polar species *C. hyperborues*. Recent molecular studies led by Nord University and UNIS revealed that species identification of these three "climate indicator species" is not as trivial as previously assumed. The work is published in high-ranked peer-reviewed journals, led by guest PhD student Marvin Choquet, who defended his PhD in December 2017. In May 2017 guest PhD student Lauris Boissonnot completed her PhD work on turnover of trophic markers and lipid carbon in Arctic marine food webs on small, numerous copepods and the pteropods *Limacina* spp. and *Clione limacina*.

Meroplankton is an important component of the zooplankton community in nearshore regions, but most of these benthic larval forms are morphological

*Top:*
**July 2017:** The students in AB-327/827 Arctic Microbiology perform fieldwork on Longyearbreen.
Photo: Lise Øvreås/UNIS.

*Middle:*
**August 2017:** A young snow crab (*Chionoecetes opilio*) was caught in Raudfjorden during the AB-321/821 Ecology of Arctic Marine Benthos course cruise. This is the first observation of snow crab in Svalbard fjords.
Photo: Fredrik Broms/Akvaplan-niva.

*Bottom:*
**May 2017:** Fieldwork in Ringhorndalen, an area of amazing species richness.
Photo: Pernille Bronken Eidesen/UNIS.

unidentifiable beyond class level. We thus know very little about reproduction and recruitment of marine hard and soft bottom invertebrate fauna at high latitudes. Since 2015, UNIS has run a project on *Meroplankton biodiversity, seasonal dynamics and function in high latitude coastal ecosystems* funded by the Fjord and Coast Flagship at the Fram Centre in close collaboration with the Polish funded project LARVEA. The project is also expanded to include organisms living inside the sea ice. Extensive weekly field sampling was conducted in the ice free Adventfjorden with comparative parallel studies in Van Mijen fjorden. Preliminary results indicate that the zooplankton species composition are not so different, but that ice free fjords has a much higher abundance of zooplankton and meroplankton. The first Svalbard observation of the sea ice cnidarian *Sympagohydra tulie* was found in Van Mijen fjorden in 2017. The AB department will intensify the research on the sympagic meiofauna community to identify the importance of seasonal fjord ice for successful benthic reproduction. In 2017, UNIS became a large partner in the NIVA-led project TerrACE: *Where land meets sea: Effects of terrestrial inputs on contaminant dynamics in Arctic coastal ecosystems* (RCN financed 2017-2020).

The FAABulous project (*Future Arctic Algae Blooms – and their role in the context of climate change*; RCN 2015-2019) collected seasonal data during five cruises between January and August. Furthermore, a sea ice sampling campaign was conducted in Van Mijen fjorden from March to May 2017, with an extended stay there during late April and early May. The 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. The field campaign allowed *in situ* experiments with natural sea ice algae and phytoplankton to compare to the laboratory experiments conducted in Bremerhaven, to study combined stress of light and ocean acidification on key phytoplankton species.

The department's terrestrial research platform *Adventdalen Integrated Research Operations* (ANCHOR) has increased its activity in Adventdalen through collaboration with *Climate-Ecological Observatory for Arctic Tundra* (COAT). COAT 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). During the summer 2017 a range of transects focusing on monitoring long-term changes in vegetation growth and reindeer numbers were established throughout Adventdalen. These transects will be integrated into fieldwork on some AB courses, where student projects will collect winter data to supplement the summer monitoring.

Together with the Norwegian Polar Institute, the AB department hosted a workshop on the Svalbard reindeer, focusing on bringing current research groups together to provide a first complete status of the species. The interdisciplinary project *SVALGREEN*, initiated in 2016 by AB department and the Arctic Geology (AG) department, was continued in 2017 with several joint publications.

Studies on the effects of climate change on the Arctic species and their systems form a central part of the research at the department. The retreating Arctic sea ice may lead to declined growth in tundra shrubs suggests a recent study from AB. Using data from three different species of willow and birch from the tundra of Svalbard and Greenland in a plant growth model, a more complex relationship was found between ice and vegetation growth. The research points to the fact that multiple factors may influence growth of plants in the Arctic region. Herbivorous grazing by reindeer and musk oxen, drought stress induced by rising temperature in an already dry environment, as well as local variations in permafrost preservation and soil humidity are such factors.

AB continued to solve biological puzzles related to drivers of spatial and temporal variation of terrestrial biodiversity and speciation. One focus area the last couple of years have been the arctic hot-spot area detected in the Ringhorndalen-Flatøyrdalen area in Wijdefjorden. This area has revealed amazing species richness, and several new species for Svalbard have been detected in this area the last couple of years. In cooperation with colleagues from the universities in Oslo and Tromsø and Ecofact, we have found several species of butterflies and Svalbard´s only carnivorous plant. One of the main aims for the current investigations is to untangle whether this biodiversity oasis is a relict remnant from the warmer periods in early Holocene, or if the species have dispersed in recently due to climatic changes. We have addressed these questions through phylogeography, biogeography and most recently through analyses of ancient DNA. With support from the Svalbard Environmental Protection Fund, and in cooperation with colleagues from the University of Tromsø and AG at UNIS, we have recently started the analyses of ancient DNA in a sediment core from the area, dating back 12.000 years. Our overall preliminary results support long-time presence in the area.

It was previously believed that one of the major types of mycorrhiza, the arbuscular mycorrhizas, were absent in Svalbard. However, a recent published study based on data collected during our courses in Arctic mycology, led by our former adjunct professor Kevin Newsham, concludes that the mycorrhizas symbiosis is present in grass and forb roots in Svalbard.

Studies of the ecological and evolutionary consequences of seasonality form a core part of research efforts at the department. Studies published in 2017 include reports on life history adaptations to seasonality, with two articles emerging from the *Symposium on Evolutionary Consequence of Seasonality*; the linkages between pollutant levels and reproductive strategies in marine mammals, the foraging behaviour of seabirds, and how sea ice decline in the Arctic impact the annual light regime and thereby visually searching foragers, such as fish.

AB started in 2017 a two-year project on the conflicts between polar bears and humans (*CONBEAR*, funded by the Svalbard Environmental Protection Fund), together with the Norwegian Polar Institute, the Norwegian Environmental Agency and the Governor of Svalbard. The aim is to reduce the frequency of conflicts and to mitigate the effects if such conflicts occur.

### APPOINTMENTS

Børge Damsgård was appointed member of the board in the project *Nansen Legacy*, and vice leader in Biofagrådet.

# GRADUATES 2017

### PHD DEGREE:

**LAURIS BOISSONNOT**
Turnover of trophic markers and lipid carbon in Arctic marine food webs. (*University of Bremen and UNIS*).

**MARVIN CHOQUET**
Combining ecological and molecular approaches to redefine the baseline knwoledge of the genus *Calanus* in the North Atlantic and the Arctic Oceans. (*Nord University and UNIS*).

**JULIE CORNELIUS GRENVALD**
Understanding winter patterns of zooplankton diel vertical migration (DVM) in a high Arctic fjord (Kongsfjorden, Svalbard). (*UNIS and University of Tromsø*).

### MASTER DEGREE:

**CALUM BACHELL**
The role of the male Common Eider *Somateria mollissima* as a protector against nest-predation. (*University of Tromsø and UNIS*).

**MATHILDE BOURREAU**
Impact of climate change on protist communities in Isfjorden, Svalbard. (*University Pierre et Marie Curie and UNIS*).

**HANNA BÖHNER**
The effect of simulated goose grubbing and warming on biomass, nitrogen, phosphorus and silicon concentrations of graminoids in High Arctic tundra ecosystems. (*University of Freiburg and UNIS*).

**HÉLÉNA CUNY**
Zooplankton dynamics in ice free versus ice covered fjords in Svalbard. (*University of South Brittany and UNIS*).

**JULIA DUSAUCY**
From dark to light; development of *Phaeocystis pouchetii* spring blooms in Isfjorden (IsA station), Western Spitsbergen. (*University of South Brittany and UNIS*).

**MARTA DAHL GROTHEIM**
Effects of Experimental Icing and Summer Warming on the Polar Willow Salix polaris on Svalbard. (*NTNU and UNIS*).

**HELENE OVERAA EIDE**
Fate of *Calanus* spp. reproduction and development under different environmental stressors. (*University of Tromsø and UNIS*).

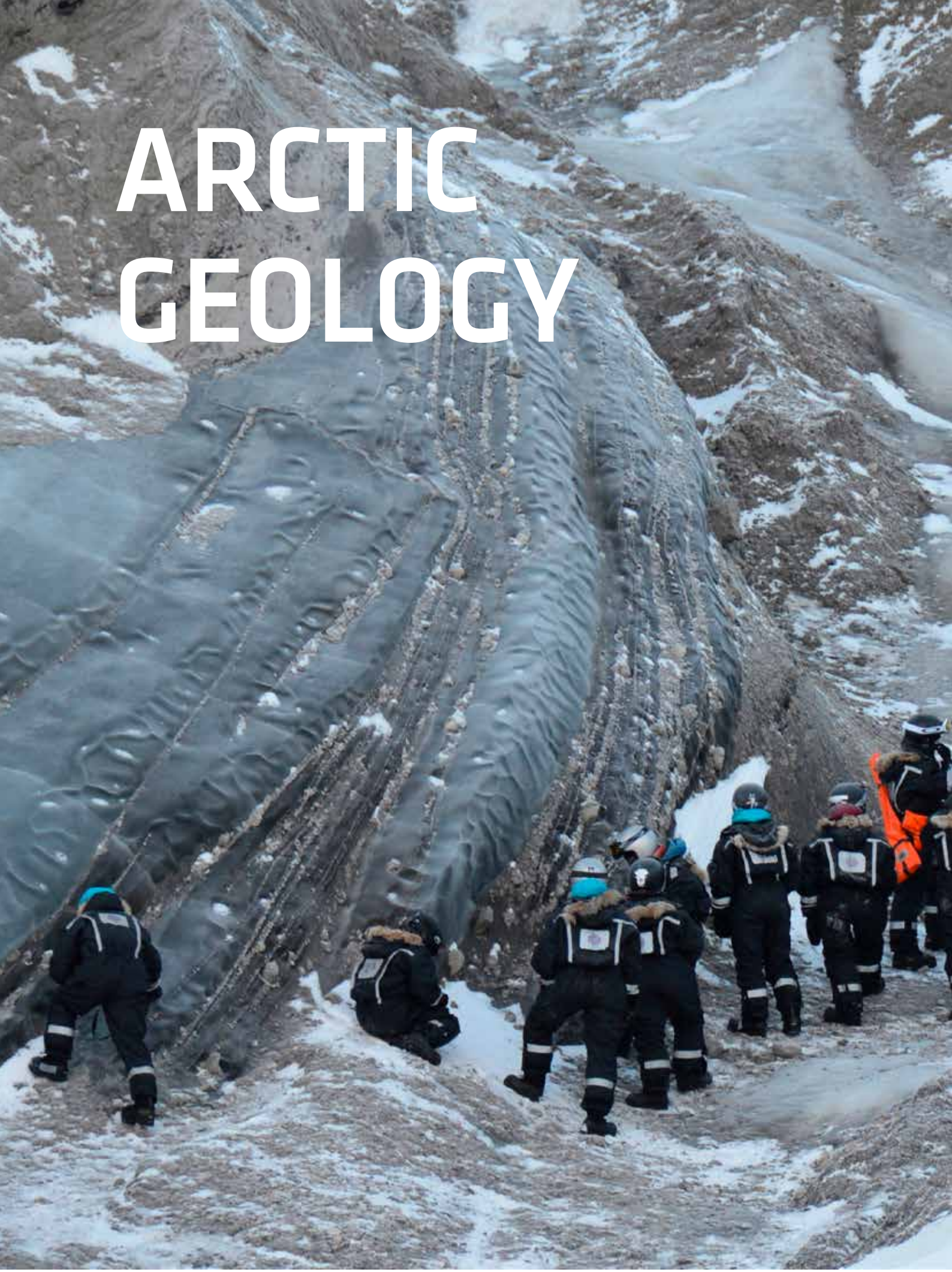
**SVENJA HALFTER**
Large-scale phenology of marine plankton in the North Atlantic and Arctic Ocean. (*University of Rostock and UNIS*).

**HANNE KRISTIN HARALDSEN**
Effects of experimental winter icing and summer warming on high Arctic tundra vascular plants: A comparison of growth forms. (*NTNU and UNIS*).

**LINN SVENDHEIM HUNSTAD**
Seasonal progression of the zooplankton community in a high Arctic fjord and the main physical and biological drivers. (*Nord University and UNIS*).

**PATRICK SCHIMMEL**
Late winter activity of *Micromonas pusilla.* (*Wageningen University & Research and UNIS*).

# ARCTIC GEOLOGY



**February 2017:** AG-325/825 Glaciology excursion to the glacier Tunabreen in Tempelfjorden. Photo: Sebastian Sikora/UNIS.

BY HANNE H. CHRISTIANSEN, HEAD OF DEPARTMENT

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.

## PEOPLE

During 2017 the department had nine full time faculty positions, which were filled by four professors and four associate professors. Andy Hodson started as professor in glaciology and Riko Noormets got promoted to full professor during 2017. Kim Senger was appointed member of the Young Academy of Norway in autumn 2017, joining a group of multi-disciplinary and geographically spread young researchers that aim to be particularly active in outreach activities and shaping research politics. We had thirteen adjunct positions, four of which were externally funded. Five of these adjuncts were from Norwegian universities and one from the Geological Survey of Norway. One externally funded postdoc and ten internally and externally funded PhD students worked in the department.

## EDUCATION

Six bachelor courses, 13 master courses and 11 PhD courses were taught in the department in 2017. There were quite large numbers of qualified applicants for most of our courses and there were waiting list for several courses. The department was responsible for 31 % of all UNIS student production in 2017.

During 2017 AG prepared the new full-year Arctic bachelor study for third year geology students, and the physical geography Arctic bachelor study for the summer/autumn semester. This expansion of bachelor courses has been done in direct contact with the Norwegian universities, who have requested more field practise for their geology and physical geography students.

AG has since 2014 used UArctic funding, and from 2016 also INTPART funding, to develop courses and education in geology. Lena Håkansson, Maria Jensen and Hanne Christiansen are UNIS representatives in a national group working to establish a Centre for Excellence in Education called iEarth *Centre for integrated Earth System education*. iEarth 's aim is to strengthen collaboration and developing future geoscience education between the four largest geology departments in Norway. A national committee with representatives from each university has been established. The third national committee meeting was held at UNIS in October.

The UArctic project *Circum-Arctic Geology for Everyone* culminated with getting ready to start a bachelor course called "Integrated Geological Methods: from outcrop to geomodel" in January 2018. The project brings UNIS into the 21st century with respect to state-of-the-art digital tools for use both in the field and in the classroom. Digital tablet-based field notebooks, for instance, are incorporated into a number of UNIS courses and are generally well received by the students. At UNIS, a virtual reality system has been set-up and used in both education and outreach activities – effectively extending our short-lived field season.

The teaching and learning project "A digital learning environment for field-based geoscience teaching" was funded by Norwegian Agency for Digital Learning in Higher Education at the end of 2017. This project involves all undergraduate courses in AG and will provide digital solutions to better link field- and classroom learning. The project also has a scholarship of teaching and learning component on spatial understanding, for which the main data will come from the AG-209 course. The project involves all faculty teaching bachelor courses in AG, the University of Bergen and University of Oslo. The project has close collaboration with bioCEED and the iEarth initiative.

Several staff members participated in the development of an educational offer in the Arctic Safety Centre and in the development of a local awareness society in Longyearbyen, also part of the Arctic Safety Centre.

## RESEARCH

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

### Basin studies

The basin studies group work on modern and ancient depositional systems in Svalbard and offshore links to the Barents Sea. The group consisted of one professor, two associate professors, seven adjuncts, six PhD students and several master students.

UNIS continues to be an active and important partner within the *Research Centre for Arctic Petroleum Exploration* (ArcEx), with co-lead of the geology work package. Two fully funded ArcEx PhD students are hosted by UNIS. Extensive field work of the Hollenderdalen Formation was executed in 2017 and the preliminary conclusion is consistent with the conceptual model that the formation marks the change from a Palaeocene sag basin to an Eocene foreland Basin. A research project will improve the understanding of the tectono-stratigraphic evolution of the Forlandsundet graben. ArcEx was evaluated during 2017 as part of the mid-way evaluation, an important step to set the direction for the final three years of the centre.

The Upper Jurassic shales continued in 2017 as a major internal R&D activity. This is based on two industrial sponsored projects conducted in close cooperation with the University of Oslo and University of Stavanger. In addition to being the dominating shale unit for sealing of buoyant fluids (e.g. $CO_2$ and hydrocarbons), the high organic rich succession is also an enigmatic unit; it is the time when the globe got black. Together with a Middle Cretaceous unit, it is the main source rocks for the world's oil reserves. Studies both from outcrops and wells in Adventdalen have improved the depositional setting and stratigraphy of the Upper Jurassic succession in Svalbard and Barents Sea. In addition, there is continuous work on the shale gas in Adventdalen.

The end of 2017 also marked the end of the SUCCESS centre where UNIS has been an active partner through the Longyearbyen $CO_2$ lab site (http://co2-ccs.unis.no). The eight-year project focused on understanding the processes relevant for $CO_2$ storage and how this knowledge can contribute to large-scale $CO_2$ storage in the North Sea.

UNIS is also a partner in the new *Norwegian CCS Research Centre* (NCCS) hosted by Sintef. Research activity in NCCS focusses on understanding how faults and other structural heterogeneities affect subsurface fluid flow. A number of research proposals were submitted to CLIMIT and FRINATEK utilising the immense data set from Adventdalen, and work is ongoing to publish a special volume in the Norwegian Journal of Geology during 2018, with a number of recently published papers on both the reservoir and cap rock successions.

Kim Senger has been actively promoting the use of virtual outcrops derived from cost-effective photogrammetry in both teaching and research projects. As an example, synthetic seismic modelling of a large-scale outcrop of igneous rocks in Argentina has recently been published and work is ongoing to follow up with outcrops from Svalbard.

PhD and master students continue to study the Carboniferous and Permian succession in Svalbard and the Barents Sea. A newly discovered well exposed Carboniferous outcrop shows the transition from coal bearing fluvial facies to fluvial red beds with calcrete soil profiles. It will give the opportunity to document the climate change in the Early to Late Carboniferous.

**June 2017:** Students in the AG-218 International Bachelor Permafrost Summer Field School perform fieldwork in Adventdalen. Photo: Ole Humlum/UNIS.

**August 2017:** AG-323/823 Sequence Stratigraphy course fieldwork in Asvinddalen, Billefjorden. Photo: Øystein Grasdal/UNIS.

The Triassic North was finalised in 2017. From autumn 2017 UNIS is participating in a new Research Council of Norway (RCN) project entitled ISBAR, which focus on depositional environments and sequence stratigraphy of the uppermost Triassic to Middle Jurassic in the Greater Barents Sea and Svalbard.

PhD student Malte Jochmann continued his studies on the regional stratigraphy of lower part of the Palaeogene basin. Several spin-off MSc projects on various detailed aspects of this basin were started, tied to long term data collection from the Firkanten Formation. One of these projects has also used new virtual outcrop methods to obtain data from otherwise inaccessible outcrops of the lowermost part of the basin, the Grønfjorden Bed at Festningen.

The modern systems research covers a number of externally funded projects, and is mainly focused on coastal system sedimentology and valley to fjord sediment transport and storage. *The Coastal Link – from source to sink project* studies the modern to Holocene sediment transportation and storage from land to sea in two fjord basins (Kongsfjorden and Dicksonfjorden). The project has produced new knowledge on Arctic tidal systems, mapping of the coastal zone in Dicksonfjorden and collected data for volume calculations for sediment transport and storage in the two fjord systems. The project is led by Maria Jensen, has partners from 11 institutions in addition to UNIS, and has involved five PhD students from Korea, France and Russia.

### Cryosphere

The research group focuses on permafrost, periglacial, snow and avalanche sciences. In 2017, the group consisted of two professors, one associate professor, one adjunct professor, one postdoc and three PhD students.

The *Svalbard Automated Snow Monitoring* (SASM) project, funded by the Svalbard Environmental Protection Fund, aims to automatically monitor the snow pack in potential avalanche areas. Three monitoring stations were established in the most important well-known avalanche areas that endanger Longyearbyen (Lia, Nybyen and Sverdruphammeren). Data on snow depth, snow temperature, air temperature and humidity were collected, and were already in December 2017 used for managing avalanche hazardous conditions. The data collected is displayed on the UNIS website. *Hazard Zonation Sukkertoppen*, funded by NVE, compare different approaches of dynamic avalanche modelling for Arctic conditions to create a reliable avalanche hazard map for the Sukkertoppen area. The UNIS objective is to model the avalanches for the return periods 1/100, 1/1000 and 1/5000 years using SAMOS-AT. Other on-going research projects are *Permafrost, Rock fall, Ice and Snow Monitoring and Modelling* (PRISM) project in the Auste Lovénbreen basin near Ny-Ålesund, and a project on detection of avalanches using an acoustic fibre optic sensing system in the Austrian Alps.

PhD work on laser scanning the snow pack dimensions on avalanche prone slopes around Longyearbyen, has resulted in an analysis of the December 2015 and February 2017 avalanche events in Longyearbyen, using the laser scan derived snow depth maps in combination with the meteorological conditions.

The EU project *LowPerm*, led by Andy Hodson and Hanne Christiansen, has shown that the emission of greenhouse gases from West Spitsbergen is controlled not just by modern climate warming, but also by ongoing landscape change in response to the end of the glaciation. In Adventdalen, isostatic land recovery is still out-pacing sea level rise and so methane and other greenhouse gas emissions from the active layer are dominated by former marine sediments subjected to uplift. These sediments are not immediately conducive to the production of methane because they take time to accumulate organic matter. Before this, they are dominated by other microbial processes, especially iron reduction, making carbon dioxide the principal greenhouse gas. However, the project has also established that older thermogenic methane which has accumulated beneath the permafrost is also contributing to landscape emissions via Adventdalen's pingos, whose formation can also be connected to isostatic uplift. Remarkably, emissions from four small pingo springs increase atmospheric methane fluxes by about 30% in Adventdalen. Therefore, quantifying greenhouse gas emissions from a warming Svalbard environment requires an understanding of both the active layer and the sub-permafrost environment. The latter has yet to be considered in any estimates of Arctic methane emissions.

Professor Hanne Christiansen is the president of the International Permafrost Association (IPA). The IPA secretariat is now based at UNIS. The Norwegian IPA leadership, including operation of the IPA Secretariat is funded by RCN.

The AG and AB departments, together with Aarhus University, University of Copenhagen, Danish Technical University, Aqua Arctic and Svalbard Science Forum, arranged the first ever SVALGREEN workshop on developing research and education collaboration across the largest climatic gradient in the Arctic, between warm Svalbard and cold Northern Greenland in May 2017. 31 researchers working in northern Greenland and/or in Svalbard attended the workshop. A collaboration agreement was signed between UNIS and Aarhus University to promote research and education collaboration. SVALGREEN should lead to joint research projects and potential development of university level courses in bio- and geosciences using the Fram Strait climate gradient.

### Quaternary geology

The terrestrial and marine geology Quaternary research group consisted of one professor, one associate professor, three adjunct professors, two PhD students and several master students.

Work continued on the *Holocene Precipitation Seasonality in Svalbard* (HOPS) project, with the purpose to reconstruct Holocene hydroclimate by analyzing leaf wax hydrogen isotopes in lake sediment cores. A lake sediment core from Austre Nevlingen (outer Wijdefjorden) was analysed in the biogeochemistry laboratory of at the University at Buffalo during the spring of 2017. The results will be written up and published in the first half of 2018. Lena M. Håkansson is involved in a project using lake sediment records to reconstruct and monitor vegetation in the Ringhorndalen Valley in collaboration with the AB department. In spring of 2017 she did fieldwork in Ringhorndalen together with AB colleagues Pernille B. Eidesen and Tina Dahl. During the three day field campaign data loggers were put out to measure soil temperature and moisture on the south facing Ringhorndalen valley side.

PhD student Wesley Farnsworth continued to focus on glacial history within the project *Holocene history of Svalbard ice caps and glaciers*. Data was collected during several field campaigns around Isfjorden to highlight Holocene glacial oscillations, focusing on meltwater signals in threshold lakes, glacial morphology and raised beaches. Regions were mapped and lake cores as well as field samples will be used to better understand Holocene glacial fluctuations and relative sea level. Lake sediment analysis continued with lake sediment cores from several lake basins from Wijdefjorden.

In 2017, Riko Noormest was on a sabbatical leave from UNIS. Part of his sabbatical, he stayed at the Bolin Centre for Climate Research at Stockholm University and Scott Polar Research Institute at the University of Cambridge, where he worked with colleagues on the seafloor mapping and glacial reconstructions of Svalbard and the Barents Sea. New, high-resolution data from calving glacier margins collected during 2016 campaigns were presented in several meetings, including the CalvingSEIS workshop at the Institute for Coastal and Marine Environment on Sicily, and the Svalbard Science Conference in Oslo.

Anne Flink completed her PhD studies by defending her thesis titled “Glacier dynamics in the fjords of Svalbard, inferred from submarine landforms and marine sediment cores”.

# GRADUATES 2017

## PHD DEGREE:

**ANNE E. FLINK**
Glacier dynamics in the fjords of Svalbard, inferred from submarine landforms and marine sediment cores. (*UNIS and University of Bergen*).

**GARETH STEVEN LORD**
Sequence Stratigraphy and Facies Development of the Triassic Succession of Svalbard and the Northern Barents Sea. (*NTNU and UNIS*).

## MASTER DEGREE:

**ANDREAS ALEXANDER**
Numerical modeling of the cold based glacier Larsbreen in Svalbard. (*Friedrich-Alexander-Universität Erlangen and UNIS*).

**NÍNA ARADÓTTIR**
Glacial history and geomorphology of Trygghamna, western Spitsbergen. (*University of Tromsø and UNIS*).

**DANIEL BEN-YEHOSHUA**
Crevasse-Squeeze Ridges in Trygghamna, Svalbard. (*University of Iceland and UNIS*).

**ELLIOT BROZE**
The occurrence of flow transformations within sandy submarine fans: A case study from the Eocene on Spitsbergen. (*University of Tromsø and UNIS*).

**MARI EIKEN**
Dynamic avalanche modeling in Svalbard’s arctic environment: terrestrial laser scanning as tool for model verification. (*University of Oslo and UNIS*).

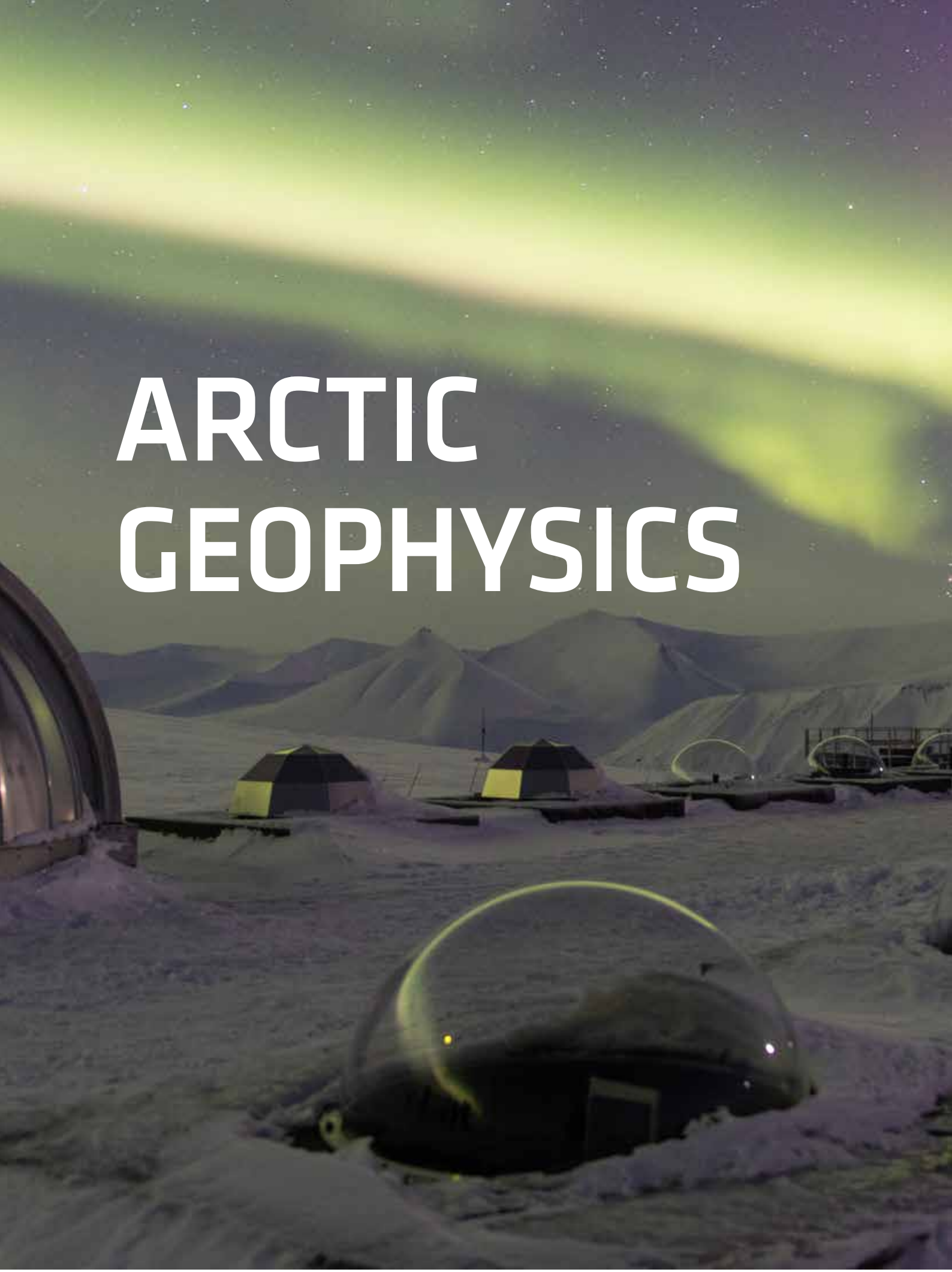
**MARTE FESTØY**
Integrated characterization of igneous intrusions in Central Spitsbergen. (*University of Tromsø and UNIS*).

**CATHINKA FORSBERG**
A sedimentological study of the deltaic De Geerdalen Formation in Fulmardalen and of fluvial deposists in the Snadd Formation on the Finnmark Platform. (*NTNU and UNIS*).

**BÅRD HEGGEM**
An analysis of facies in the De Geerdalen Formation and provenance across the Middle to Late Triassic boundary on Spitsbergen, Svalbard. (*NTNU and UNIS*).

**KAROLINE THU SKJÆRPE**
Sedimentological facies analyses of Clinothem 8C (Eocene), Battfjellet Formation, Brogniartfjella, Svalbard. (*University of Bergen and UNIS*).

# ARCTIC GEOPHYSICS



**March 2017:** The Aurora Borealis (northern lights) dances over the roof of the Kjell Henriksen Observatory. Photo: Mikko Syrjäsuo/UNIS.

BY DAG A. LORENTZEN, HEAD OF DEPARTMENT

The Arctic Geophysics (AGF) department consists of two research groups; the *Air-Cryosphere-Sea Interaction* (ACSI) group and the *Space Physics* group. The department thus performs research and education in the vertical column from deep ocean to near space with researchers within physical and chemical oceanography, the cryosphere and meteorology (which constitutes the ACSI group), and within the middle atmosphere and the ionosphere/magnetosphere (which constitutes the Space Physics group).

## PEOPLE

At the end of 2017 the department consisted of nine full time faculty, two post docs (space physics), ten adjuncts (20 % position) and five PhD's (three in the ACSI group and two in the Space Physics group). Two technicians are closely linked to each of the two research groups. The two technicians provide valuable service and support with instrumentation and fieldwork, and is as such an integral part of the AGF department.

## EDUCATION

All courses taught in AGF use the Svalbard nature as a laboratory. The fieldwork is conducted in or around Svalbard, using the natural environment, research installations and scientific cruises. The department offers both bachelor and master/PhD courses linked to both research groups. The department offers six 15 ECTS bachelor courses, one 10 ECTS master course and seven 5-15 ECTS combined master/PhD courses. A new 15 ECTS bachelor course in "Remote Sensing and Space Instrumentation" was approved in 2017, and will run for the first time in 2018. AGF also offers two 5 ECTS cross-disiplinary bachelor courses; "The Stormy Sun and the Northern Lights" and "Shipping in the Arctic". The department is represented in the exchange project "RemoteEx: Remote Sensing of the Cryosphere" funded by the Norwegian Centre for International Cooperation in Higher Education (SIU).

Associate Professor Borstad was awarded the inaugural Joanna Renc-Roe Award for "Pushing the Boundaries of Scholarship of Teaching and Learning (SoTL)" at the 2017 EuroSoTL conference in Lund, Sweden in June 2017. This was the result of a project conducted with colleagues in the Arctic Biology Department to improve strategies for active learning and course alignment in multidisciplinary courses at UNIS.

## RESEARCH

### The Air-Cryosphere-Sea Interaction (ACSI) Group

After many years of intense work, the final decision by the RCN to fund *The Nansen Legacy* project (http://nansenlegacy.org) was taken at the end of 2017. 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 ACSI group's main delivery into The Nansen Legacy is to provide data sets from year-long moored instruments and process cruises around Svalbard, and study the processes contributing to the ocean heat budget of the region north of Svalbard. Moreover, the ACSI research team will map the distribution of Arctic Water (ArW) and Atlantic Water (AW) north and east of Svalbard, describe the thermohaline polar front between them, understand the processes that control this front position and variability, and hence, the effects on volume, heat and salt exchange across the front.

An online cabled ocean observatory was collecting important marine data during winter 2017 in connection to the Svalbard Environmental Protection Fund project *Blir det is på Isfjorden i år?*, led by the AGF department. The mooring made it possible to reveal some of the controlling forces and possible weather conditions for warm water intrusion into the Isfjorden system, and clearly demonstrated that measurements of the water column in Isfjorden during winter and spring months are necessary to evaluate the potential danger for weak and melting sea ice. The ocean observatory is now a national infrastructure through SIOS-InfraNor.

Important exchanges processes take place between the West Spitsbergen Current (WSC), the coastal shelf waters in the Spitsbergen Polar Current, and the fjords along the west coast of Svalbard. Research on these processes was conducted through a master project and the UNIS-led project *Remote Sensing of Ocean Circulation and Environmental Mass Change* (REOCIRC).

A study conducted together with the University of Uppsala on $CO_2$ uptake in Adventfjorden has demonstrated the importance of water-side convection for air-sea gas transfer. For Arctic fjords and coastal waters the water-side convection resulting from surface cooling significantly influences the total air-sea $CO_2$ exchange. The results highlight that air-sea $CO_2$ transfer at these latitudes may be significantly underestimated, which has serious ramifications for the global carbon budget estimates.

The meteorology section was involved in two field campaigns during 2017. The first was in connection with the research project *Innovative Strategies for Observation in the Arctic Atmospheric Boundary Layer* (ISOBAR), and took place in northern Finland. Its main focus was obtaining observations for a better understanding of the processes governing stable, nocturnal boundary layers over homogenous terrain. The second field campaign was a scientific cruise to the north of Spitsbergen with the German research vessel "Polarstern". The focus was an enhanced understanding of atmospheric boundary layer processes over sea ice. Observations were made by several international research groups, both under and over the sea ice during the 1,5 week long sea ice camp. The meteorology section also has co-lead on the new 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 is improved weather prediction capability for the Arctic, benefiting amongst others increased high-latitude activities related to e.g. shipping, fishery, transportation and tourism.

In snow and ice mechanics, guest master students conducted field studies aimed at improving predictions of avalanche risk by developing new methods for measuring snow hardness and incorporating variability in elastic snow properties in stress calculations. Studies were also done on the dynamic regimes of a kilometer-thick floating ice shelf that once covered the entire Arctic basin, evidence for which was recently discovered in bathymetric scans of the ocean floor that revealed glacier scour marks. The cryosphere section of the ACSI group also received international media attention with model predictions of the fate of the Larsen C ice shelf in Antarctica following the calving of a 6000 square kilometer iceberg.

### The Space Physics Group

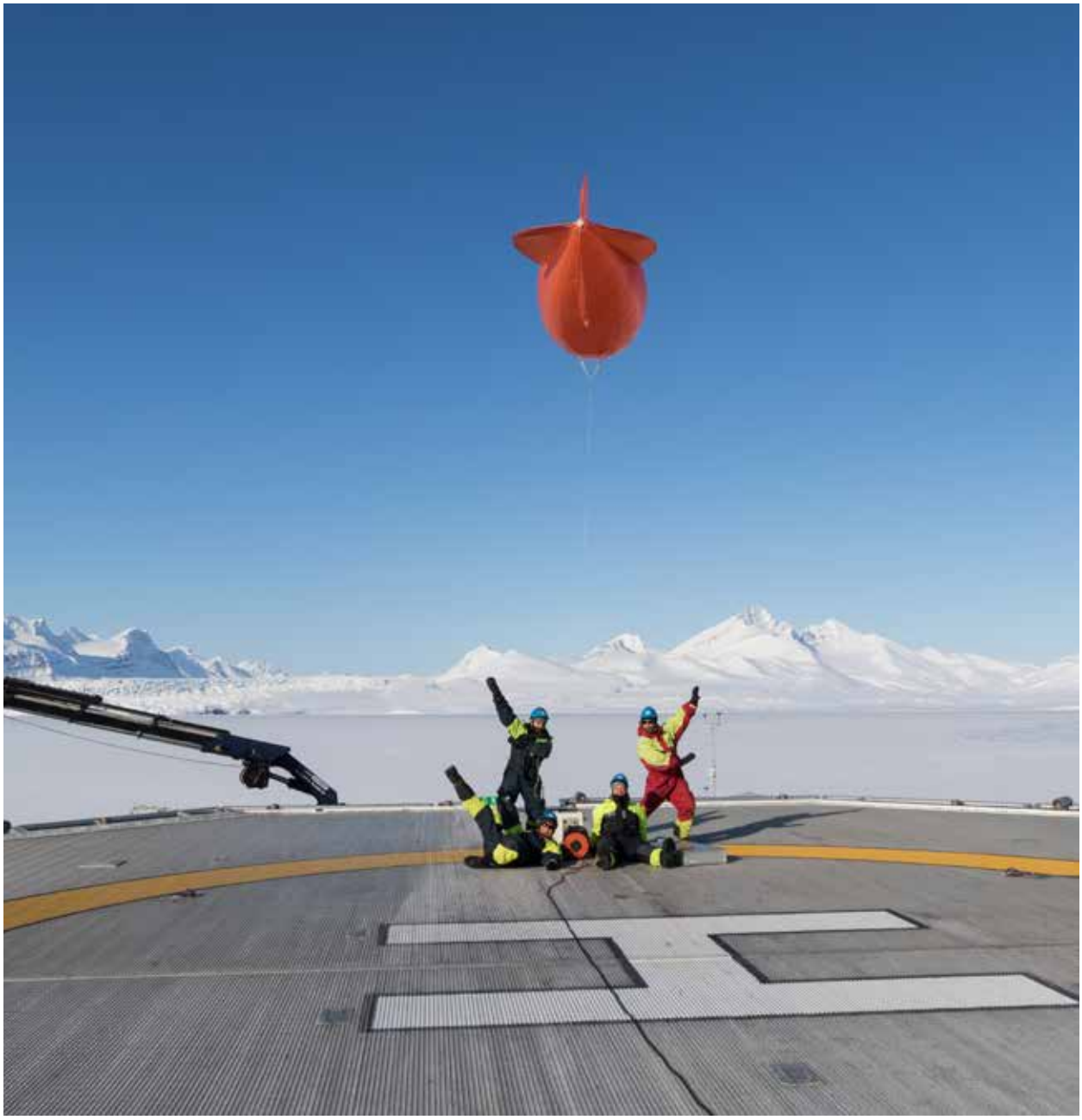
The space physics group is member of the centre of excellence *Birkeland Centre for Space Science*, led by the University of Bergen. The centre went through its mid-term evaluation in 2017 with excellent reviews and a further five year continuation.

The *Svalbard SuperDARN radar* is continuing to provide realtime continuous monitoring of the upper atmospheric particle flow over an area of 3 million square km to the North East of Svalbard over the polar cap. Real-time data are available online (http://kho.unis.no/SD/Sd.htm) and archived data is available through the Virginia Tech online data portal (http://vt.superdarn.org/tiki-index.php). In the latter, the data are combined with other radars from the network to produce real-time global maps of the particle flow.

*The Kjell Henriksen Observatory* (KHO) has now operated successfully for 10 years and is the largest facility of its kind for optical instruments studying the aurora. The history of the observatory dates back to 1978 with the first station in Adventdalen. During the auroral winter season from November to the end of February, 25 optical instruments operate 24 hours a day. The 15 non-optical instruments run all-year-round 24 hours a day. 21 different institutions from 12 nations are present at KHO. Only 6 domes out of 30 are currently not in use. The full KHO report for 2017 may be downloaded here: http://kho.unis.no/doc/KHO_2017.pdf.

**February 2017:** AGF-304/804 Radar Diagnostics of Space Plasma students build "cantennas"; small antenna radars built out of old metal boxes. Photo: Anja Strømme/UNIS.

**February 2017:** AGF-212 Snow and Ice Processes students digging snow pits. Photo: Chris Borstad/UNIS.



**April 2017:** AGF-211 Air–Ice–Sea Interaction I students ready to launch a weather balloon during the course cruise. Photo: Mikko Syrjäsuo/UNIS.

The middle atmosphere section focuses on characterisation of particle precipitation, and studies of the effects of high-energy particle precipitation on the Earth's atmosphere. Particle precipitation occurs over a wide range of energies and produces several kinds of aurora. In 2017 particular attention was given to "pulsating aurora", which is produced by energetic electrons from the Earth's radiation belts. During pulsating aurora, the intensity of the auroral light is low, but the particle energy is high enough to reach altitudes below 100 km where the atmospheric density rapidly increases with decreasing height. Pulsating aurora is a common type of aurora and has a large spatial extent, so it is likely that its effect in depleting mesospheric ozone is significant.

The ionosphere/magnetosphere section developed a new experiment using the Svalbard EISCAT and SuperDARN radars in a synchronized pattern to observe a common field of view in the ionosphere. The experiment goal was to observe narrow flow channels inside the polar cap ionosphere and map any temperature or density changes inside those flows, something which has not been achieved before. The group also published a study on a prolonged sequence of equatorward moving arc structures in the dusk-side auroral oval over Svalbard. The detailed analysis provides the first direct assessment of the energy loss suffered by the wave field due to both ionospheric heating and particle precipitation, something which will serve as important quantitative validation for theoretical models of magnetosphere-ionosphere coupling. The ongoing RCN *PolarProg* project (which is a collaborative project between scientists at UNIS and in Russia) has resulted in several research papers and visits by both UNIS scientists to Moscow and Russian scientists to UNIS. The BACC (*Boreal Aurora Camera Constellation*) project is starting to grow, forming a constellation of low cost, high sensitive all-sky color cameras monitoring the aurora oval at multiple sites. Two camera stations have already been tested at KHO (2015-2017) and in Ny-Ålesund (2016-2017) by the University of Oslo. Two new stations are under construction, by the Finnish Meteorological Institute (FMI), in Kevo and Muonio in northern Finland. The plan is to utilize existing auroral boreal infrastructure to create a constellation of cameras.

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 small, lightweight, push-broom Hyper Spectral Imager (HSI) has been constructed for drone operations. The next step is to design, develop and test a new prototype for CubeSat satellites aimed at detecting various oceanic targets.

**April 2017:** AGF-211 Air–Ice–Sea Interaction I course cruise. Photo: Mikko Syrjäsuo/UNIS.

# GRADUATES 2017

## PHD DEGREE:

**XIANG-CAI CHEN**
A study of dayside open/closed field line boundary dynamics using simultaneous ground-based optical and HF radar observations. (*UNIS and University of Oslo*).

**STEFAN MUCKENHUBER**
High resolution sea ice monitoring using space borne Synthetic Aperture Radar. *(University of Bergen, UNIS and Nansen Environmental Sensing Centre)*.

**ÅSMUND SKJÆVELAND**
Energy inputs and upflow motion in the cusp. (*UNIS and University of Oslo*).

## MASTER DEGREE:

**KARL BOLMGREN**
Time dependence of average structure size and precipitation energy in pusating aurora. (*KTH Royal Institute of Technology, Sweden and UNIS*).

**NATALIE FORSETH**
The structuring of high latitude aurora. (*Norwegian University of Life Sciences and UNIS*).

**LÉA OLIVIER**
Coastal current and shelf-fjord interaction on the West Spitsbergen Shelf. (*École Normale Supérieure, Paris and UNIS*).

**KRISTIAN REED**
Study of meso-scale reersed flow events in the polar ionosphere by SuperDARN radars. (*University of Bergen and UNIS*).

**MARKUS RICHTER**
Snow mechanical properties and risk of avalanche triggering derived from measures of snow penetration resistance. (*University of Göttingen and UNIS*).

**LAURA SWINKELS**
Stress distribution calculations through a snow slab of varying hardness; comparison with stability evaluation in the field. (*University of Tromsø and UNIS*).

# ARCTIC TECHNOLOGY


**April 2017:** AT-211 Ice Mechanics, Loads on Structures and Instrumentation course cruise with the Governor of Svalbard's vessel "Polarsyssel". Photo: Sebastian Sikora/UNIS.

BY ARNE AALBERG, HEAD OF DEPARTMENT

The Arctic Technology (AT) department offers courses and conducts research within two fields: *Arctic Engineering* concentrates on engineering problems to be tackled when settling in the Arctic environment: frozen ground that may be subject to 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 2017, the department consisted of two professors, one associate professor, one research associate, one postdoc, two PhD candidates, one staff engineer, and an adjunct staff with six professors and one engineer.

## EDUCATION

The research activities generate material closely linked to the courses at all levels, giving students a good opportunity to study both the theoretical and practical aspects of Arctic technology, engineering and environmental technology. In 2017, 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. Students conducted a survey to qualify and quantify micro plastics from Longyearbyen beach samples. Findings and method demonstration were presented at the UNIS Open Day which was well attended by the Longyearbyen community.

## RESEARCH

The Arctic Technology Department had a wide portfolio of research activities in 2017, within ice mechanics and offshore engineering, marine technology, geotechnics, environmental chemistry, snow engineering, and hydrology/hydromechanics.

### Ice mechanics and offshore engineering

The research group consisted of one full time professor and two adjunct professors. In addition, one research associate and one postdoc were part of the group through external projects. One master student finished in 2017.

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 wave damping by land fast ice were performed together with the group from the University of Oslo. A model of wave damping in marginal ice zone of drift ice was formulated and adopted for the North-West Barents Sea.

Experiments on scour strudel formation were conducted in Sveabukta, in cooperation with the group from the Russian Research Center in Barentsburg. Field investigation and modelling of tidal currents in Akselsundet were performed according to the request of the port captain in Svea.

AT adjunct professor Sveinung Løset is the director of the Centre for Excellence in Innovation project *Sustainable Arctic Marine and Coastal Technology* (SAMCOT). AT professor Aleksey Marchenko is leader of work package 1 (WP1), while postdoc Aleksey Shestov is deputy leader.

The SAMCoT WP1group performed fieldwork to investigate properties of drift ice on Spitsbergenbanken and further to Bjørnøya, a region interesting for offshore development. Sea ice occasionally drifting in the region can influence engineering structures and navigation. Information about ice properties and drift patterns is useful potential risk estimates.

Full-scale tests on ice strength in tension, compression, bending and indentation were performed in Sveabukta, Van Mijenfjorden. Deformed sea ice structure was studied by thin section analysis in-situ just after the tests. Obtained results are used for the validation of models describing ice-structure interaction and identification of scale effect in ice loads on structures. Scientists from CRREL, Osaka University, and Lomonosov Moscow State University participated in the field campaign.

The group also performed laboratory tests on frozen soils saturated with fresh or saline water, to better understand how these behave under cyclic changes of temperature. The formation of thermal contraction cracks is directly connected with the thermal expansion/contraction of frozen soils. This knowledge is necessary for the design of engineering structures in the coastal zone of the northern seas.

Large-scale sea ice fracture tests were conducted successfully in March 2017, as part of a four-year campaign (2015-2018) aiming to studying the fracture properties of sea ice by performing splitting tests on large ice floes of various sizes at different loading rates at Svea (Vallunden Lagoon). The measured data shall shed light to the fracture properties of sea ice, whose exact value has been under academic debate for more than 20 years now. Being able to characterize the fracture properties of sea ice will enable us to calculate more accurately how much force is needed to fracture an ice floe, which in turn gives better insight in designing the Arctic structures, e.g., offshore structures and ice-going ships. In the laboratory, the group performed microstructure characterization analysis of sea ice floe samples where fracture cracks run through. Thin sectioning was done for a detailed view of the crack path and microscopic analysis, and thick sectioning for constructing the crack surface. This work will provide a more in-depth understanding of the mismatch between fracture energy and surface energy in ice, as on the microscopic level, the crack surface is far from the plane due to crack branching. Moreover, the group also performed large-scale ice rubble thermodynamic consolidation experiment over the season, to further develop the knowledge of thermodynamic scaling of first-year ice ridges. Ice rubble field was built in-situ in February and the development of its thermodynamic and mechanical properties was observed. At the end of the field season, ice fracture test was performed in the consolidated rubble providing interesting results.

Research associate Nataly Marchenko continued laser scanning (RIEGL VZ1000) and creating 3D models of ice rubbles, floes and samples and started scanning of transport infrastructure, airport runway and roads in the town, to assess deformations occurring from permafrost degradation for later maintenance optimization. The data collected by the ice mechanics group, including measurements in the Barents Sea, are gathered in a special Geographical Information System, the online version SAMCoT GIS.

Other international research and education projects in the group:

*FIMA* (2015-2017) in partnership with NTNU, State Research Oceanographic Institute (Moscow, Russia), and VNIIGAZ Gazprom (Moscow, Russia).

*Petromaks2 Waves in Oil and Ice* (WOICE) (2015-2017) in collaboration with the University of Oslo.

*SITRA* (2015-2018) in cooperation with Memorial University of Newfoundland (Canada), Dartmouth College (USA), University of Alaska (USA), Lomonosov Moscow State University and Moscow University of Physics and Technology (Russia).

*MARPART*, www.marpart.no, Maritime Preparedness and International Partnership in the High North in collaboration with Nord University (Norway), University of Greenland, University of Iceland, Northern (Arctic) Federal University Arkhangelsk and Murmansk State Technical University (Russia).

### Geotechnics

This research group consists of one full time professor, one adjunct professor and one technician, with two master students this year.

The development of the Research Council of Norway (RCN) supported *Norwegian Geo Test Site* (NGTS) field

**April 2017:** The underwater drone «BluEye», developed by NTNU (AMOS), is tested in Van Mijenfjorden. Photo: Martin Ludvigsen/UNIS.

**May 2017:** AT-331/831 Arctic Environmental Pollution fieldwork in Mohnbukta, on the east coast of Spitsbergen. Photo: Richard Hann/UNIS.

in Adventdalen continued in 2017, to exist for at least a 20-year period as the permafrost test site of the five new national test sites for sand, silt, clay and quick-clay. Professors Arne Aalberg and Arne Instanes are running this activity from UNIS. Drilling, instrumenting, soil sampling and analysis were performed, and laboratory programmes conducted for determining mechanical and thermal properties of frozen soils.

The RCN supported 3-year project *Monitoring of Arctic Infrastructures* (MONARC) started its first year. The project aims are to investigate 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). Building survey and foundation levelling to observe future settlements and characterization were performed, and foundation marks placed on several building foundations in piles in Pyramiden, Barentsburg, Svea and Longyearbyen.

Another project by Sintef, SNSK and Longyearbyen Lokalstyre is *Impact of changing climate on infrastructure in Longyearbyen: Stability of foundations on slope terrain* – case study (FST), where experimental investigations on soil in the slopes and numerical simulations of temperature development in the frozen ground were performed. The aim is to become able to predict slope stability around Longyearbyen in the future.

### Environmental chemistry

The research group consisted of one full time associate professor, two adjunct professors and one PhD candidate. The group has participated in several projects, including the investigation programme on *Perfluoroalkyl substances sources and distribution in Ny-Ålesund* (funded by Kings Bay), *Network for capacity building in water sanitation and health in the Arctic* (NorCan) and *Reducing the impact of fluorinated compounds on the environment and human health* (PFOslo). Two master students finished their theses in 2017. A PhD project and a Master project have investigated the effects of PFAS on the thyroid hormone homeostasis of Glaucous gulls. In a Master thesis in collaboration with NTNU, concentrations of essential and toxic elements in reindeer feces have been examined to investigate possible antropogenic pollution in Longyearbyen, Adventdalen and Kapp Linné.

The Environmental Waste Management (EWMA) project completed its experimental work into investigating the effects of sub marine deposition of mine tailings waste on early life stages of Atlantic cod, conducting a large two-month exposure of embryos and larvae in collaboration with Akvaplan-niva and the UiT the Arctic University of Norway. As part of a master project we conducted a molecular toxicology study looking at endocrine disruption in maturing polar cod exposed to oil residues simulating acute oil spill response scenario followed by six months recovery period. In the past year, the research in this area has developed working methods for molecular toxicology, including a wide panel of stress, genotoxic, epigenetic, and endocrine control genes for gene expression studies in Polar and Atlantic cod. Further links and collaborations with environmental chemistry researchers from the EnviTox program at NTNU were established, providing a solid basis for research bids, projects, and master students in the coming years.

### Hydromechanics and Hydrology

This research group consists of one adjunct professor, with activity supported by part of a full professor position. The group represents UNIS in the international networking project *Water Management in Cold Climates* ("Water Magic", 2016-2017). This is a "High North" programme funded by the Norwegian Ministry of Foreign Affairs. Participating institutions are the Norwegian University of Life Sciences (lead); Qingdao Technological University (China); Seoul National University (South Korea); Hokkaido University (Japan), University of British Columbia (Canada), University of Washington (USA), and UNIS. The main activities in 2017 have been project student and teacher exchange. A seven day 5 ECTS specialized course "Water Management in Climate Change" with 65 participants was held at UNIS in June, organized by the AT department and the Norwegian University of Life Sciences. The project is also developing a textbook on water management in cold climates.

### Marine technology

This group consists of one 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.

Together with the AB project FAABOLOUS a field campaign was carried out in van Mijenfjorden deploying an AUV for under ice operations in April 2017. The AUV REMUS, owned and operated by NTNU AUR-Lab, was deployed for two successful under ice dives. The vehicle carried sonars and water column sensors, and LBL navigation beacons were installed under the ice.

As a preparation to the *Nansen Legacy* program, AUVs were deployed in Adventfjorden, Billefjorden and Tempelfjorden in collaboration with the course AT-334. Two vehicles were deployed, one for seabed investigations and one for upper water column work. The mixing in Isfjorden was measured together with the concentration to Chlorophyll, and used as a proxy for primary production. The seabed of the glacial fjords was also mapped and in Tempelfjorden interesting features were discovered in the area close to the Murdoch Hole.

# GRADUATES 2017

## PHD DEGREE:

**RENAT YULMETOV**
Observations and Numerical Simulations of Icebergs in Broken Ice. (*UNIS and NTNU*)

## MASTER DEGREE:

**ANNE-NIEKOLAI HEIJKOOP**
Sea ice subjected to cyclic compression: laboratory experiments and a dislocation based model. (*TU Delft and UNIS*).

**CAROLINE HUBER**
Study of Long Range Transported Pollutants in Arctic Soil. (*NTNU and UNIS*).

**JAN ARE JACOBSEN**
Måling av snøsig i et snødekke i den sentrale delen av Svalbard, Spitsbergen. (*NMBU and UNIS*).

**PERNILLE KVERNLAND**
Do levels of per and poly-fluoroalkylated substances (PFASs) in snow bunting eggs increase with proximity to airports in Svalbard. (*NTNU and UNIS*).

**ARTEM NESTEROV**
Temperature deformations of frozen soils in the foundations of hydrotechnical structures. (*St. Petersburg Polytechnical University and UNIS*).

**MARTE SUNDBY NYBO**
An experimental study of unfrozen water content in fine-grained permafrost soils. (*NTNU and UNIS*).

**KRISTIN SUNDBY**
Determination of nitrated and oxygenated polycyclic aromatic hydrocarbons in arctic air by GC/NICI-MS. (*NTNU and UNIS*).

**April 2017:** Waves in beautiful pancake ice in the Barents Sea. Photo: Aleksey Shestov/UNIS.

# STUDENT COUNCIL

**February 2017:** Students building "cantennas"; small antenna radars built out of old metal boxes. Photo: Anja Strømme/UNIS.

BY MARIANNE S. TJOMSLAND AND PATRICK CASEY, STUDENT COUNCIL LEADERS 2017/2018

The UNIS Student Council (SC) consists of thirteen elected members which form the local student democracy. In addition, the leaders of the three permanent student groups: Bruktikken, the Ski and Bike Workshop (SBW) and the Student Equipment (SE), are invited to the SC meetings. Student representatives are elected at the beginning of every semester by the student body. In general, the SC has four main responsibilities. The first one is the representation within political and administrative structures: SC members are part of the UNIS leader group, the Educational Committee and the UNIS board. They bring students suggestions, opinions and demands forward, take part in discussions and vote from the students' perspective. Close contact and collaboration with the Student Parliament in Tromsø, the Norwegian Student Organization and the Arctic Welfare Organization in Tromsø are maintained in order to obtain a high quality learning environment. The second task is to support student social life by running activity groups and organizing social events via activity groups. Students are also encouraged to engage with the Longyearbyen community and several events organized by the SC are open to the whole town. The third role is the administration of the student welfare in Svalbard. Students are provided with different kinds of equipment and service offers. Finally, the SC works to improve the living situation for students. This is achieved by close cooperation with Arctic Welfare Organization, helping new students getting started in town and running the second-hand shop Bruktikken.

**May 2017:** UNIS students gathered at Skjæringa after partaking in the 17th of May parade. Photo: Nina Elisabeth Hansen/UNIS.

**July 2017:** Students find an important message on Longyearbreen.... Photo: Lise Øvreås/UNIS.

**October 2017:** Contemplation while on the AGF-214 Polar Ocean Climate course cruise. Photo: Inger Lise Næss/UNIS.

Student life in Svalbard would not be the same without its social activities. The students organized themselves in many different activity groups throughout the semesters, including, baking, hiking, board games, party, photography, cannonball, frisbee, knitting, igloo-building, techno-music and skiing-groups.

When the SC for fall semester 2017 was established, we were informed that 90% of the budget had been spent by the spring semester students. As a result, a new routine has been established that divides the funds 60/40 between the spring/summer semester and the fall semester. This prevents an unfair distribution of the funds from being spent within the spring semester. All of this lead to very restricted spending in the first part of fall 2017 semester. Additionally, we were informed a few weeks before Christmas that there was over 40 000 NOK (40% of the budget) left in our account that would be lost if it was not spent by the end of the semester. These excess funds went to Student Equipment and were used to repair broken sleeping bags, buying new avalanche beacons, probes and shovels.

A lack of economical routines, guidelines for budgets, allocations etc., has become apparent, and a set of usable guidelines have been established to reassure that the SC money is spent on things that is of the interest of the entire the student body.

As a continuation of this, a reviewing of the economical and administrative routines of the three permanent student groups (Bruktikken, SBW, and SE) became necessary. There has been an issue of non-students being leaders of the SBW and SE groups. UNIS has reinforced restrictions on this, where all participants and leaders must have an active student status. The exception is for a 2-3-week period where a previous student leader can train the new leader.

### Bruktikken

Bruktikken's activity has increased exponentially, but the funds have not. Svalbardposten was contacted about this issue. Resulting from this article, Sparebank 1 gave a gift of 25 000 NOK and a positive signal from the Longyearbyen Community Council about increased funding starting from next year. Funding received from *Korkpenger* amounted to 59 000 NOK.

### Ski and Bike Workshop

Poor communication has affected the administration of SBW and has caused confusion with respect to finances and distribution of tasks. Our (SBW and SC) main conclusion is that SBW needs a higher grade of continuity in the leadership than semester/short-term students can provide. A discussion for the future of the SBW is necessary to review its goals and the appropriate path to reach them.

### Student Equipment

Statistics are now being kept of what items SE runs out of and how frequently. All purchases must be preapproved by the SC if the cost is more than 1000 NOK. For larger purchases, we ask for offers and the best one (keeping in mind quality of the product) is approved by the treasurer, who approves it in collaboration with the SC. This year we have replaced broken ropes, fixed skins for skis and have planned to prioritize purchasing sleeping bags and skiing shoes.

### Student Housing Kitchens

2017 was the first year with a new division of responsibilities between SC and Samskipnaden concerning the inventory of the student kitchens. SC's responsibilities have been reduced to only the smaller electrical equipment in the kitchens. Due to this it has been necessary to make an inventory list of what should be in each kitchen/floor/barrack of the student housing.

### Student Housing

The housing situation has been a challenge for Samskipnaden due to a lack of rooms. This has made it necessary for students to move several times within a stay/semester here. This is disruptive for the ones forced to move, but this is a temporary solution as new student housing is being planned on Elvesletta. Little snow fall this winter has rendered no evacuations necessary, except for a few days during the Christmas Holidays. There has been close collaboration with Samskipnaden in designing the new student housing.


**August 2017:** A polar fox (*Vulpes lagopus*) has found something interesting to chew on... Photo: Tina Dahl/UNIS.

# SCIENTIFIC PUBLICATIONS 2017

*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).*


Abay, T. B., Karlsen, D. A., Lerch, B., **Olaussen, S.**, Pedersen, J. H., & Backer-Owe, K. (2017). Migrated petroleum in outcropping Mesozoic sedimentary rocks in Spitsbergen: organic geochemical characterization and implications for regional exploration. *Journal of Petroleum Geology,* 40(1), 5-36. doi: http://dx.doi.org/10.1111/jpg.12662

Abay, T. B., Karlsen, D. A., Pedersen, J. H., **Olaussen, S.**, & Backer-Owe, K. (2017). Thermal maturity, hydrocarbon potential and kerogen type of some Triassic-Lower Cretaceous sediments from the SW Barents Sea and Svalbard. *Petroleum Geoscience*, 25. doi: http://dx.doi.org/10.1144/petgeo2017-035

Aguirre-Martínez, G. V., **Reinardy, H.**, Martin-Diaz, M. L., & Henry, T. B. (2017). Response of gene expression in zebrafish exposed to pharmaceutical mixtures: Implications for environmental risk. *Ecotoxicology and Environmental Safety,* 142, 471-479. doi: http://dx.doi.org/10.1016/j.ecoenv.2017.04.038

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**February 2017:** Tunabreen in Tempelfjorden. Photo: Thorben Dunse/UNIS.

# GUEST LECTURERS 2017

## ARCTIC BIOLOGY

| LAST NAME | FIRST NAME | INSTITUTION |
|---|---|---|
| Aars | Jon | Norwegian Polar Institute |
| Andresen | Steinar | Fridtjof Nansen Institute, Norway |
| Berntsen | Ronald | UiT The Arctic University of Norway |
| Bluhm | Bodil | UiT The Arctic University of Norway |
| Brekke | Harald | Norwegian Petroleum Directorate |
| Broms | Fredrik | Akvaplan-Niva, Norway |
| Convey | Peter | British Antarctic Survey |
| Cooper | Elisabeth | UiT The Arctic University of Norway |
| Coulson | Steve | Swedish University of Agricultural Sciences |
| Cusa | Marine | UiT The Arctic University of Norway |
| Daase | Malin | UiT The Arctic University of Norway |
| Davidsen | Jan | Norwegian University of Science and Technology |
| Degen | Renate | University of Vienna, Austria |
| Dunlop | Katherine | Akvaplan-Niva, Norway |
| Ehrich | Dorothee | UiT The Arctic University of Norway |
| Forsström | Laura | Academy of Finland |
| Forwick | Matthias | UiT The Arctic University of Norway |
| Geoffroy | Maxime | UiT The Arctic University of Norway |
| Gjøsæter | Harald | Institute of Marine Research, Norway |
| Hansen | Brage | Norwegian University of Science and Technology |
| Hart | Tom | University of Oxford, UK |
| Herstad | Bente | Norad, Norway |
| Janik | Vincent | University of St. Andrews, UK |
| Khaitov | Vadim | Saint Petersburg State University, Russia |
| Kruusmaa | Maarja | Tallin University of Technology, Estonia |
| Lee | Hanna | Uni Research Climate, Norway |
| Logares Haurie | Ramiro | Institute of Marine Sciences, Spain |
| Lydersen | Christian | Norwegian Polar Institute |
| Majaneva | Sanna | Trondheim Biological Station, Norway |
| Merkel | Benjamin | Norwegian Polar Institute |
| Müller | Eike | Randsfjordmuseene AS, Norway |
| Norgren | Petter | Norwegian University of Science and Technology |
| Potts | Tavis | Scottish Association for Marine Science, UK |
| Reiersen | Lars-Otto | Arctic Monitoring and Assessment Programme, Norway |
| Riis | Tenna | University of Aarhus, Denmark |
| Sabacka | Marie | University of Bristol, UK |
| Salonen | Ari | University of Helsinki, Finland |
| Sander | Gunnar | UiT The Arctic University of Norway |
| Simonelli | Anne-Laure | University of Bergen, Norway |
| Soule | Jonathan | Universitety of Bergen, Norway |
| Strøm | Hallvard | Norwegian Polar Institute |
| Svenning | Martin | Norwegian Institute for Nature Research |
| Søli | Geir | University of Oslo, Norway |
| Sørensen | Asgeir | Norwegian University of Science and Technology |
| Tomkiewicz | Stanley | Telonics Inc., USA |
| Ulfstein | Geir | University of Oslo, Norway |
| Vacquie Garcia | Jade | Norwegian Polar Institute |
| Vogedes | Daniel | UiT The Arctic University of Norway |
| von Quillfeldt | Cecilie | Norwegian Polar Institute |
| Walløe | Lars | University of Oslo, Norway |
| Westergaard | Kristine B. | Norwegian Institute for Nature Research |
| Zielke | Matthias | Troms County Council, Norway |
| Åström | Emmelie | UiT The Arctic University of Norway |
| Weslawski | Jan-Marcin | Polish Academy of Sciences |

## ARCTIC GEOLOGY

| LAST NAME | FIRST NAME | INSTITUTION |
|---|---|---|
| Alaei | Behzad | Rocksource Exploration Norway |
| Alexanderson | Helena | Lund University, Sweden |
| Ballantyne | Colin | University of St. Andrews, UK |
| Benediksson | Ivar | University of Iceland |
| Bingham | Robert | University of Edinburgh, UK |
| Brian | Micheal | British Antarctic Survey |
| Briner | Jason P. | University of Buffalo, USA |
| Eckerstorfer | Markus | Norut Northern Research Institute, Norway |
| Eiken | Trond | University of Oslo, Norway |
| Forwick | Matthias | UiT The Arctic University of Norway |
| Grundvåg | Sten-Andreas | UiT The Arctic University of Norway |
| Hasiotis | Stephen | University of Kansas, USA |
| Hendrikx | Jordy | Montana State University, USA |
| Hogan | Kelly Anne | University of Cambridge, UK |
| Huss | Matthias | University of Freiburg, Germany |
| Husum | Katrine | Norwegian Polar Institute |
| Huwald | Wolf | EPFL, Switzerland |
| Hynek | Bernhard | ZAMG, Austria |
| Irvine-Fynn | Tristram | Aberystwyth University, UK |
| Kirchner | Nina | Stockholm University, Sweden |
| Kjær | Knut | Natural History Museum of Denmark |
| Larsen | Eiliv | Geological Survey of Norway |
| Lecomte | Isabelle | NORSAR, Norway |
| Licciardi | Joseph | University of New Hampshire, USA |
| McNabb | Robert | University of Oslo, Norway |
| Mertes | Jordan | Michigan Technological University, USA |
| Moholdt | Geir | Norwegian Polar Institute |
| Murton | Julian | University of Sussex, UK |
| Nowak | Aga | Sheffield University, UK |
| Nøttvedt | Arvid | Christian Michelsen Research, Norway |
| O'Regan | Matt | Stockholm University, Sweden |
| Osmundsen | Per Terje | Geological Survey of Norway |
| Porter | Philip | University of Hertfordshire, UK |
| Prieme | Anders | University of Copenhagen, Denmark |
| Riis | Fridtjof | Norwegian Petroleum Directorate |
| Riverman | Kiya | Penn State University, USA |
| Roof | Steven | Hampshire College, USA |
| Sannel | Britta | Stockholm University, Sweden |
| Schekulin | Clemens | Austrian Federal Railways |
| Schomacker | Anders | UiT The Arctic University of Norway |
| Schrott | Lothar | University of Bonn, Germany |
| Spielhagen | Robert | GEOMAR, Germany |
| Svendsen | John Inge | University of Bergen, Norway |
| Thompson | Sarah | Swansea University, UK |
| Tveranger | Jan | Centre for Integrated Petroleum Research, Norway |
| Werner | Alan | Mount Holyoke College, USA |
| Winsborrow | Monica | UiT The Arctic University of Norway |
| Yde | Jacob | Western Norway University of Applied Sciences |

# ARCTIC GEOPHYSICS

| LAST NAME | FIRST NAME | INSTITUTION |
|---|---|---|
| Abermann | Jakob | Asiaq, Greenland Survey |
| Antonsen | Nils-Ottar | Western Norway University of Applied Sciences |
| Asplin | Lars | Institute of Marine Research, Norway |
| Behlke | Rico | Kongsberg Satellite Services, Norway |
| Borch | Odd Jarl | Nord University, Norway |
| Boylan | Brandon | University of Alaska-Fairbanks, USA |
| Damm | Ellen | Alfred Wegener Institute, Germany |
| Dello | Kathie | Oregon State University, USA |
| Endresen | Øyvind | DnV GL, Norway |
| Flier | Evert | Norwegian Mapping Authority |
| Groh | Andreas | Technische Universität Dresden, Germany |
| Grydeland | Tom | Northern Research Institute, Norway |
| Hallerstig | Matilda | Norwegian Meteorological Institute |
| Hoppe | Ulf-Peter | Norwegian Defence Research Establishment |
| Karpechko | Alexey | Finnish Meteorological Institute |
| Kosch | Mike | Lancaster University, UK |
| Kristiansen | Svein | UiT The Arctic University of Norway |
| LaCasce | Joseph | University of Oslo, Norway |
| LaHoz | Cesar | UiT The Arctic University of Norway |
| Mansell | Damien | Univeristy of Exeter, UK |
| Mertes | Jordan | Michigan Technological University, USA |
| Miller | Lisa Ann | Institute of Ocean Sciences, Canada |
| Moe | Arild | Fridtjof Nansen Institute, Norway |
| Muckenhuber | Stefan | Nansen Environmental and Remote Sensing Center, Norway |
| Nielsen | Finn Gunnar | University of Bergen, Norway |
| Nilsen | Jan Even | Nansen Environmental and Remote Sensing Center, Norway |
| Olafsson | Kjartan | University of Bergen, Norway |
| Olason | Einar | Nansen Environmental and Remote Sensing Center, Norway |
| O'Leary | Martin | Swansea University , UK |
| Wannberg | Asta Pellinen | Umeå University, Sweden |
| Praplan | Arnaud | Finnish Meteorological Institute |
| Randelhoff | Achim | Norwegian Polar Institute |
| Schuler | Thomas Vikhamar | University of Oslo, Norway |
| Spengler | Thomas | University of Bergen, Norway |
| Stephenson | Scott | University of Connecticut, USA |
| Stober | Gunter | Leibniz-Institute of Atmospheric Physics, Germany |
| Thorud | Bjørn | Multiconsult, Norway |
| Tyssøy | Hilde Nesse | University of Bergen, Norway |
| Vancoppenolle | Martin | French National Centre for Scientific Research |
| Vierinen | Juha | UiT The Arctic University of Norway |

# ARCTIC TECHNOLOGY

| LAST NAME | FIRST NAME | INSTITUTION |
|---|---|---|
| Arbo | Peter | UiT The Arctic University of Norway |
| Ayele | Yonas | UiT The Arctic University of Norway |
| Berggren | Anne-Lise | Geofrost AS, Norway |
| Bihs | Hans | Norwegian University of Science and Technology |
| Bogen | Jim | Norwegian Water Resources and Energy Directorate |
| Breivik | Knut | University of Oslo, Norway |
| Bøggild | Carl Egede | Technical University of Denmark |
| Carlsson | Pernilla | Norwegian Institute for Water Research |
| Christen | Marc | Swiss Federal Institute for Snow and Avalanche Research |
| Ciesielski | Tomasz | Norwegian University of Science and Technology |
| Dietz | Rune | Aarhus University, Denmark |
| Ehlers | Søren | Norwegian University of Science and Technology |
| Eltoft | Torbjørn | UiT The Arctic University of Norway |
| Engelhardt | Markus | University of Oslo, Norway |
| Faksness | Liv-Guri | Sintef, Norway |
| Grande | Lars | Norconsult, Norway |
| Grote | Rafael | Norwegian Meteorological Institute |
| Hung | Hayley | Environment Canada |
| Hylland | Ketil | University of Oslo, Norway |
| Høgda | Kjell Arild | Norut Northern Research Institute, Norway |
| Høyland | Knut Vilhelm | Norwegian University of Science and Technology |
| Isaksen | Ketil | Norwegian Meteorological Institute |
| Jensen | Einar | UiT The Arctic University of Norway |
| Johnson | Mark | University of Alaska-Fairbanks, USA |
| Khan | Alia | University of Colorado, USA |
| Killingtveit | Ånund | Norwegian University of Science and Technology |
| Knutsson | Sven | Luleå Technical University, Sweden |
| Köhler | Jochen | Norwegian University of Science and Technology |
| Larsen | Kjell | Norwegian University of Science and Technology |
| Larsen | Jan Otto | Norwegian University of Science and Technology |
| Naseri | Masoud | UiT The Arctic University of Norway |
| Nerentorp | Michelle | Chalmers University of Technology, Sweden |
| Pedersen | Kristine Bondo | Akvaplan-Niva, Norway |
| Reimann | Stefan | EMPA, Switzerland |
| Renshaw | Carl | Dartmouth College, USA |
| Rønning | Jan Steinar | Geological Survey of Norway |
| Schmidbauer | Norbert | Norwegian Institute for Air Research |
| Sonne | Christian | Aarhus University, Denmarkw |
| Steinnes | Eiliv | Norwegian University of Science and Technology |
| Sydnes | Are | UiT The Arctic University of Norway |
| Turnbull | Ian | C-CORE, Canada |
| Vetter | Walter | University of Hohenheim, Germany |

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**CONTACT INFORMATION**

The University Centre in Svalbard (UNIS)
P.O. Box 156 | N-9171 Longyearbyen
Norway

Phone: (+47) 79 02 33 00
E-mail: post@unis.no
Web: www.unis.no



MILJØMERKET 7240 0762
TRYKKSAK LUNDBLAD MEDIA AS