# The University Centre in Svalbard – 1993-2012

Publications, staff & students

Dag W. Aksnes (ed.)

Rapport 34/2013

NIFU

UNIS
The University Centre in Svalbard

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# Preface - UNIS

Since its foundation in 1993, the University Centre in Svalbard (UNIS) has developed gradually to become a visible and significant institution for Arctic Studies in the natural sciences, now attracting about 500 students from around 30 countries annually. UNIS is a limited company with the Norwegian Ministry of Education and Research as the shareholder. In the letter of intent from the Ministry the unique operation of the institution is clear: 'UNIS shall offer higher education and conduct research of high international quality based on its location at Svalbard in a high Arctic area'.

On reaching twenty years and becoming a mature organisation, a holistic evaluation is timely. As part of the twenty year anniversary, the UNIS Board is pleased to present a bibliography describing, comparing and evaluating the academic 'footprint' of UNIS. To explore these issues in an independent, objective way, NIFU has conducted the analyses.

UNIS hopes the result will be a pleasure to read, and that the report will benefit the further development of UNIS and Norwegian Polar Research and Education.

Longyearbyen, 24.08 2013

Ole Arve Misund
Managing Director

# Preface - NIFU

This report presents a quantitative analysis of the publication output, staff and students at the University Centre in Svalbard (UNIS), covering the 20 year period 1993-2012. The report also includes an overview of the scientific publications authored by UNIS personnel during the period. UNIS commissioned Research Professor Dag W. Aksnes at the Nordic Institute for Studies in Innovation, Research and Education (NIFU), to conduct the analysis. Several people at UNIS have also contributed to the study. A project group consisting of Head Librarian Berit Jakobsen (coordinator of the project), Professor Hanne H. Christiansen, Director Ole Arve Misund and Senior Librarian Gro Heidi Råmunddal managed the project at UNIS. Berit Jakobsen, Gro Heidi Råmunddal and student Sara M. Cohen contributed significantly to the bibliographic overview. Iben Nicola Andersen collected data on students, and Ingrid Vinje and Wenche Kvernelv provided data on the personnel. Eva Therese Jenssen assisted in incorporating photos. In addition several members of UNIS staff contributed facts about their research, presented in a separate chapter in the report. NIFU would like to thank the people above for their valuable contributions and for a fruitful collaboration in conducting the project

Oslo, 25.09.2013

Sveinung Skule
Director

Susanne Lehmann Sundnes
Head of Research

# Contents

Overview of Longyearbyen in August 2008. UNIS and the Svalbard Science Centre in the lower middle of the photo. (Photo: Elise Strømseng/UNIS).

# Summary


- During UNIS's 20 year history, its employees have published almost 950 scientific publications, and UNIS has developed to become a major contributor to Norwegian polar research.
- There has been a very strong growth in the volume of publications during the period. In the first years only a few publications were published annually. A peak was reached in 2012 with more than 120 publications.
- The Arctic Biology Department is the largest in terms of publication output and has contributed to 35 per cent of the UNIS publications from the 1993-2012 period. Then follows the Arctic Geophysics Department with a proportion of 26 per cent and the Arctic Geology Department with 24 per cent. The proportion for the Arctic Technology Department is 15 per cent.
- UNIS performs reasonably well in terms of citation rates, and its publications have been cited 17 per cent more than the average publications within their fields. There are, however, significant differences between the UNIS departments, and the highest citation rates are obtained by the Arctic Geology Department.
- During the 20 year period, UNIS researchers have contributed to several highly-cited publications, including articles in high impact prestigious journals like *Nature*, *Science* and *PNAS*.
- The research profile of UNIS is characterised by extensive international collaboration. This is reflected in the number of co-authorships with scientists from foreign institutions. Of all UNIS publications (1993-2012), 68 per cent had co-authors from other countries.
- In total 892 work-years have been carried out by UNIS employees during the entire 1993-2012 period, including work carried out by both scientific and technical/administrative personnel. The annual figures have increased continuously during the period, from 3.2 work-years in 1993 to almost 85 work-years in 2012.
- UNIS is characterised by a strong international profile both in terms of staff and students. Over the years, numerous people from other countries have been recruited to academic positions at UNIS. This is most pronounced for PhD candidates, where 70 per cent have been foreigners.
- In 2012, 467 students from 23 countries studied at UNIS. The proportion of international students was 53 per cent.

Arctic Geophysics students and staff on fieldwork in Van Mijenfjorden. (Photo: Anna Sjöblom Coulson/UNIS).

# 1 Introduction

Dag W. Aksnes

From its foundation in 1993 the size of UNIS in terms of research efforts and educational capacity has increased significantly. The purpose of this report is to characterise this development by various quantitative indicators covering the period 1993-2012. The main focus is on the research output of UNIS in terms of scientific publications. In addition, the staff numbers and student data are analysed.

A basic idea underlying the report is that publication data provide interesting information on the development of UNIS, in terms of research volume, scientific profile and impact of the research. Indicators based on publications ('bibliometric indicators') have increasingly been applied as performance measures in the context of science policy and research evaluation. The basis for the use of such indicators is that new knowledge – the principal objective of basic and applied research – is disseminated to the research community through publications. Publications can thereby be used as indirect measures of knowledge production. Data on how much the publications have been referred to, or cited, in the subsequent scientific literature can in turn be regarded as an indirect measure of the scientific impact of the research.

A detailed description of the data and methods applied in the project can be found in Chapter 5. Here only a brief presentation of some of the basic methodological principles is given. An important issue concerns the identification and delimitation of the UNIS-publications. We have relied on the criteria developed by the The Norwegian Association of Higher Education Institutions (UHR). Here, a basic principle is that a publication is credited to an institution only when the institution is listed as one of the author addresses. It is reasonable to apply this principle also in this study as the focus is on the performance of UNIS as an organisation, and less on the population of individuals that have been employed at UNIS.

The study is limited to *scientific* publishing. The delimitation of scientific versus other publications is also based on the criteria developed by UHR. Only contributions published in publication channels qualifying as scientific in the performance-based budgeting system are included. The following publication types are eligible: full-papers (regular articles, proceedings articles) and review articles published in journals or books (i.e. not short contributions like editorials, corrections, meeting abstracts, etc.) and books/monographs (excluding text-books).

To identify UNIS-publications we have relied on various bibliographic databases, most importantly Web of Science, Scopus and the Norwegian CRIStin database. We have also used other data sources available such as the UNIS annual reports and the previous 10 year anniversary bibliographic report (Lindner and Jakobsen, 2003). The list of publications in the latter documents is, however, insufficient

for the purpose of this study. The reason is that all publications by authors affiliated with UNIS are listed, not only publications where UNIS has been credited. This is particularly relevant for people in adjunct positions at UNIS. Careful and time-consuming investigations have been carried out in order to identify all UNIS publications. Nevertheless, we cannot preclude the possibility that some qualifying articles have escaped our attention and thus are not included in the study.

The report is structured as follows:  Chapter 2 presents the results of the publication analysis. Then there follow two chapters with statistics and indicators on the development of the number of staff and students at UNIS over the 20-year period 1993-2012. The fifth chapter presents the data and methodology applied in the study. The report finally contains separate chapters with a lists of all UNIS publications, the staff employed, as well as the PhD candidates produced at UNIS 1993-2012.

The exterior of the UNIS library in the Svalbard Science Centre. (Photo: Eva Therese Jenssen/UNIS).

# 2 Publication analysis

Dag W. Aksnes

This chapter gives an overview of the production of scientific publications at UNIS during the period 1993-2012. Various bibliometric indicators are presented, both for UNIS in total and for the individual departments. In the first section the publication output is analysed by volume, publication channels and the academic positions of the authors. Then follows a section on scientific productivity where the publications output is seen in conjunction with the research efforts measured in work-years. The next section provides an analysis of the content of the UNIS research as this is shown through the titles of the publications. Various citation indicators are presented in the next section. The final section of the chapter provides an overview of the scientific collaboration of UNIS based on data on co-authored publications.

## 2.1 Publication indicators

In total, 941 UNIS publications have been published during the 20 year period 1993-2012. This number includes scientific publications fulfilling the criteria described in Chapter 5. No publications were identified from the first year, 1993. This is not surprising, considering the publication lag involved in the publishing process and the fact that UNIS only started during summer 1993. The figures and tables presented in this chapter, therefore cover the period 1994-2012. There has been a very large growth in the annual number of publications. In 1994 only four publications were published. Since then, the annual number has gradually increased to a peak of 124 publications in 2012. The main reason for this growth is that UNIS has increased considerably in size and number of scientific staff during the period (see Chapter 3). The growth rate varies from year to year, but there was a particular large rise in the number of publications from 1997 to 1998, from 2003 to 2005 and from 2011 to 2012. For unknown reasons, the publication number drops significantly from 2005 to 2006.

During the period UNIS has developed to become a major contributor to Norwegian polar research. This was documented in a previous analysis of Norwegian polar research (Aksnes, Rørstad and Røsdal, 2012). Among the Norwegian universities and institutes active in polar research, UNIS ranks as number five, after the University of Tromsø, the University of Oslo, the University of Bergen, and the Norwegian Polar Institute in terms of number of polar research articles 2005-2010. When considering the publications related to Svalbard only, UNIS ranks as number three after the Norwegian Polar Institute and University of Oslo.

Figure 2.1 shows the annual number of publications by department. For all departments there has been a significant increase in the volume of publications during the period. During the 1990s the Arctic Geophysics Department contributed to the majority of the UNIS publications. After 2001 the Arctic

Biology Department became the largest in terms of publication output. In this period, the Arctic Geology Department has also produced more publications than the Arctic Geophysics Department. The Arctic Technology Department was founded later than the other departments (1996), and the first publications were recorded in 1997. It is the smallest department both in terms of size and publication output.

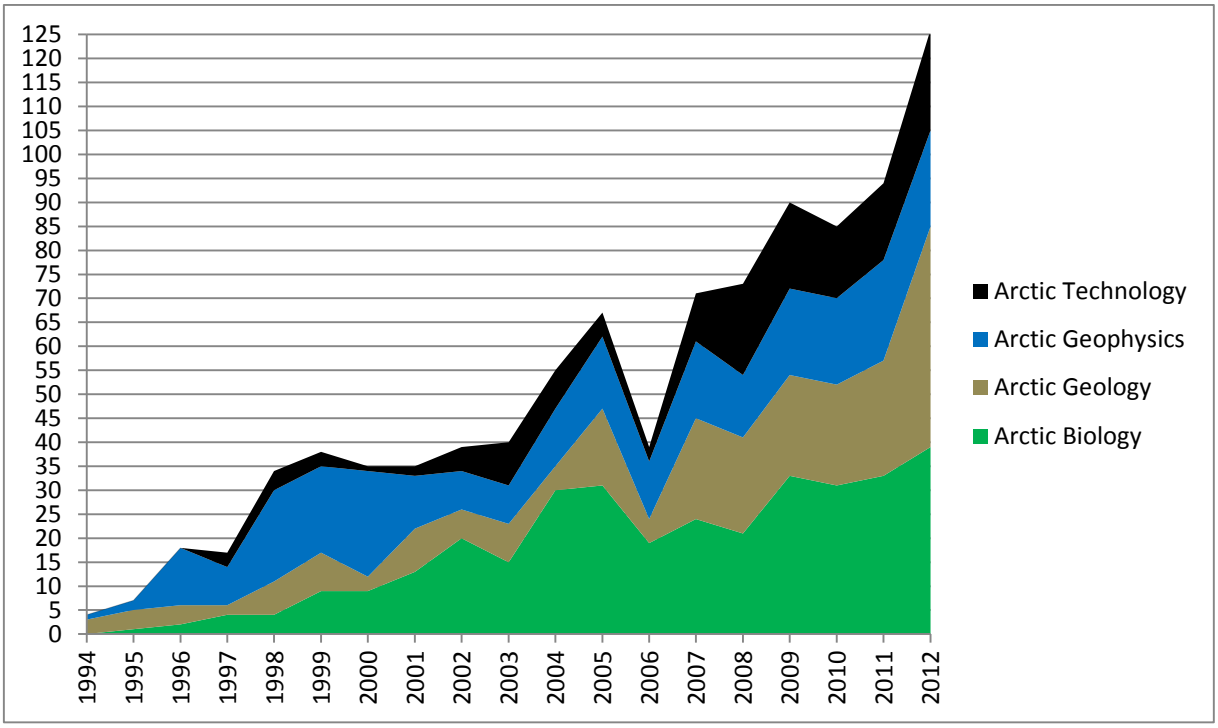
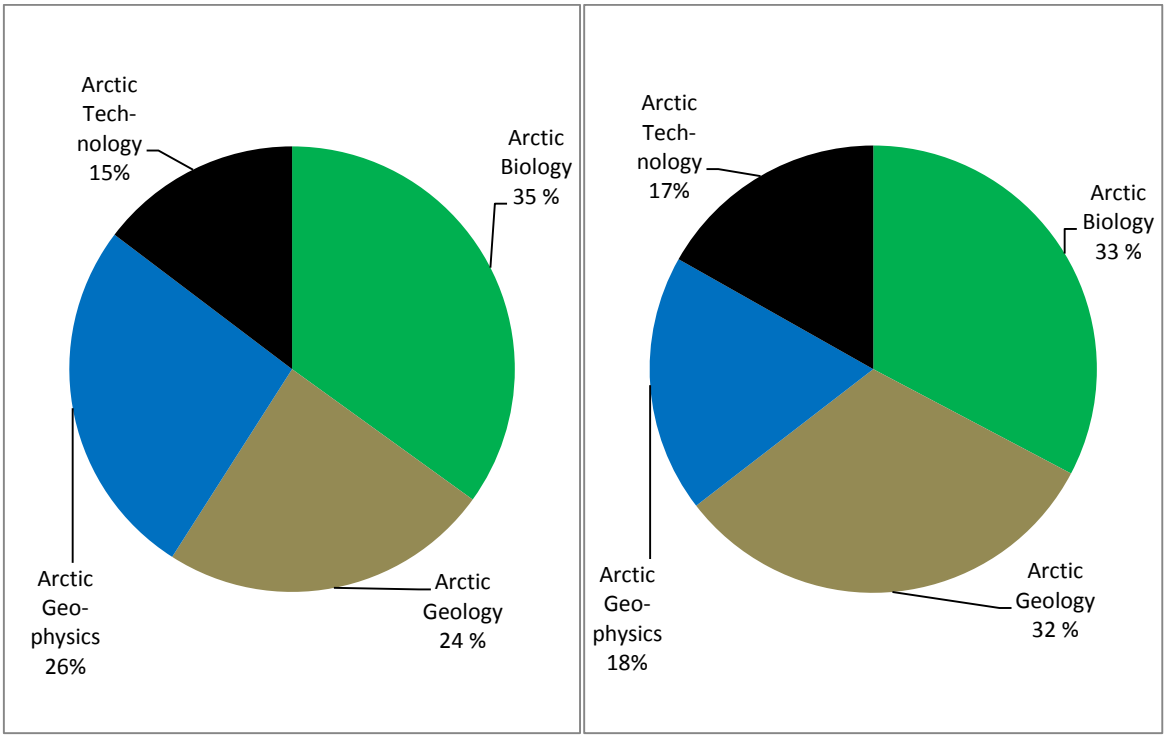



**Figure 2.1 Number of publications by department 1994-2012.***

*) A few publications are co-authored by scientists from more than one UNIS department. These are multiply counted in the figure.

Figure 2.2 shows the proportion of the publication output by department for two periods: 1994-2012 and for the two most recent years, 2011 and 2012. The Arctic Biology Department has contributed to 35 per cent of the UNIS publications from the entire 1994-2012 period (Figure 2.2a). Next follows the Arctic Geophysics Department with a proportion of 26 per cent and the Arctic Geology Department with 24 per cent. The proportion for the Arctic Technology Department is 15 per cent. In the most recent period (Figure 2.2b), a notable difference is the lower proportion of the Arctic Geophysics Department (18 %) and a higher proportion for the Arctic Geology Department (32 %).




**a) 1994-2012** **b) 2011-2012**

**Figure 2.2 Proportion of publications by department.**

The UNIS publications are distributed across a large number of different journals. However, the frequency distribution is skewed, and a limited number of journals account for a substantial amount of the publication output. Table 2.1 presents the publication counts for the most frequently used journals for each UNIS department for the entire period 1994–2012. From the list of journals one also gets an impression of the overall research profile of UNIS.

For the Arctic Biology Department, the journal *Polar Biology* is at the top of the list (41 articles), followed by *Marine Ecology Progress Series* (13), *Marine Biology* (10) and *Polar Research* (10). The table also gives the citation rate (impact factor) of the journals. As can be seen, scientists at the department have published five articles in the high impact journal *Proceedings of the National Academy of Sciences of the USA* (PNAS).

The staff of the Arctic Geology Department have published most frequently in *Quaternary Science Reviews* (20 articles), followed by three journals each with 12 articles: *Boreas*, *Journal of Glaciology* and *Permafrost and Periglacial Processes*.

For the Arctic Geophysics Department we find three journals with a very large number of articles: *Journal of Geophysical Research – Space Physics* (44 articles), *Geophysical Research Letters* (40) and *Annales Geophysicae* (38).

The publication profile of the Arctic Technology Department differs from the other UNIS departments with a much higher proportion of the publications in proceedings and fewer publications in journals. The journal most frequently used is the *Cold Regions Science and Technology* (22 articles).

**Table 2.1 Frequently used journals at UNIS by department, number of articles 1994-2012 and impact factor.**

| Dep | Journal | Number of articles | Impact factor* |
|---|---|---|---|
| Arctic Biology | POLAR BIOLOGY | 41 | 3.1 |
| | MARINE ECOLOGY PROGRESS SERIES | 13 | 5.9 |
| | MARINE BIOLOGY | 10 | 4.9 |
| | POLAR RESEARCH | 10 | 3.1 |
| | CANADIAN JOURNAL OF ZOOLOGY | 8 | 3.0 |
| | JOURNAL OF ANIMAL ECOLOGY | 8 | 8.9 |
| | PROCEEDINGS OF THE ROYAL SOCIETY B-BIOLOGICAL SCIENCES | 8 | 10.0 |
| | DEEP-SEA RESEARCH PART II-TOPICAL STUDIES IN OCEANOGRAPHY | 7 | 6.7 |
| | OECOLOGIA | 7 | 6.9 |
| | PROGRESS IN OCEANOGRAPHY | 7 | 9.0 |
| | ARCTIC ANTARCTIC AND ALPINE RESEARCH | 6 | 3.8 |
| | BOTANY-BOTANIQUE (PREV CAN J. BOT) | 6 | 2.8 |
| | JOURNAL OF PLANKTON RESEARCH | 6 | 3.4 |
| | AMERICAN JOURNAL OF BOTANY | 5 | 5.2 |
| | MOLECULAR ECOLOGY | 5 | 12.2 |
| | PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE USA | 5 | 19.9 |
| | ZOOTAXA | 5 | 1.6 |
| | ADVANCES IN ECOLOGICAL RESEARCH | 4 | 5.7 |
| | BIOLOGY LETTERS | 4 | 7.2 |
| | OIKOS | 4 | 6.9 |
| | PARASITOLOGY | 4 | 5.3 |
| Arctic Geology | QUATERNARY SCIENCE REVIEWS | 20 | 8.8 |
| | BOREAS | 12 | 5.1 |
| | JOURNAL OF GLACIOLOGY | 12 | 4.5 |
| | PERMAFROST AND PERIGLACIAL PROCESSES | 12 | 4.8 |
| | NORWEGIAN JOURNAL OF GEOLOGY | 9 | 2.8 |
| | POLAR RESEARCH | 8 | 3.1 |
| | JOURNAL OF QUATERNARY SCIENCE | 7 | 5.3 |
| | ADVANCES IN ECOLOGICAL RESEARCH | 6 | 5.7 |
| | CRYOSPHERE | 6 | 3.6 |
| | MARINE AND PETROLEUM GEOLOGY | 6 | 3.7 |
| | ANNALS OF GLACIOLOGY | 5 | |
| | GEOLOGY | 5 | 8.1 |
| | BULLETIN OF THE AMERICAN METEOROLOGICAL SOCIETY | 4 | 12.7 |
| | EARTH SURFACE PROCESSES AND LANDFORMS | 4 | 4.2 |
| | GEOMORPHOLOGY | 4 | 4.7 |
| | MARINE GEOLOGY | 4 | 6.0 |
| | NORWEGIAN JOURNAL OF GEOGRAPHY | 4 | |
| | SEDIMENTOLOGY | 4 | 4.5 |
| | TECTONOPHYSICS | 4 | 4.2 |
| Arctic Geophysics | JOURNAL OF GEOPHYSICAL RESEARCH-SPACE PHYSICS | 43 | 5.3 |
| | GEOPHYSICAL RESEARCH LETTERS | 40 | 7.5 |
| | ANNALES GEOPHYSICAE | 38 | 3.8 |
| | JOURNAL OF GEOPHYSICAL RESEARCH-OCEANS | 10 | 5.0 |
| | JOURNAL OF ATMOSPHERIC AND SOLAR-TERRESTRIAL PHYSICS | 6 | 3.3 |
| | JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES | 6 | 7.9 |
| | JOURNAL OF GLACIOLOGY | 6 | 4.5 |
| | ANNALS OF GLACIOLOGY | 5 | |
| | COLD REGIONS SCIENCE AND TECHNOLOGY | 5 | 2.9 |
| | RADIO SCIENCE | 5 | 1.9 |
| | CONTINENTAL SHELF RESEARCH | 4 | 4.2 |
| | ADVANCES IN SPACE RESEACRH | 4 | 2.2 |
| Arc Tech | COLD REGIONS SCIENCE AND TECHNOLOGY | 22 | 2.9 |
| | CHEMOSPHERE | 4 | 7.1 |

*) Average citation rate per paper, based on total cumulative 2006-2011 papers and 2006-2011 citation counts (the 'standard' journal impact factor is calculated in a different way).

The publications have been distributed in categories of scientific personnel. Each publication has been classified according to which position the author occupied at UNIS at the time of publication. The results are shown in Figure 2.3. Associate professors have contributed to the highest number of publications, in total 310 during the period 1994-2012. An almost equal number of publications have been published by adjunct professors and adjunct associate professors. The professors at UNIS have published almost 270 articles, while PhD candidates have contributed to approximately 170 articles. There are also quite a few publications in the category 'No position'. This category includes publications authored by people who have not been formally employed by UNIS (for example master's students), or have been employed more than two years prior to the appearance of the publication.

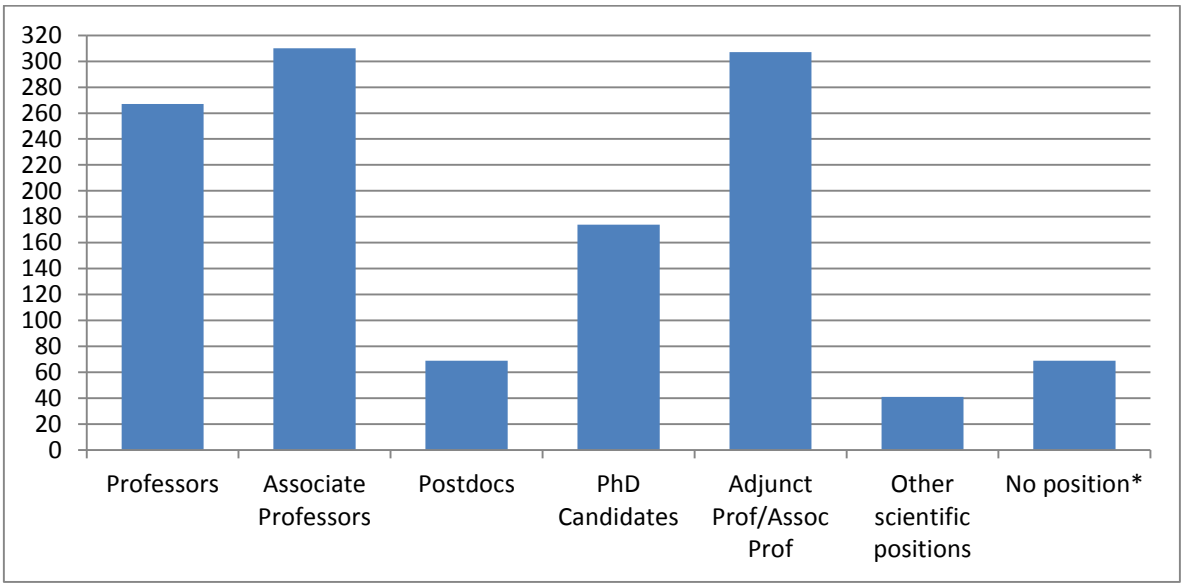



**Figure 2.3 Number of publications by position, total 1994-2012.**

*) Publications authored by people who have not been formally employed by UNIS or have been employed more than two years prior to the appearance of the publication. Publications co-authored by scientists in different position categories are multiply counted in the figure.

Figure 2.4 shows similar numbers as in Figure 2.3, but as time-series. As can be seen, the relative importance of publications by professors has increased during the period. This also holds for PhD candidates, while fewer publications relatively speaking have been published by associate professors. This development reflects changes in the composition of scientific personnel at UNIS, as will be further described in the next chapter.

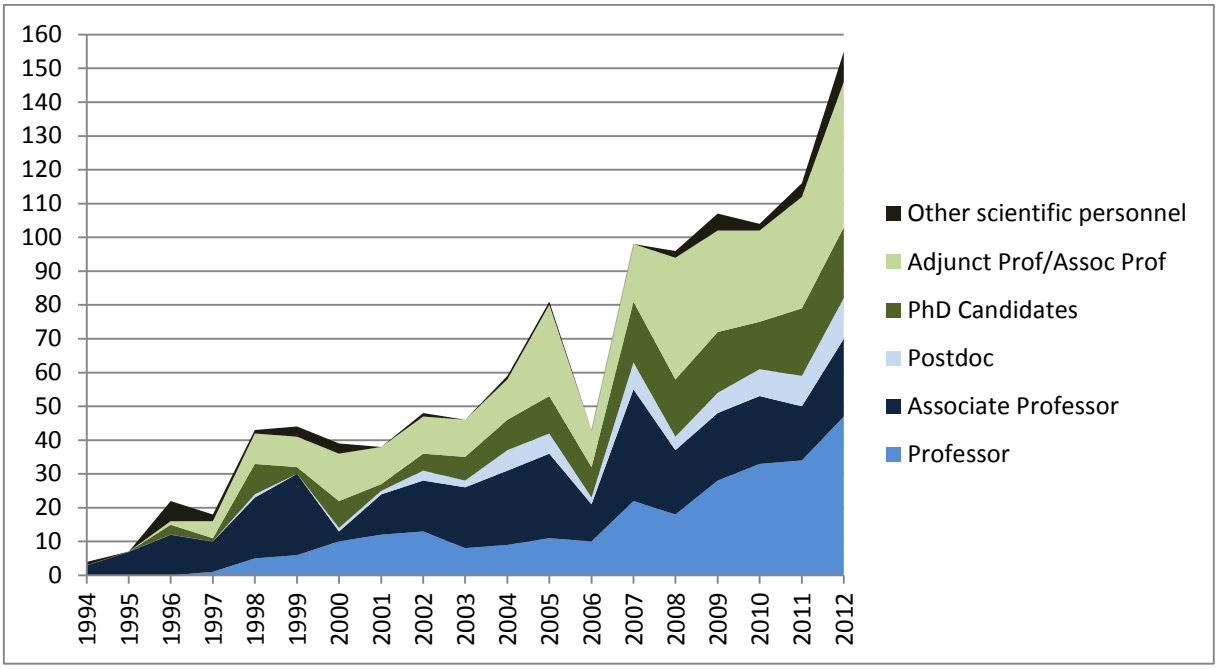



**Figure 2.4 Number of publications by position, 1994-2012.***

*) Publications co-authored by scientists in different position categories are multiply counted in the figure.

## 2.2 Scientific productivity

Chapter 3 contains a detailed overview of the number of work-years of research and education carried out at UNIS during the 20 year-period. Based on these data we are able to compare the input in terms of work-years with the output in terms of publications. Such indicators provide interesting information on the scientific productivity at UNIS, and can be calculated at various levels such as departments and groups of scientific personnel.

Table 2.2 gives an overview of the productivity of the different groups of scientific personnel for the entire period 1994-2012. The adjunct professors and adjunct associate professors are by far the most productive personnel group, with 5 publications per work-year. A significant number of people have been appointed at UNIS in adjunct positions, usually with 0.2 work-year annually. Generally, since adjunct professors are appointed on the basis of their scientific merit, they can be very productive. Thus, their high productivity is perhaps not surprising. In addition, they often use dual address affiliations, their main institutions and UNIS, and no corrections have been made for this in the calculations. It should be noted, however, that the analysis does not include publications by these persons where UNIS has not been credited.

The professors follow as the second most prolific group of scientific personnel with 3.5 publications per work-year. The scientific productivity of the associate professors is significantly lower, at 1.7. The postdocs have an almost equal productivity (1.8). The PhD candidates have the lowest productivity rate of the scientific personnel, with 1.3 publications per work-year. This is not surprising as the PhD students still are training as researchers.

**Table 2.2 Number of publications per work-year, by position groups, total 1994-2012.**

| Position group | Number of publications per work-year |
|---|---|
| Professors | 3.5 |
| Associate Professors | 1.7 |
| Postdocs | 1.8 |
| PhD Candidates | 1.3 |
| Adjunct Professor/ Adjunct Associate Professor | 5.0 |
| Other scientific positions | 1.2 |

There is no simple way to compare the productivity level of UNIS with the one of the other Norwegian universities. However, the pattern identified corresponds well with previous findings concerning productivity. For example, several studies have shown that individual publication productivity tends to increase when moving up in the academic hierarchy (Kyvik, 1991; Aksnes et al. 2011), where professors are the most prolific personnel. It is also well established that PhD students are much less productive than more established researchers. Moreover, scientific productivity has been shown to depend on numerous factors such as academic position, gender, age, time for research/teaching loads, availability of research funds (and equipment, research assistants etc.), department culture and working conditions, and departmental size and organisational context. Data from a study of the scientific personnel at the universities in Oslo, Trondheim, Bergen and Tromsø show that that on average a professor in the natural sciences published 3.4 scientific publications per year. The figures for associate professors, postdocs and PhD candidates were 1.3, 1.4 and 0.8 publications per person, respectively (Piro et al. 2013). Thus, for all groups of personnel, UNIS has higher productivity than the average for the main Norwegian universities.

A factor which is likely to contribute to this high productivity is that the scientific personnel at UNIS have a 40/60 distribution of their working hours between education responsibilities and research. For the main Norwegian universities there is generally a 50/50 distribution between education responsibilities and research. In addition, the scientific staff at UNIS have the right to apply for sabbatical leave to focus on research every fourth year. Finally, UNIS provides basic financial research support to all scientific staff, enabling increased research activity.

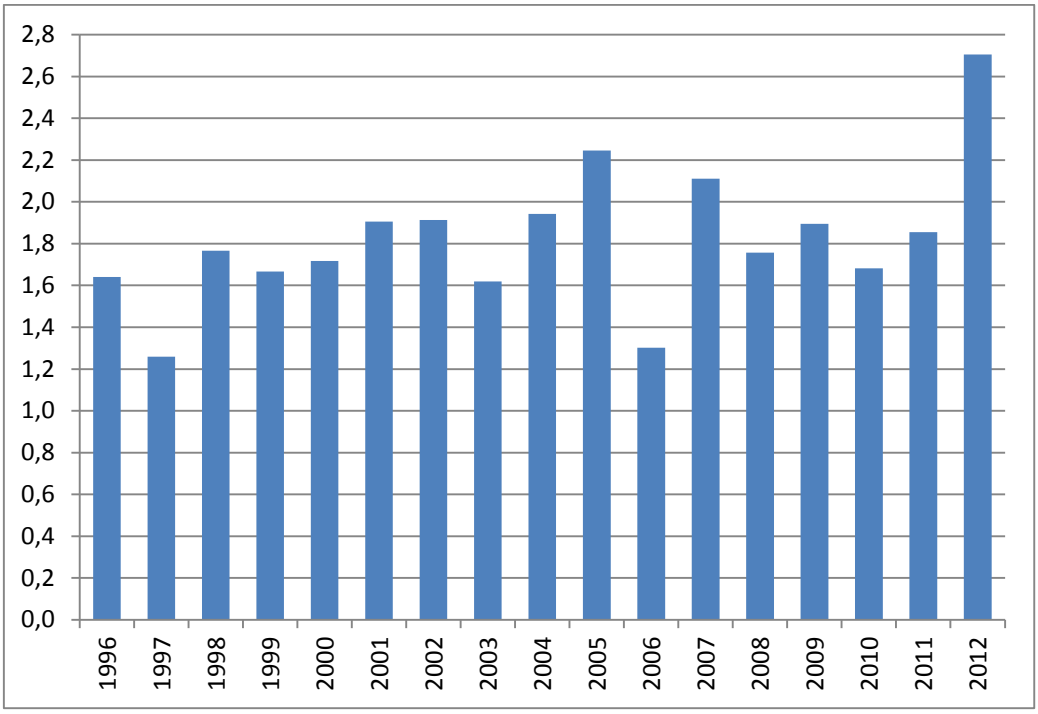



**Figure 2.5 Number of articles per scientific work-year (one year time lag), total 1996-2012.**

The overall scientific productivity at UNIS has been calculated by year, using a one year time lag between the input and output measures (Figure 2.5). Due to the small numbers, figures have not been calculated for the first years. The annual productivity has varied between 1.3 publications per work-year (1997 and 2006) to 2.7 (2012). There is no clear pattern in the development over time except that the 2012 value is significantly higher than any years before. Most likely the annual differences reflect more random fluctuations in the publication volume.

The average scientific productivity for the different UNIS departments based on numbers for the entire 1994-2012 period is presented in Figure 2.6. The Arctic Biology Department has a somewhat higher productivity level than the other departments, almost 2.2 publications per work-year. There are only minor differences between the three other departments, but the Arctic Geology Department has a slightly higher productivity level (1.6) than the Arctic Geophysics and Arctic Technology Departments (1.5).

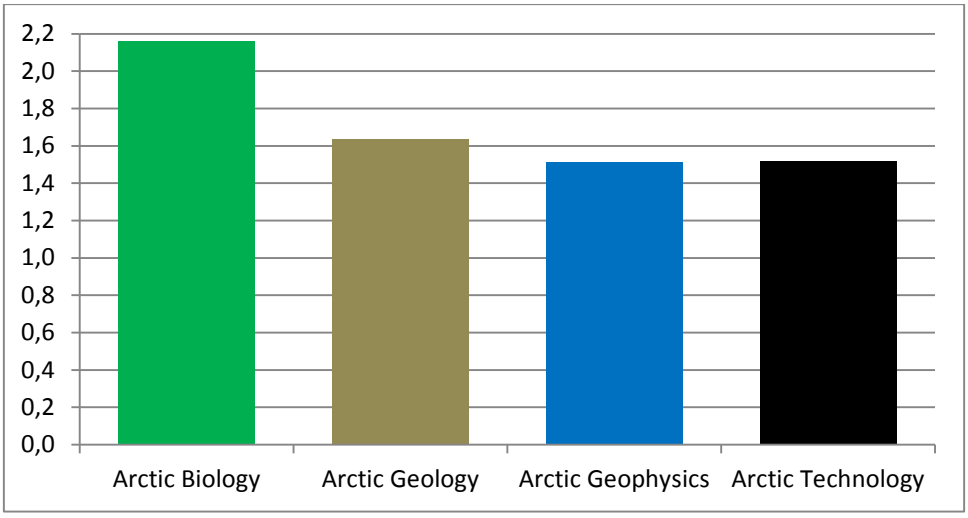



**Figure 2.6 Number of articles per scientific work-year by department, total 1994-2012.**

## 2.3 Scientific profile

The present report describes UNIS by quantitative indicators. Such an approach provides little direct information on the actual content of the research carried out at UNIS. This has to be analysed by other methods. Nevertheless, some indications of the content of the research can be obtained by analysing the title of the publications quantitatively. This can be done by analysing the word frequencies of title words. The results for all UNIS publications from 1994-2012 are presented as a cloud of words in Figure 2.7. In the figure the size of a word is proportional to the number of times the word appears in the titles (common words like *and*, *of*, *a*, *the*, etc. have been deleted). By far, the most frequently appearing words are *ice*, *Arctic*, and *Svalbard*, with frequencies in the range of 170 to 190 times. Then follow the words *sea* and *high* as the fourth and fifth most frequently appearing words.


**Figure 2.7 Most frequently appearing words in UNIS publication titles, total for 1994-2012.**

Source, software: wordle.net.

To provide supplementary information on the geographical profile of the UNIS research, a search based on selected geographical terms was performed. In addition to the titles of the publications, the abstracts of the publications were included in the searches (limited to publications in Web of Science where abstracts were available). For Svalbard, specific locations and regions were also included in the searches. Svalbard, and Svalbard areas accounted for more than 420 unique publications or 45 per cent of all UNIS publications. This suggests that more than half of the publications are not specifically related to Svalbard. An important example here will be marine research carried out in seas and waters outside the coastline of Svalbard. In addition, UNIS researchers are involved in polar research in other primarily Arctic areas. As an example, there are 67 articles in which Greenland appears in the title or abstracts. It should also be acknowledged that some publications may be based on observations or measurements in Svalbard without mentioning the archipelago in the titles and abstracts.

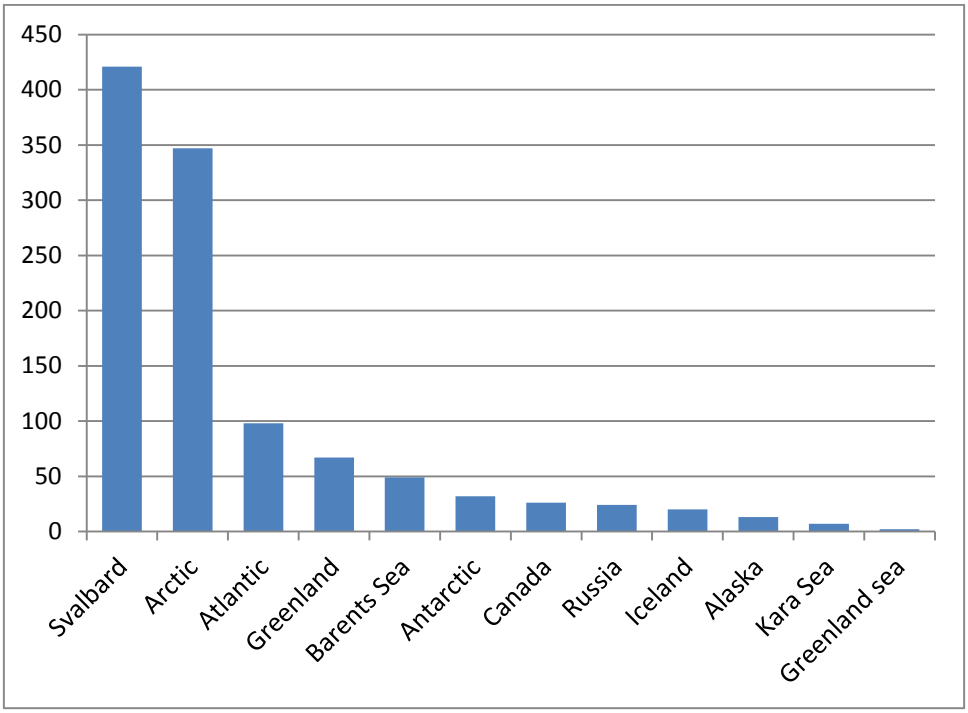



**Figure 2.8 Geographical profile of UNIS research. Number of UNIS publications by selected geographical search terms, total 1994-2012.***

*) The analysis is based on searches in the titles and abstracts of the publications. Variations in the spelling of the different geographical areas are used in the identification process. For Svalbard, specific locations and regions are also searched for and included (e.g. Spitsbergen, Adventdalen).

To characterise the research profiles of the scientific departments at UNIS, clouds of paper title words have also been constructed for the individual scientific UNIS departments. For the Arctic Biology Department the pattern of most frequently appearing words is similar to the one found for UNIS overall. *Arctic* is by far most frequent (123), followed by *Svalbard* (69) (Figure 2.9). In terms of species names, *reindeer* and *deer* appear most frequently, followed by *calanus*. However, some species are written in different forms, for example, *amphipoda/amphipod/amphipods,* and when the latter variants are summed up, this species is the most frequent.

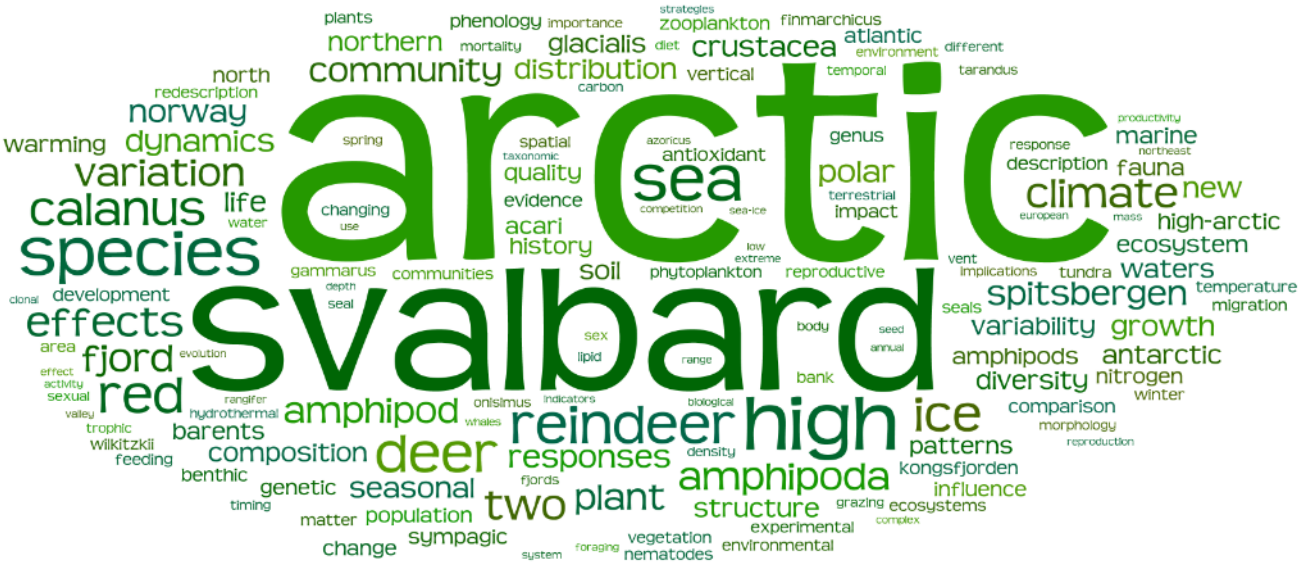



**Figure 2.9 Most frequently appearing words in publication titles from the UNIS Arctic Biology department 1994-2012.**

Source, software: wordle.net.

For the Arctic Geology Department, the most frequently appearing word is *Svalbard* (55 times) (Figure 2.10). However, *glacier*, *glaciers* and *glacial* in total appears 63 times in the titles.


**Figure 2.10 Most frequently appearing words in publication titles from the UNIS Arctic Geology Department 1994-2012.**

Source, software: wordle.net.

In Arctic Geophysics, *auroral* is the most frequently appearing word (47 times), and there are in addition variants like *aurora* (15 times) (Figure 2.11). *Observations*, *Svalbard*, *cusp* and *dayside* also appear very frequently in the titles of the publications.

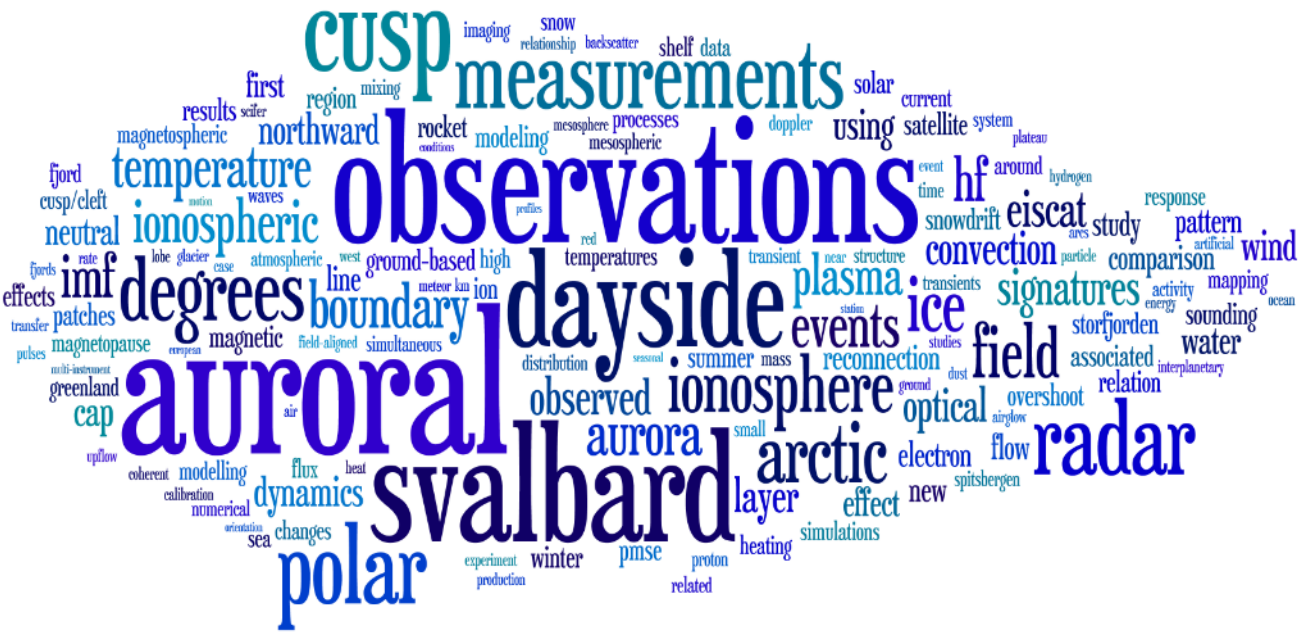



**Figure 2.11 Most frequently appearing words in publication titles from the UNIS Arctic Geophysics Department 1994-2012.**

Source, software: wordle.net.

Finally, in Arctic Technology *ice* is by far the most frequently appearing word (101 times), followed by *sea* (42) and *arctic* (26) (Figure 2.11).

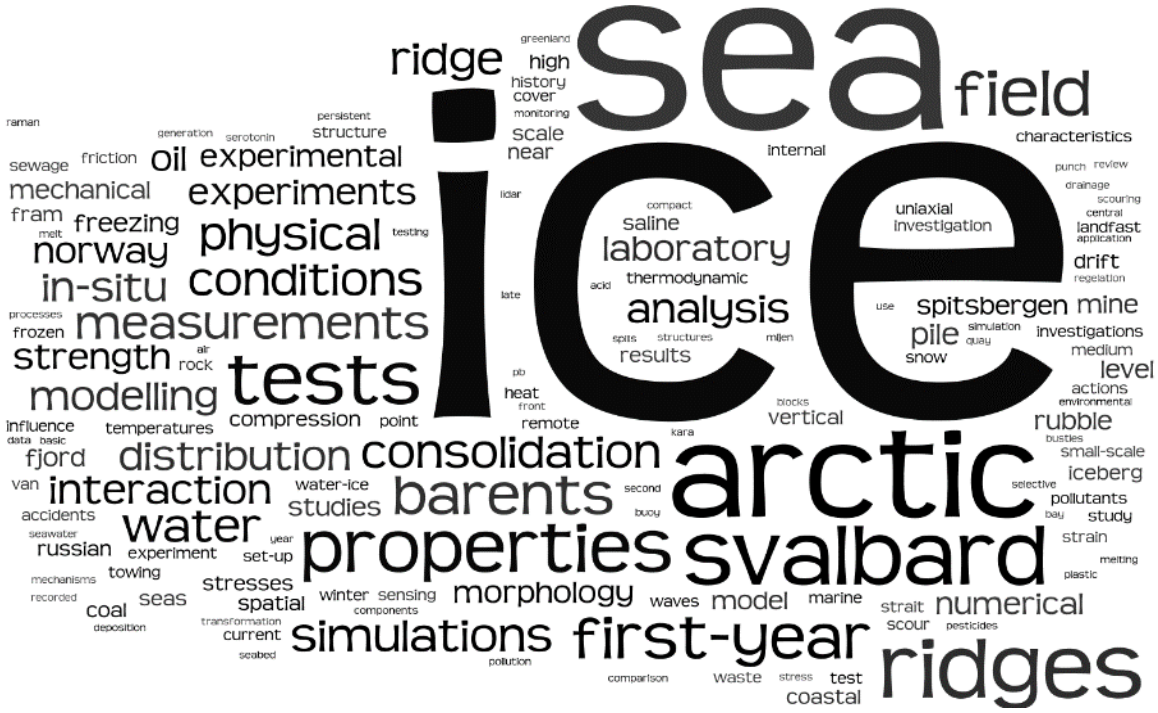



**Figure 2.12 Most frequently appearing words in publication titles from the UNIS Arctic Technology Department 1997-2012.**

Source, software: wordle.net.

## 2.4 Citation indicators

The extent to which publications have been referred to or cited in the subsequent scientific literature provides interesting information on the scientific impact of the UNIS research. This section presents data and indicators on the citation rate of the publications. The analysis is based on the articles indexed in Web of Science only. The large majority of the UNIS publications are included (cf. Method section). However, the Arctic Technology Department at UNIS has many publications in proceedings which are not indexed. This is a typical pattern for technology/engineering research, and as a consequence citation indicators are less reliable within this area.

UNIS staff have contributed to several articles with particular high citation counts. An overview of the most highly cited articles is given in Table 2.3. As the articles are listed by declining accumulated citation numbers, it is dominated by older articles. More recent articles have typically not yet been available in the literature long enough to obtain high citation numbers. Several of the articles are published in high impact prestigious journals like *Nature*, *Science* and *PNAS*. It should be noted, however, that some of the articles have a very large number of authors, and the UNIS contribution is accordingly minor. Moreover, the list also includes review papers summing up the research on a particular issue, with minor or no original research contributions.

The most highly cited publication with a first-author from UNIS is ‘Rapid changes in the mechanism of ocean convection during the last glacial period’ published in *Nature* in 1999 by TM Dokken and E Jansen. A facsimile of the title page of this article is printed on the next page.

12. Lagrange, A.-M., Backman, D. & Artymowicz, P. Planetary material around main-sequence stars. In *Protostars and Planets IV* (eds Mannings, V., Boss, A. & Russell, S.) (Univ. Arizona Press, Tucson, in the press).
13. Dominik, C., Laureijs, R., Jourdain de Muizon, M. & Habing, H. J. A Vega-like disk associated with the planetary system $\rho^1$ Cnc. *Astron. Astrophys.* **329**, L53–L56 (1998).
14. Jourdain de Muizon, M., Laureijs, R. J., Dominik, C. & Habing, H. J. A very cold disc of dust around the G0V star HD 207129. *Astron. Astrophys.* (In the press).
15. Dohnanyi, J. Collisional model of asteroids and their debris. *J. Geophys. Res.* **74**, 2531–2554 (1969).
16. Stern, S. A. & Colwell, J. E. Accretion in the Edgeworth-Kuiper belt: forming 100–1000 km radius bodies at 30 AU and beyond. *Astron. J.* **114**, 841–849 (1997).
17. Stern, S. A. & Colwell, J. E. Collisional erosion in the primordial Edgeworth-Kuiper Belt and the generation of the 30–50 AU Kuiper Gap. *Astrophys. J.* **490**, 879–882 (1997).
18. Duncan, M. J., Levison, H. F. & Budd, S. M. The dynamical structure of the Kuiper Belt. *Astron. J.* **110**, 3073–3081 (1995).
19. Weissman, P. In *The New Solar System* 4th edn (eds Beatty, J. K., Petersen, C. C. & Chaikin, A.) 59–68 (Sky Publishing Corp. and Cambridge Univ. Press, Cambridge, Massachusetts, 1999).
20. Butler, R., Marcy, G. W., Williams, E., Hauser, H. & Shirts, P. Three new 51 Pegasi-type planets. *Astrophys. J.* **474**, L115–L118 (1997).
21. Trilling, D. & Brown, R. A circumstellar dust disk around a star with a known planetary companion. *Nature* **395**, 775–777 (1998).
22. Henry, T., Soderblom, D., Donahue, R. & Baliunas, S. A survey of CaII H and K chromospheric emission in southern stars. *Astron. J.* **111**, 439–465 (1996).

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# Rapid changes in the mechanism of ocean convection during the last glacial period

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**High-amplitude, rapid climate fluctuations are common features of glacial times. The prominent changes in air temperature recorded in the Greenland ice cores[1,2] are coherent with shifts in the magnitude of the northward heat flux carried by the North Atlantic surface ocean[3,4]; changes in the ocean's thermohaline circulation are a key component in many explanations of this climate flickering[5]. Here we use stable-isotope and other sedimentological data to reveal specific oceanic reorganizations during these rapid climate-change events. Deep water was generated more or less continuously in the Nordic Seas during the latter part of the last glacial period (60 to 10 thousand years ago), but by two different mechanisms. The deep-water formation occurred by convection in the open ocean during warmer periods (interstadials). But during colder phases (stadials), a freshening of the surface ocean reduced or stopped open-ocean convection, and deep-water formation was instead driven by brine-release during sea-ice freezing. These shifting magnitudes and modes nested within the overall continuity of deep-water formation were probably important for the structuring and rapidity of the prevailing climate changes.**

We studied two high-resolution mid-depth sediment cores, IMAGES MD95-2010 and ENAM93-21, from the Nordic Seas. Our main results come from core MD95-2010 (1,226 m depth; 66° 41.05′ N, 04° 33.97′ E) (Fig. 1), which we compare with results from core ENAM93-21 (1,020 m depth; 62° 44.β′ N, 03° 59.92′ W). A striking feature of these records is the high amplitude variability in benthic $\delta^{18}O$ (Fig. 2; see also Methods), which represents changes occurring at >1 km water depth. Almost identical large $\delta^{18}O$ variations on millennial timescales are recorded in the two cores. These strong fluctuations in deep water properties occur concomitantly with the rapid climatic changes (D–O cycles) recorded in the Greenland ice cores[1,2]. Light isotopic events occur during the stadials (cold events), and heavy oxygen isotopic values occur during interstadial (warmer) events. This relationship is documented by the magnetic susceptibility (MS) record which shows detailed correlation with the Greenland ice cores (Fig. 1a, b), and between the cores (Fig. 2a; see Methods). Pronounced maxima (interstadial periods) and minima (stadial periods) in the MS record shift coherently with $\delta^{18}O$ fluctuations in GISP2. The stadials and interstadials are distinguished by the high content of ice rafted debris (IRD) within the stadials (high content of lithic grains during each stadial event) and by low IRD content during the interstadial events (Fig. 1d, e). Analogues to Heinrich layers, H1 to H6 (refs 3, 4), are identified by a high concentration of lithic grains, and by increased freshening of the surface waters as indicated by light $\delta^{18}O$

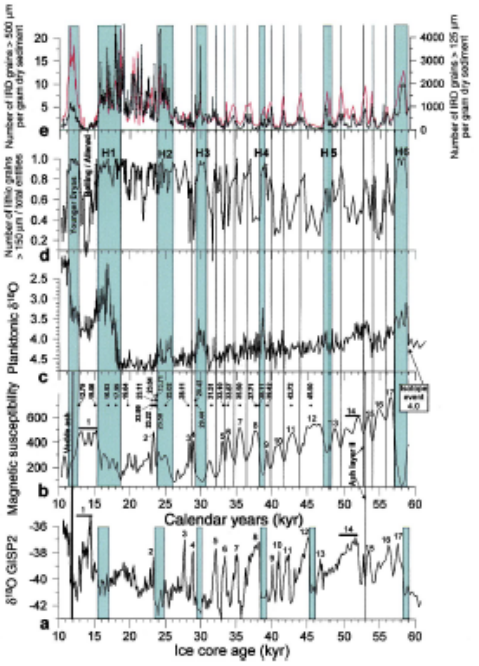



**Figure 1** Stratigraphic data sets. Sediment core MD95-2010 versus the GISP2 ice core record. Comparisons of stadial and interstadial events documented from climate proxy data in MD95-2010 (**b**–**e**), and from the GISP2 ice core (**a**) are plotted on individual time scales (see Methods). Corresponding interstadial events (1–17) in the marine record and the ice core are indicated in **a** and **b**. **a**, GISP2 $\delta^{18}O$ record[2]. **b**, Magnetic susceptibility (MS) record, with dated levels in MD95-2010 in calendar years indicated. **c**, $\delta^{18}O$ record of the planktonic species *N. pachyderma* sin. **d**, Ratio of lithic grains >150 µm to the sum of lithic grains and foraminifera. **e**, Number of lithic grains per gram dry weight sediment. Size fraction >500 µm shown in black, and size fraction >150 µm in red. Coloured bars indicate placement of Heinrich-layer analogues, and vertical lines correspond to MS-minima intervals.





**Facsimile of the most highly cited publication with a first-author from UNIS.**

By courtesy of Nature Publishing Group.

**Table 2.3 Most cited articles with contributions by a UNIS author, 1994-2012. UNIS authors underlined..**

| Dep | Authors | Title | Journal | Year | Vol,issue pages | Citation count* |
|---|---|---|---|---|---|---|
| AB | Walker, MD; Wahren, CH; Hollister, RD; Henry, GHR; Ahlquist, LE; Alatalo, JM; Bret-Harte, MS; Calef, MP; Callaghan, TV; Carroll, AB; Epstein, HE; Jonsdottir, IS; Klein, JA; Magnusson, B; Molau, U; Oberbauer, SF; Rewa, SP; Robinson, CH; Shaver, GR; Suding, KN; Thompson, CC; Tolvanen, A; Totland, O; Turner, PL; Tweedie, CE; Webber, PJ; Wookey, PA | Plant community responses to experimental warming across the tundra biome | PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE USA | 2006 | 103(5), 1342-1346 | 303 |
| AB | Schipper J, Chanson JS, Chiozza F, Cox NA, Hoffmann M, Katariya V, Lamoreux J, Rodrigues AS, Stuart SN, Temple HJ, Baillie J, Boitani L, Lacher TE Jr, Mittermeier RA, Smith AT, Absolon D, Aguiar JM, Amori G, Bakkour N, Baldi R, Berridge RJ, Bielby J, Black PA, Blanc JJ, Brooks TM, Burton JA, Butynski TM, Catullo G, Chapman R, Cokeliss Z, Collen B, Conroy J, Cooke JG, da Fonseca GA, Derocher AE, Dublin HT, Duckworth JW, Emmons L, Emslie RH, Festa-Bianchet M, Foster M, Foster S, Garshelis DL, Gates C, Gimenez-Dixon M, Gonzalez S, Gonzalez-Maya JF, Good TC, Hammerson G, Hammond PS, Happold D, Happold M, Hare J, Harris RB, Hawkins CE, Haywood M, Heaney LR, Hedges S, Helgen KM, Hilton-Taylor C, Hussain SA, Ishii N, Jefferson TA, Jenkins RK, Johnston CH, Keith M, Kingdon J, Knox DH, Kovacs KM, Langhammer P, Leus K, Lewison R, Lichtenstein G, Lowry LF, Macavoy Z, Mace GM, Mallon DP, Masi M, McKnight MW, Medellín RA, Medici P, Mills G, Moehlman PD, Molur S, Mora A, Nowell K, Oates JF, Olech W, Oliver WR, Oprea M, Patterson BD, Perrin WF, Polidoro BA, Pollock C, Powel A, Protas Y, Racey P, Ragle J, Ramani P, Rathbun G, Reeves RR, Reilly SB, Reynolds JE 3rd, Rondinini C, Rosell-Ambal RG, Rulli M, Rylands AB, Savini S, Schank CJ, Sechrest W, Self-Sullivan C, Shoemaker A, Sillero-Zubiri C, De Silva N, Smith DE, Srinivasulu C, Stephenson PJ, van Strien N, Talukdar BK, Taylor BL, Timmins R, Tirira DG, Tognelli MF, Tsytsulina K, Veiga LM, Vié JC, Williamson EA, Wyatt SA, Xie Y, Young BE. | The status of the world's land and marine mammals: Diversity, threat, and knowledge | SCIENCE | 2008 | 322 (5899), 225-230 | 236 |
| AB | Hop, H; Pearson, T; Hegseth, EN; Kovacs, KM; Wiencke, C; Kwasniewski, S; Eiane, K; Mehlum, F; Gulliksen, B; Wlodarska-Kowalczuk, M; Lydersen, C; Weslawski, JM; Cochrane, S; Gabrielsen, GW; Leakey, RJG; Lonne, OJ; Zajaczkowski, M; Falk-Petersen, S; Kendall, M; Wangberg, SA; Bischof, K; Voronkov, AY; Kovaltchouk, NA; Wiktor, J; Poltermann, M; di Prisco, G; Papucci, C; Gerland, S | The marine ecosystem of Kongsfjorden, Svalbard | POLAR RESEARCH | 2002 | 21(1), 167-208 | 169 |
| AG | Dokken, TM; Jansen, E | Rapid changes in the mechanism of ocean convection during the last glacial period | NATURE | 1999 | 401(6752), 458-461 | 160 |
| AG | Landvik, JY; Bondevik, S; Elverhoi, A; Fjeldskaar, W; Mangerud, J; Salvigsen, O; Siegert, MJ; Svendsen, JI; Vorren, TO | The last glacial maximum of Svalbard and the Barents Sea area: Ice sheet extent and configuration | QUATERNARY SCIENCE REVIEWS | 1998 | 17(1-3), 43-75 | 159 |
| AB | Post, E; Forchhammer, MC; Bret-Harte, MS; Callaghan, TV; Christensen, TR; Elberling, B; Fox, AD; Gilg, O; Hik, DS; Hoye, TT; Ims, RA; Jeppesen, E; Klein, DR; Madsen, J; McGuire, AD; Rysgaard, S; Schindler, DE; Stirling, I; Tamstorf, MP; Tyler, NJC; van der Wal, R; Welker, J; Wookey, PA; Schmidt, NM; Aastrup, P | Ecological dynamics across the Arctic associated with recent climate change | SCIENCE | 2009 | 325(5946), 1355-1358 | 150 |

| Dep | Authors | Title | Journal | Year | Vol, issue, pages | Citation count* |
|---|---|---|---|---|---|---|
| **AB** | Forchhammer, MC; Stenseth, NC; Post, E; Langvatn, R | Population dynamics of Norwegian red deer: density-dependence and climatic variation | PROCEEDINGS OF THE ROYAL SOCIETY B-BIOLOGICAL SCIENCES | 1998 | 265 (1393), 341-350 | 137 |
| **AG** | Sejrup, HP; Larsen, E; Landvik, J; King, EL; Haflidason, H; Nesje, A | Quaternary glaciations in southern Fennoscandia: evidence from southwestern Norway and the northern North Sea region | QUATERNARY SCIENCE REVIEWS | 2000 | 19(7), 667-685 | 131 |
| **AB** | Mysterud, A; Stenseth, NC; Yoccoz, NG; Langvatn, R; Steinheim, G | Nonlinear effects of large-scale climatic variability on wild and domestic herbivores | NATURE | 2001 | 410 (6832), 1096-1099 | 125 |
| **AB** | Post, E; Stenseth, NC; Langvatn, R; Fromentin, JM | Global climate change and phenotypic variation among red deer cohorts | PROCEEDINGS OF THE ROYAL SOCIETY B-BIOLOGICAL SCIENCES | 1997 | 264(1386), 1317-1324 | 123 |
| **AGF** | Beig, G; Keckhut, P; Lowe, RP; Roble, RG; Mlynczak, MG; Scheer, J; Fomichev, VI; Offermann, D; French, WJR; Shepherd, MG; Semenov, AI; Remsberg, EE; She, CY; Lubken, FJ; Bremer, J; Clemesha, BR; Stegman, J; Sigernes, F; Fadnavis, S | Review of mesospheric temperature trends | REVIEWS OF GEOPHYSICS | 2003 | 41(4) | 111 |
| **AB** | Mysterud, A; Yoccoz, NG; Stenseth, NC; Langvatn, R | Relationships between sex ratio, climate and density in red deer: the importance of spatial scale | JOURNAL OF ANIMAL ECOLOGY | 2000 | 69(6), 959-974 | 106 |
| **AG** | Mangerud, J; Dokken, T; Hebbeln, D; Heggen, B; Ingolfsson, O; Landvik, JY; Mejdahl, V; Svendsen, JI; Vorren, TO | Fluctuations of the Svalbard Barents Sea Ice Sheet during the last 150000 years | QUATERNARY SCIENCE REVIEWS | 1998 | 17(1-3), 11-42 | 104 |

*) Only articles indexed in Web of Science (WoS) are included in the citation analysis. Number of citations in WoS by January 2013. AB=Arctic Biology Department. AG=Arctic Geology Department. AGF=Arctic Geophysics Department.

In Figure 2.13 annual citation indexes have been calculated for the years 1996-2011 (1994 and 1995 have been omitted due to the very small number of publications). The relative citation index is an indicator showing whether the publications have been cited above or below the world average (=100). In the figure, two reference standards have been used, the journal and the field average. Here the citation count of each paper is matched to the mean citation rate per publication of the particular fields and journals (cf. Chapter 5). Both indexes show relatively large annual fluctuations. This is not unexpected and may be caused by the presence or absence of particularly highly cited papers. The field normalised citation index varies between 87 and 138, with the lowest values in 1996 and 1997. The average field normalised citation index for the entire period is 117, and the average for the period 2008-2011 is 124. This means that the UNIS articles from the period 2008-2011 have been cited 24 per cent more than the average publication in their fields. The world average is, however, not a very ambitious reference standard, and most Western countries have citation indexes significantly above this average. In comparison, the average for Norway (all fields combined) is 128 in the period 2008-2011 (Norges forskningsråd, forthcoming). The national averages (2008-2011) in UNIS's two main research areas, earth sciences and biology, are 140 and 124, respectively.

Based on these figures, it can be concluded that UNIS performs reasonably well in terms of citation rates, but is not among the most highly cited Norwegian institutions in polar research. This was shown in a previous analysis by Aksnes et al. (2012) where UNIS appears to have the lowest citation index among the Norwegian polar research universities and institutions for the years 2005 -2009. This report also shows that Svalbard-related research in general is cited below the average for other polar research.

The UNIS researchers tend to publish in journals that are cited close to the world average, therefore there are not large differences between the journal normalised indicator and the field normalised indicator.

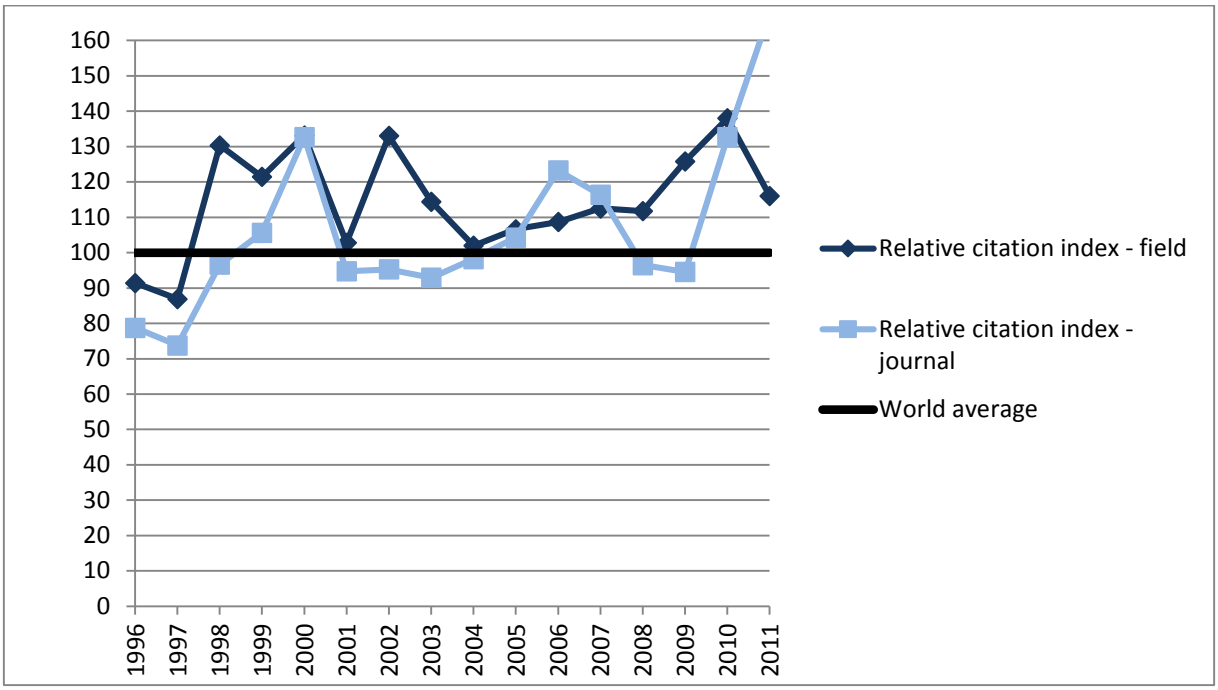



**Figure 2.13 Relative citation indexes of UNIS publications* annually from 1994 to 2011.**

*) Only articles indexed in Web of Science (WoS) are included in the citation analysis (N=666, 1994-2011)

The field normalised citation index at department levels for the two nine-year periods 1994-2002 and 2003-2011 is shown in Figure 2.14. The Arctic Geology Department obtains the highest citation indexes in both periods, followed by the Arctic Biology Department. The publications of the Arctic Geophysics and Arctic Technology departments have been cited below the world average. Thus, the analysis shows that there are significant differences between the individual UNIS departments, where the Arctic Geology Department performs very well in terms of citation rates.

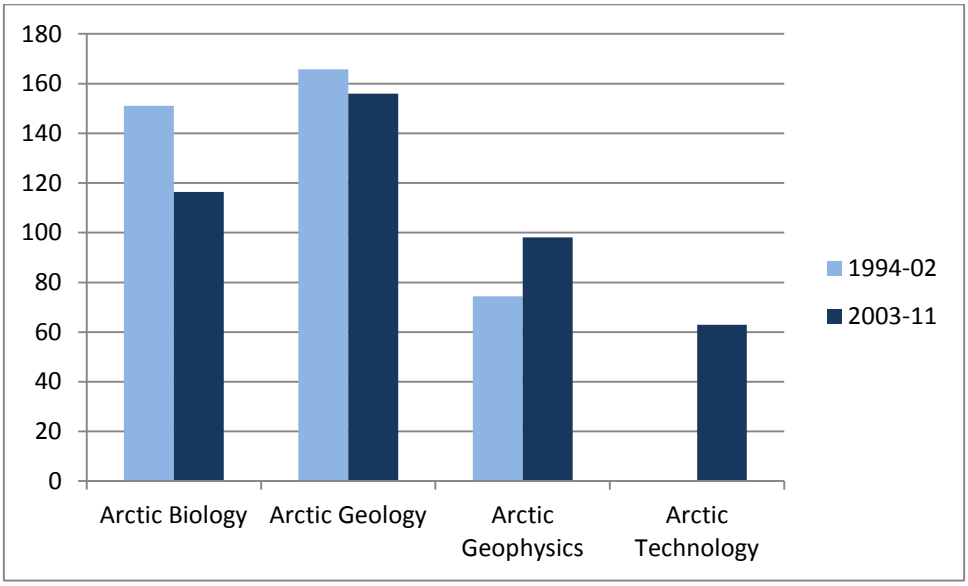



**Figure 2.14 Relative citation indexes – field of UNIS publications* by department and period.**

*) Only articles indexed in Web of Science (WoS) are included in the citation analysis (N=666, 1994-2011). The index has not been calculated for the Arctic Technology Department 1994-2002, due to the small number of articles.

Citation indicators have various limitations as performance measures, and as explained in Chapter 5, a citation analysis cannot substitute for an evaluation carried out by peers. The research at UNIS has been assessed in former evaluations organised by the Research Council of Norway. In the bio-evaluation (2011), the scientific quality of the Arctic Biology Department was rated as *good* (Research Council of Norway, 2011a). In the view of the panel, the range of research topics at the department appeared too broad considering the personnel available.

Likewise, the research at the Departments of Arctic Geology and Arctic Geophysics was assessed in the evaluation of research in earth sciences in Norway (2011) (Research Council of Norway, 2011b). In this evaluation, each research group was examined and most of them were graded *2-3* (*fair-good*):

Air-Cryosphere-Sea Interaction & Modelling, Arctic Geophysics Department: Grade 2-3 (fair-good).
Sedimentary Bedrock Geology, Arctic Geology Department: Grade 2-3 (fair-good).
Quaternary and Marine Geology, Arctic Geology Department: Grade 2-3 (fair-good).
Cryosphere, Arctic Geology Department: Grade 4 (very good).

Among other things, the evaluation recommended an increase in the size of these rather small groups, and to consider the merits of an integrated department of earth sciences, rather than two small departments of geology and geophysics. The middle/upper atmosphere group at the Department of Arctic Geophysics was evaluated in the Physics evaluation in 2010 (Research Council of Norway, 2010) and graded 4 (very good). Thus, UNIS research has been assessed to be, on average, very good quality. On the positive side two very strong research groups have been developed and fostered at UNIS.

## 2.5 Scientific collaboration

Co-authorship is a commonly used indicator of research collaboration. When researchers from different institutions together author a publication, this indicates that the research has involved collaboration. On this basis co-authorship can be used as indicator of national and international collaboration. Increasing collaboration in publications is an international phenomenon and is one of the

most important changes in publication behaviour among scientists during the last decades, particularly within the natural sciences.

The collaboration profile of the UNIS research has been studied based on data on national and international co-authorship (i.e. publications with author addresses both from UNIS and other institutions). The analysis encompasses publications indexed in WoS and Scopus only (N=837). This limitation mainly affects the Arctic Technology Department, which has many non-indexed publications. As a consequence, the collaboration profile of this department is less well represented, and it should be noted that the department collaborates with Russian researchers in particular (offshore engineering and permafrost engineering).

Of all UNIS publications (1994-2012), 68 per cent had co-authors from other countries. Thus, the extent of international collaboration is wide, apparently involving the majority of the UNIS research. The proportion of international collaboration has varied from 53 per cent to 80 per cent during the 20 year period, with no systematic trend (Figure 2.15). In 2012 the proportion was 75 per cent. In contrast, the national total for Norway has increased continually during the period, from 34 per cent in 1994 to 58 per cent in 2012 (Research Council of Norway, forthcoming). The natural sciences have, however, higher proportions than the national average.[1] UNIS high rate of international collaboration may be partly caused by the turnover of positions at the institution and the fact that many researchers have been recruited from abroad (cf. Chapter 3).

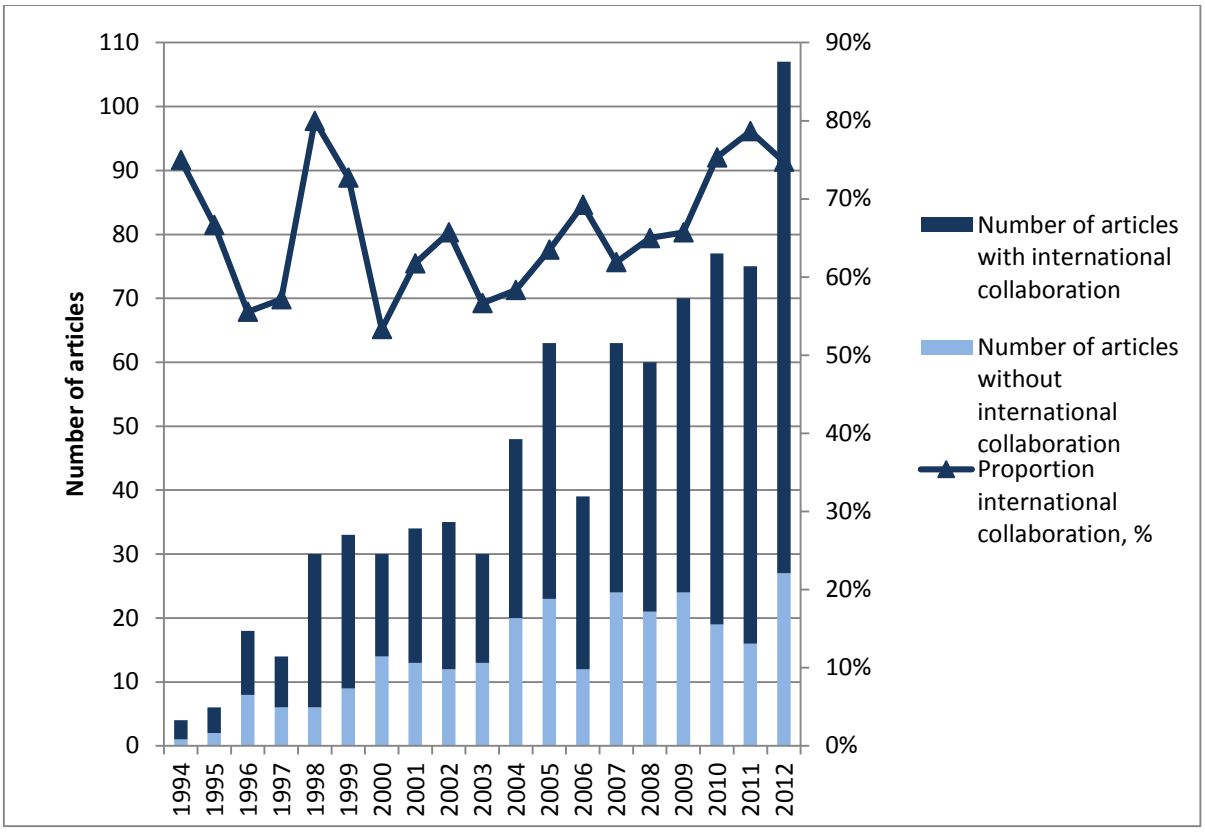



**Figure 2.15 Number and proportion of UNIS articles with international collaboration,1994-2012.**

Which countries are the most important collaboration partners for UNIS? To answer this, the distribution of co-authorship by country has been studied. Table 2.4 shows the frequencies of co-authorship for the nations that comprise UNIS's main collaboration partners from 1994 to 2012.

[1] Updated national figures are not available. As an example, 65 per cent of the publications of the Faculty of Mathematics and Natural Sciences at the University of Bergen involved international co-authorship in the period 2009-2011 (Mikki and Aksnes, 2012).

The UK is the most important collaboration nation. More than a quarter (27 % or 226 articles) of the UNIS articles had co-authors from the UK. Next follow USA, Denmark, and Sweden with proportions of 20, 11, 10 per cent, respectively. The national pattern may partly be influenced by the nationalities of the staff working at UNIS. This will be analysed in the next chapter, and the results show that staff from Germany, Denmark, UK, Sweden, and Russia account for the largest number of work-years carried out by foreigners.

**Table 2.4 UNIS articles with international collaboration, by country*, total 1994-2012.**

| Country | Number of publications | Proportion of all UNIS publications |
|---|---|---|
| UK | 226 | 27 % |
| USA | 165 | 20 % |
| Denmark | 89 | 11 % |
| Sweden | 83 | 10 % |
| Germany | 67 | 8 % |
| Canada | 51 | 6 % |
| Russia | 48 | 6 % |
| Poland | 38 | 5 % |
| France | 36 | 4 % |
| Japan | 31 | 4 % |
| Finland | 27 | 3 % |
| Netherlands | 21 | 3 % |
| Iceland | 21 | 3 % |
| Italy | 20 | 2 % |
| Australia | 18 | 2 % |
| Switzerland | 17 | 2 % |
| Belgium | 14 | 2 % |
| New Zealand | 13 | 2 % |
| Spain | 10 | 1 % |
| Greenland | 10 | 1 % |
| Austria | 10 | 1 % |

*) Only countries with 10 or more co-authored articles with UNIS are shown in the table. The figures are based on the data from WoS and Scopus only (N=837).

Table 2.5 gives an overview of the number of collaborative articles with UNIS by institution. Norwegian institutions are also included in this table. The universities in Tromsø and Oslo rank at the top of this list with 190 and 189 collaborative articles during the period 1994-2012. Thus, almost one quarter of the UNIS articles also had co-authors from each of these institutions. It should be noted, however, that when a researcher at UNIS reports dual address affiliations in the publications (e.g. due to an adjunct position at UNIS), this will be recorded as a collaborative article. If such articles were removed, the figures would have been lower, particularly for the Norwegian institutions. The University of Bergen follows as the third most frequent collaborative partner with 120 articles.

The Norwegian Polar Institute (NP) ranks highest among collaborative institutes by being the fourth largest overall partner with 82 joint articles.

Of the foreign universities, University of Copenhagen, University of Alaska, and University of St. Andrews appear with the highest number of co-authored publications.

**Table 2.5 Number of collaborative UNIS articles with other institutions, total 1994-2012.**

| Institution | Country | Number of co-authored articles | Institution | Country | Number of co-authored articles |
|---|---|---|---|---|---|
| Univ Tromsø | Norway | 190 | Univ Aberdeen | UK | 16 |
| Univ Oslo | Norway | 189 | Rutherford Appleton Lab | UK | 16 |
| Univ Bergen | Norway | 120 | Stockholm Univ | Sweden | 16 |
| Norw Polar Institute | Norway | 82 | Univ Stirling | UK | 16 |
| NTNU | Norway | 53 | Univ Cambridge | UK | 15 |
| Univ Copenhagen | Denmark | 44 | EISCAT Sci Assoc | Norway | 15 |
| Univ Alaska | USA | 33 | British Antarctic Survey | UK | 14 |
| Univ St Andrews | UK | 33 | Univ Wales | UK | 14 |
| Norwegian Inst Nat Res | Norway | 32 | Univ Iceland | Iceland | 14 |
| Univ Leicester | UK | 32 | Johns Hopkins Univ | USA | 13 |
| Geol Survey Norway | Norway | 31 | Natl Inst Polar Res | Japan | 13 |
| Univ Lund | Sweden | 28 | UNI Research | Norway | 12 |
| US Air force | USA | 28 | Inst Marine Res | Norway | 12 |
| Polish Academy of Sci | Poland | 28 | Nagoya Univ | Japan | 12 |
| Aarhus Univ | Denmark | 28 | NASA | USA | 12 |
| Akvaplan Niva | Norway | 25 | Arctic & Antarctic Res Ins | Russia | 11 |
| Alfred Wegener Inst | Germany | 24 | Norwegian Geotech Inst | Norway | 11 |
| Russian Acad Sci | Russia | 22 | Ctr Ecol & Hydrol | UK | 11 |
| Gothenburg Univ | Sweden | 22 | Univ Lancaster | UK | 11 |
| Univ New Hampshire | USA | 20 | Univ Alberta | Canada | 10 |
| Geol Survey Denmark & Greenland | Denmark | 19 | Univ Helsinki | Finland | 10 |
| SINTEF | Norway | 19 | Utah State Univ | USA | 10 |
| Norwegian Univ Life Sci | Norway | 18 | Danish Meteorol Inst | Denmark | 10 |

*) Only institutions with 10 or more co-authored articles with UNIS are shown in the table. The figures are based on the data from WoS and Scopus only (N=837).

Table 2.6 contains similar statistics as in Table 2.5 but at UNIS scientific department level.

**Table 2.6 Number of collaborative articles with other institutions by UNIS departments, 1994-2012.**

| Dep | Institution | Country | Number of co-authored articles | Dep | Institution | Country | Number of co-authored articles |
|---|---|---|---|---|---|---|---|
| Arctic Biology | Univ Tromsø | Norway | 110 | Arctic Geology | Aarhus Univ | Denmark | 18 |
| | Univ Oslo | Norway | 64 | | Geol Survey Denmark & Greenland | Denmark | 15 |
| | Norw Polar Inst | Norway | 55 | | Norw Polar Inst | Norway | 13 |
| | Norw Inst Nat Res | Norway | 32 | | Stockholm Univ | Sweden | 12 |
| | Polish Acad of Sci | Poland | 26 | | Univ Cambridge | UK | 10 |
| | Akvaplan Niva | Norway | 25 | | Gothenburg Univ | Sweden | 9 |
| | Univ Bergen | Norway | 22 | | NTNU | Norway | 8 |
| | NTNU | Norway | 22 | Arctic Geophysics | Univ Oslo | Norway | 79 |
| | Univ Copenhagen | Denmark | 18 | | Univ Bergen | Norway | 55 |
| | Univ Stirling | UK | 16 | | Univ Tromsø | Norway | 54 |
| | Univ Aberdeen | UK | 15 | | Univ Leicester | UK | 32 |
| | Norw Univ Life Sci | Norway | 14 | | US Air force | USA | 28 |
| | Gothenburg Univ | Sweden | 13 | | Univ Alaska | USA | 25 |
| | Aarhus Univ | Denmark | 12 | | Univ New Hampshire | USA | 16 |
| | Univ Lund | Sweden | 11 | | Rutherford App Lab | UK | 16 |
| | Ctr Ecol & Hydrol | UK | 11 | | Norw Polar Institute | Norway | 16 |
| | Alfred Wegener Inst | Germany | 10 | | EISCAT Sci Assoc | Norway | 15 |
| | British Antarctic Sur | UK | 9 | | Natl Inst Polar Res | Japan | 13 |
| | SINTEF | Norway | 8 | | Nagoya Univ | Japan | 12 |
| | Russian Acad Sci | Russia | 8 | | Univ Wales | UK | 12 |
| | Inst Marine Res | Norway | 8 | | Alfred Wegener Inst | Germany | 11 |
| | Norw Sch Vet Sci | Norway | 8 | | Johns Hopkins Univ | USA | 11 |
| Arctic Geology | Univ Oslo | Norway | 48 | | Utah State Univ | USA | 10 |
| | Univ Bergen | Norway | 43 | | NASA | USA | 9 |
| | Geol Survey Norway | Norway | 30 | | Polar Geophysical Inst | Russia | 8 |
| | Univ St Andrews | UK | 27 | | Max Planck Society | Germany | 8 |
| | Univ Tromsø | Norway | 26 | Arctic Tech | NTNU | Norway | 22 |
| | Univ Copenhagen | Denmark | 22 | | SINTEF | Norway | 9 |
| | Univ Lund | Sweden | 19 | | | | |

*) Only institutions with 8 or more co-authored articles with UNIS are shown in the table. The figures are based on the data from WoS and Scopus only (N=837).

In Figure 3.9 we have illustrated the collaboration profile of UNIS graphically for the 19 most important institutional partners measured in number of co-authored publications. In the figure, the surface area of the circles and width of the lines are proportional to the number of collaborative articles.

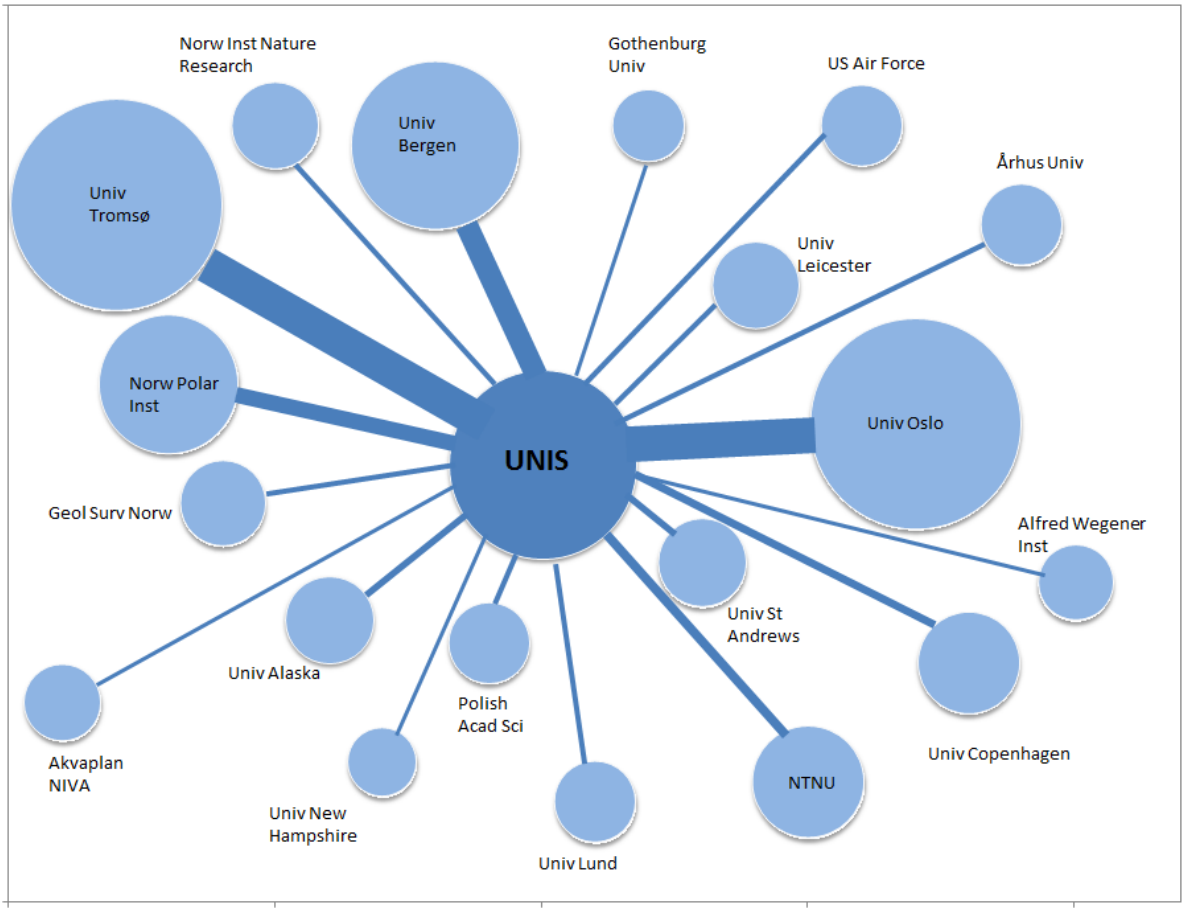



**Figure 2.16 UNIS's institutional collaboration profile based on the number of co-publications total 1994-2012.***

*) Only institutions with 20 or more co-authored publications with UNIS are shown. The area of the circles and the width of the lines are proportional to the numbers of co-publications with UNIS. The figure is based on the data from WoS and Scopus only.

# 3 Staff at UNIS

Dag W. Aksnes

This chapter presents various statistics and indicators of the staff employed at UNIS during its 20 year history. The basis for the analyses is annual employee lists with information on the length of each person's employment, appointment terms, position, age, etc. In most cases, work-years are used as measures. This means that a person who has been working at UNIS in a 20 per cent position, will count as 0.2 work-years (see also Chapter 5).

In total 892 work-years have been carried out at UNIS during the entire 1993-2012 period; this number includes work carried out by both scientific and technical/administrative staff. The annual figures have increased continuously during the period, from 3.2 work-years in 1993 to almost 85 work-years in 2012 (Figure 3.1). There was a strong growth during the period 1993-1998, followed by a few years with status quo. The increase continued from 2002, with particularly strong growth in the period 2007-2009. The work effort did not increase in 2010 and 2011, but a further rise is seen in 2012.

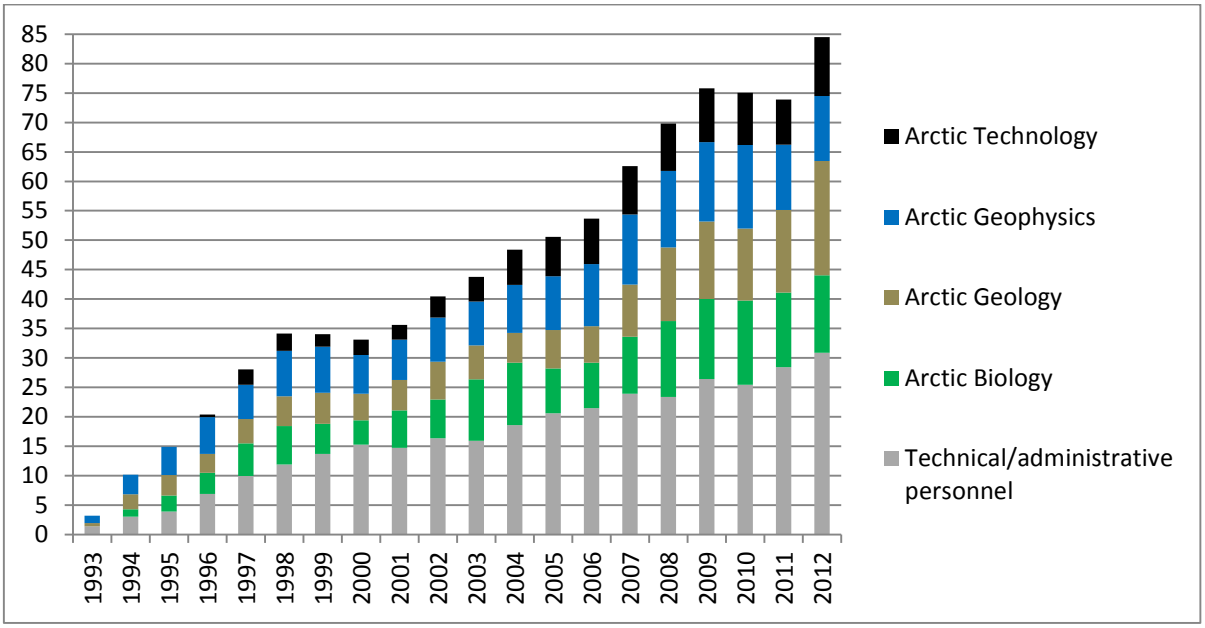



**Figure 3.1 Number of UNIS man-years by department* and year.**

*) Only scientific personnel included in department counts.

At departmental level, figures only include the scientific personnel, and there is one separate category for both the administrative and technical personnel at UNIS. This category includes staff working in the central administration at UNIS as well as staff in such positions at the scientific department level. In total, administrative and technical personnel carried out 37 per cent of the work at UNIS. The relative growth of work-years carried out by this group has kept pace with the relative growth of the scientific personnel at UNIS. As the main focus of this chapter is the scientific personnel at UNIS, administrative and technical personnel have not been included in several of the following figures.

Clearly, there has been a strong growth in the number of work-years at all departments during the period. The growth is particularly strong for the Arctic Geology Department which has increased from approximately 6 work-years in 2006 to 19 in 2012. The Arctic Geophysics Department has been the largest in terms of work-years for most years, but in 2011 and 2012, the Arctic Geology and the Arctic Biology departments were larger.

The proportion of work-years carried out by the scientific personnel for each department is shown in Figure 3.2. This analysis covers the entire 20 year period. The Arctic Geophysics Department is the largest with a proportion of 30 per cent, followed by the Arctic Biology and Arctic Geology Departments which are almost equal in size (proportions 26-27 %). The Arctic Technology Department is the smallest and has contributed to 17 per cent of the work-years at UNIS.

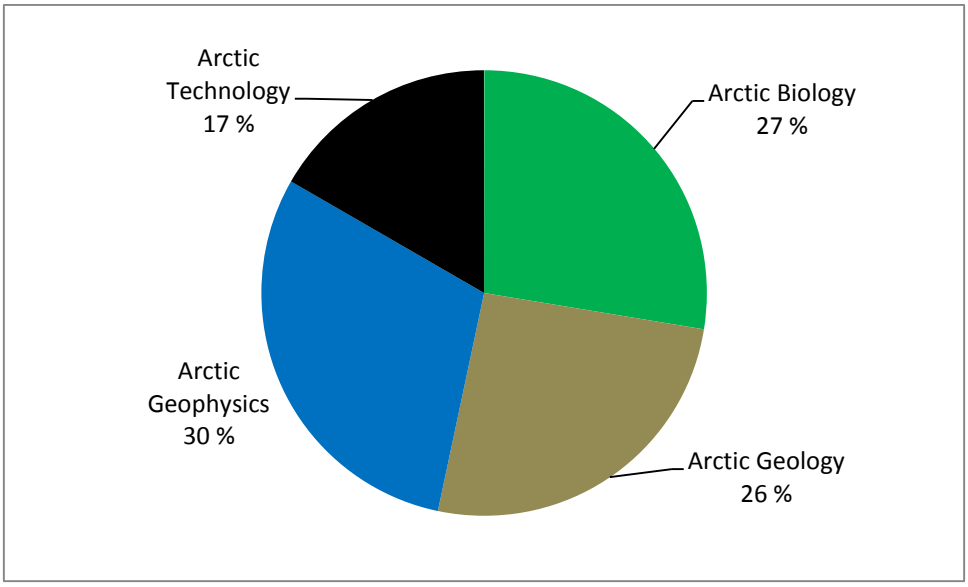



**Figure 3.2 Proportion of work-years by department,* total 1993-2012.**

*) Only scientific personnel included in department counts

Figure 3.3 shows how the work-years are distributed across different categories of positions based on figures for the entire 1993-2012 period. Of the scientific positions, the associate professors contributed to the largest number of work-years (188), followed by PhD candidates (154), professors (82), adjunct professors/associate professors (63), and postdocs (41). There are in addition 34 work-years carried out by people in other scientific positions such as researchers. Staff in administrative positions have contributed to 192 work-years, while the figure for the technical personnel is 134.

During the entire 1993-2012 period, 23 different people have been employed in positions as professors, 51 in positions as associate professors, 22 as postdocs, 60 as PhD candidates, 51 as adjunct professors/associate professors, and 20 in other scientific positions. In addition, 64 people have been employed in administrative positions and 38 in technical positions. Several people have, however, held more than one position, and are thus multiply counted in this statistics.

Compared to other universities in Norway, the contribution by professors is lower at UNIS and the contribution by associate professors higher. This is probably a consequence of the institution's young age and the fact that until 2009 only fixed-term contracts were provided. UNIS also has an unusual high proportion of personnel in adjunct positions, which reflects UNIS's strategy mainly to hire external professors for teaching and research purposes.

The data also give information on the gender balance for types of position (Figure 3.3). In all categories of scientific positions, except postdocs, the majority of the work effort has been carried out by men. However, women contribute to a much higher share when it comes to administrative positions. The female proportions are: professors 13 per cent, associate professors 34 per cent, postdocs 70 per cent, PhD candidates 49 per cent, adjunct professors/associate professors 3 per cent, other scientific personnel 44 per cent, technical personnel 17 per cent, administrative positions 72 per cent.

The lack of gender balance in tenured scientific positions is obvious, but it is, however, not unique to UNIS. The national R&D statistics for the higher education sector show that in mathematics and natural sciences, 16 per cent of professors were women and 28 per cent of the associate professors (2011 figures, source NIFU).

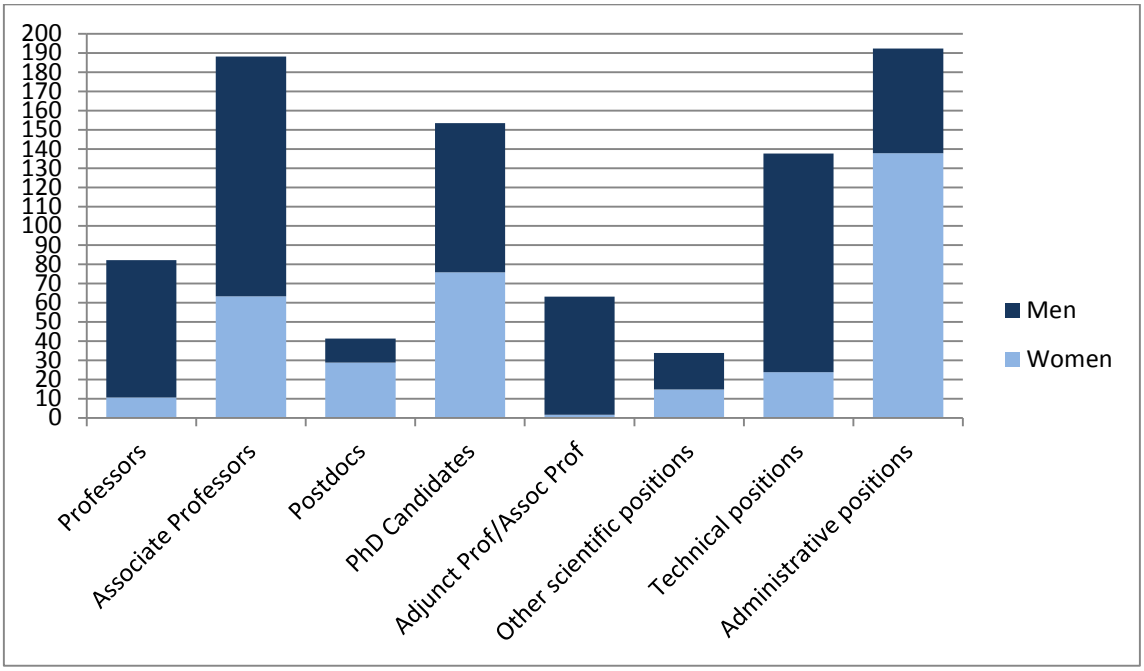



**Figure 3.3 Number of work-years by positions and gender, total 1993-2012.**

Figure 3.4 shows the number of work-years by position, groups, and scientific departments based on figures for the period 1993-2012. For all departments the highest number of work-years is carried out by associate professors, except for the Arctic Technology Department where PhD candidates rank at the top. The contribution by scientists in professor positions is highest for the Arctic Geology Department. On the other hand, this department has the lowest number of work-years carried out by PhD candidates.

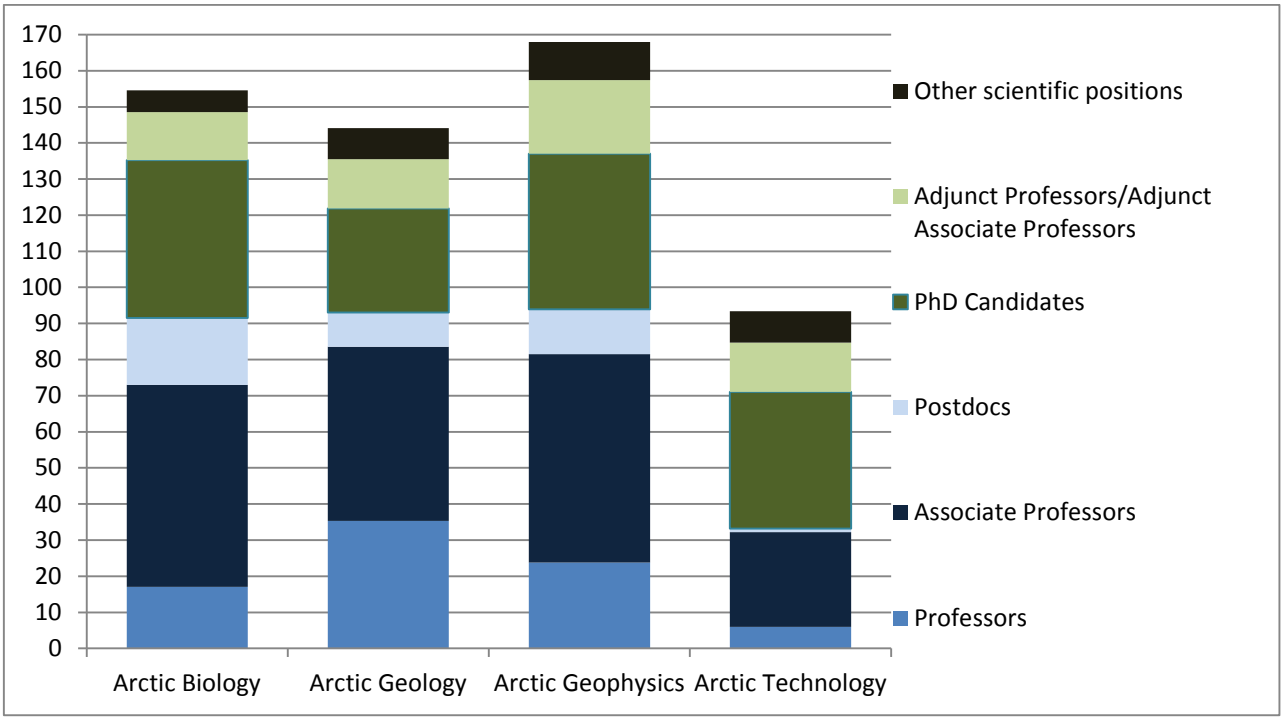



**Figure 3.4 Number of work-years by positions and department, total 1993-2012.**

The different groups of scientific personnel have varied in size over the 20 year period (Figure 3.5). One notable change is the increasing number of work-years carried out by PhD candidates, particularly after the year 2001 when UNIS was for the first time assigned PhD students as part of the funding from the Ministry for Education and Knowledge. UNIS does not award PhD degrees (exams are taken at mainland institutions), but has been the employer of a significantly increasing number of PhD candidates. During 2006 to 2008 the number of professors has increased significantly.

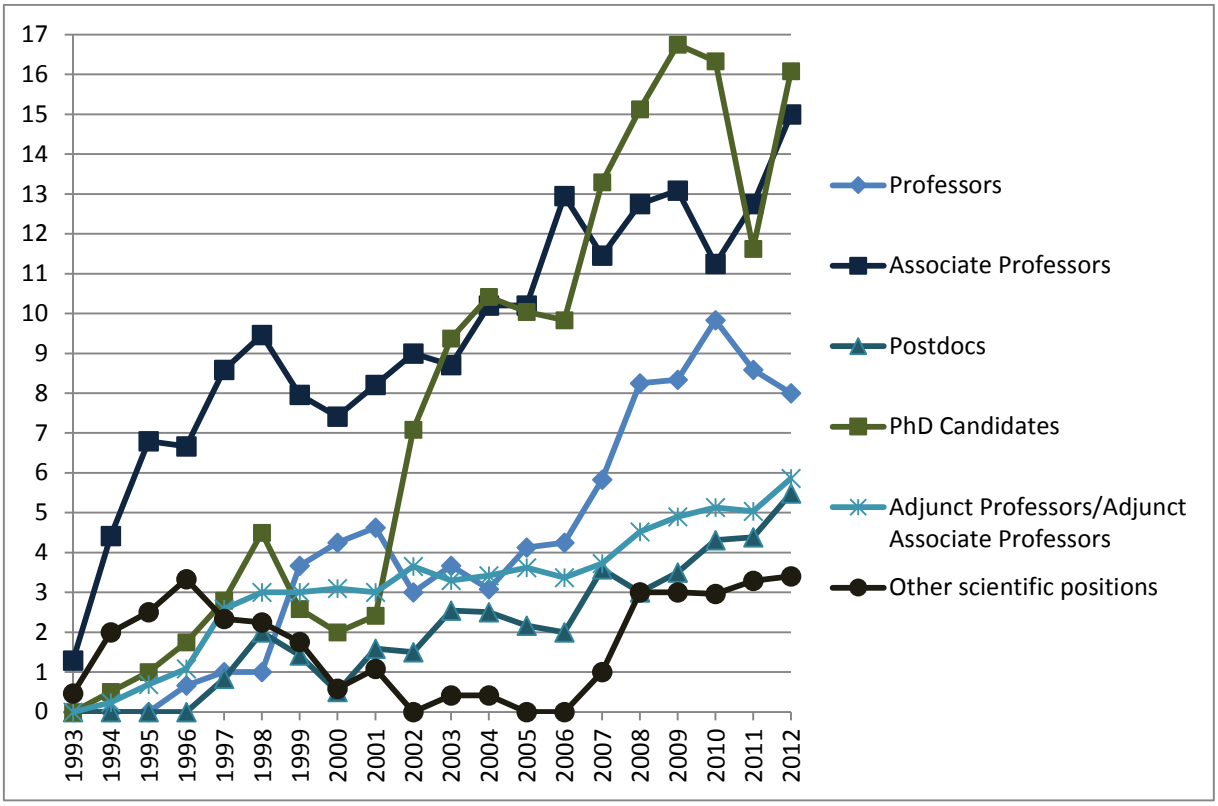



**Figure 3.5 Number of work-years by position, 1993-2012.**

UNIS is characterised by a very international profile both in terms of staff and students. Over the years, numerous foreign scientists have been recruited for the academic positions at UNIS. On average only 30 per cent of the PhD candidates have been Norwegian. This is evident from Figure 3.6. Of the work-years carried out by professors during the entire 1993-2012 period, 53 per cent have been by Norwegian citizens. The proportion for associate professors is 63 per cent, for the postdocs 60 per cent, and adjunct professors/associate professors 80 per cent. The large majority of the technical and administrative personnel, however, have been Norwegian (95 per cent).

Staff from Germany account for the largest number of work-years carried out by foreigners (50), followed by Denmark (46), UK (32), Sweden (29), Russia (25), France (14) and Finland (13). Staff from additional other countries have carried out in total 60 work-years.

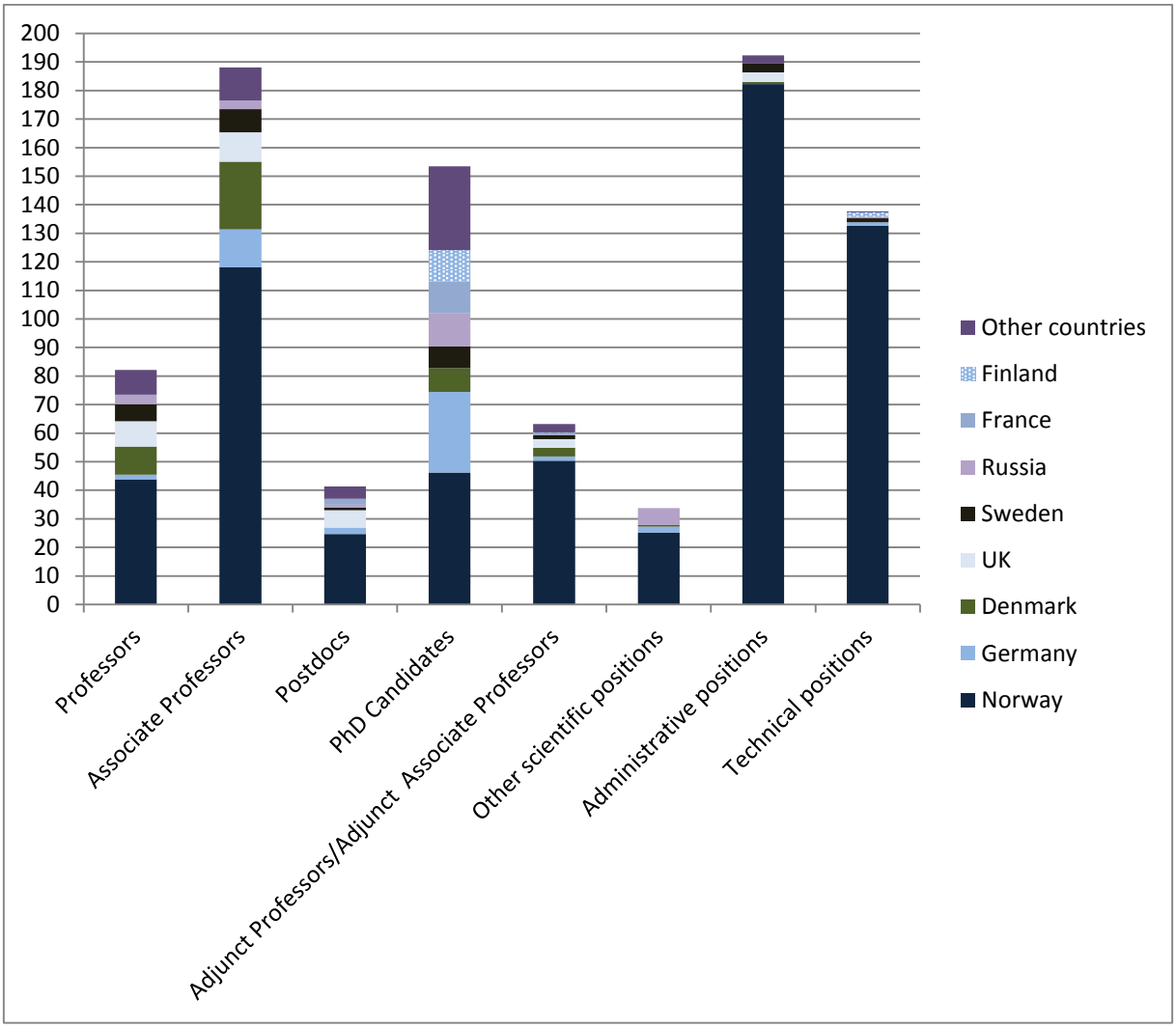



**Figure 3.6 Number of work-years by position and nationality, total 1993-2012.**

Finally, the age profile of the scientific staff at UNIS, and its development over the 20 year period has been analysed (Figure 3.7). Here, PhD candidates have not been included as they have significant influence on the average, and usually are in their late 20s. Figure 3.7 shows the average age of the scientific personnel at department level. For all departments, the average age has fluctuated during the period. In the first years, the staff was rather young, but with only a few people employed. In recent years, the average age has clearly been highest in the Arctic Technology Department (54 years in 2012), which, however, also started out with a higher age profile compared to the three other departments (Figure 3.7). There are rather small differences among the other departments (ranging from 47 to 50 years in 2012). Potentially the introduction of permanent positions since 2009 could have been expected to increase the age profile somewhat, but this does not seem to be the case generally. Potentially the increasing number of postdocs (Fig. 3.5) can be counterbalancing an increasing age profile.

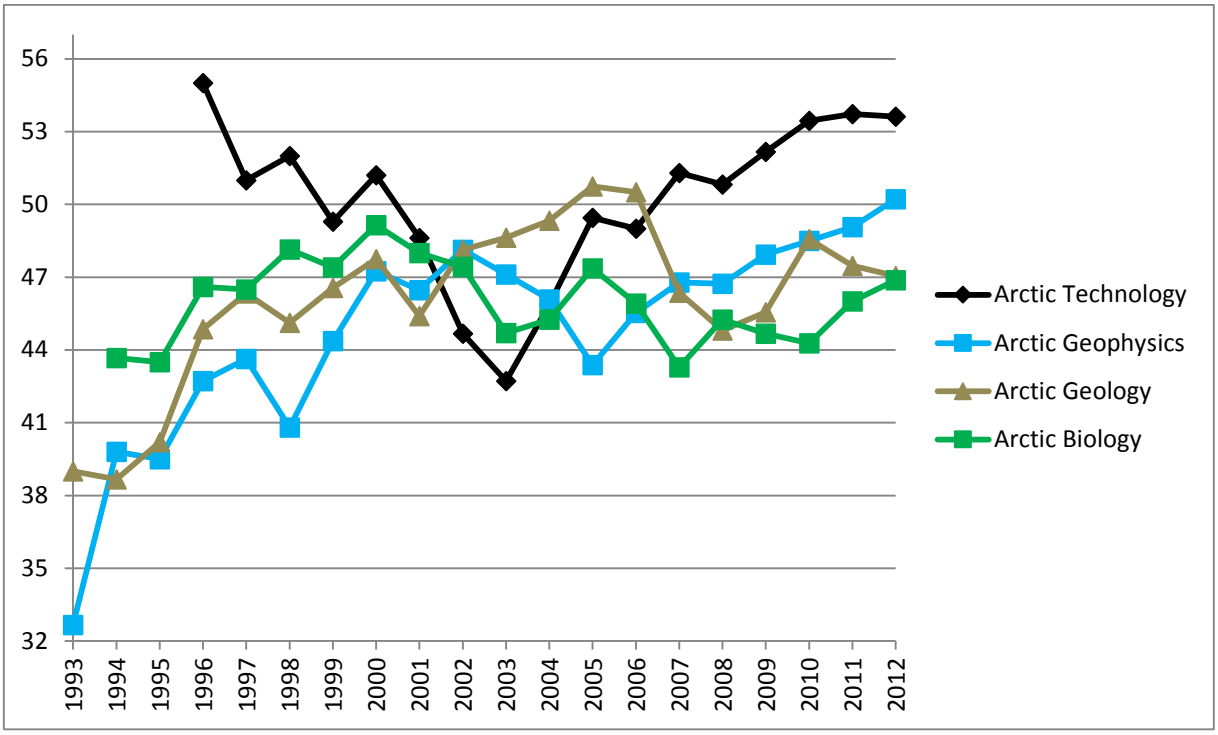



**Figure 3.7 Average age of the scientific personnel* by department, 1993-2012.**

*) Excluding PhD candidates.

The staff regulations at UNIS have changed during the 20 year period: UNIS did not offer permanent positions until 2009. Before 2005 staff were employed for a fixed term of 3+3 years. From 2005 until the permanent positions were introduced, staff could apply for unlimited additional three year periods. As a consequence there has been a high turnover rate in the staff at UNIS until the changes in 2005 and 2009. Figure 3.8 shows the annual changes in the senior scientific staff at UNIS, limited to professors, associate professors, researchers and assistant professors in full time positions. As expected, the number of new appointments is higher than the number of terminations for most of the years, and the number of employees is growing. In recent years, the turnover rate is much lower and there is more stability in the scientific staff.

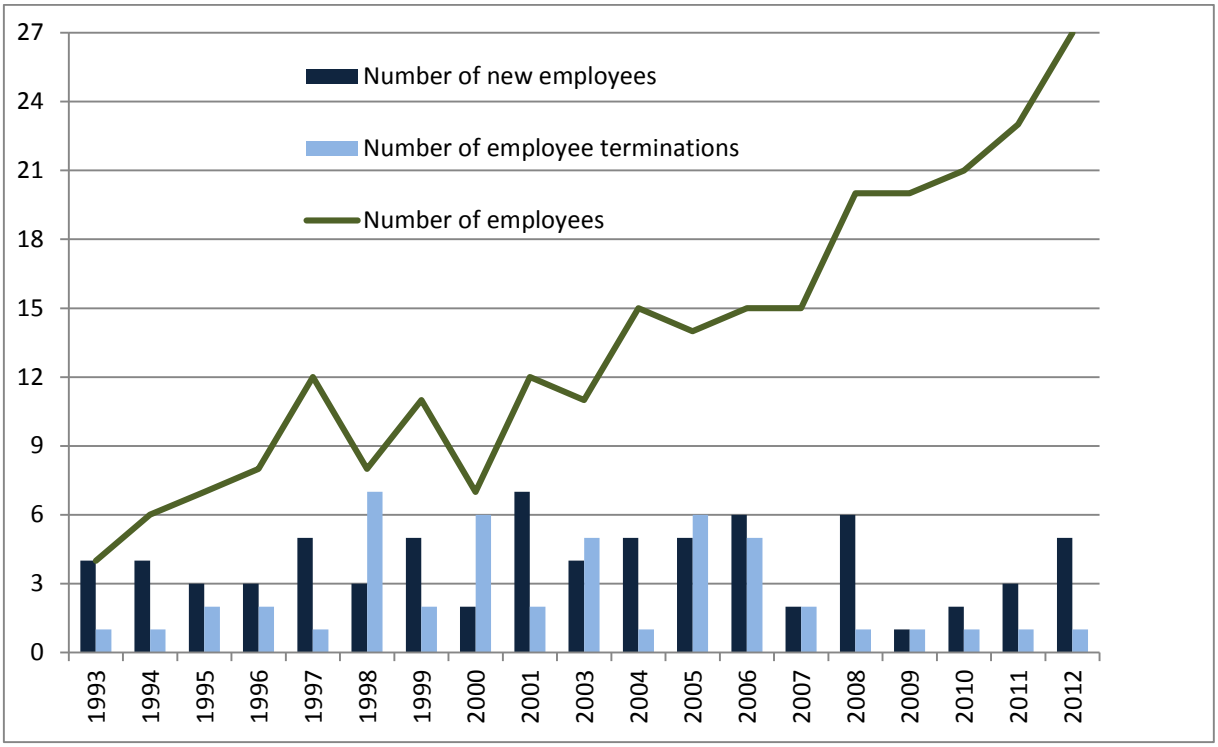



**Figure 3.8 Annual changes in the full-time senior* scientific staff at UNIS 1993-2012.**

*) Limited to professors, associate professors, researchers and assistant professors.

Despite the staff regulations, there are a few people with a very long career at UNIS. Of the total staff, six scientists and six people in technical/administrative positions have been working at UNIS for more than 10 work-years.

# 4 Education at UNIS

Iben Nicola Andersen

In February 1993, the four Norwegian universities (UiO, UiB, UNIT (later NTNU) and UiT) were invited to make suggestions for appropriate programme options and courses, specifically relevant for Svalbard, to be offered at UNIS. The University of Tromsø was asked to review the suggestions and propose a curriculum. Based on this, it was decided to provide education within Arctic Geology (AG) and Arctic Geophysics (AGF) from autumn 1993. Researchers at the Norwegian universities had put considerable effort into designing the content of the courses and identifying lecturers. This ensured the scientific quality of the curricula, which was essential for a successful beginning of the new educational programme of UNIS.

Before the first autumn 1993 semester UNIS received 37 applications from Norwegian students, of which 23 were granted admission for the academic year 1993/1994. Five courses were offered at basic level by the two scientific departments. In 1993 UNIS was located in an office building in the centre of Longyearbyen, in anticipation of the new university building being completed. The four Norwegian universities and UNIS signed a cooperation agreement on 18 January 1994. This regulated issues concerning cooperation in education, research, lecturers, internationalisation and administrative services. In 1994 a new scientific department was introduced, Arctic Biology (AB), and 38 students, including a few international students, were admitted to nine courses in the academic year 1994/1995.

From 1995 UNIS attracted the first students, who wanted to collect data and write their master's thesis at UNIS. At the same time the student population became increasingly international (about 25%). The number of courses offered increased to 15 in 1995. In many ways the following year was an exciting year for UNIS with the addition of the Department of Arctic Technology as a new scientific department. It was decided that all teaching should be conducted in English. On 23 August 1996, Fred Sigernes received his doctoral degree, and thereby became the first Norwegian to obtain a PhD degree with his doctoral defence[2] held at UNIS.

Starting in 1997, UNIS offered interdisciplinary courses such as The History of Svalbard which are open to all UNIS students and inhabitants in Longyearbyen as part of the outreach commitment. Also in 1997 the mandatory UNIS safety courses started.

During 1998 the first 24 students finished their master's theses. Among the three students who studied for their doctoral degree at UNIS was Pu Bu Ci Ren, the first ever Tibetan to complete a doctoral

[2] Sigernes, Fred (1996). *Optical studies of proton aurora*. Thesis (dr. scient). University of Tromsø.

degree[3]. The number of international students exceeded 45 per cent that year, and the course portfolio reached 33 courses spread over the four scientific departments.

Due to the insecure economic situation in 1999, the number of courses decreased: the number of students remained stable, but the proportion of foreign students reached approximately 50 per cent. UNIS celebrated its 10 year anniversary in 2003, by which time it had admitted 279 students, of which 63 per cent were international. 28 different nations were represented at UNIS.

UNIS became a member of The University of the Arctic (UArctic) and since 2004 has facilitated the UArctic Field School Secretariat.

When UNIS teaching facilities were expanded through moving into the Svalbard Science Centre in 2005, the learning environment was significantly improved and student numbers increased to 331.

After a budget reduction in 2008/2009, the number of students and courses offered declined. This followed well into 2010. From 2011, the number of students increased and 459 students attended UNIS courses in that year. The ratio of foreign students remained high (59%) representing 31 different countries.

In 2012, 467 students from 23 countries studied at UNIS. The proportion of international students was 53 per cent. There are several UNIS courses which now have a waiting list of students, as the number of students attending each course is relatively limited due to the large amount of fieldwork and excursions involved. The number of applications increased by 21 per cent from 2011, totalling 1,487 applications for the 61 courses offered in 2012. The increase from 37 applications for 9 subjects in 1993 is evident, and proves that UNIS has established itself as a competent and reputable educational institution in the Arctic.

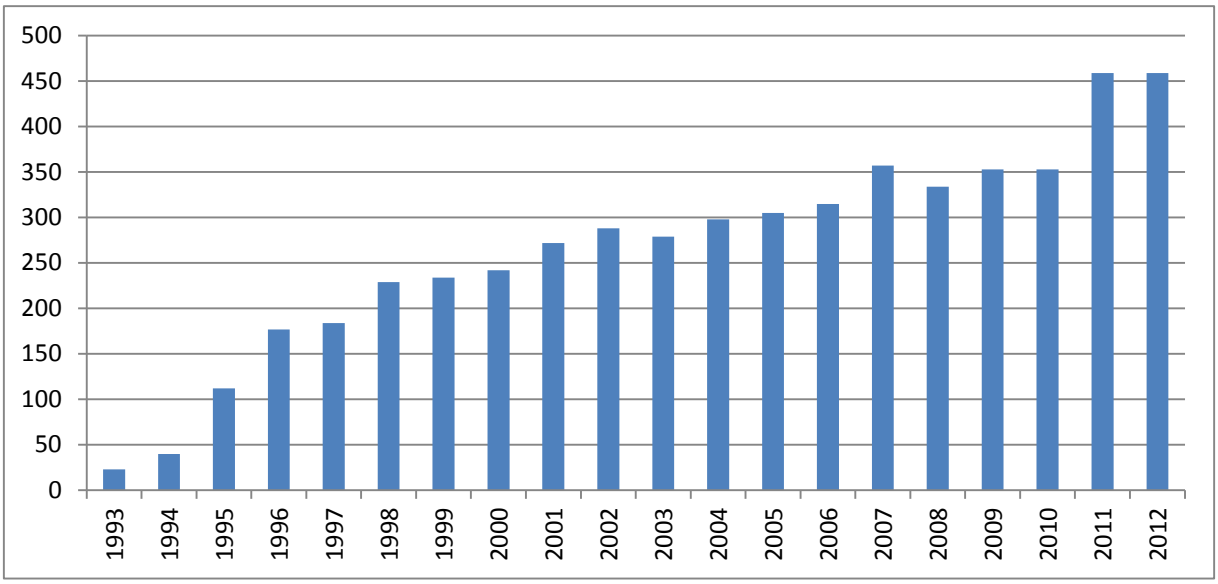



**Figure 4.1 Total number of UNIS students per year, 1993-2012.**

The total number of students has generally increased over the 20 years of UNIS operation (Figure 4.1).

The number of students at each scientific department varied between years. It is closely related to which courses are offered, as several UNIS courses are offered every other year due to limitations in

[3] Ren, Pu Bu Ci. (1998). *Solar ultraviolet radiation on the Tibetan Plateau: measurements and modeling*. Thesis (PhD). University of Bergen

the available teaching resources (Figure 4.2). Most students take more than one course and are therefore included for each course separately. Over the years there has been a shift of focus regarding the courses offered. Until 2005 more student credits were produced at bachelor's level. In the past 8 years more courses have been offered at master's level and hence more student credits are produced at this advanced level.

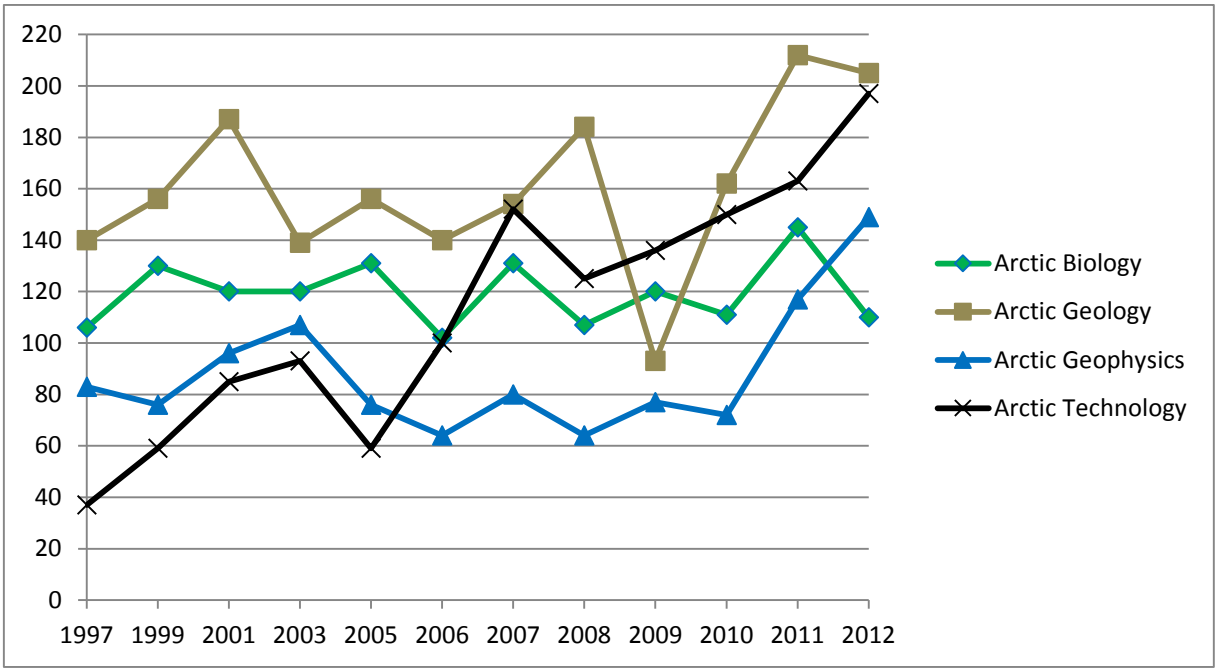



**Figure 4.2 Number of bachelor's students admitted annually by department and year, 1993-2012.***

*) Number of course-students. Most students attend more than one course and are multiply counted in the figure.

Generally UNIS has a relatively balanced gender distribution between male and female students. In total, female students produce approximately half of the study points. The equality in production differs slightly depending on academic level. Female students produce more credits at bachelor's level and fewer at master's level. At PhD level, female students account for only 37 per cent of the study point production. The distribution of sexes also differs slightly in the departments. At the Department of Arctic Technology there are more male students, while the Department of Arctic Biology has more female students.

Over the years the number of international students has increased every year (Figure 4.3). Since its establishment UNIS has had very good collaboration with other academic institutions, primarily the Norwegian universities, but also especially with universities within the circumpolar area. This, and the fact that all education at UNIS is taught in English, attracts large numbers of foreign students, despite no marketing of the UNIS study opportunities to other than Norwegian students.

The allocations from the Ministry of Foreign Affairs and the Norwegian Centre for International Cooperation in Education (SIU) have partly contributed to the high numbers of international students by providing good scholarship schemes for Russian, Canadian and American students.

In 2009-2012 UNIS arranged IPY Field Schools under the umbrella of the International Polar Year. The field school received a large number of applications (300 students annually applied for 24 seats) to the interdisciplinary courses. Having so many international students in the classroom gives an extra dimension to education, both in the different approaches to the topic and opportunities to create networks around the world.

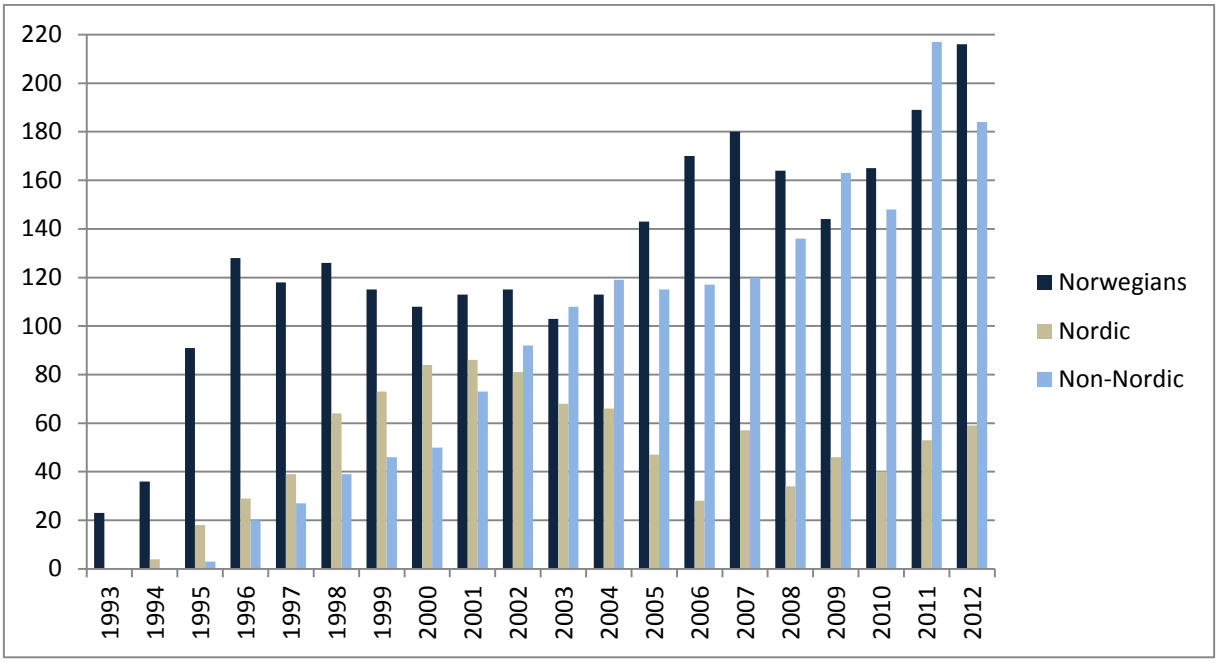



**Figure 4.3 Number of UNIS students from Norway, the Nordic countries and non-Nordic countries, 1993-2012.**

In 2011 UNIS signed a new cooperation agreement with the eight Norwegian universities. An action plan for further development of the educational administrative systems, rules and regulations was initiated. The collaboration with the Norwegian universities at all levels of the institution is as important for UNIS now as it was back in 1993. It ensures that the courses offered at UNIS are truly additional to the Norwegian mainland universities course curricula.

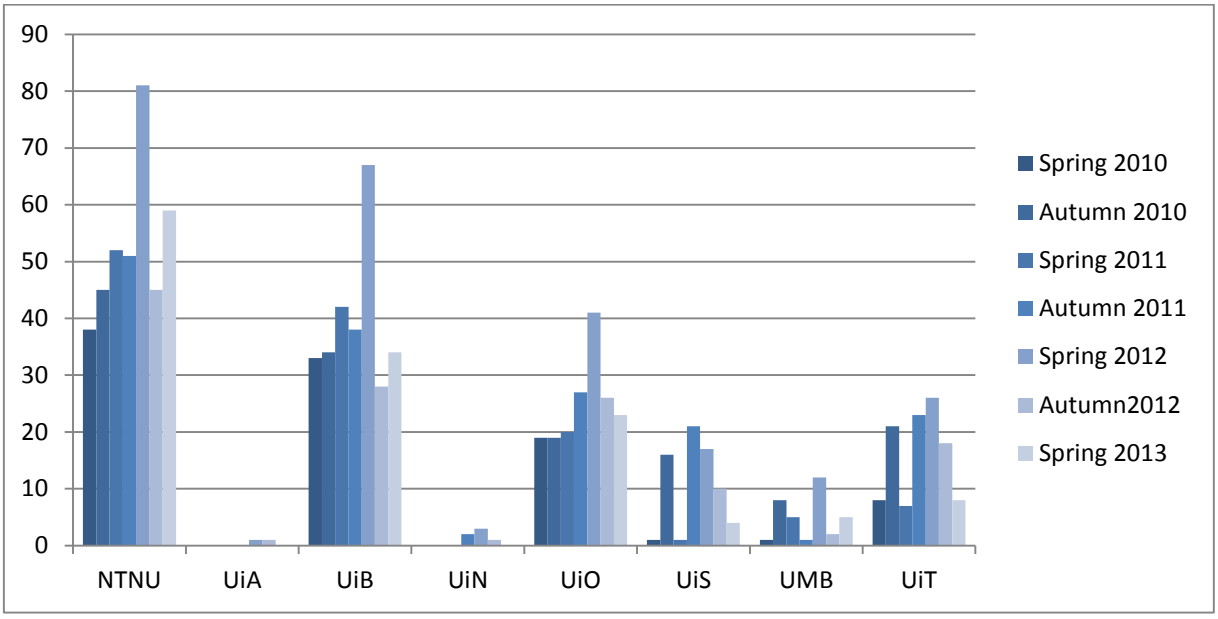



**Figure 4.4 Distribution of UNIS students from the Norwegian mainland universities by semester from spring 2010 to spring 2013.***

*) Legend: NTNU: Norwegian University of Science and Technology, UiA: University of Agder, UiB, University of Bergen, UiN: University of Nordland, UiO: University of Oslo, UiS: University of Stavanger, UMB: Norwegian University of Life Sciences, UiT: University of Tromsø/The Arctic University of Norway.

The UNIS student statistics for the last three years show that by far the majority of students from the Norwegian universities came from NTNU (on average 54 students studied at UNIS per semester, Figure 4.4). Then follows UiB (average 39 students at UNIS per semester), UiO (average 24 students at UNIS per semester), and UiT (on average 15 students at UNIS per semester), UiS (on average 9 students at UNIS per semester) and UMB (on average 4 students at UNIS per semester). The relatively recently established universities of Agder and of Nordland have also started to send students to UNIS.

The purpose of the UNIS quality assurance system is to secure and develop the quality of education at all three levels: bachelor's, master's and PhD. A continuous focus on education of high academic quality through a quality assurance system is important for UNIS. This ensures that our education maintains the desired quality, enhances quality development through the entire institution and uncovers quality issues. Course evaluations enable students to provide feedback and suggest improvements to courses. The evaluations are part of the continuous, systematic work to improve the quality of the education at UNIS. UNIS is now fulfilling the course descriptions of the Norwegian Qualifications Framework (KR), describing the anticipated learning outcomes for candidates that have successfully completed the relevant course.

As described in Chapter 3, there has been a strong growth in the number of PhD candidates at UNIS. A complete overview of those who have been awarded a PhD can be found in the final chapter of the report. Table 3.1 provides an overview of the number of awarded PhDs by year and UNIS department. In total 72 candidates have been awarded a PhD during the period 1996-2012. The Arctic Geophysics Department accounts for the highest number of the degrees (27). These numbers include PhDs fully or partly conducted at UNIS, while the degrees themselves have been awarded by mainland universities. In total, 53 of the PhD degrees have been awarded by Norwegian universities and 19 by foreign universities. The highest number of degrees has been awarded by the University of Bergen (21), followed by the University of Tromsø (15), the Norwegian University of Science and Technology (9), and the University of Oslo (8).

Arctic Biology students performing fieldwork in 2007. (Photo: Steve Coulson/UNIS).

**Table 3.1 Number of candidates awarded a PhD (Dr. scient., Dr. ing. and Dr. philos. degree) conducted fully or partly at UNIS, by department and year.**

| Year | Arctic Biology | Arctic Geology | Arctic Geophysics | Arctic Technology | Total |
|---|---|---|---|---|---|
| 1996 | | | 1 | | 1 |
| 1998 | | | 2 | | 2 |
| 1999 | | | 2 | | 2 |
| 2000 | | | 2 | 1 | 3 |
| 2001 | | | 3 | | 3 |
| 2002 | 1 | 1 | 1 | 1 | 4 |
| 2003 | 1 | | 1 | | 2 |
| 2004 | 3 | 1 | 2 | | 6 |
| 2005 | 2 | | 2 | 1 | 5 |
| 2006 | | 2 | 1 | | 3 |
| 2007 | 2 | 1 | 1 | 2 | 6 |
| 2008 | 1 | 2 | | 1 | 4 |
| 2009 | 2 | 1 | 4 | 1 | 8 |
| 2010 | | 1 | 2 | 2 | 5 |
| 2011 | 4 | 2 | 3 | 1 | 10 |
| 2012 | 1 | 6 | | 1 | 8 |
| Total | 17 | 17 | 27 | 11 | 72 |

UNIS students conduct measurements almost no matter the weather. (Photo: Johannes Lorentzen/UNIS).

# 5 Data and methods

Dag W. Aksnes

This chapter describes the data sources and methods applied in the study.

## 5.1 Data sources

The study is based on different bibliographic data sources. The most important is the Web of Science database of Thomson Reuters (formerly known as Institute for Scientific Information (ISI)). The Web of Science consists of three citation indexes: Science Citation Expanded; Social Sciences Citation Index; and Arts & Humanities Citation Index. In addition, there is an index for proceedings papers: The Conference Proceedings Citation Index, which also has been applied in the study. The Web of Science database covers a large number of specialised and multidisciplinary journals within the natural sciences, medicine, technology, the social sciences and the humanities. The database has a very good coverage of scientific literature within the natural sciences and medicine, but the coverage of technology, the social sciences and humanities has substantial limitations.

The bibliographic database Scopus, produced by Elsevier, has been applied as a supplementary database in the study. This database has many similarities with the Web of Science database, but with a somewhat different coverage of journals. Scopus covers some journals and series not indexed in Web of Science (and vice versa).

Another bibliographic data source included is the publicly accessible database CRIStin (and the two former databases Frida and Forskdok), which is a joint system for registration of scientific publications applied by Norwegian higher education institutions, institutes and hospitals. The performance-based funding model of the higher education institutions in Norway (implemented in 2005) is partly based on data from this database. UNIS has used this database since 2006. In addition, other data sources available such as the UNIS annual reports and the previous 10 year anniversary bibliographic report have been used.

The calculation of citation indicators has been based on aggregated bibliometric statistics at country and field/subfield level, which NIFU purchased from CWTS at Leiden University, the Netherlands. These data were applied for the purpose of creating reference standards (see below).

Finally, the analysis of the personnel who have been employed at UNIS during its 20 year history is based on annual employee lists with information on the length of each person's employment, appointment terms, position, age, etc. The analyses of students and PhD candidates at UNIS have been based on data collected through UNIS archives.

## 5.2 Publications included

An important issue in the implementation of the project concerned the delimitation of publications to include. Previous annual reports for UNIS have contained lists of publications published during the year. Prior to 2006, all publications published by the current UNIS staff were included in these reports, not only publications where UNIS has been credited (i.e. listed as one of the author addresses). This was also the principle applied in the 10 year anniversary bibliographic report. In particular, people in adjunct professor positions at UNIS may have published many articles crediting their main organisation only because the research published is not related to the person's affiliations with UNIS. Moreover, publications may be listed where the research is carried out at another organisation prior to a person's employment at UNIS. Such a principle is therefore likely to overestimate the publication output that reasonably could be credited to UNIS.

However, the performance-based funding model of the higher education institutions in Norway only counts publications where the particular institution is credited by an author address. UNIS is not part of this system. Nevertheless, we have found it reasonable to apply this principle also in this study as the focus is on the performance of UNIS as an organisation, not on the population of individuals that have been employed at UNIS.[4]

The focus of the report is on the *scientific* publishing only, not any other type of publishing such as popular science and text books. The scope of the scientific publications has also been based on the criteria applied in the Norwegian performance-based budgeting system. In this system, almost 23,000 journals and series as well as 1,500 publishers qualify as scientific.[5] The accreditation of scientific publication channels is based on reviews carried out by expert panels within the various scientific disciplines. In this system, the scope of scientific publications is accordingly based on the publication channel and not the actual content of the publication. This has important implications for conference proceedings in particular, and only proceedings published by accredited publishers and journals will be included. In addition, only the following publication types are eligible: full papers (regular articles, proceedings articles) and review articles published in journals or books (i.e. not short contributions like editorials, corrections, book reviews, meeting abstracts, etc.) and books/monographs. Textbooks and popular scientific publications are not included. A publication that has appeared in more than one journal/series will only be counted once.

## 5.3 Methods

In order to identify UNIS publications we first applied the Web of Science database and searched for publications with UNIS in the author address field of the publications (using spelling variants of the institution). We also searched for all publications with Svalbard or Longyearbyen in the address field in order to verify whether some relevant publications had been omitted by the first search method. Then we searched in the Scopus database, using the same search method. The results of the two subsets of publications were then compared. Scopus publications not present in Web of Science were added to the list of publications identified from Web of Science.

Web of Science and Scopus do not cover all journals and series accredited as scientific publication channels in the Norwegian performance-based budgeting system. We therefore used other bibliographic databases as supplementary bibliographic data sources. These include the CRIStin database (UNIS indexed publications), UNIS annual reports as well as the 10-year anniversary

[4] A source of error is, nevertheless, introduced by the fact that people with multiple organisational affiliations may apply different criteria for which organisations to list as author addresses. Sometimes people in adjunct positions list both/all addresses, even if the research published not is related to their UNIS employment. There might be contrary examples where UNIS employees have not listed an UNIS address as far as they should (e.g. due to short and temporary positions).

[5] See the web-page: http://dbh.nsd.uib.no/kanaler/. This is a dynamic register with annual changes in the accreditations. We have used the most recent version, although this means that a few publications have been included from channels which were not approved as scientific at the time the publications were published.

bibliography as the main sources. We identified publications missing in the publication list based on Web of Science and Scopus. Missing publications had to be checked manually to verify whether UNIS had been listed as an author address or not, and whether the publication channel was accredited as scientific (according to the 2012 accreditation). Careful and time-consuming investigations were carried out in order to identify all UNIS publications. Nevertheless, we cannot preclude the possibility that some qualifying publications have escaped our attention and thus are not included in the study.

In total, 941 UNIS publications were identified from the period 1993-2012. Most of the analyses in the report are based on this full set of publications. However, the analyses of collaboration are based on the Web of Science and Scopus subset only (n= 837). The reason is that we need complete bibliographic information of the co-authors' institutional affiliations, and this information is only available for the Web of Science and Scopus records. The citation analysis is based on the Web of Science records only, excluding 2012 publications (n=666). The Scopus database also contains citation counts, but these counts are based on a different set of source publications. Thus, the citation counts from Web of Science and Scopus cannot be compared directly. As the reference values used in the citation analyses are based on Web of Science, the Scopus records had to be excluded from the analyses.

The individual researcher represents the basic unit in the study, and the data were subsequently aggregated to the level of departments. We have here used the department and personnel overview provided by UNIS.

## 5.4 Bibliometric indicators

As the main bibliometric measure we have used number of publications, 'whole counts', and not derivative measures such as publication points or fractionalised publications. This is the most common and simple way of measuring publication output. It should be noted, however, that most publications are multi-authored, and are the results of collaborative efforts involving more than one researcher or institution. Thus, the UNIS contribution may in several cases be rather minor. The indicator may therefore be interpreted as the number of publications in which UNIS has 'participated'.

The productivity indicators are measured as number of publications per full-time equivalents (FTE) (work-years). Although this may appear as a rather abstract measure it represents, nevertheless, the fairest way of comparing and assessing scientific productivity. There is a delay between the time the research is carried out and the appearance of the publication, and a one year time lag is used. We have excluded periods of leave (e.g. maternity leave) in the calculation of work-years.

The individual articles and their citation counts represent the basis for the citation indicators. In the citation indicators we have used accumulated citation counts and calculated an overall (total) indicator for the whole period. This means that for the articles published in 2008, citations are counted over a 5 year period, while for the articles published in 2010, citations are counted over a 3 year period (or more precisely a 2-3 year period: the year of publication, 2011 and 2012). Articles from 2012 are not included in the citation analysis as these have not been available in the literature for a sufficiently long time to be cited. To a certain extent this also holds for the 2011 articles. We have however included these articles, but it is 'expected' that these articles are uncited or very poorly cited.

The average citation rate varies a lot between the different scientific disciplines. As a response, various reference standards and normalisation procedures have been developed. The most common is the average citation rates of the journal or field in which the particular papers have been published. An indicator based on the journal as a reference standard is the Relative citation index – journal (also called the Relative Citation Rate). Here the citation count of each paper is matched to the mean citation rate per publication of the particular journals (Schubert & Braun, 1986). This means that the journals are considered as the fundamental unit of assessment. If two papers published in the same

journal receive a different number of citations, it is assumed that this reflects differences in their inherent impact (Schubert & Braun, 1993). Below the indicators are further described.

### Relative citation index – journal

For the Relative citation index – journal we used the mean citation rate of the department's journal package, calculated as the average citation rate of the journals in which the department has published, taking into account both the type of paper and year of publication (using the citation window from year of publication until and including 2012). For example, for a review article published in a particular journal in 2007 we identified the average citation rates (2007–2012) to all the review articles published by this journal in 2007. For each department we calculated the mean citation rate of its journal package, with the weights being determined by the number of papers published in each journal/year. The indicator was subsequently calculated as the ratio between the average citation rate of the department's articles and the average citation rate of its journal package. For example, an index value of 110 would mean that the department's articles are cited 10 per cent more frequently than 'expected' for articles published in the particular journal package.

### Relative citation index – field

A similar method of calculation was adopted for the Relative citation index – field (also termed the Relative Subfield Citedness (cf. Vinkler, 1986)). Here, as a reference value we used the mean citation rate of the subfields in which the department has published. The departments are usually active in more than one subfield (i.e. the journals they publish in are assigned to different subfields). For each department we therefore calculated weighted averages with the weights being determined by the total number of papers published in each subfield/year. In the Thomson Reuters classification system some journals are assigned to more than one subfield. In order to handle this problem we used the average citation rates of the respective subfields as basis for the calculations for the multiple assigned journals. The indicator was subsequently calculated as the ratio between the average citation rate of the department's articles and the average subfield citation rate. In this way, the indicator shows whether the department's articles are cited below or above the world average of the subfield(s) in which the department is active.

### Example

The following example can illustrate the principle for calculating relative citation indexes: a scientist has published a regular journal article in Journal of Glaciology in 2008. This article has been cited 12 times. The articles published in Journal of Glaciology were, by contrast, cited 10.71 times on average this year. The Relative citation index – journal is: (12/10.71)*100 = 112. The world average citation rate for the subfield to which this journal is assigned is 9.1 for articles published this year. In other words, the article obtains a higher score compared to the field average. The Relative citation index – field is: (12/9.10)*100 = 132. The example is based on a single publication. The principle is, however, identical when considering several publications. In these cases, the sum of the received citations is divided by the sum of the 'expected' number of citations.

It is important to notice the differences between the field and journal adjusted relative citation index. A department may have a publication profile where the majority of the articles are published in journals being poorly cited within their fields (i.e. have low impact factors). This implies that the department obtains a much higher score on the journal adjusted index than the field adjusted index. The most adequate measure of the research performance is often considered to be the indicator in which citedness is compared to field average. This citation index is sometimes considered as a bibliometric

‘crown indicator’ (van Raan, 2000). In the interpretation of the results this indicator should accordingly be given the most weight.

The following guide can be used when interpreting the Relative citation index – field:

- Citation index: > 150: Very high citation level
- Citation index: 120-150: High citation level, significant above the world average.
- Citation index: 80-120: Average citation level. On a level with the international average of the field (= 100).
- Citation index: 50-80: Low citation level.
- Citation index: < 50: Very low citation level.

It should be emphasised that the indicators cannot replace an assessment carried out by peers. In the cases where a research group or department is poorly cited, one has to consider the possibility that the citation indicators in this case do not give a representative picture of the research performance. Moreover, the unit may have strong and weak years. Citations have highest validity in respect to high index values. But similar precautions should be taken also here. For example, in some cases one highly cited researcher or one highly cited publication may strongly improve the citation record of a group, or even a department.

# 6 Glimpses of the research at UNIS

This chapter presents some brief examples of the research carried out in the four academic departments at UNIS. Most references used in these texts are to be found as part of the entire bibliography. Those not included in the bibliography are found in the footnotes.

## 6.1 Marine biology at UNIS 1993-2013

Janne E. Søreide, Tove M. Gabrielsen, Ole Jørgen Lønne and Jørgen Berge

At the department of Arctic Biology (AB), teaching and research in marine biology have been central since UNIS was founded in 1993. The marine biology education is strongly research-based and covers all trophic levels from primary producers to marine mammals, with prime focus on the lower trophic levels in Svalbard and nearby seas, including the Arctic Ocean. The number of research projects and staff in AB has increased significantly in recent years, reflecting the importance of Svalbard as a research platform for investigating climate impacts on Arctic marine systems. The unique placement of UNIS in the high Arctic combined with its strong logistic support, modern sea water and molecular laboratory facilities, makes UNIS an attractive and up-to-date place for advanced studies and research.

Marine biology at UNIS spans a wide range of topics from pure taxonomy to complex system studies in the pelagic, benthic and ice-associated realms. The overall goal is to increase our knowledge of Arctic marine biodiversity and ecosystem functioning. Svalbard is situated in the dynamic transition zone between Atlantic and Arctic water masses, and open vs. seasonally ice-covered seas which make this archipelago an ideal place to study potential climate effects on population and ecosystem level. Marine biologists at UNIS take advantage of actually living in the Arctic by performing seasonal studies at high resolution, including during the polar night, which to date is poorly studied due to logistical constraints. Marine biology at the AB department is highly multidisciplinary and cooperates closely with oceanographers, biochemists and technologists nationally and internationally. Since 2001, UNIS, together with the Scottish Association for Marine Science (SAMS), UK, has placed several underwater sea observatories in Svalbard. These observatories continuously measure hydrography, currents and fluorescence (proxi for algal biomass) in fjords of key focus, e.g. Rijpfjorden in Nordaustlandet and Kongsfjorden and Isfjorden, Spitsbergen.

The laboratory facilities at UNIS are modern and include cold rooms with large tanks and running sea water, and large teaching laboratories. The group has, in cooperation with the terrestrial group, established a state-of-the-art molecular laboratory.

In the future, the biology group will continue to search for new technology and methods for studying biological processes at DNA, population and ecosystem level. UNIS is currently leading several larger marine biology projects which focus on the research topics listed below:

- CircA: Circadian rhythms of Arctic zooplankton from polar twilight to polar night – patterns, processes, and ecosystem implications
- MicroFUN: Spatial and temporal variability of eukaryotic microbes
- CLEOPATRA II: Climate effects on planktonic food quality and trophic transfer in Arctic Marginal Ice Zones.

These projects can be followed on www.mareincognitum.no.

The marine biology group at UNIS is in the progress of expanding its teaching and research capacity by establishing a new permanent position in Marine Ecology from 2014.

Since 2001, UNIS has investigated the plankton community in Billefjorden. This is a sill fjord with extensive seasonal sea ice cover which is easy reachable for UNIS scientists and students all year round. The more than 10 year record from this seasonal ice covered location is important data for investigating climate effects on Arctic plankton communities. Sampling at this site is part of the regular fieldwork of AB-204 and ongoing research projects at UNIS (Photo: Janne E. Søreide).

## 6.2 Terrestrial biology at UNIS during 20 years

Rolf Langvatn and Steve Coulson

After a modest start in 1994 the department of Arctic Biology, by the end of the decade, had established a staff structure and professional profile focusing on two main fields: *terrestrial and marine biology.* This was reflected in the course portfolio as well as in research activities. Within the terrestrial field, vegetation ecology and reindeer biology were the main focal areas.

New staff employed in mid 1990 brought with them ideas and funding for increased research activities. This was particularly the case for the 'Svalbard reindeer project', funded by the Research Council of Norwegian and led by professor Rolf Langvatn in close cooperation with British colleagues and the Zoological Museum, University of Oslo. The project took a broad approach to studying the interaction between weather, plant production, parasites and the effect on reindeer performance, both on individually marked animals and at population level. Extensive field work, collection of various biopsy samples, new techniques and technologies like VHF transmitters, GPS collars, DNA analysis, and portable ultrasound scanning machines, opened research perspectives rarely applied to Svalbard reindeer and its ecological environment before. Personnel working on the project have represented

many institutions and different backgrounds, providing an inspiring working environment and professional network, as well as strong teams with complementary expertise.

The 'Svalbard reindeer project' has brought new insight and understanding to many questions and ecological mechanisms concerning life in the high arctic terrestrial environment. It has also demonstrated the robustness and adaptability of a large herbivore living under extreme physical conditions. More than 30 refereed papers have been published in high ranking journals from this project, and more are to come. Some of the papers (e.g. Albon et al. 2002) have received particular attention and were highlighted in leading commentary journals[6], and also referred in an internationally distributed textbook in population ecology[7]. Results from the studies of parasites and their effect on reindeer under varying conditions represent in some cases new knowledge to science, both with respect to the parasites' ecology and the dynamic interaction between the parasite and its host.

Since the beginning in 1994, more than 20 students have been affiliated to the 'Svalbard reindeer project', and graduated either with a master's or PhD. A dozen or so students have done both their undergraduate and master's studies in terrestrial biology at UNIS. Also, a former student doing both undergraduate, master's and PhD studies at UNIS is now professor at one of our universities. Many other candidates with a background from UNIS hold central positions at academic institutions, management bodies and NGOs both in Norway and abroad.

The 'Svalbard reindeer project' continues as a cross-institutional initiative with NTNU as the coordinating part. However, UNIS still has an important supporting role.

In 2005 UNIS appointed an invertebrate ecophysiologist, Steve Coulson, and a new line of terrestrial research commenced. Studies initially focused on the biogeography of the terrestrial and freshwater invertebrate fauna of the archipelago. This resulted in the production of a referenced checklist providing baseline information for Svalbard. One outcome of this analysis was that the Arctic biodiversity report produced by the Arctic Council cited Svalbard as the region of the Arctic with the most complete overview of the invertebrate fauna (Hodkinson 2013). This work was progressed by a wide international network of invertebrate ecologists working on a variety of projects, operating in collaboration with, or through UNIS. To date over 1,000 species of terrestrial and freshwater invertebrate have been recorded from Svalbard. However, it is clear that there are many taxonomic confusions in the literature and that the great majority of reports originate from the west coast of the archipelago, primarily Isfjorden and Kongsfjorden. It has become evident that the faunas of the eastern and western regions of the archipelago have distinct elements, probably relating to the geographic location of the source populations and dispersal routes employed by the invertebrates in question. This understanding has resulted in current research themes around the local biogeography, dispersal, and colonisation processes to determine source populations for the colonisation of the European High Arctic and dispersal pathways for the re-colonisation of the Arctic following the retreat of the ice. The approaches taken have involved the use of traditional taxonomy and cutting edge molecular techniques; both of which have revealed new species and cryptic species. One new species was named after a member of the UNIS staff. Current projects in 2013 centre on the Avian Vectors of Invertebrate Faunas (AVIFauna) study which will clarify whether flightless soil invertebrates, which are involved in many soil processes such as accumulation of organic soils, can 'hitch-hike' to remote archipelagoes with migrating birds. In addition to natural dispersal routes, alien species introduced by human activities are also being studied. The threat of such alien, and possible invasive species, to the native flora and fauna is under evaluation. Clarifying these issues also has implications for projecting the response of the terrestrial and freshwater fauna of the Arctic to climate change scenarios. This work has brought together a large international team and has resulted in some 26 articles in reviewed journals. Moreover, a review of the terrestrial and freshwater invertebrate fauna of the archipelagoes involving the joint efforts of 37 authors has recently been published. As part of the outreach activities

[6] Morgan, E.R., E.J. Milner-Gulland, P.R. Torgerson & G.F. Medley. (2004). Ruminating on complexity: macroparasites of wildlife and livestock. *Trends in Ecology & Evolution,* 19(4), 181-199. doi: 10.1016/j.tree.2004.01.011

[7] Begon, M., C.R. Townsend & J.L. Harper. (2006). *Ecology: from individuals to ecosystems*. 4th ed. Blackwell. ISBN 978-1-4051-1117-1

of UNIS, the 'spider' website (www.svalbardinsects.net) has been produced to explain the diversity and variety of Svalbard invertebrates.

Linkages with the Svalbard reindeer projects continue to exist, primarily through PhD and master's student projects investigating social behaviour of the reindeer, and ecophysiology of the invertebrate gut parasites which are transmitted from host to host during the winter season. In addition, UNIS is part of the current REINKLIM study investigating the effects of winter icing on the reindeer population dynamics.

Glaciologists on fieldwork inside Hansbreen in Hornsund. (Photo: Jason Gulley/UNIS).

## 6.3 Glaciology at UNIS

Doug Benn

With 60% of the Svalbard archipelago covered by glacier ice, UNIS is an ideal place to conduct in-depth studies of glaciers and their interactions with the atmosphere, oceans and landscape. Glaciology is a strong and growing discipline at UNIS, with research groups in the Departments of Arctic Geology and Arctic Geophysics collaborating with an extensive network of international partners.

Svalbard glaciers are very varied, and include large numbers of calving glaciers (which discharge icebergs into the sea) and surging glaciers (which undergo periodic large-scale speed-ups). Calving is a very important process globally, with important implications for rates of sea-level change, although the factors controlling calving rates are still poorly understood. Research at UNIS focuses on developing predictive computer models and collecting field and remote sensing data for model testing and calibration. A new approach to the problem of modeling calving was proposed by Benn et al. (2007a, b), and implemented in a time-evolving glacier flow model by Nick et al. (2010). The model has been adopted by several research groups worldwide, and most recently has been used to predict the 21st Century sea level contribution from the Greenland Ice Sheet[8]. UNIS calving research has been conducted under the umbrella of a succession of high-profile projects: the International Polar

[8] Nick, F.M., A. Vieli, M.L. Andersen, I. Joughin, A. Payne, T. L. Edwards, F. Pattyn & R.S.W. van der Wal. (2013). Future sea-level rise from Greenland's main outlet glaciers in a warming climate. *Nature*, 497(7448), 235-238. doi: 10.1038/nature12068

Year project GLACIODYN (Dynamic Response of Arctic Glaciers to Climate Change), The Nordic Centre of Excellence project SVALI (Stability and Variations of Arctic Land Ice), and the Conoco-Phillips / Lundin funded Northern Area Program project CRIOS (Calving Rates and Impact on Sea Level).

Surges are spectacular, transient events, and UNIS researchers are particularly well placed to respond quickly when a glacier surges, to collect the data needed to understand how and why they occur. UNIS PhD student Lene Kristensen made the first ever time-lapse movie of a Svalbard surge, when Paulabreen advanced over 2 km in 2005 (Kristensen and Benn, 2012). Additional contributions to knowledge on Svalbard surges were made by Sund (2009, 2012), and current PhD student Heidi Sevestre is deploying a wide range of remote sensing, modeling and geophysical techniques to probe deeply into the problem of surging.

UNIS staff have also made pioneering contributions to the study of englacial and subglacial drainage systems (ice caves). During the winter months, it is possible to go deep into these fascinating and beautiful caves, gaining access to otherwise inaccessible environments. Humlum et al. (2005) were able to recover in situ plant material from the bed of Longyearbreen, and showed by radiocarbon dating that the plants died over 1000 years ago, providing a rare insight into the growth of Svalbard's glaciers in medieval times. Systematic studies of ice caves in Svalbard, the Himalaya and Alaska have been conducted by Benn et al. (2009a, b), Gulley (2009), and Gulley et al. (2007, 2009a, b, 2012, [9]), often in collaboration with the Polish Research Station at Hornsund. This work has revolutionized understanding of how meltwater can find its way through glacier ice. UNIS also works closely with local tour companies, providing safety advice and information on ice cave science.

UNIS staff and students have also been active in the emerging science of glacier biology, studying how microbial communities living on and below glaciers contribute to nutrient fluxes (e.g. Hodson et al., 2010a, b; Cameron et al., 2012a, b; Cook et al., 2012; Irvine-Fynn et al., 2012). Detailed studies have also been conducted on snow physics, including the refreezing of water in the snowpack (superimposed ice formation: Bøggild, 2007), and the role of black carbon and other impurities in altering ice melting rates (Bøggild et al., 2010, Aamaas et al., 2011).

## 6.4 Permafrost science at UNIS

Hanne H. Christiansen and Ole Humlum

The geographical location of UNIS provides excellent opportunities for studying permafrost and landforms conditioned by permafrost (Humlum et al., 2003). As permafrost is continuous, found in all parts of the high relief Svalbard landscape outside glaciers, it is possible to study most of the characteristic landforming processes controlled by permafrost in central Svalbard in close proximity to UNIS both for staff and students. Thus year-round studies have been carried out allowing new understanding of the permafrost thermal state and its associated landforms, as well as the importance of the prevailing meteorological conditions.

In 1998 the first permafrost deeper borehole with continuous long-term ground thermal monitoring was established at the Janssonhaugen bedrock mountain top in the inner parts of Adventdalen. UNIS was involved in establishing this borehole[10] as the main part of the EU-funded 'Permafrost and Climate in Europe' (PACE) research project activity in Svalbard. In 2000 UNIS established a meteorological station on the Janssonhaugen mountain ridge close by the borehole. Permafrost temperatures from

[9] Gulley, J.D., M. Grabiec, J.B. Martin, J. Jania, G. Catania & P. Glowacki. (2012). The effect of discrete recharge by moulins and heterogeneity in flow-path efficiency at glacier beds on subglacial hydrology. *Journal of Glaciology*, 58(211), 926-940. doi: 10.3189/2012JoG11J189

[10] Sollid, J.L., P. Holmlund, K. Isaksen & C. Harris. (2000). Deep permafrost boreholes in western Svalbard, northern Sweden and southern Norway. *Norwegian Journal of Geography*, 54(4), 186-191. doi: 10.1080/002919500448567

this 102 m deep borehole have been widely used in long-term permafrost temperature development studies (e.g. Romanovsky et al., 2010). Temperatures are around -5.4˚C below the level of the annual ground temperature variations, with a slight positive trend at 60 m depth of 0.09˚C from 1998 to 2011. The mean annual air temperature varied from -6.3˚C to -4.3˚C in the decade 2000 to 2011 for the 6 years with full data coverage[11].

In summer 2000 a long-term active layer thickness monitoring grid was established in the lower part of Adventdalen right next to the old Aurora station, which is also the location of UNIS first meteorological station. This site is part of the circumpolar active layer monitoring network CALM, and the grid is called UNISCALM. Due to the easy access annual thaw progression data have been collected from spring and into autumn. There is no simple correlation between air temperature and active layer thickness, but insolation is also important (Christiansen & Humlum, 2008). The active layer has varied from 74 cm to 110 cm on average for the 121 UNISCALM grid points from 2000 to 2012, with the thickest active layer recorded in 2008 and the thinnest in 2005.

The detailed field observations of periglacial landforms, made possible by having UNIS as the base, significantly improved the understanding of the importance of snow, in the form of avalanches, for talus-derived rock glacier formation (Humlum et al., 2007). Likewise winter cold spells have been identified as the most important drivers for ice-wedge thermal contraction cracking (Christiansen, 2005). Together with international colleagues and using multi-year observations, it has been shown that winter snow cover and its interannual variability can have as great an importance as summer thawing on solifluction rates and dynamics (Harris et al., 2011). Intensive multi–year collection of snow and snow avalanche data allowed the first quantitative characterisation of avalanching and its meteorological and topographical control in the area around Longyearbyen, presented as a PhD thesis by Markus Eckerstorfer in 2013. This showed that cornice fall avalanches clearly dominate and that there is significant sediment transport by plucking from slopes conditioned by the combination of permafrost and cornices existing through the winter. However, specific meteorologically conditioned events such as large winter rain amounts were also studied directly in the field, and the direct landforming slush and wet slab avalanches were analysed (Eckerstorfer, 2013). The UNIS based collection of meteorological data from various parts of the landscape around Longyearbyen have now allowed the first decadal analysis of the key meteorological parameters and their influence on periglacial landscape development[12].

The interaction between glaciers and permafrost have been the topic of research focusing also partly on submarine permafrost in the surging Paulabreen system in Van Mijenfjorden in the PhD thesis by Lene Kristensen (2009), who used the opportunity to study this once an active glacier surge happened during the early stages of her PhD.

During the International Polar Year 2007-2009 as part of the 'Permafrost Observatory Project: A Contribution to the Thermal State of Permafrost' (TSP) international research project, the TSP NORWAY research project was run, both coordinated from UNIS. In the Norwegian part permafrost drilling campaigns were performed, one in north Norway and one in Svalbard, providing permafrost thermal information from various landforms in Svalbard (Christiansen et al., 2010). During 2008, 15 new, typically 10 m deep, boreholes were drilled and instrumented in the area around Longyearbyen and in Adventdalen, but also in the Kapp Linne area in west Svalbard, constituting the Nordenskioldland Permafrost Observatory, with the ambition to collect long-term permafrost ground thermal observations from various landforms. The boreholes were drilled into different periglacial landforms of both sediment and bedrock, and at altitudes from 10 m to 901 m. The first collection of the international permafrost thermal snapshot showed that the permafrost in Svalbard was the warmest this far north (Romanovsky et al., 2010). Permafrost temperatures varied from -3˚C to -6˚C in the permafrost boreholes, with the warmest being at Kapp Linne and around Longyearbyen at

[11] Christiansen, H.H., O. Humlum & M. Eckerstorfer. (2013). Central Svalbard 2000-2011 meteorological dynamics and periglacial landscape response. *Arctic, Antarctic, and Alpine Research*, 45(1), 6-18. doi: 10.1657/1938-4246-45.16
[12] Christiansen, H.H., O. Humlum & M. Eckerstorfer. (2013), op. cit.

landforms with thicker snow cover, whereas the coldest site was in the lower part of Adventdalen with only little snow and cold air drainage along the valley in winters[13].

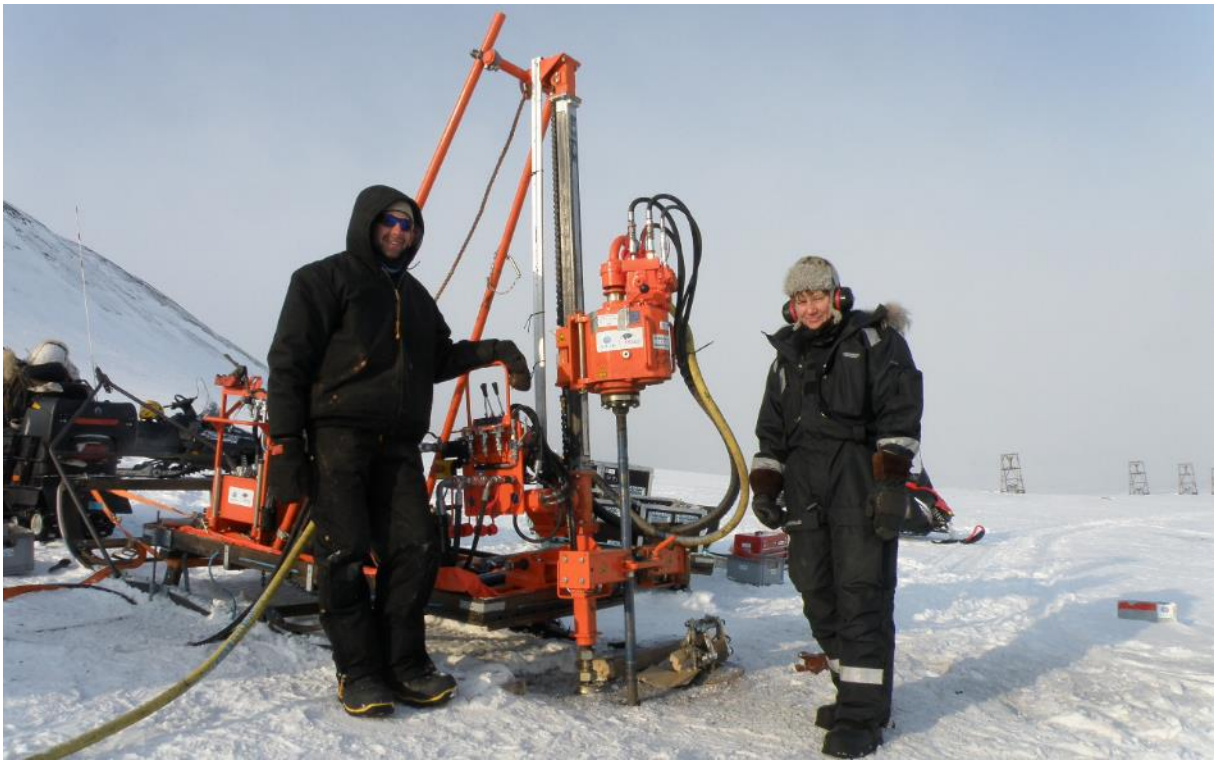
The first Norwegian permafrost database, NORPERM, was established as part of the TSP project, within the Geological Survey of Norway's national borehole database (Juliussen et al., 2010). Svalbard has its own geographical part of this database, which has been used extensively also for UNIS permafrost education. At the moment NORPERM is one of the more advanced national permafrost databases, and data have been extensively used for designing the Global Terrestrial Database for Permafrost (GTN-P) of WMO. In the near future NORPERM will be developed to become truly Nordic, as part of the Nordic Centre of Excellence, DEFROST and the Nordic Council of Ministers' permafrost network, Perma-Nordnet.

In June 2010 we organised together with Norwegian permafrost colleagues, both scientists and engineers, the Third European Conference on Permafrost (EUCOP 2010), for the first time held directly on permafrost at UNIS. The conference, attended by 241 participants, focused on the 'Thermal state of frozen ground in a changing climate during IPY', thus showing the first results from the IPY permafrost research activities. A joint half-day field excursion to both science and engineering permafrost research sites in and around Longyearbyen was successfully conducted for all conference participants. Also, two days of various one-day field excursions were offered, making this an intensive highly international conference, and the largest conference so far hosted at UNIS.

In 2011 UNIS became a partner in the EU 7th framework research project 'Changing Permafrost in the Arctic and its Global Effects in the 21st Century'. Our participation focuses on providing and analysing field data from the Nordenskioldland Permafrost Observatory in Svalbard for improved permafrost physical process understanding, and to improve the knowledge about the amounts and types of ice in the permafrost. This is important knowledge for future better predictions of how the Svalbard landscape will react to future climatic changes. We acquired a medium size drill rig, named Betty, in late 2011. It performed a 10 day drilling campaign in 2012, and 45 m of permafrost cores are now being studied with respect to the content and types of ice for cryolithological characterisation of the permafrost in the dominant and ice-rich permafrost landforms of Adventdalen. This will enable improved understanding of the Holocene landscape development and permafrost extent, valuable also for improved future understanding of the landscape sensitivity.

The most pronounced climatic gradient within the high arctic is measured between warm Svalbard and cold NE Greenland, only about 450 km apart. During the IPY in 2008 we operated the first UNIS course to study the permafrost conditions across this gradient in close collaboration with University of Copenhagen. One of the results was the identification of nitrous oxide as a potential important greenhouse gas in permafrost, with the highest amounts found on Svalbard (Elberling et al., 2010). The next course comparing permafrost conditions in Svalbard and Greenland takes place in 2013, and we aim to in the future strengthen this collaboration with the increased research possibilities now being established also in N Greenland.

[13] Christiansen, H.H., O. Humlum & M. Eckerstorfer. (2013), op cit..



Betty drill rig collecting permafrost cores in Endalen outside Longyearbyen, being operated by Ulrich Neumann and with Hanne Christiansen. April 2012. (Photo: Ole Humlum/UNIS).

## 6.5 Two decades of Quaternary geological research at UNIS – science on the international scene

Ólafur Ingólfsson and Jon Y. Landvik

Quaternary research has been an integral part of the UNIS Arctic geology programme since the start in 1993. Svalbard had for decades been an important venue for developing and testing new ideas and concepts regarding the glacial history of the Arctic, as well as a natural laboratory for studying the glacial debris cascade and processes and products in the glaciated land system, where observations have served as analogues for interpreting landscapes, deposits and dynamics of glaciers and ice sheets at lower latitudes. When UNIS was taking off, the PONAM programme (Late Cenozoic Evolution of the Polar North Atlantic Margins), a major European research effort focusing on the Late Quaternary environmental development on a transect from north-east Greenland to Svalbard and the Barents Sea, was being concluded. Among outputs from the PONAM programme were syntheses on the Late Quaternary glacial history of Svalbard and the Barents Sea. This state-of-the-art research formed the framework and set the course for Quaternary research and course development at UNIS.

Among the UNIS Quaternary geology research highlights over the past 20 years are numerous high-impact contributions relating to the last glaciation (Late Weichselian), the deglaciation of Svalbard as well as the development of Holocene glaciers and climate. Studies underlining architecture and stratigraphy of Quaternary sediments and landforms, raised beach sequences and landscape developments have also been important output of Arctic geology at UNIS. In the crossover zone between Quaternary geology and biology, important lake-sediment studies have, for example, cast light on the anthropogenic influence on late Holocene environmental development, and a recent study highlighted the evolutionary history of the polar bear (*Ursus maritimus*). Quaternary marine geologists at UNIS have contributed with important studies of the Late Quaternary Polar North Atlantic and Barents Sea developments, linking their results to terrestrial evidences on glacial- and climate oscillations through time. State-of-the-art numerical models have been used for evaluating and testing

hypotheses resulting from marine and terrestrial studies. Lately, with the development of new dating methods (Optical Stimulated Luminescence (OSL) and cosmogenic dating), new geophysical methods (3-D seismics and swath bathymetry), and armed with better understanding of processes and products in the different sedimentary environments, UNIS Quaternary scientists have been front runners in developing a more dynamic view of the geometry, behaviour and oscillations of the Svalbard-Barents Sea ice sheet.

The Svalbard-Barents Sea region has always been subject to international research, resulting in science being developed in the crossroads between different schools and traditions. Quaternary geology at UNIS has always had strong links to international networks, calling upon outstanding international colleagues to participate in UNIS research and teaching, as well as attracting highly qualified students from key foreign universities. Quaternary research at UNIS has grown progressively, and with increased number of graduate students (MSc and PhD) the volume of courses, research and published contributions has steadily expanded. Future challenges include increasingly holistic approaches to research on the Quaternary environmental history of Svalbard and adjacent shelves and oceans, for better understanding of this dynamic land-ocean-cryosphere system and its oscillations through time and space.

## 6.6 Physical oceanography at UNIS 1993-2013

Frank Nilsen, Ragnheid Skogseth and Tor Gammelsrød

Education and research in physical oceanography at the department of Arctic Geophysics (AGF) spans over a vertical range from the deep ocean (thousands of metres) to small scale turbulent boundary layers (centimetre scale) under floating sea ice on the sea surface. Emphasis has been on the ocean currents and heat transport towards the Arctic Ocean related to shelf dynamics along the West Spitsbergen Shelf, dense water production in Storfjorden related to the Arctic halocline layer and renewal of deep water in the Arctic, air-ice-sea interaction processes, turbulent mixing and ocean chemistry. The AGF department was established when UNIS was founded in 1993. From the start it consisted of the fields of meteorology, oceanography and upper atmosphere. Since then the department has gradually grown, and research in oceanography has been an important factor in the growth of external funded projects and increased student numbers at the AGF department.

UNIS is situated in a unique location to study complicated physical oceanographic processes that are important for the less accessible Arctic Ocean and for the understanding of the global climate system. Three major oceans envelope Svalbard and UNIS; the Greenland Sea to the west, the Barents Sea to the east and the Arctic Ocean to the north. Svalbard is situated in the middle of the Arctic Front between warm Atlantic Water from south flowing northwards, and cold Arctic Water originating from the Arctic Ocean and modified locally during winter. The warm Atlantic Water is found in the West Spitsbergen Current (WSC) on the western side of Spitsbergen and the Arctic Water is found to the east and north of Spitsbergen. This makes the Barents Sea and the Arctic Ocean ideal and accessible field laboratories for studying sea ice production, and the Greenland Sea and western Spitsbergen are field laboratories for research on sea ice melt. Through research in these unique oceans, oceanography at UNIS has developed from, and still includes, classical polar oceanography towards an expertise in air-ice-ocean interaction studies. This is reflected in the AGF course portfolio and the Master's and PhD thesis in oceanography at UNIS.

The air-ice-ocean research has developed through dedicated research projects in Storfjorden and on student cruises in the marginal ice zone around Svalbard. By using the northwestern Barents Sea and Storfjorden as a field laboratory, sea ice dynamics and polynya processes are studied through fieldwork campaigns and analytical- and numerical modelling (Fer et al., 2003, 2004; Skogseth et al., 2004, 2005a, 2005b, 2006, 2007, 2008, 2009, 2013a, 2013b). Based on case studies, general models for ice production in latent heat polynyas, and corresponding dense water formation through brine release, are developed in order to better understand thermohaline circulation processes, a process of

relevance to global climate. The Arctic and Antarctic thermohaline circulation processes was thoroughly observed and studied during the International Polar Year 2007-08 through the Norwegian project 'Bipolar Atlantic Thermohaline Circulation (BIAC)', where UNIS was responsible for the Storfjorden Work Task and the IPY-project was led by UNIS Prof. II Tor Gammelsrød. Dense water production and ventilation in the Barents Sea and the exchange processes with the Arctic Ocean were also studied in BIAC. It turned out that the warm Atlantic water flowing into the Barents Sea through the Barents Sea Opening gets so efficiently cooled down that it acts as a heat sink rather than a heat source when it enters the Arctic Ocean near Novaya Zemlja (Gammelsrød et al., 2009). In this way, the most important heat source for the Arctic Ocean is via the West Spitsbergen Current.

To avoid this warm current rapidly melting the sea ice in the Nansen and Amundsen Basin north of Svalbard, the warm Atlantic Water west of Spitsbergen has to become denser and sink below the cold surface layer protecting the sea ice. This is done through oceanic cooling processes. Cooling of the Atlantic Water entering the Arctic Ocean through Fram Strait has been one of the main research interests within the oceanography group. UNIS was also partner in the Norwegian IPY project 'iAOOS-Norway, Closing the loop', where UNIS was responsible for the monitoring of the WSC. Process studies of topographic vorticity waves (Nilsen, 2001; Nilsen et al., 2006) and eddies along the West Spitsbergen Shelf slope (Teigen et al., 2010, 2011) have given knowledge and a better understanding of the exchange mechanisms between the deep ocean and shelf areas. The exchange of water masses between the slope and shelf acts as a heat loss for the northward flowing warm and saline Atlantic Water. Current meter moorings in the WSC monitor these processes. Tidal waves interacting with the continental slope around Spitsbergen induce mixing that contributes to the heat loss for the Atlantic Water. This is especially pronounced in the vicinity of the Yermak Plateau at the northwestern corner of Spitsbergen (Fer et al., 2010). Once on the shelf, the warm Atlantic Water is some years able to penetrate into the fjords along western Spitsbergen. This has a major influence on the sea ice cover and marine life in these arctic fjords. Ever since the start in 1993, the oceanographic group at UNIS has conducted a dedicated monitoring programme in these fjords in order to explain the exchange mechanisms between the fjords and the shelf (Nilsen et al., 2008).

The oceanography group at UNIS will continue to teach and study physical oceanographic processes in the Arctic and Antarctic from small- to mesoscale dynamics in short and long oceanic time series provided by UNIS and our national and international partners. Within the context of declining arctic sea ice cover and reduced sea ice thickness, our core teaching and research focus on basic physical oceanographic processes are becoming more and more important when we want to understand the global climate system and the reason for the declining arctic sea ice cover. In the future, the oceanography group will take more advantage of remote sensed data available for the Arctic Ocean, both in our courses and research projects, and we are currently leading the Research Council of Norway project 'Remote Sensing of Ocean Circulation and Environmental Mass Changes (REOCIRC)' that will combine *in situ* data collected in the ocean with remote sensed data form space. The group has recently expanded the teaching and research capacity by establishing a permanent position in chemical oceanography, and new courses and important collaboration projects are already established for the future development in oceanography.

## 6.7 Space physics at UNIS

Dag Lorentzen

Space physics has been an integral part of UNIS since the start in 1993. This was not by chance, since there had been optical observations of the aurora and the upper atmosphere in Longyearbyen since 1978. Prof. Kjell Henriksen at the University in Tromsø – together with colleagues from USA – started out with a hut in Endalen filled with scientific instrumentation. Their goals were to make measurements of the dayside aurora. The high latitude location of Svalbard is especially suited for observations of this type of aurora – and the only place in the world with an infrastructure that permits regular access. By 1984, the hut in Endalen had evolved into the Auroral Station in Adventdalen. In

addition to the station providing an instrument platform for researchers, it also allowed students to gain hands-on research experience. This resulted in space physics being one of the first subjects taught at UNIS.

In the two decades since 1993, the space physics group at UNIS has evolved to be an internationally recognised research group, with an outstanding competence in optical instrumentation for auroral and mesospheric studies. The group has worked steadily to augment the space physics research infrastructure in the vicinity of Longyearbyen. In 2008, a new chapter in space physics at UNIS occurred when a new auroral optical observatory was inaugurated – the Kjell Henriksen Observatory (KHO), named after Prof. Kjell Henriksen, who initiated the old auroral station in Adventdalen. KHO is a world-class facility for studies of the aurora and upper atmosphere. It is owned and operated by UNIS, and is now used by more than 16 research groups from all over the globe. The space physics group is currently expanding its research infrastructure by building an upper atmospheric radar – a so called SuperDARN radar. This new facility will be used to measure – among other parameters - the flow-speed of plasma (an ionised gas) in the upper atmosphere. The radar will be part of a network of radars across the globe, which is used by the international space physics community. This new facility, along with the instrumentation at KHO provides important measurements, since they give an indication of the activity in the upper atmosphere. This again is important since it affects a wide range of systems, including radio communication, GPS systems and power grids.

Being a group of high scientific merit, the space physics group at UNIS became a member of the first Centre of Excellence in space physics in Norway – the Birkeland Centre for Space Science (BCSS). The centre was launched spring 2013 and is led by the University of Bergen. It includes two nodes – UNIS and the Norwegian University of Science and Technology. For the UNIS group, this entails a further expansion and an incentive for the continuation of the work that started with the birth of UNIS

The Kjell Henriksen Observatory (KHO) was formally opened in February 2008. (Photo: Eva Therese Jenssen/UNIS).

The Space physics research group at the Kjell Henriksen Observatory with H.M. Queen Sonja in February 2013. Left: Henrik Bjørklund, Margit Dyrland, Pål Brekke, H.M. Queen Sonja, Ole Arve Misund, Lisa Baddeley, Dag Lorentzen, Silje Eriksen Holmen, Fred Sigernes, and Xiangcai Chen. (Photo: Pål Brekke/UNIS).

## 6.8 Cooperation of Arctic Technology Department with local industry in Svalbard

Lars Grande, Jan Otto Larsen, Arne Instanes, Jomar Finseth, Knut Høyland, and Aleksey Marchenko

Many research projects in the Arctic Technology Department were organised in close cooperation with the local authorities and the local coal mine company, SNSK. AT Department considers regions of industrial development in Svalbard, such as the settlements of Longyearbyen, Svea, Barentsburg and Piramiden, mining facilities, and harbour infrastructure as natural laboratories. They provide good opportunities for the investigation of environmental actions and loads on engineering structures in the Arctic, as well as inverse action of the industrial objects on the Arctic nature. Typical examples of cooperative projects are listed below with a short description of their content.

The project ‘Measurements technique and analysis of thermal conditions of constructions in permafrost regions’ coordinated by Lars Grande, is focused on the monitoring of buildings and constructions in Longyearbyen and delivered important information about stability of foundations in frozen soils. Within this project temperature sensors were installed on supporting pillars below the UNIS building. Long-term temperature measurements show the influence of the construction on the thermodynamic state of soils below it.

The project ‘Arctic coastal structures and protection against sea ice loads’ (2006-2010) supported partially by SINTEF and SNSK, was related to the study of ice/water actions on geo-textile bags filled with local soil and used for the protection of shorelines in the Arctic. Fabrice Caline defended his PhD thesis at UNIS in 2010 on this topic. Later the project was given an extension to investigate the efficiency of plastic tubes for shoreline protection.

The project ‘Planning of optimal design for roads in relation to avalanche risk and instability under temperature fluctuations around 0°C’ (2010) supported by SNSK and led by Jan Otto Larsen, focused on the planning of a road to the Mine 7 near Longyearbyen, which is also very important for the logistic operations of EISCAT facilities. Several MSc students of NTNU delivered their theses as part of this project’s activities.

The road to Mine 7 outside Longyearbyen. (Photo: UNIS).

The projects ‘Investigation of possible routes for transport across Slakbreen to Höganäsbreen using Ground penetrating radar’ (SNSK), ‘Possible routes for power cable to earthquake station at Janssonhaugen’ (with Instanes Svalbard/NORSAR) and ‘Geotechnical laboratory soil investigations for the design and maintenance of the building at Longyearbyen Kulturhuset’ were carried out, supervised by Arne Instanes.

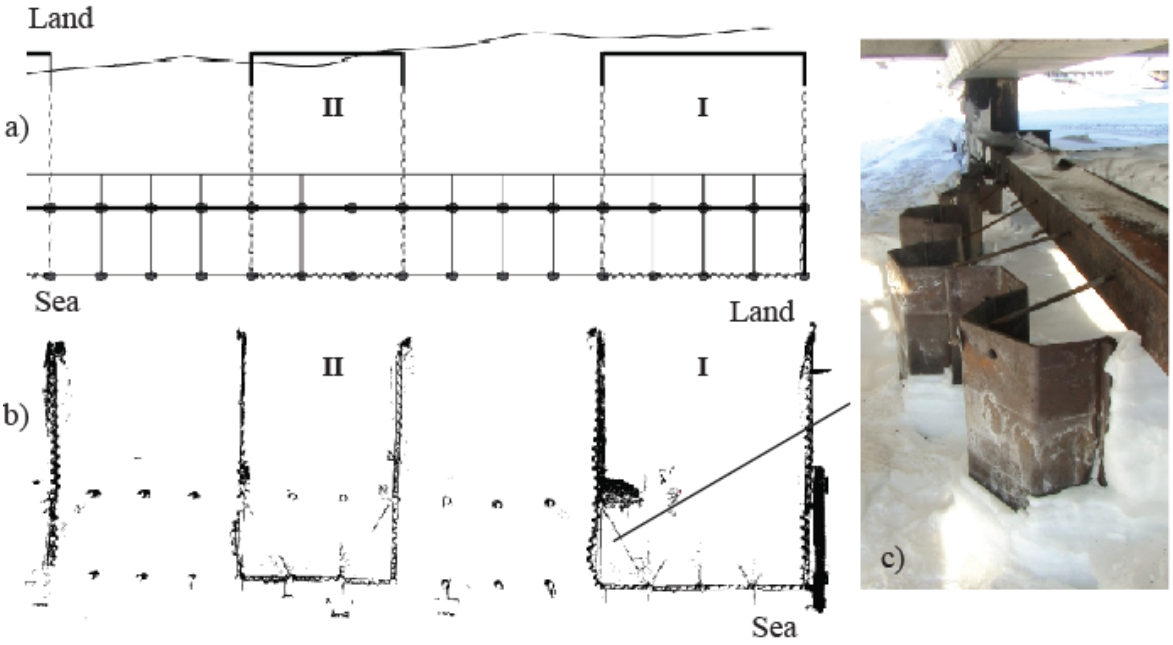
The project ‘Ice conditions in the Van Mijen fjord’ was studied by Knut Høyland in collaboration with SNSK and the department of Geophysics at UNIS. The ice conditions in the Van Mijen fjord became important for SNSK when they wanted to extend the season for shipping out coal after the Svea Nord mine opened.

The project ‘Environmental controls on subsurface processes in coal waste rock dumps in Svalbard including Barentsburg’ (2008) was coordinated by Bo Elberling, and was a good example of the cooperation between Norwegian (SNSK) and Russian (Arctic Ugol) coal companies. Main topics of the project were measurements of oxygen content and temperature inside coal waste rock dumps, modelling of their thermodynamic characteristic, and estimates of the ignition risks. Jorgen Hollesen from the University of Copenhagen & UNIS defended his PhD thesis on this topic. Several MSc students were involved in the project.

The project ‘Ice and water actions on a floating jetty’ (2004 -2011) conducted in close cooperation with the administration of Longyearbyen harbour, was supervised by Knut Høyland and Aleksey Marchenko. The forces during ice break-up were studied. Floating jetties are much cheaper and mobile than stationary quays. The construction of stationary quays in the Arctic environment meets significant problems caused by weak soils in the coastal zone in combination with loads due to the wind, waves and ice actions. Construction of protective cofferdams and the filling of these with special soils is very expensive. The use of floating jetties helps to avoid these problems. The project aims to

study the stability of a mooring line system for the floating jetties, elaborate technical recommendations for their sizes and location near shorelines during summer and winter seasons depending on the local conditions in the Advent Fjord. Movements of the plastic jetty in Longyearbyen were registered with tilt-meters and pressure sensors in 2010 and 2011 over the winter and summer seasons. Mathematical modelling of the jetty and numerical simulations were performed to specify resonant frequencies of the jetty in rough sea.

The project 'Ice loads on stationary quays' (from 2011) is coordinated by Aleksey Marchenko in close cooperation with SNSK, and aims to study the stability of fixed quays in the Arctic conditions. Effects of ice bustles on vertical piles and thermal expansion of the ice inside protecting cofferdams influence vertical and horizontal loads on structural elements of the quays. Significant deformations of the cofferdam increasing with the time are observed in the coal quay in Kapp Amsterdam in Svea. Registration of deformations was performed with laser scanning by PhD student David Wrangborg, and ice loads on the cofferdam walls measured with pressure cells systematically. The physical processes inside the cofferdam were reproduced in the UNIS ice tank in the model scale, where measurements of thermal expansion of saline ice were performed with fibre optic strain sensors. Numerical simulations in Comsol Multiphysics were performed to estimate sizes of ice bustle on vertical piles and ice loads on the stationary coal quays in Longyearbyen and Kapp Amsterdam.




Scheme of the east part of the coal quay in Kapp Amsterdam (a), deformations of the cofferdam registered with the laser scanner (b) and photo of deformed cofferdam (c).

## 6.9 Norwegian-Russian collaboration projects

Nataly Marchenko

The Arctic Technology department developed international cooperation, using support from RCN and SUI. Cooperation with Russia was especially fruitful.

The first two students came to UNIS from St.Petersburg State Polytechnic University (SPbSPU) in autumn 1996, just three years after UNIS was established. Moscow Institute of Physics and Technology (MIPT) was involved in cooperation in 2006, and Moscow State University (MSU) in 2009. More than 60 Russian students studied at UNIS in the period 1996-2013. In 2008-2010 UNIS hosted

the SIU (Norwegian Centre for International Cooperation in Education) project 'Safe loading and transport of hydrocarbons from the Barents Sea' (Acronym: SafeLOT, project leader – Sveinung Løset). This allowed support for more Master's Students, one PhD student at SPbSPU, who was an external PhD at UNIS and performed field and lab experiments on Svalbard and one PhD student, constantly located at UNIS. Several common publications, including the book in Russian and English had been prepared[14], [15].

The new SUI collaboration project 'Safety of Maritime operation and sustainable industrial development in the Arctic' (SMIDA, project leader – Aleksey Marchenko) started in 2012 for 3 years. SMIDA inherits the SafeLOT project and continues collaboration in the field of ice mechanics. Cooperation partners in SMIDA project are UNIS, NTNU, SPbSPU, MIPT, MSU and the State Marine Technical University of St.Petersburg, Russia. The project develops communication between students, academic and administrative staff, helps to synchronise the teaching procedures in both countries and to organise joint laboratory and fieldwork in the Svalbard region, Barents Sea and the industrial regions of the Russian Arctic.

Alongside the fieldwork and teaching, the unique research equipment was created and tested, new techniques and methods were developed and original results on physical and mechanical properties of sea ice, and ice load on construction were obtained. Fieldwork and study included the test on fast ice, and a survey on research vessels in the Svalbard fjords and the Barents Sea.

In 2008-2010 UNIS hosted a Norwegian-Russian collaborative project in the field of environmental chemistry 'Emerging persistent organic pollutants in the high North and North-Western Russia' (NorthPOP, project leader – Roland Kallenborn), supported by RCN.

In 2008-2011 the AT department participated in the PetroArctic project, hosted by NTNU. One of the tasks of the project was the 'collection of ice pilot experience'. In the course of the project information about ice conditions and ice-induced accidents in the Russian Arctic were collected and presented in the form of a bi-lingual (Russian-English) book, printed by Springer (Marchenko, 2012). The accidents in the Arctic Sea were classified, described and connected with weather and ice conditions. The behaviour of the crew was taken into consideration. Such investigation is important for safety in the Arctic.

[14] Løset, S., K.N. Shkhinek, O.T. Gudmestad & K.V. Høyland (2006). *Actions from ice on Arctic offshore and coastal structures*. Lan. ISBN 5-8114-0703-3
[15] Gudmestad, O.T., S. Løset, A.I. Alhimenko, K.N. Shkhinek, A. Tørum & A. Jensen. *Engineering aspects related to Arctic offshore developments*. Lan. ISBN 978-5-8114-0723-1

Arctic Technology staff performing fieldwork on the sea ice. (Photo: Lucie Strub-Klein/UNIS).

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Below follows a complete list of UNIS-publications, according to the criteria described in Chapter 5. The list covers the period 1993-2012. The list also includes some publications with publication year 2013 which were issued and indexed in 2012. The bibliographic entries have been compiled from different data sources, hence author names and geographical names have not been set to a specific standard. The only exception is UNIS affiliated authors. They have been standardized to hold the Norwegian letters Æ, Ø, Å, Swedish Ä, Ö etc. We have also tried to standardize the proceedings names, and also included the acronyms.

## 1994


Funder, S., C. Hjort, & J. Y. Landvik. (1994). The last glacial cycles in East Greenland: an overview. *Boreas, 23*(4), 283-293. doi: 10.1111/j.1502-3885.1994.tb00601.x

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Sigernes, F., G. Fasel, C. S. Deehr, R. W. Smith, D. A. Lorentzen, L. T. Wetjen, & K. Henriksen. (1994). Proton aurora on the dayside. *Geomagnetizm I Aeronomiya, 34*(5), 69-75.


## 1995


Hjort, C., J. Mangerud, L. Adrielsson, S. Bondevik, J. Y. Landvik, & O. Salvigsen. (1995). Radiocarbon dated common mussels Mytilus edulis from eastern Svalbard and the Holocene marine climatic optimum. *Polar Research, 14*(2), 239-243. doi: 10.1111/j.1751-8369.1995.tb00691.x

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## 1996


Blixt, E. M., & A. Brekke. (1996). A model of currents and electric fields in a discrete auroral arc. *Geophysical Research Letters, 23*(18), 2553-2556. doi: 10.1029/96gl02378

Etzelmüller, B., J. O. Hagen, G. Vatne, R. S. Ødegård, & J. L. Sollid. (1996). Glacier debris accumulation and sediment deformation influenced by permafrost: examples from Svalbard. *Annals of Glaciology, 22*, 53-62.

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# List of personnel, UNIS 1993-2012

This table provides an overview of the UNIS staff for the period 1993-2012.[16]

| Name | Born year | Nationality | Job title | Percentage | Department | Start (ddmmyy) | End (ddmmyy) |
|---|---|---|---|---|---|---|---|
| **Alsos, Inger Greve** | 1968 | NO | Associate Professor | 100 | AB | 01/09/06 | 31/12/09 |
| **Amundsen, Roy-Erik** | 1971 | NO | Head Engineer | 100 | IT | 11/12/06 | 30/11/10 |
| **Andersen, Gerd Irene (1)** | 1967 | NO | Laboratory Manager | 50/80/100 | Laboratory | 24/08/98 | 31/07/08 |
| **Andersen, Iben Nicola** | 1964 | DK | Head of Department | 100 | Academic affairs | 01/08/12 | |
| **Andersen, Trond** | 1971 | NO | Research Assistant | 100 | AGF | 12/01/98 | 04/04/98 |
| **Andresen, Arild** | 1944 | NO | Adjunct Professor | 20 | AG | 01/04/02 | 14/03/06 |
| **Anell, Ingrid** | 1981 | SE | Postdoctoral Fellow | 100 | AG | 01/01/12 | |
| **Arlov, Thor Bjørn** | 1958 | NO | Adjunct Associate Prof | 20 | Administration | 01/04/02 | |
| **Arndt, Carolin** | 1975 | DE | PhD Candidate | 100 | AB | 01/01/02 | 31/12/04 |
| **Aske, Gunnar (1)** | 1967 | NO | Staff Engineer | 100 | IT | 01/09/98 | 31/07/99 |
| **Aske, Gunnar (2)** | 1968 | NO | Head Engineer | 100 | IT | 01/08/99 | 30/04/03 |
| **Ávila Jiménes, Maria Luisa** | 1981 | ES | PhD Candidate | 100 | AB | 01/08/07 | 31/07/11 |
| **Baddeley, Lisa J (1)** | 1977 | UK | Postdoctoral Fellow | 100 | AGF | 01/07/09 | 28/02/12 |
| **Baddeley, Lisa J (2)** | 1977 | UK | Associate Professor | 100 | AGF | 01/03/12 | |
| **Bælum, Karoline (1)** | 1980 | DK | PhD Candidate | 100 | AG | 01/01/07 | 31/12/10 |
| **Bælum, Karoline (2)** | 1980 | DK | Research Assistant | 100 | AG | 15/01/11 | 31/07/11 |
| **Barrault, Sebastien** | 1976 | CH | PhD Candidate | 100 | AT | 01/10/05 | 30/09/09 |
| **Benn, Douglas I.** | 1957 | UK | Professor | 100 | AG | 01/02/06 | |
| **Berge, Jørgen (1)** | 1970 | NO | Associate Professor | 100 | AB | 15/06/03 | 17/06/07 |
| **Berge, Jørgen (2)** | 1970 | NO | Professor | 100 | AB | 18/06/07 | 31/10/12 |
| **Beuchel, Frank** | 1968 | DE | Research Assistant | 100 | AB | 05/09/00 | 31/03/01 |
| **Bjørke, Anita** | 1964 | NO | Higher Executive Officer | 100 | Finance | 08/06/11 | |
| **Bjørkhaug, Bjørnar** | 1973 | NO | Civilian Worker/Engineer | 100 | Logistics | 17/06/96 | 01/07/97 |
| **Bjørknes, Bente** | 1964 | NO | Higher Executive Officer | 100 | Academic affairs | 26/05/95 | 31/05/99 |
| **Bjørndal, Anne Dall-Larsen** | 1970 | NO | Adviser | 100 | Academic affairs | 16/02/11 | |
| **Bjørsvik, Ane Hammervoll (1)** | 1976 | NO | Higher Executive Officer | 100 | Academic affairs | 01/10/08 | 31/08/10 |
| **Bjørsvik, Ane Hammervoll (2)** | 1976 | NO | Adviser | 100 | Academic affairs | 01/09/10 | |
| **Blichfeldt, Eirin** | 1967 | NO | Senior Secretary | 50 | Reception | 15/08/99 | 31/12/99 |
| **Bøggild, Carl Egede** | 1959 | DK | Associate Professor | 100 | AGF | 01/01/06 | |
| **Braathen, Alvar (1)** | 1964 | NO | Professor | 100 | AG | 01/07/06 | |
| **Braathen, Alvar (2)** | 1964 | NO | Adjunct Professor | 20 | Co2 | 01/01/12 | |
| **Braathen, Cathy** | 1965 | UK | Executive Officer | 60/80 | Co2 | 10/11/08 | |
| **Brandvik, Kari Myrseth** | 1962 | NO | Senior Secretary | 50 | Reception | 01/01/00 | 25/06/00 |
| **Brandvik, Per Johan (1)** | 1951 | NO | Associate Professor | 100 | AT | 01/07/99 | 30/06/05 |
| **Brandvik, Per Johan (2)** | 1951 | NO | Adjunct Associate Prof | 20 | AT | 01/07/05 | 31/08/10 |
| **Brattli, Jan Gunnar** | 1968 | NO | Higher Executive Officer | 100 | Academic affairs | 01/08/99 | 31/07/07 |
| **Brekke, Asgeir** | 1942 | NO | Adjunct Professor | 20 | AGF | 01/09/94 | 30/04/12 |
| **Brekke, Pål** | 1961 | NO | Adjunct Associate Prof | 20 | AGF | 01/01/12 | |
| **Brekke, Tor** | 1942 | NO | Executive Officer | 50 | Administration | 01/02/97 | 30/04/97 |
| **Brembu, Tore** | 1973 | NO | Civilian Worker/Technician | 100 | Logistics | 23/09/97 | 09/10/98 |

[16] Please note that short time staff and field workers have not been added to the list. The UNIS staff list is compiled with information from the archives as well as an old staff list. The manual work involved may leave some printing errors hard to detect. The overview covers the period up to 31 December 2012.

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|---|---|---|---|---|---|---|---|
| **Bruland, Oddbjørn** | 1965 | NO | PhD Candidate | 100 | AT | 15/08/97 | 30/06/98 |
| **Caline, Fabrice** | 1977 | FR | PhD Candidate | 100 | AGF | 18/10/04 | 17/10/07 |
| **Camus, Lionel** | 1972 | FR | Postdoctoral Fellow | 100 | AB | 01/07/02 | 30/06/04 |
| **Carlsson, Pernilla** | 1986 | SE | PhD Candidate | 100 | AT | 11/05/09 | |
| **Chauhan, Teena** | 1981 | IN | PhD Candidate | 100 | AG | 10/01/11 | |
| **Chen, Xiangcai** | 1987 | CN | PhD Candidate | 100 | AGF | 22/10/12 | |
| **Christiansen, Hanne Hvidtfeldt (1)** | 1965 | DK | Associate Professor | 100 | AG | 01/09/03 | 14/09/07 |
| **Christiansen, Hanne Hvidtfeldt (2)** | 1965 | DK | Professor | 100 | AG | 15/09/07 | |
| **Claes, Stefan (1)** | 1962 | NO | Staff Engineer | 100 | Instrumentation | 12/11/01 | 31/07/06 |
| **Claes, Stefan (2)** | 1962 | NO | Head Engineer | 100 | Instrumentation | 01/08/06 | |
| **Cook, Susan Jennifer** | 1985 | UK | Postdoctoral Fellow | 100 | AG | 01/09/12 | |
| **Cooper, Elisabeth (1)** | 1965 | UK | Postdoctoral Fellow | 100 | AB | 16/01/03 | 31/12/05 |
| **Cooper, Elisabeth (2)** | 1965 | UK | Associate Professor | 100 | AB | 01/04/06 | 31/12/07 |
| **Coulson, Anna Sjöblom (2)** | 1972 | SE | Associate Professor | 100 | AGF | 01/04/05 | 07/08/12 |
| **Coulson, Anna Sjöblom (3)** | 1972 | SE | Professor | 100 | AGF | 08/01/12 | |
| **Coulson, Stephen James (1)** | 1965 | UK | Associate Professor | 100 | AB | 01/11/05 | 14/09/12 |
| **Coulson, Stephen James (2)** | 1965 | UK | Professor | 100 | AB | 15/09/12 | |
| **Daase, Malin** | 1974 | DE | PhD Candidate | 100 | AB | 01/06/02 | 31/05/05 |
| **Delmas, Louis** | 1981 | FR | PhD Candidate | 100 | AT | 01/01/07 | 31/12/10 |
| **Dokken, Trond** | 1961 | NO | Associate Professor | 100 | AG | 01/08/98 | 31/07/01 |
| **Dørmenen, Jon** | 1963 | NO | Engineer | 100 | Logistics | 01/07/96 | 31/08/98 |
| **Drage, Magne Andersen** | 1975 | NO | PhD Candidate | 100 | AGF | 01/09/01 | 01/09/04 |
| **Due, Anne Lise (1)** | 1973 | NO | Executive Officer | 100 | Reception | 16/09/06 | 31/05/08 |
| **Due, Anne Lise (2)** | 1973 | NO | Higher Executive Officer | 100 | Reception | 01/06/08 | 14/08/08 |
| **Dybdahl, Jørn** | 1961 | NO | Engineer | 100 | Logistics | 23/07/98 | 22/07/04 |
| **Dyrland, Margit Elisabeth (1)** | 1979 | NO | PhD Candidate | 100 | AGF | 15/08/05 | 31/03/10 |
| **Dyrland, Margit Elisabeth (2)** | 1979 | NO | Postdoctoral Fellow | 100 | AGF | 01/04/10 | |
| **Eckerstorfer, Markus** | 1982 | AT | PhD Candidate | 100 | AG | 01/01/09 | 31/12/12 |
| **Eggenfellner, Frank (1)** | 1969 | NO | Staff Engineer | 100 | IT | 15/08/03 | 31/07/06 |
| **Eggenfellner, Frank (2)** | 1969 | NO | Head Engineer | 100 | IT | 01/08/06 | 25/08/11 |
| **Eggenfellner, Heinrich (1)** | 1966 | NO | Staff Engineer | 100 | IT | 01/05/03 | 31/07/06 |
| **Eggenfellner, Heinrich (2)** | 1966 | NO | Head Engineer | 100 | IT | 01/08/06 | |
| **Eggenfellner, Ingrid (1)** | 1972 | NO | Secretary | 100 | Reception | 01/01/04 | 31/12/04 |
| **Eggenfellner, Ingrid (2)** | 1972 | NO | Executive Officer | 100 | Reception | 01/01/05 | 30/11/06 |
| **Eggenfellner, Ingrid (3)** | 1972 | NO | Higher Executive Officer | 100 | Human resources | 01/12/06 | 31/08/10 |
| **Eggenfellner, Ingrid (4)** | 1972 | NO | Senior Executive Officer | 100 | Human resources | 01/09/10 | 15/08/11 |
| **Eiane, Ketil** | 1968 | NO | Associate Professor | 100 | AB | 01/12/99 | 30/11/05 |
| **Eidesen, Pernille Bronken** | 1974 | NO | Associate Professor | 100 | AB | 01/01/08 | |
| **Eidesen, Ruben (1)** | 1973 | NO | Higher Executive Officer | 80 | Academic affairs | 20/08/08 | 31/08/10 |
| **Eidesen, Ruben (2)** | 1973 | NO | Adviser | 100/80 | Academic affairs | 01/09/10 | |
| **Elberling, Bo** | 1968 | DK | Adjunct Professor | 20 | AB/AG/AT | 01/03/07 | |
| **Engebu, Anne Stenhamar** | 1978 | NO | Higher Executive Officer | 100 | Human resources | 01/06/11 | |
| **Faksness, Liv-Guri** | 1963 | NO | PhD Candidate | 100 | AT | 01/03/04 | 28/02/07 |
| **Falck, Eva** | 1956 | NO | Associate Professor | 100 | AGF | 06/01/12 | |
| **Finseth, Jomar** | 1964 | NO | Senior Engineer | 20 | AT | 01/02/10 | |
| **Fjerdingøy, Trine** | 1970 | NO | Higher Executive Officer | 100 | Travel | 01/10/07 | |
| **Flå, Helen (1)** | 1954 | NO | Executive Officer | 100 | Administration | 04/10/93 | 31/03/99 |
| **Flå, Helen (2)** | 1954 | NO | Head of Office | 100 | Administration | 01/04/99 | 31/10/04 |
| **Flå, Helen (3)** | 1954 | NO | Assistant Director | 100 | Administration | 01/11/04 | |
| **Foldvik, Arne** | 1930 | NO | Adjunct Professor | 20 | AT | 01/08/96 | 31/07/01 |

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|---|---|---|---|---|---|---|---|
| **Frengstad, Bjørn** | 1964 | NO | Executive Officer | 100 | Academic affairs | 01/07/93 | 31/09/93 |
| **Gabrielsen, Geir Wing** | 1955 | NO | Adjunct Professor | 20 | AB/AT | 01/05/08 | |
| **Gabrielsen, Tove** | 1971 | NO | Associate Professor | 100 | AB | 01/03/08 | |
| **Gammelsrød, Tor (1)** | 1944 | NO | Professor | 100 | AGF | 01/08/99 | 15/02/01 |
| **Gammelsrød, Tor (2)** | 1944 | NO | Adjunct Professor | 20 | AGF | 01/08/01 | 31/07/06 |
| **Gilberg, Thorbjørn** | 1968 | DK | Adviser | 50/70 | Administration | 20/08/12 | |
| **Gjedrem, Kjersti** | 1973 | NO | Higher Executive Officer | 100 | Academic affairs | 19/05/11 | 18/05/12 |
| **Gjessing, Yngvar (1)** | 1938 | NO | Adjunct Professor | 20 | AGF | 01/08/94 | 31/12/96 |
| **Gjessing, Yngvar (2)** | 1938 | NO | Professor | 100 | AGF | 01/01/97 | 31/12/02 |
| **Gjessing, Yngvar (3)** | 1938 | NO | Adjunct Professor | 20 | AGF | 01/01/03 | 31/03/04 |
| **Gölles, Thomas** | 1980 | AT | PhD Candidate | 100 | AGF | 01/09/10 | |
| **Grande, Lars (1)** | 1943 | NO | Professor | 100 | AT | 15/08/04 | 14/08/05 |
| **Grande, Lars (2)** | 1943 | NO | Adjunct Professor | 20 | AT | 01/08/05 | 31/07/12 |
| **Grenvald, Julie Cornelius** | 1982 | DK | PhD Candidate | 100 | AB | 11/09/12 | |
| **Grundvåg, Sten-Andreas** | 1983 | NO | Postdoctoral Fellow | 100 | AG | 01/07/12 | |
| **Grydeland, Tom** | 1972 | NO | Associate Professor | 100 | AGF | 01/09/05 | 31/05/06 |
| **Guldberg, Wenche** | 1972 | NO | Secretary | 50/100 | Reception | 11/09/00 | 31/07/07 |
| **Gulliksen, Bjørn** | 1945 | NO | Adjunct Professor | 20 | AB | 01/08/94 | 31/12/12 |
| **Haagensli, Jørgen** | 1962 | NO | Staff Engineer | 100 | Logistics | 13/09/04 | 21/10/10 |
| **Hagen, Jon Ove** | 1950 | NO | Adjunct Professor | 20 | AGF | 01/11/10 | |
| **Hall, Chris** | 1953 | UK | Associate Professor | 100 | AGF | 01/06/93 | 31/12/93 |
| **Halsband-Lenk, Claudia** | 1971 | DE | Postdoctoral Fellow | 100 | AB | 01/10/05 | 31/08/07 |
| **Hamre, Øyvind** | 1976 | NO | Civilian Worker/Technician | 100 | Logistics | 07/09/99 | 31/10/00 |
| **Hansen, Fred Skancke (1)** | 1964 | NO | Head of Department | 100 | Logistics | 22/07/98 | 28/11/10 |
| **Hansen, Fred Skancke (2)** | 1964 | NO | Director | 100 | Logistics | 29/11/10 | |
| **Hansen, Geir Arne** | 1967 | NO | Engineer | 100 | Logistics | 11/04/97 | 28/08/98 |
| **Hatlestad, Marianne (1)** | 1974 | NO | Secretary | 50 | Reception | 01/11/01 | 31/10/05 |
| **Hatlestad, Marianne (2)** | 1974 | NO | Executive Officer | 100 | Reception/Arch | 01/11/05 | 28/02/07 |
| **Hatlestad, Marianne (3)** | 1974 | NO | Higher Executive Officer | 100 | Archives | 01/03/07 | 31/10/07 |
| **Haugan, Hildegun** | 1959 | NO | Secretary | 80 | Reception | 04/08/97 | 18/06/99 |
| **Haugan, Peter M. (1)** | 1958 | NO | Associate Professor | 100 | AGF | 01/08/97 | 30/04/99 |
| **Haugan, Peter M. (2)** | 1958 | NO | Professor | 100 | AGF | 01/05/99 | 31/07/99 |
| **Haugnes, Kjell Ivar** | 1970 | NO | Head Engineer | 100 | IT | 01/08/11 | |
| **Havnes, Ove** | 1940 | NO | Adjunct Professor | 20 | AGF | 01/08/96 | 31/12/12 |
| **Heese, Birgit** | 1962 | DE | Associate Professor | 100 | AGF | 14/08/95 | 16/08/98 |
| **Helland-Hansen, William** | 1958 | NO | Adjunct Professor | 20 | AG | 01/04/07 | |
| **Henriksen, Mona** | 1970 | NO | Assistant Professor | 100 | AG | 01/08/01 | 30/11/01 |
| **Hermanson, Mark** | 1953 | US | Associate Professor | 100 | AT | 01/08/09 | |
| **Hermansson, Klas** | 1980 | SE | Staff Engineer | 100 | Logistics | 29/11/12 | |
| **Hodson, Andrew** | 1969 | UK | Adjunct Professor | 20 | AG | 01/01/11 | |
| **Hole, Lars Robert (1)** | 1971 | NO | PhD Candidate | 100 | AGF | 01/04/96 | 31/08/98 |
| **Hole, Lars Robert (2)** | 1971 | NO | Associate Professor | 100 | AGF | 01/01/04 | 31/03/05 |
| **Holm, Elis** | 1947 | SE | Adjunct Professor | 20 | AT | 01/11/01 | 31/10/06 |
| **Holmén, Kim** | 1955 | SE | Adjunct Professor | 20 | AGF | 01/11/04 | 31/10/10 |
| **Holmen, Silje Eriksen** | 1983 | NO | PhD Candidate | 100 | AGF | 03/04/12 | |
| **Holmes, Jeff (1)** | 1976 | US | Technician | 100 | AGF | 01/12/03 | 31/03/04 |
| **Holmes, Jeff (2)** | 1976 | US | PhD Candidate | 100 | AGF | 27/09/04 | 26/09/07 |
| **Holter, Kari** | 1953 | NO | Laboratory Manager | 50 | Laboratory | 17/03/97 | 30/06/98 |
| **Hormes, Anne** | 1970 | DE | Associate Professor | 100 | AG | 01/02/07 | |
| **Hovinen, Johanna** | 1981 | FI | PhD Candidate | 100 | AB | 01/04/09 | 31/03/12 |
| **Høyland, Knut Vilhelm (1)** | 1967 | NO | PhD Candidate | 100 | AT | 12/01/98 | 29/05/98 |
| **Høyland, Knut Vilhelm (2)** | 1967 | NO | Associate Professor | 100 | AT | 01/08/01 | 30/08/06 |

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|---|---|---|---|---|---|---|---|
| **Høyland, Knut Vilhelm (3)** | 1967 | NO | Adjunct Associate Prof | 20 | AT | 01/05/07 | 31/12/09 |
| **Høyland, Knut Vilhelm (4)** | 1967 | NO | Adjunct Professor | 20 | AT | 01/01/10 | 30/09/12 |
| **Hübner, Christiane** | 1971 | DE | PhD Candidate | 100 | AB | 01/01/03 | 31/12/05 |
| **Humlum, Ole (1)** | 1949 | DK | Professor | 100 | AG | 01/09/99 | 31/08/03 |
| **Humlum, Ole (2)** | 1949 | DK | Adjunct Professor | 20 | AG | 01/10/03 | |
| **Hurum, Jørn** | 1967 | NO | Adjunct Associate Prof | 20 | AG | 01/07/09 | |
| **Husteli, Berit** | 1978 | NO | PhD Candidate | 100 | AG | 09/03/12 | |
| **Hygen, Hans Olav** | 1971 | NO | PhD Candidate | 100 | AGF | 01/07/98 | 31/12/00 |
| **Ikonen, Jukka Pekka** | 1975 | FI | Staff Engineer | 100 | Logistics | 01/07/11 | |
| **Indreiten, Martin** | 1972 | NO | Head of Department | 100 | Logistics | 01/02/09 | |
| **Ingolfsson, Olafur (1)** | 1953 | IS | Professor | 100 | AG | 15/08/00 | 31/09/03 |
| **Ingolfsson, Olafur (2)** | 1953 | IS | Adjunct Professor | 20 | AG | 01/10/03 | 31/12/03 |
| **Ingolfsson, Olafur (3)** | 1953 | IS | Adjunct Professor | 20 | AG | 01/01/07 | 31/12/12 |
| **Instanes, Arne (1)** | 1961 | NO | Associate Professor | 100 | AT | 15/08/99 | 31/07/01 |
| **Instanes, Arne (2)** | 1961 | NO | Adjunct Associate Prof | 20 | AT | 01/08/01 | 31/07/05 |
| **Ivarrud, Venke** | 1969 | NO | Executive Officer | 100 | Reception | 09/01/12 | |
| **Jaedicke, Christian** | 1973 | DE | PhD Candidate | 100 | AGF | 01/07/98 | 30/06/01 |
| **Jakobsen, Berit (1)** | 1960 | NO | Head Librarian | 100 | Library | 01/07/97 | 30/06/08 |
| **Jakobsen, Berit (2)** | 1960 | NO | Head Librarian | 100 | Library | 01/07/08 | |
| **Jakobsson, Martin** | 1966 | SE | Adjunct Professor | 20 | AG | 07/02/11 | |
| **Jaldemark, Christian** | 1971 | SE | Staff Engineer | 100 | IT | 11/02/02 | 15/06/03 |
| **Jensen, Maria** | 1974 | DK | Associate Professor | 100 | AG | 01/06/08 | |
| **Jensen, Steinar** | 1970 | NO | Higher Executive Officer | 100 | Human resources | 01/05/05 | 30/11/06 |
| **Jenssen, Bjørn Munro** | 1959 | NO | Adjunct Professor | 20 | AT | 01/10/11 | |
| **Jenssen, Eva Therese (1)** | 1971 | NO | Higher Executive Officer | 100 | Information | 01/09/06 | 31/07/08 |
| **Jenssen, Eva Therese (2)** | 1971 | NO | Adviser | 100 | Information | 01/08/08 | 30/11/10 |
| **Jenssen, Eva Therese (3)** | 1971 | NO | Information Manager | 100 | Information | 01/12/10 | |
| **Johansen, Kåre** | 1963 | NO | Staff Engineer | 100 | Logistics | 01/03/07 | |
| **Johansen, Tor Arne (1)** | 1958 | NO | Adjunct Associate Prof | 20 | AG | 01/01/98 | 31/12/00 |
| **Johnsen, Geir (1)** | 1961 | NO | Adjunct Associate Prof | 20 | AB | 01/07/02 | 31/12/03 |
| **Johnsen, Geir (2)** | 1961 | NO | Adjunct Professor | 20 | AB | 01/01/04 | |
| **Jonsdottir, Ingibjørg** | 1955 | IS | Professor | 100 | AB | 01/09/00 | 31/08/06 |
| **Jørgensen, Tore S** | 1947 | NO | Director | 100 | Administration | 01/07/93 | 31/07/95 |
| **Juliussen, Håvard** | 1977 | NO | Postdoctoral Fellow | 100 | AG | 01/05/07 | 31/07/10 |
| **Kallenborn, Roland (1)** | 1960 | DE | Associate Professor | 100 | AT | 01/08/05 | 05/12/06 |
| **Kallenborn, Roland (2)** | 1960 | DE | Professor | 100 | AT | 06/12/06 | 31/07/08 |
| **Kallenborn, Roland (3)** | 1960 | DE | Adjunct Professor | 20 | AT | 01/08/08 | |
| **Kangas, Tor Villy** | 1956 | NO | Research Assistant | 100 | AGF | 26/02/01 | 15/05/01 |
| **Karlsen, John Inge** | 1961 | NO | Staff Engineer | 100 | Logistics | 01/09/04 | 30/11/11 |
| **Keck, Aleksander** | 1954 | DE | Associate Professor | 100 | AB | 01/06/94 | 31/12/96 |
| **Ketil Rønning** | 1972 | NO | Higher Executive Officer | 100 | Information | 01/02/04 | 31/07/06 |
| **Kiil, Randi** | 1950 | NO | Executive Officer | 100 | Library | 21/08/95 | 31/07/97 |
| **Kildal, Frithjof (1)** | 1957 | NO | Operating Technician | 100 | Maintenance | 01/05/99 | 31/07/12 |
| **Kildal, Frithjof (2)** | 1957 | NO | Operating Manager | 100 | Maintenance | 01/08/12 | |
| **Killingtveit, Ånund** | 1946 | NO | Adjunct Professor | 20 | AT | 01/01/98 | 30/06/01 |
| **Kilpeläinen, Tiina** | 1982 | FI | PhD Candidate | 100 | AGF | 01/05/07 | 30/04/11 |
| **Klanderud, Kari** | 1965 | NO | Assistant Professor | 100 | AB | 01/08/03 | 31/12/03 |
| **Kolbjørnsen, Petter** | 1958 | NO | Higher Executive Officer | 100 | Logistics | 01/04/97 | 31/07/98 |
| **Kolnes, Ingvild** | 1986 | NO | Higher Executive Officer | 100 | Reception | 14/06/11 | 09/12/11 |
| **Kovacs, Kit M. (1)** | 1956 | CA | Associate Professor | 100 | AB | 01/03/97 | 30/04/99 |
| **Kovacs, Kit M. (2)** | 1956 | CA | Professor | 100 | AB | 01/05/99 | 31/08/99 |
| **Kovacs, Kit M. (3)** | 1956 | CA | Adjunct Professor | 20 | AB | 01/08/04 | |

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|---|---|---|---|---|---|---|---|
| **Kristensen, Lene** | 1974 | DK | PhD Candidate | 100 | AG | 17/11/04 | 16/11/08 |
| **Kristoffersen, Christin** | 1973 | NO | Head of Department | 100 | Academic affairs | 01/02/09 | 25/10/11 |
| **Kuckero, Lilith** | 1983 | DE | Staff Engineer | 100 | AB | 07/11/12 | |
| **Kvernelv, Wenche** | 1963 | NO | Higher Executive Officer | 100 | Salary | 04/06/12 | |
| **Lagerborg, Mikael** | 1959 | SE | Librarian | 100 | Library | 01/06/07 | 30/09/09 |
| **Landl, Barbara** | 1977 | AT | Secretary | 100 | Reception | 14/06/99 | 20/08/99 |
| **Landvik, Jon Y. (1)** | 1955 | NO | Associate Professor | 100 | AG | 15/07/93 | 30/04/96 |
| **Landvik, Jon Y. (2)** | 1955 | NO | Professor | 100 | AG | 01/05/96 | 14/07/00 |
| **Langvatn, Rolf (1)** | 1941 | NO | Associate Professor | 100 | AB | 01/08/96 | 30/04/99 |
| **Langvatn, Rolf (2)** | 1941 | NO | Professor | 100 | AB | 01/05/99 | 31/07/05 |
| **Larsen, Elisabeth** | 1979 | NO | Cleaning Officer | 100 | Cleaning | 15/06/99 | 10/08/99 |
| **Larsen, Jan Otto (1)** | 1943 | NO | Associate Professor | 100 | AT | 01/08/05 | 15/10/07 |
| **Larsen, Jan Otto (2)** | 1943 | NO | Adjunct Associate Prof | 20 | AT | 16/10/07 | 31/12/10 |
| **Larsen, Jan Otto (3)** | 1943 | NO | Associate Professor | 100 | AT | 01/01/11 | |
| **Larsen, Tove Kaldbekken** | 1949 | NO | Cleaning Officer | 85/100 | Cleaning | 01/04/99 | 31/03/05 |
| **Lebesbye, Erland** | 1953 | NO | Assistant Professor | 100 | AG | 01/12/93 | 31/08/99 |
| **Lervik, Sølvi Janita** | 1974 | NO | Higher Executive Officer | 100 | Reception/travel | 01/09/08 | |
| **Leu, Eva** | 1975 | DE | Postdoctoral Fellow | 100 | AB | 01/11/10 | 30/04/11 |
| **Lischka, Silke** | 1967 | DE | PhD Candidate | 100 | AB | 07/08/98 | 31/07/99 |
| **Loe, Leif Egil** | 1973 | NO | PhD Candidate | 100 | AB | 01/01/01 | 31/12/03 |
| **Lønne, Gerd Stenseth (1)** | 1957 | NO | Senior Secretary | 50 | Reception | 30/08/99 | 22/12/00 |
| **Lønne, Gerd Stenseth (2)** | 1957 | NO | Higher Executive Officer | 20 | Reception | 01/11/09 | 30/09/10 |
| **Lønne, Ida** | 1959 | NO | Associate Professor | 100 | AG | 01/04/97 | 30/06/03 |
| **Lønne, Ole Jørgen (1)** | 1954 | NO | Associate Professor | 100 | AB | 01/01/97 | 31/12/02 |
| **Lønne, Ole Jørgen (2)** | 1954 | NO | Associate Professor | 100 | AB | 25/08/08 | |
| **Lønnum, Lasse (1)** | 1960 | NO | Director | 100 | Administration | 01/08/98 | 31/07/02 |
| **Lønnum, Lasse (2)** | 1960 | NO | Senior Adviser | 20 | Administration | 01/08/02 | 31/07/03 |
| **Lønnum, Lasse (3)** | 1960 | NO | Director | 100 | Administration | 01/04/04 | 31/03/06 |
| **Lønnum, Merethe** | 1963 | NO | Executive Officer | 100 | Finance | 15/08/04 | 31/07/06 |
| **Lorentzen, Dag (1)** | 1967 | NO | PhD Candidate | 100 | AGF | 10/01/96 | 31/07/98 |
| **Lorentzen, Dag (2)** | 1967 | NO | Assistant Professor | 100 | AGF | 01/08/98 | 31/07/99 |
| **Lorentzen, Dag (3)** | 1967 | NO | Associate Professor | 100 | AGF | 13/08/01 | 24/02/08 |
| **Lorentzen, Dag (4)** | 1967 | NO | Professor | 100 | AGF | 25/02/08 | |
| **Løset, Sveinung** | 1956 | NO | Adjunct Professor | 20 | AT | 01/01/97 | |
| **Lüthje, Charlotta Jenny** | 1974 | SE | PhD Candidate | 100 | AG | 06/09/04 | 05/09/07 |
| **Lyså, Astrid** | 1963 | NO | Associate Professor | 100 | AG | 01/08/95 | 31/12/95 |
| **Månum, Katharina (1)** | 1978 | NO | Executive Officer | 100 | Academic affairs | 01/02/06 | 31/07/06 |
| **Månum, Katharina (2)** | 1978 | NO | Higher Executive Officer | 100 | Academic affairs | 01/08/06 | 31/12/11 |
| **Marchenko, Aleksey (1)** | 1960 | RU | Associate Professor | 100 | AT | 01/09/06 | 01/09/09 |
| **Marchenko, Aleksey (2)** | 1960 | RU | Professor | 100 | AT | 02/09/09 | |
| **Marchenko, Nataly (1)** | 1966 | RU | Research Assistant | 100 | AT | 01/01/07 | 31/12/10 |
| **Marchenko, Nataly (2)** | 1966 | RU | Researcher | 100 | AT | 01/01/11 | |
| **Markusson, Eystein (1)** | 1970 | NO | Higher Executive Officer | 100 | Administration | 05/01/00 | 31/07/06 |
| **Markusson, Eystein (2)** | 1970 | NO | Adviser | 100 | Academic affairs | 01/08/06 | 31/03/07 |
| **Markusson, Eystein (3)** | 1970 | NO | Head of Department | 100 | Academic affairs | 01/04/07 | 30/09/08 |
| **Marquardt, Miriam** | 1984 | DE | PhD Candidate | 100 | AB | 07/01/12 | |
| **Mercadal, Sofia** | 1982 | NO | Executive Officer | 100 | Reception | 05/11/12 | |
| **Meshram, Archana** | 1980 | IN | PhD Candidate | 100 | AB | 04/01/10 | |
| **Midtkandal, Ivar** | 1975 | NO | Associate Professor | 100 | AG | 12/04/12 | |
| **Misund, Ole Arve** | 1957 | NO | Managing Director | 100 | Administration | 01/03/12 | |
| **Moen, Jøran (1)** | 1963 | NO | Associate Professor | 100 | AGF | 05/01/94 | 30/04/99 |
| **Moen, Jøran (2)** | 1963 | NO | Professor | 100 | AGF | 01/05/99 | 31/12/99 |

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|---|---|---|---|---|---|---|---|
| **Moen, Jøran (3)** | 1963 | NO | Adjunct Professor | 20 | AGF | 01/07/00 | |
| **Mølmann. Truls (1)** | 1952 | NO | Assistant Professor | 80 | AT | 01/08/96 | 15/10/99 |
| **Mølmann, Truls (2)** | 1952 | NO | Adjunct Assistant Professor | 20 | AT | 16/10/99 | 31/12/99 |
| **Moslet, Per Olav** | 1976 | NO | PhD Candidate | 100 | AT | 18/02/02 | 17/02/05 |
| **Moxnes, Kari** | 1959 | NO | Adviser | 100 | Academic affairs | 23/07/12 | |
| **Müller, Eike (1)** | 1973 | DE | PhD Candidate | 100 | AB | 01/09/07 | 31/08/11 |
| **Müller, Eike (2)** | 1973 | DE | Associate Professor | 100 | AB | 01/07/12 | 31/07/12 |
| **Mundra, Sunil** | 1983 | IN | PhD Candidate | 100 | AB | 20/11/11 | |
| **Nagy, Jenö** | 1938 | NO | Adjunct Professor | 20 | AG | 01/08/96 | 31/07/01 |
| **Neumann, Ulrich (1)** | 1978 | DE | Technician | 100 | Logistics | 15/01/07 | 31/12/07 |
| **Neumann, Ulrich (2)** | 1978 | DE | Senior Research Technician | 100 | AG | 01/01/08 | 31/12/09 |
| **Nichols, Gary** | 1957 | UK | Professor | 100 | AG | 15/06/04 | 31/05/06 |
| **Nielsen, Tove** | 1955 | DK | Associate Professor | 100 | AG | 01/12/04 | 30/11/06 |
| **Nilsen, Frank (1)** | 1971 | NO | Assistant Professor | 100 | AGF | 01/01/01 | 30/06/01 |
| **Nilsen, Frank (2)** | 1971 | NO | Associate Professor | 100 | AGF | 01/07/01 | |
| **Nilsen, Rune** | 1955 | NO | Assistant Professor | 100 | AB | 01/07/95 | 30/06/97 |
| **Noormets, Riko** | 1967 | EE | Associate Professor | 100 | AG | 01/04/08 | |
| **Nøst, Ole Anders** | 1965 | NO | Adjunct Associate Prof | 20 | AGF | 01/11/04 | 31/10/07 |
| **Nygård, Henrik** | 1979 | FI | PhD Candidate | 100 | AB | 15/01/07 | 14/01/11 |
| **Nygard, Jarle** | 1957 | NO | Director | 100 | Administration | 01/08/95 | 31/08/98 |
| **Ogata, Kei** | 1980 | IT | Postdoctoral Fellow | 100 | AG | 01/11/10 | |
| **Oksavik, Kjellmar (1)** | 1974 | NO | Associate Professor | 100 | AGF | 01/09/07 | 24/02/08 |
| **Oksavik, Kjellmar (2)** | 1974 | NO | Professor | 100 | AGF | 25/02/08 | 31/07/11 |
| **Olaussen, Snorre (1)** | 1946 | NO | Professor | 100 | AG | 01/01/10 | |
| **Olaussen, Snorre (2)** | 1946 | NO | Adjunct Professor | 20 | Co2 | 01/01/12 | |
| **Olsen, Rolf Arnt** | 1939 | NO | Adjunct Professor | 20 | AB | 01/02/97 | 31/01/08 |
| **Olstad, Arne Kristian** | 1966 | NO | Staff Engineer | 100 | Logistics | 01/10/10 | 31/12/10 |
| **Onarheim, Sølvi** | 1970 | NO | Higher Executive Officer | 100 | Reception | 28/11/10 | 31/12/11 |
| **Osmundsen, Per Terje** | 1962 | NO | Adjunct Professor | 20 | AG | 01/01/08 | |
| **Pearce, David A.** | 1969 | UK | Adjunct Associate Prof | 20 | AB | 01/01/10 | |
| **Persson, Malin** | 1974 | SE | Secretary | 100 | Reception | 01/12/04 | 30/11/05 |
| **Pettersen, Gerd (1)** | 1954 | NO | Higher Executive Officer | 100 | Administration | 28/07/97 | 31/12/97 |
| **Pettersen, Gerd (2)** | 1954 | NO | Head of Office | 100 | Administration | 01/01/98 | 30/04/99 |
| **Prick, Angelique (1)** | 1970 | BE | Postdoctoral Fellow | 100 | AG | 01/06/01 | 01/07/03 |
| **Prick, Angelique (2)** | 1970 | BE | Higher Executive Officer | 100 | AG | 01/05/05 | 30/09/07 |
| **Quillfeldt, Cecilie Hellum von** | 1962 | NO | Postdoctoral Fellow | 100 | AB | 01/08/97 | 31/05/99 |
| **Råmunddal, Gro Heidi** | 1965 | NO | Senior Librarian | 100 | Library | 01/07/12 | |
| **Rasmussen, Tine** | 1958 | DK | Associate Professor | 100 | AG | 01/10/01 | 30/09/04 |
| **Reeh, Niels** | 1940 | DK | Professor | 100 | AGF | 01/01/01 | 30/06/01 |
| **Renaud, Paul** | 1964 | FR | Adjunct Professor | 20 | AB | 01/08/08 | |
| **Rønneberg, Ragnhild (1)** | 1954 | NO | Senior Adviser | 20 | SIOS | 15/02/10 | |
| **Rønneberg, Ragnhild (2)** | 1954 | NO | Managing director | 100 | Co2 | 01/01/12 | |
| **Roy, Srikumar** | 1984 | IN | PhD Candidate | 100 | AG | 10/01/11 | |
| **Rugtvedt, Stian** | 1973 | NO | Civilian Worker/Technician | 100 | Logistics | 05/08/98 | 31/05/99 |
| **Sælthun, Nils Roar** | 1946 | NO | Adjunct Professor | 20 | AT | 01/10/12 | 31/12/12 |
| **Sand, Gunnar (1)** | 1951 | NO | Director | 100 | Administration | 01/07/06 | 31/12/11 |
| **Sand, Gunnar (2)** | 1951 | NO | Senior Adviser | 20 | Co2 | 01/01/12 | |
| **Sand, Knut** | 1954 | NO | Associate Professor | 100 | AG | 01/09/96 | 31/08/99 |
| **Sandaker, Knut** | 1966 | NO | Staff Engineer | 100 | Instrumentation | 11/01/99 | 31/12/01 |
| **Sandven, Stein** | 1952 | NO | Adjunct Professor | 20 | AGF | 01/04/06 | |
| **Schancke, Audhild** | 1951 | NO | Director | 100 | Administration | 01/09/02 | 30/04/04 |
| **Seglsten, Liv-Hege** | 1971 | NO | Higher Executive Officer | 100 | Finance | 01/06/06 | 31/08/08 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sevestre, Heidi** | 1988 | FR | PhD Candidate | 100 | AG | 03/10/11 | |
| **Shafrova, Svetlana** | 1978 | RU | PhD Candidate | 100 | AT | 15/08/03 | 14/08/06 |
| **Shestov, Aleksey** | 1985 | RU | PhD Candidate | 100 | AT | 01/10/08 | 31/12/12 |
| **Shumilov, Nikita (1)** | 1968 | RU | Technician | 100 | AGF | 15/10/98 | 30/04/99 |
| **Shumilov, Nikita (2)** | 1968 | RU | PhD Candidate | 100 | AGF | 29/10/01 | 05/03/02 |
| **Sigernes, Fred (1)** | 1966 | NO | Research Assistant | 100 | AGF | 11/08/93 | 31/12/96 |
| **Sigernes, Fred (2)** | 1966 | NO | Associate Professor | 100 | AGF | 01/08/98 | 07/06/06 |
| **Sigernes, Fred (3)** | 1966 | NO | Professor | 100 | AGF | 08/06/06 | |
| **Sigernes, Gerd Irene (2)** | 1967 | NO | Staff Engineer | 100 | Laboratory | 01/08/08 | |
| **Sinitsyn, Anatoly** | 1983 | RU | Postdoctoral Fellow | 100 | AT | 09/01/12 | |
| **Sjöblom, Anna (1)** | 1972 | SE | Associate Professor | 100 | AGF | 01/08/03 | 31/12/03 |
| **Skjæveland, Åsmund** | 1979 | NO | PhD Candidate | 100 | AGF | 01/01/08 | 31/12/10 |
| **Skogseth, Ragnheid (1)** | 1973 | NO | PhD Candidate | 100 | AGF | 01/08/01 | 31/12/03 |
| **Skogseth, Ragnheid (2)** | 1973 | NO | Postdoctoral Fellow | 100 | AGF | 01/01/04 | 31/12/07 |
| **Skogseth, Ragnheid (3)** | 1973 | NO | Researcher | 100 | AGF | 01/01/08 | |
| **Slubowska, Marta** | 1976 | PL | PhD Candidate | 100 | AG | 01/03/02 | 28/02/05 |
| **Smyrak-Sikora, Aleksandra** | 1984 | PL | PhD Candidate | 100 | AG | 01/03/12 | |
| **Solheim, Anders** | 1953 | NO | Adjunct Professor | 20 | AG | 01/08/01 | 31/07/06 |
| **Søreide, Janne (1)** | 1973 | NO | Postdoctoral Fellow | 100 | AB | 01/04/07 | 31/03/11 |
| **Søreide, Janne (2)** | 1973 | NO | Researcher | 100 | AB | 01/04/11 | |
| **Søvik, Guldborg** | 1970 | NO | PhD Candidate | 100 | AB | 01/08/97 | 11/09/98 |
| **Spjelkavik, Sigmund** | 1952 | NO | Associate Professor | 100 | AB | 01/06/94 | 31/05/00 |
| **Stangeland, Lars Frode** | 1980 | NO | Staff Engineer | 100 | Marine operations | 09/01/12 | |
| **Steel, Ron** | 1945 | UK | Adjunct Professor | 20 | AG | 01/08/95 | 31/07/05 |
| **Stemmerik, Lars** | 1956 | DK | Adjunct Professor | 20 | AG | 01/01/12 | |
| **Stiberg, Kine** | 1976 | NO | Executive Officer | 40 | Administration | 01/07/12 | |
| **Stien, Audun** | 1967 | NO | Postdoctoral Fellow | 100 | AB | 01/01/01 | 31/01/02 |
| **Storleer, Stein Michael** | 1957 | NO | Head of Student Affairs | 100 | Academic affairs | 24/07/95 | 31/07/98 |
| **Størseth, Ivar** | 1961 | NO | Technician | 100 | Logistics | 01/03/96 | 30/04/97 |
| **Storvik, Nina Elisabeth (1)** | 1976 | NO | Higher Executive Officer | 100 | Archives | 24/09/07 | 31/08/10 |
| **Storvik, Nina Elisabeth (2)** | 1976 | NO | Head of Records | 100 | Archives | 01/09/10 | |
| **Strømseng, Elise (1)** | 1982 | NO | Higher Executive Officer | 40/100 | Academic affairs | 20/08/07 | 31/12/10 |
| **Strømseng, Elise (2)** | 1982 | NO | Adviser | 100 | Academic affairs | 01/01/11 | |
| **Strub-Klein, Lucie** | 1984 | FR | PhD Candidate | 100 | AT | 27/08/07 | 26/08/11 |
| **Stübner, Eike** | 1981 | DE | PhD Candidate | 100 | AB | 01/11/10 | |
| **Stuliy, Alexei** | 1969 | RU | PhD Candidate | 100 | AGF | 01/06/02 | 31/05/05 |
| **Sund, Monica** | 1971 | NO | PhD Candidate | 100 | AG | 01/01/07 | 31/12/10 |
| **Sundfjord, Arild** | 1970 | NO | Research Assistant | 100 | AGF | 14/04/98 | 26/06/98 |
| **Svenøe, Trond (1)** | 1962 | NO | PhD Candidate | 100 | AGF | 01/07/94 | 31/12/95 |
| **Svenøe, Trond (2)** | 1967 | NO | Associate Professor | 100 | AGF | 01/01/01 | 30/06/01 |
| **Teigen, Sigurd Henrik** | 1980 | NO | PhD Candidate | 100 | AGF | 01/01/07 | 31/12/10 |
| **Thiede, Jørn** | 1941 | DE | Adjunct Professor | 20 | AG | 01/11/07 | 31/10/10 |
| **Thiis, Thomas K.** | 1970 | NO | PhD Candidate | 100 | AGF | 01/02/98 | 30/04/98 |
| **Trümper, Monika** | 1977 | DE | PhD Candidate | 100 | AT | 01/08/06 | 31/07/10 |
| **Tverberg, Vigdis (1)** | 1962 | NO | Associate Professor | 100 | AGF | 01/10/93 | 31/07/97 |
| **Tverberg, Vigdis (2)** | 1962 | NO | Postdoctoral Fellow | 100 | AGF | 01/08/97 | 30/06/00 |
| **Vader, Anna (1)** | 1967 | NO | Postdoctoral Fellow | 80 | AB | 01/04/10 | 31/05/12 |
| **Vader, Anna (2)** | 1967 | NO | Researcher | 80 | AB | 01/06/12 | |
| **Valtyrson, Linda** | 1964 | NO | Higher Executive Officer | 100 | Academic affairs | 20/07/98 | 01/12/99 |
| **Varpe, Øystein (1)** | 1975 | NO | Postdoctoral Fellow | 100 | AB | 01/06/07 | 14/01/10 |
| **Varpe, Øystein (2)** | 1975 | NO | Researcher | 100 | AB | 15/01/10 | 31/12/10 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Varpe, Øystein (3)** | 1975 | NO | Adjunct Associate Prof | 20 | AB | 01/05/12 | |
| **Veiberg, Vebjørn** | 1970 | NO | PhD Candidate | 100 | AB | 01/01/04 | 31/12/06 |
| **Vihma, Timo Pekka** | 1963 | FI | Adjunct Associate Prof | 20 | AGF | 01/06/12 | |
| **Vinje, Ingrid (1)** | 1966 | NO | Higher Executive Officer | 100 | Finance/Human resources | 01/08/99 | 30/04/05 |
| **Vinje, Ingrid (2)** | 1966 | NO | Higher Executive Officer | 100 | Human resourses | 24/06/12 | |
| **Vogedes, Daniel** | 1974 | DE | PhD Candidate | 100 | AB | 01/09/05 | 31/08/09 |
| **Votvik, Monica** | 1969 | NO | Staff Engineer | 100 | Logistics | 07/01/08 | 31/10/12 |
| **Winther, Jan-Gunnar** | 1962 | NO | Adjunct Professor | 20 | AT | 01/10/02 | 30/06/08 |
| **Wolfe, Alexander P.** | 1966 | CA | Associate Professor | 100 | AG | 22/07/04 | 19/08/05 |
| **Woxholth, Kristin** | 1979 | NO | Executive Officer | 100 | Reception | 01/11/06 | 31/08/07 |
| **Wrangborg, David** | 1982 | SE | PhD Candidate | 100 | AT | 09/01/12 | |
| **Yulmetov, Renat** | 1988 | RU | PhD Candidate | 100 | AT | 09/01/12 | |
| **Ødegård, Rune** | 1958 | NO | Associate Professor | 100 | AG | 01/06/94 | 30/07/96 |
| **Østerhaug, Reidar** | 1948 | NO | Higher Executive Officer | 100 | Academic affairs | 01/08/93 | 30/07/95 |
| **Aars, Jon** | 1966 | NO | Adjunct Associate Prof | 20 | AB | 01/08/04 | 31/07/11 |

AB=Arctic Biology Department. AG=Arctic Geology Department. AGF=Arctic Geophysics Department.

Maiden name -> Married name
Andersen, Gerd Irene -> Sigernes, Gerd Irene
Sjöblom, Anna -> Coulson, Anna Sjöblom
Slubowska, Marta -> Woldengen-Slubowska, Marta A.
Storemark, Katharina -> Månum, Katharina

# PhD candidates at UNIS 1993-2013

This table provides an overview of persons awarded a PhD (Dr. scient., Dr. ing. and Dr. philos. Degree) conducted fully or partly at UNIS (degrees awarded by mainland universities).[17]

| Year | Name of the candidate | Title of the thesis | Mainland university | UNIS dep |
|---|---|---|---|---|
| **1996** | Sigernes, Fred | Optical studies of proton aurora | Universitetet i Tromsø | AGF |
| **1998** | Hole, Lars Robert | Sound propagation in the atmospheric boundary layer: an experimental and theoretical study | Universitetet i Bergen | AGF |
| **1998** | Ren, Pu Bu Ci | Solar ultraviolet radiation on the Tibetan Plateau: measurement and modeling | Universitetet i Bergen | AGF |
| **1999** | Haugan, Peter Mosby | On transports of mass, heat and carbon in the Arctic Mediterranean | Universitetet i Bergen | AGF |
| **1999** | Lorentzen, Dag | Auroral signatures of dayside particle precipitation in the polar cap boundary region: modeling and measurements | Universitetet i Tromsø | AGF |
| **2000** | Høyland, Knut V. | Measurements and simulations of the consolidation in first-year sea ice ridges, and some aspects of mechanical behaviour | Norges teknisk-naturvitenskapelige universitet, Trondheim | AT |
| **2000** | Svenøe, Trond | Re-evaluation, statistical analysis and prediction based on the Tromsø total ozone record | Universitetet i Tromsø | AGF |
| **2000** | Thiis, Thomas K. | Experimental validations of numerical simulations of snowdrifts around buildings and in terrain | Norges teknisk-naturvitenskapelige universitet, Trondheim | AGF |
| **2001** | Hygen, Hans Olav | On the relationship between large scale atmospheric circulation pattern and sound propagation on a local scale: an experimental study | Universitetet i Bergen | AGF |
| **2001** | Jaedicke, Christian | Drifting snow and snow accumulation in complex Arctic terrain: field experiments and numerical modelling | Universitetet i Bergen | AGF |
| **2001** | Saloranta, Tuomo M. | The sea west of Svalbard: structures, trends and variability in hydrography | Universitetet i Bergen | AGF |
| **2002** | Bruland, Oddbjørn | Dynamics of the seasonal snowcover in the Arctic | Norges teknisk-naturvitenskapelige universitet, Trondheim | AT |
| **2002** | Lokrantz, Hanna | Pleistocene stratigraphy, ice sheet history and environmental development in the southern Kara Sea area, Arctic Russia | Göteborgs universitet | AG |
| **2002** | Oksavik, Kjellmar | A study of temporal and spatial variations in the polar cusp/cleft region using multi-instrument techniques | Universitetet i Bergen | AGF |
| **2002** | Søvik, Guldborg | Population biology and life history of the oribatid mite Ameronothrus lineatus in a high arctic site | Universitetet i Oslo | AB |
| **2003** | Birkely, Sten-Richard (previously Richardsen) | Biology and ecology of selected marine cold-water organisms in the Arctic | Universitetet i Tromsø | AB |
| **2003** | Skogseth, Ragnheid | Dense water production processes in Storfjorden | Universitetet i Bergen | AGF |

[17] As UNIS is not the awarding institution, UNIS has no formal register of the PhD candidates. The list of PhD candidates is compiled with information from archives and lists not kept fully updated. Annual reports and personal communication have contributed to some entries. The bibliographic information is verified in library catalogues. The compilation stopped on 2 August 2013.

| | | | | |
|---|---|---|---|---|
| **2004** | Gelsor, Norsang | Studies on solar ult[r]aviolet radiation and ozone over the Tibetan Plateau: based on satellite data and ground measurements | Universitetet i Bergen | AGF |
| **2004** | Kuklinski, Piotr | Ecology of bryozoans from Svalbard waters | Polish Academy of Sciences | AB |
| **2004** | Loe, Leif Egil | Patterns and processes in the life history of red deer | Universitetet i Oslo | AB |
| **2004** | Nicholson, Lindsey | Modelling melt beneath supraglacial debris: implications for the climatic response of debris-covered glaciers | University of St. Andrews | AG |
| **2004** | Partamies, Noora | Meso-scale aroral physics from ground-based observations | University of Helsinki | AGF |
| **2004** | Zielke, Matthias | Diversity and nitrogen fixation activity of cyanobacterial communities in terrestrial arctic ecosystems | Universitetet i Tromsø | AB |
| **2005** | Arndt, Carolin | Ecosystem dynamics in Arctic sea ice: the impact of physical and biological processes on the occurrence and distribution of sympagic amphipods | Universitetet i Tromsø | AB |
| **2005** | Behlke, Rico | Dissipation at the Earth's Quasi-Parallel Bow Shock | Uppsala universitet | AGF |
| **2005** | Drage, Magne Andersen | Atmospheric icing and meteorological variables: full scale experiment and testing of models | Universitetet i Bergen | AGF |
| **2005** | Gornall, Jemma | The functional role of mosses in arctic ecosystems | University of Aberdeen | AB |
| **2005** | Liferov, Pavel | First-year ice ridge scour and some aspects of ice rubble behavior | Norges teknisk-naturvitenskapelige universitet, Trondheim | AT |
| **2006** | Ross, Neil | A re-evaluation of the origins of Late Quaternary ramparted depressions in Wales | Cardiff University | AG |
| **2006** | Slubowska, Marta A. (Slubowska-Woldengen after marrying) | Last deglaciation and Holocene reconstructions of Atlantic water flow variability to the Nordic and Barents Seas with a special emphasis on the Svalbard continental margin | Universitetet i Tromsø | AG |
| **2006** | Widell, Karolina | Ice-ocean interaction and the under-ice boundary layer in an Arctic fjord | Universitetet i Bergen | AGF |
| **2007** | Hübner, Christiane | Spring stopover in the Arctic: implications for migrating geese and their food plants | Universitetet i Tromsø | AB |
| **2007** | Juliussen, Håvard | Near-surface ground thermal regime in permafrost areas of Norway and Svalbard: processes and geomorphic implications | Universitetet i Oslo | AG |
| **2007** | Maus, Sönke | On brine entrapment in sea ice: morphological stability, microstructure and convection | Universitetet i Bergen | AGF |
| **2007** | Moslet, Per Olav | In-situ measurements of sea-ice parameters that affect the loads on coastal and offshore structures | Norges teknisk-naturvitenskapelige universitet, Trondheim | AT |
| **2007** | Shafrova, Svetlana | First-year sea ice features: investigation of ice field strength heterogeneity and modelling of ice rubble behaviour | Norges teknisk-naturvitenskapelige universitet, Trondheim | AT |
| **2007** | Veiberg, Vebjørn | Patterns, causes and consequences of tooth wear in cervids | Universitetet i Oslo | AB |

| Year | Name of the candidate | Title of the thesis | Mainland university | UNIS dep |
|---|---|---|---|---|
| **2008** | Daase, Malin | Mesozooplankton distribution in Svalbard waters: Calanus spp. and its relationship to hydrographic variability | Universitetet i Bergen | AB |
| **2008** | Faksness, Liv-Guri | Weathering of oil under Artic conditions: distribution and toxicity of water soluble oil components dissolving in seawater and migrating through sea ice: a combined laboratory and field study | Universitetet i Bergen | AT |
| **2008** | Holmgren, Sofia | Marked 20th Century Stratigraphical Changes in Lake Sediments from Western Spitsbergen, Svalbard | University of Gothenburg | AG |
| **2008** | Lüthje, Charlotta Jenny | Transgressive development of coal-bearing coastal plain to shallow marine setting in a flexural compressional basin, Paleocene, Svalbard, Arctic Norway | Universitetet i Bergen | AG |
| **2009** | Fausto, Robert Schjøtt | Improving surface boundary conditions for large-scale ice sheet models of Greenland | University of Copenhagen | AGF |
| **2009** | Kristensen, Lene | Glacier surges and landforms in a permafrost environment at the tidewater glacier Paulabreen, inner Van Mijenfjorden, Svalbard | Universitetet i Oslo | AG |
| **2009** | Lunde, June | Particle precipitation: effects on selected ionospheric phenomena | Universitetet i Tromsø | AGF |
| **2009** | Schütte, Ursel M.E. | Spatial and temporal patterns of bacterial communities in a high Arctic glacier foreland | University of Idaho | AB |
| **2009** | Sirevaag, Anders | Small-scale dynamics of the under-ice boundary layer | Universitetet i Bergen | AGF |
| **2009** | Speed, James D.M. | Ecosystem engineers of the tundra: the impacts and extent of goose herbivory in the high Arctic | University of Aberdeen | AB |
| **2009** | Søndergaard, Jens | Contamination from Arctic coal mining | Københavns universitet | AT |
| **2009** | Volent, Zsolt | Remote sensing of marine environment: applied surveillance with focus on optical properties of phytoplankton, coloured organic matter and suspended matter | Norges teknisk-naturvitenskapelige universitet, Trondheim | AGF |
| **2010** | Caline, Fabrice | Coastal-sea-ice action on a breakwater in a microtidal inlet in Svalbard | Norges teknisk-naturvitenskapelige universitet, Trondheim | AT |
| **2010** | Dyrland, Margit Elisabeth | Multi-instrument studies of polar mesopause region temperature and airglow variability | Universitetet i Tromsø | AGF |
| **2010** | Gulley, Jason Daniel | Mechanisms of englacial conduit formation and their implications for subglacial recharge | University of Florida | AG |
| **2010** | Hollesen, Jørgen | Subsurface temperature modelling in permafrost areas: with a focus on modelling processes and remediation actions in heat-producing mine waste piles and soils | University of Copenhagen | AT |
| **2010** | Rinne, Yvonne | EISCAT Svalbard Radar studies of meso-scale plasma flow channels in the polar cusp ionosphere | Universitetet i Oslo | AFG |
| **2011** | Ávila Jiménes, Maria Luisa | High arctic invertebrate biogeography: patterns and colonization processes since the last glacial maximum | Universitetet i Bergen | AB |
| **2011** | Bælum, Karoline | Geophysical and geological investigations of subsurface reservoirs: case studies of Spitsbergen, Norway | Universitetet i Bergen | AG |
| **2011** | Johnsen, Magnar Gullikstad | The dayside open/closed field line boundary: ground-based optical determination and examination | Universitetet i Tromsø | AGF |
| **2011** | Kilpeläinen, Tiina | The atmospheric boundary layer over arctic fjords | Universitetet i Bergen | AGF |

| Year | Name of the candidate | Title of the thesis | Mainland university | UNIS dep |
|---|---|---|---|---|
| **2011** | Müller, Eike | Dispersal and recruitment in the Arctic: studies of migration and germination in arctic-alpine vascular plants | Universitetet i Tromsø | AB |
| **2011** | Nygård, Henrik | Scavenging amphipods in the high Arctic: studies of benthic and sympagic amphipods in the genera Onisimus and Anonyx | Universitetet i Tromsø | AB |
| **2011** | Sinitsyn, Anatoly | Obosnovanie stroitel'stva svajnych fundamentov v plastično-mer zlych gruntach | St. Petersburg State Polytechnical University | AT |
| **2011** | Sund, Monica | On the dynamics of surge-type and tidewater glaciers in Svalbard | Universitetet i Oslo | AG |
| **2011** | Tandberg, Anne Helene Solberg | Studies on the amphipod genus Metopa (Stenothoidae): taxonomy, ecology, phylogeny | Universitetet i Tromsø | AB |
| **2011** | Teigen, Sigurd Henrik | Water mass exchange in the sea west of Svalbard: a process study of flow instability and vortex generated heat fluxes in the West Spitsbergen current | Universitetet i Bergen | AGF |
| **2012** | Banwell, Alison | Modelling the hydrology of the Greenland Ice Sheet | University of Cambridge | AG |
| **2012** | Bjarnadottir, Lilja Run | Processes and dynamics during deglaciation of a polar continental shelf: examples from the marine-based Barents Sea Ice Sheet | Universitetet i Tromsø | AG |
| **2012** | Carlsson, Anja Morven | Survival through the Arctic winter: Svalbard reindeer and their nematode parasites | Lancaster University | AB |
| **2012** | Clifton, Abigail Joy | The Eocene flora of Svalbard and its climate significance | University of Leeds | AG |
| **2012** | Eckerstorfer, Markus | Snow avalanches in central Svalbard: a field study of meteorological and topographical triggering factors and geomorphological significance | Universitetet i Oslo | AG |
| **2012** | Grundvåg, Sten-Andreas | Outcrop and subsurface characterization of shelf-margin clinoform systems: an integrated approach for understanding processes and controls of facies distribution and depositional architectures | Universitetet i Bergen | AG |
| **2012** | Strub-Klein, Lucie | Field measurements and analysis of the morphological, physical and mechanical properties of level ice and sea ice ridges | Norges teknisk-naturvitenskapelige universitet, Trondheim | AT |
| **2012** | Watanabe, Tatsuya | Dynamics and variability of patterned ground at a continuous permafrost site, Central Spitsbergen | University of Tsukuba | AG |
| **2013** | Gjermundsen, Endre Før | Quaternary glacial history of northern Spitsbergen, Svalbard: cosmogenic nuclide constraints on configuration, chronology and ice dynamics | Universitetet i Oslo | AG |
| **2013** | Małecki, Jakub | The present-day state of Svenbreen (Svalbard) and changes of its physical properties after the termination of the Little Ice Age | Adam Mickiewicz University in Poznań | AG |

AB=Arctic Biology Department. AG=Arctic Geology Department. AGF=Arctic Geophysics Department.

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