



*Arctic Technology
Project Catalogue*

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Introduction

In this catalog you find the projects available in 2012 for course 11427 as well as for Special Courses, Bachelor Projects and Master Projects at ARTEK. Special Courses with fieldwork in Greenland should be at least 10 ECTS. *Please be aware that the course runs over two semesters – spring and fall, and course participation is restricted to students who are present at DTU during the whole course period.*

Your study program

Students following a DTU study program *must make sure to get acceptance from their study program leader* for taking this course (usually no problem). This is in particular important for those studying Diplomingeniør.

Fieldwork in Greenland 2011

All students going to Greenland *must participate in and pass the preparatory part of 11427 during spring (workload 2.5 ECTS) in order to be eligible to go to Greenland with ARTEK.* This also goes for special course, bachelor project and master project students. Please make sure to fulfill the instructions for the report, the poster and the list of equipment given in assignment 2-5 in order to do so.

Most of the projects in this catalog require field work in Greenland. Fieldwork can in 2012 be made in Sisimiut and possibly Ilulissat or South Greenland during the period 30th of July to 16th of August 2012. However, we also offer projects for students who do not want to go to Greenland on fieldwork. In that case, please contact Gunvor.

Students, who made previous ARTEK projects with fieldwork in Greenland, study Arctic Engineering or have other special prerequisites to accomplish a field work in Greenland (e.g. lived and studied or worked in Greenland) do not need to participate in the spring lectures, but should prepare themselves and prepare assignment 2-5, and are eligible make field work elsewhere or at other points of time. Preferably at least two students should travel together in that case.

Please be aware that any *recreational activities including overnight stays away from the field destination during the fieldwork period is not accepted.* If you have excess of time during the fieldwork period we expect that you'll offer your assistance for other project activities. Private excursions may instead take place prior to or after the fieldwork period.

Supervisors

If you do not find a project or a supervisor in your field in this catalog talk to Gunvor and we will try our best to develop a project for you, however we cannot promise a project exactly according to your dreams in any field. *Please be aware that all projects with fieldwork in Greenland MUST have a main- or co-supervisor from ARTEK.*

Payment

The fee of 5.500 kr. for carrying out fieldwork in Greenland shall be paid to Ingrid Vernimmen or Niels Hoedeman at the Arctic Technology Centre. The fee has to be paid before we can book your ticket.

The fee includes:

- * flight from Copenhagen to your destination in Greenland and return
- * board and lodging in Greenland

DEADLINE for payment is Tuesday 6th of March 2012 (See further information in the back)

Arctic waste management

Wastewater

Follow up on new composting toilets in tourist huts (New 2012)

In three different touristic places around Sisimiut a new type of composting toilets developed in Iceland has been installed during winter 2011-12. The goal of this project is to follow up on the function of these toilets. This should be done by: questionnaires and interviews with users and authorities and maintainers; by visiting and making observations. Suggestions for improvements are an expected outcome of this project. **Supervisor:** Pernille Erland Jensen

Biofilters for treatment of grey wastewater in Greenland (New 2012)

In many locations in Greenland it is inconvenient or even impossible to make central sewer systems. Research has been conducted on how to treat wastewater in such locations, and it seems that a continued separation of grey and black wastewater may be beneficial, followed by aerobic or anaerobic digestion of the black wastewater fraction. The grey wastewater fraction may be treated by infiltration e.g. in biofilters. A single pilot scale study was made of this option in Sisimiut. In this project the results of the previous study should be taken into account and experiments made to establish a more fundamental understanding of the advantages, disadvantages, challenges and possibilities of this method in the Arctic. **Supervisor:** Pernille Erland Jensen

The occurrence of anti-biotic resistance in marine bacteria.

It is hypothesized that antibiotic resistance due to contamination with antibiotics, and with human bacteria carrying resistance, can be transferred to naturally occurring marine bacteria. To what extent this occurs and what the consequences are is not clear. In Greenland there is a high consumption of antibiotics and poor waste water processing, which should mean that resistance can easily spread to the environment. Earlier studies have shown that antibiotic resistance can be found in a gradient from the sources in mussels, sediment and fish. This year we aim to investigate 1) how far human induced antibiotic resistance is spread, 2) the effect on antibiotics on bacterial community structure and function, and 3) how resistance is mediated in marine bacteria from sediment, mussels and fish-guts.

Supervisor: Mia Granberg, Pernille E. Jensen.

Wastewater treatment

It was shown that bacterial contamination incl. antibiotic resistant bacteria from the sewage of Sisimiut may cause a threat of health to the population. In contrast, the outlet of nutrients is generally not alarming. In this project methods of removal of bacteria from the wastewater stream should be found and compared concerning economy, efficiency and previous experiences. The project may involve laboratory experiments. **Supervisor:** Pernille E. Jensen

Wastewater treatment in Nuuk

In this project the main goal will be to map the wastewater situation in Nuuk. There are about 15000 inhabitants in Nuuk. The municipality has 18 wastewater outlets. Mapping of the wastewater situation will include establishing an overview of number of households connected to sewage or a septic tank etc. Mapping of types and quantity of wastewater would also be relevant, as well as types of recipients. Furthermore a risk assessment could be a part of the project. Particular areas of concern Malenebugten and the outlet from Dronning Ingrid's Hospital as well as Nuuk Imeq. **Supervisors:** Pernille E. Jensen

Mapping of the wastewater situation in Narsaq/South Greenland

In this project the main goal will be to map the wastewater situation in Narsaq. Mapping of the wastewater situation will include establishing an overview of number of households connected to sewage or a septic tank etc. Mapping of types and quantity of wastewater would also be relevant, as well

as types of recipients. Furthermore a risk assessment could be a part of the project. **Supervisors:** Pernille E. Jensen

Waste handling

Waste separation in villages and towns (New 2012)

In Greenland, very little waste separation is made which results in an excessive waste load on the dump and waste incinerators. This project can focus on several aspects of waste separation: when and to which extent will it be relevant, how large a collection area is needed, economical and logistic considerations, effects on the waste incineration and benefits for the dump. Location for field work can be discussed.

Supervisor: Gunvor M. Kirkelund, Zenica Larsen (KANUKOKA)

Waste reuse in villages and towns (New 2012)

First the waste situation in the village or town will be mapped. Based on estimated and measured amounts of waste and different waste fractions an assessment of reuse potentials and solutions should be made. An evaluation of local versus centralised reuse including logistical considerations should also be made. Location for field work can be discussed.

Supervisor: Gunvor M. Kirkelund

Waste handling in blocks of flats in Sisimiut

Vi har en del boligområder i Sisimiut hvor der fortsat er affaldsskakte i opgangene. Disse skakte har det med at lugte grimt, og fordelingen af affald i enden af skakten fungerer ikke optimalt, hvorfor vi anvender en del dum tid på affaldshåndtering. Vi kunne godt tænke os en analyse af affaldshåndteringen i boligblokke, så det kan ske uden at være til gene for beboere og viceværter. En container løsning kan bruges om vinteren, men om sommeren lugter containeren ikke godt og er derfor ikke nogen hensigtsmæssig løsning. I forbindelse med denne opgave vil det være nødvendigt at inddrage Qeqqata Kommunia, for at indpasse en løsningsmulighed med kommunens planer for affaldshåndtering.

Supervisor: Gunvor M. Kirkelund, Allan Werge (INI)

Arctic mining and oil/gas exploitation

Mining potential

Rare Earth Element (REE) potential in the Kangerlussuaq Fjord Region, West Greenland (New 2012)

Rare Earth Elements or Rare Earth Metals are subject to increasing demand through the further development of greentech industries, windmills, hybrid cars, and batteries. The REE group of elements includes the lathanide series in the periodic table, along with yttrium (Y) and scandium (Sc). The sediments in the Kangerlussuaq Fjord have been proven to contain yttrium and zirconium, the latter being known for containing REE's and other valuable elements as tantalum (Ta), hafnium (Hf), and niobium (Nb). The South of Greenland, Kvanefjeldet and Kringlerne, are magmatic provinces with proven abundance of REE's. This project is an attempt to establish a further understanding of the REE potential of the region, in the magmatic province of Sukkertoppen, and in sediment cores from Kangerlussuaq, and in sediments from the glacial rivers terminating in the Kangerlussuaq settlement.

Supervisors: Johan Ploug and Morten Holtegaard Nielsen

Soil contamination and remediation

Remediation of oil-contaminated soil

Oil pollution is in particular a problem in the Arctic, since oil pollutions ad large damages to the vulnerable Arctic nature, the natural removal of the oil products are slow and the environment takes a long time to regenerate. It is therefore desirable to actively enhance the removal of the oil pollution. At ARTEK several clean up experiences have been conducted with promising results. The purpose of this project is on the basis of earlier experiences to upscale clean up of oil polluted soil in the Arctic, clarify the extent of oil pollution in Sisimiut and design a robust system by which new oil pollution easily can be added to the existing cleaning system. The project should be done in close cooperation with the Sisimiut municipality, in a way that all their needs are taken into consideration. **Supervisors:** Janne Fritt-Rasmussen, Pernille E. Jensen

Mapping, characterization and risk assessment of oil-contamination

It is hypothesized that many small oils spills exist in the town of e.g. Sisimiut. The spills may arise from e.g. private tanks with oil for heating, transport etc. The aim of this project is to locate oil contaminated sites or possible sources for oil-contamination and performs risk assessment with respect to humans and the environment. To improve our knowledge about the fate of oil spilt in Sisimiut through characterization of the oil should be performed as well. **Supervisors:** Janne Fritt-Rasmussen, Pernille E. Jensen

Environmental impact assessment

Comparison of environmental impact assessment of Greenlandic mines with legislation (New 2012)

Environmental impact assessments have been made in connection to several mining projects in Greenland, but how is the quality? And are they fulfilling international and Greenlandic laws and demands towards mining? What could be improved and should the focus change in future projects?

Supervisors: Pernille E. Jensen, Lis Bach, Karsten Klausen (GA)

Impact assessment of uranium mining (New 2012)

The Greenlandic government abandoned the 0-tolerance for mining of uranium in December 2011, which consequences will this have for the local environment, working environment and what will the environmental impact assessment show?

Supervisors: Pernille E. Jensen, Lis Bach, Karsten Klausen (GA)

Environmental impacts of the developing Greenlandic mining industry

The mining industry is developing fast in Greenland, and large projects are expected to open in the near future. In this project an overview of common environmental effects of mining should be given. Examples of effects already experienced in Greenland, and their handling must be discussed. Sampling of material from developing mines and analysing in the laboratory. The fieldwork related to this project may take place at a mining development site i.e. another place and/or time than the main group.

Supervisors: Pernille E. Jensen

Environmental impact of waste materials from aluminum plant

It has been decided to establish an aluminum plant in Greenland with an eye to utilize the big Greenlandic hydropower potential which is needed for the highly energy demanding process. The aluminum is shipped to Greenland from abroad. The aim of the project is to investigate which impact waste discharge from the planned aluminum plant would have on the environment. A comparison with the process in Iceland and its waste flow is to be made. If possible and feasible, waste material from Iceland should be collected and laboratory experiments made for environmental characterization. The fieldwork related to this project may take place at a mining development site i.e. another place and/or time than the main group. **Supervisors:** Pernille E. Jensen

Natural resource management

Natural resource technology management in the arctic - is there a need for natural resource-specific competence building (New 2012)

In economics the notion of the 'natural resource curse' is predominant. According to this line of research richness in natural resources will tend to make a country poor. Recent research has shown though, that natural resources can be bad for a country if it passively accepts the services of multinational enterprises to extract and process its natural resources, but that if a country/region is able to engage in competence building, technology development and innovation in relation to its natural resources, then it is possible to develop viable innovation systems and in turn generate economic growth and social development. Can the arctic regions use their natural richness in a process of development? How are they doing it? Can we make recommendations?

Keywords: natural resources; science and technology policy; economic development; appropriate technology; 'creative adaption' of technology developed elsewhere; LICs (learning, innovation and competence building systems)

Supervisors: Allan Dahl Andersen, Pernille E. Jensen

Arctic Infrastructure

Building materials

Use of recycled paper for insulation.

Paper can be reworked and treated by fire resistant material in a way which permits its use as insulation material in houses. Practical insulation demonstration will be made in Asaqtuaq and in Sisimiut (e.g. the low energy house) to demonstrate the effectiveness of the method. The amount of recycled paper possible to obtain in Greenland and how it can be arranged will be part of the project. Another part could focus on the insulation effect. Measurements with thermo (infrared) camera and other methods will be applied. **Supervisors:** Martin Kotol, Jing Qu, Gunvor M. Kirkelund

PCB in construction materials

PCB (polychlorinated biphenyl) was frequently used in construction until the 1970ties due to its fire resistance and softening properties. The use of PCB's are now banned due to the high toxicity and the Arctic regions already have severe problems with elevated PCB concentrations in animals and humans. When renovating and demolishing buildings, there are huge problems with PCB containing materials, how should they be treated, are there reuse options and how can the risk of exposing humans and the environment for more PCB's be limited? In this project a survey of PCB containing construction materials will be made in Nuuk, together with possible end solutions for the PCB-containing construction material. **Supervisors:** Gunvor M. Kirkelund

Roads and infrastructure

Lime stabilization of fine-grained Greenlandic sediments (New 2012)

Thick deposits of fine-grained marine sediments exist in large areas of western Greenland. Many places these sediments are located above sea-level, and now complicate construction projects in urban areas. This project includes laboratory and field studies of lime stabilization on fine-grained marine sediments in Sisimiut and/or Ilulissat. The studies will include determination of the optimum lime content and the strength development in relation to both reaction time and curing temperature. Hopefully will the results from this project lead to a future use of lime stabilization and make it possible to use/reuse materials of poor quality at construction sites in Greenland.

Supervisors: Anders Stuhr Jørgensen, Thomas Ingeman-Nielsen

Road conditions in Ilulissat (New 2012)

Field studies and site investigations of the road conditions in Ilulissat, western Greenland. The studies could include:

- Stabilization problems caused by increasing air temperatures
- Thermal modeling of the temperatures influences on the thermal regime of the roads
- Design proposals for road structure: Geotechnical and geophysical site investigations
- Exploration of relevant areas for the establishment of a new test-site

Supervisors: Anders Stuhr Jørgensen, Thomas Ingeman-Nielsen, Ujaraq Rosing Petersen (Inuplan A/S)

Alternative filler materials for road construction (New 2012)

There will be an increasing demand for raw materials for road construction in relation to new industry and relating infrastructure in Greenland (oil/gas installations, aluminium plant and mines). Also, there are waste fractions that are disposed of at the dump that has geotechnical value and can be regarded as alternative filler materials. The project can include:

- Characterisation and geotechnical tests of alternative filler materials

- Feasibility and logistic studies of transporting the filler materials from towns and villages to the actual industrial locations
- Assessment of the environmental impact on the dump and incineration plant when waste fractions are reused

Supervisors: Gunvor M. Kirkelund, Anders Stuhr Jørgensen

Dust measurements on gravel roads in southern Greenland

Field studies of dust problems on gravel roads in villages in southern Greenland. The measurements will be carried out using both mobile and stationary equipment. Subsequently, dust-binding agents will be tested to determine whether treatment with these agents could be part of reducing the dust problems and maintenance of the gravel roads. **Supervisors:** Anders Stuhr Jørgensen, Rasmus Nielsen

Extension of the road network between villages and sheep farms in southern Greenland

Field studies and site investigations of road traces are needed for the extension of the road network in southern Greenland. The studies could include:

- Winter conditions: Possibly use of satellite data, establishment of meteorological stations and 3D-modeling of snow and wind conditions.
- Locate deposits of building materials along the road trace.
- Prepare design proposal for road structure: Geotechnical and geophysical site investigations.
- Exploration of relevant areas.

Supervisors: Anders Stuhr Jørgensen, Rasmus Nielsen

Road between Kangerlussuaq and Sisimiut

Further field studies of the road trace are needed for the construction of the road between Kangerlussuaq and Sisimiut. The studies include:

1. Winter conditions. Possibly use of satellite data, establishment of meteorological stations and 3D-modeling of snow and wind conditions.
2. Locate deposits of building materials along the road trace. Especially in the eastern part of the trace.
3. Exploration of the area between the fiord just north of Sisimiut (Kangerluarsuk Tulleq) to the glacier Aqutikitsoq. **Supervisors:** Thomas Ingeman-Nielsen, Anders Stuhr Jørgensen

Test-sites on roads in Sisimiut

In 2008 two test-sites were established on roads in Sisimiut. Since the completion of the construction, the thermal regime of the different test-sections has been recorded. The test-sites give opportunities to study:

1. Pavement performance (carry out strength investigations, study thermal regime etc.)
2. Thermal regime and performance of different embankment types
3. Thermal modeling of different embankment types for protection of underlying permafrost

Supervisors: Anders Stuhr Jørgensen, Thomas Ingeman-Nielsen

[Town planning](#)

Traffic in Greenlandic towns

The traffic in Greenlandic towns is growing. The growing traffic has a number of consequences e.g. bad accessibility for pedestrians and cyclists and contamination from the exhaust of cars driving short distances or left idling and finally the consumption of fossil fuels. This project will focus on the need for knowledge on traffic in the towns and be an important input to the planning in the municipalities. The project can focus on various aspects depending on the interests of the students: Investigation of traffic patterns, amounts and conditions in Sisimiut; Investigation on the air pollution and fuel consumption etc.;

Investigation of traffic safety and accidents; Traffic planning in Greenlandic towns – how? **Supervisors:** Birgitte Hoffmann, Pernille E. Jensen

Townplan in the old part of Sisimiut

- a) Hvilke gode muligheder for fortætning er der for Sisimiut bycentrum? Fx er der i Sisimiut/Grønland tradition for sammenhængende eller meget tætliggende huse i bymidterne som i mange andre lande med byer af den størrelsesorden. Jo flere der kan bo i centrum frem for Akia, jo færre biler og CO2 forbrug må formodes ligesom byggemodningsudgifterne pr enhed kan holdes på et minimum.
- b) Hvilke muligheder er der anlæggelse af stier og andre ruter for fodgængere, cyklister m.m. i den eksisterende Sisimiut by? Hvordan gøres byen optimal for handicappede og andre dårligt gående?
- c) Muligheder for at anvende GTO-pladsen i midtbyen trods den konstaterede olieforurening.

Supervisors: Birgitte Hoffmann. Laust Løgstrup

Land Development

Seismic measurements for new industrial harbor in Sisimiut (New 2012)

Qeqatta municipality is considering the establishment of a new industrial harbor in Sisimiut. Marine Seismic data will be collected for the project in April 2012 (field work possibility), and the processing and interpretation of these data will be the main goal of the project. During field work in August cores could be collected from the seabed for correlation with the seismic data, and for establishing a pollution baseline before harbor construction.

Supervisors: Thomas Ingeman-Nielsen and Morten Holtegaard Nielsen

Site investigations for a new ski-lift system in Sisimiut

Entrepreneur people in Sisimiut have visions of a new skiing area of international caliber in the Sisimiut area, with specific plans under development. This project will be focused on producing site investigations for a coming ski slope and lift system on the slopes north of town.

The project will take its onset in discussions of requirements with the entrepreneurs, and lead to actual site investigations incorporating GPS measurements and GIS mapping, and possibly geotechnical classification of physical and mechanical rock parameters. **Supervisors:** Thomas Ingeman-Nielsen

Swimming pool in the mountain in Sisimiut

The Sisimiut municipality plans to build a swimming pool in the mountain near the culture house and lake Spejder. The swimming pool is built for the local inhabitants in Sisimiut and therefore there should be pools designed for both adults and children. Being built inside the mountain, the swimming pool is different from normal buildings, f. ex. lighting, construction and view. The municipality sees the swimming pool project as a state-of-the-art and innovative project with focus on holistic planning.

Several topics could be studied in connection to establishing the swimming pool:

- Design
- Energy systems and optimization
- Energy efficiency
- Water treatment
- Feasibility study

Supervisors: Jing Qu, Laust Løgstrup

GPS measurements in Kangerlussuaq

Artek and the municipality of Sisimiut are involved in development of tourism in the area between Kangerlussuaq and the Inland Ice. In 2006 a series of aerial photos were shot in order to make a topographical model of the area. Unfortunately, GPS reference points are not available to calibrate the elevation model. In this project you will establish a number of high precision GPS control points along the

existing road to the inland ice. These points will be used to calibrate the digital elevation model, and as a basis for mapping exercises near the ice cap. NB: Some knowledge of GPS and GIS is required for this project. **Supervisor:** Thomas Ingeman-Nielsen

Constructions

New infrastructure for oil/gas/mining activities (New 2012)

The new industry in Greenland within mining and oil/gas exploitation will involve a heavy load on existing infrastructure and a demand for new infrastructure within a short time horizon. This project aims at establishing a good basis for area planning and construction design by investigating some of the following topics:

- Which installations and infrastructures are needed for oil/gas/mining investigations and/or exploitation
- Which criteria should be used when locating suitable areas for such projects
- Which challenges have been faced in other polar areas, and can we expect them to be relevant in a Greenlandic context
- Assessing, planning and projecting the most appropriate location(s), as separate projects or new industrial clusters
- Considerations about necessary adoptions in relation to climate change

Other relevant aspects could also be investigated within this topic, e.g. waste treatment, energy supply, alternative construction material

Supervisors: Thomas Ingeman-Nielsen, Gunvor M. Kirkelund

Efficient construction sites in Nuuk

Effektiviteten af byggepladser i Nuuk vil have gavn af at effektiviseres. Projektet vil indebære planlægning, logistik studier og udmøntes i en "best practice" manual.

Kontakt: Gunvor M. Kirkelund, Janus Køster (Direktoratet for boliger og infrastruktur)

Concrete constructions in tidal zones

The project can involve sampling and mechanical and chemical tests of concrete and modelling.

Contact: Gunvor M. Kirkelund, Janus Køster (Direktoratet for boliger og infrastruktur)

Geophysics and permafrost

Driving forces of thermo-mechanical properties of fine grained frozen soils (New 2012)

Successful construction on permafrost soils in the Arctic is depending on quality information on the soil conditions. Deformation properties are an important aspect of this information. As a full test programme is expensive to carry out for every site, it would be valuable to have an indicator for the deformation based on standard classification tests.

As part of this project you will collect cores of frozen soil in the Sisimiut area. Classification tests such as ice content, granulometry, salinity, Atterberg limits and mineralogy will be performed in the laboratory at DTU. Oedometer tests will be carried out in the climate chamber at a number of subzero temperatures and relations between classification parameters and deformation behavior should be investigated in an attempt to define a suitable indicator.

The project can be scaled according to your needs, e.g. from 15 ECTS to 30 ECTS master thesis.

Supervisors: Frederik Ancker Agergaard and Thomas Ingeman-Nielsen

Using electrical resistivity measurements to delineate and study time changes of permafrost (New 2012)

The Arctic regions are expected to be subject to pronounced climatic changes over the coming decades. Significant permafrost degradation has been predicted causing a risk of thaw settlements and mechanical failure of buildings and constructions in affected areas. In order to accurately simulate and forecast the thermal regime of the active layer and permafrost, a heat transport model is being developed at ARTEK combining the information about ground temperatures and geophysical data in a joint inversion scheme. In this project you will do site and permafrost characterization using geophysical methods and collect drill cores of permafrost to be analyzed in the laboratory. This information will be useful for improving the calibration of the thermo-geophysical model and for predicting the fate of infrastructure and constructions in West Greenland. The main focus will be on geoelectrical measurements at an existing permafrost monitoring site in Sisimiut or Ilulissat, possibly supplemented electromagnetic or seismic measurements. Establishment of an automatic time-lapse measurements system is being planned, and may be included as part of this project.

Project type: Standard 11427 15 ECTS, B.Sc. project, M.Sc. project or special course.

Capacity: 2 groups of 2-3 students.

Supervisors: Sonia Tomaskovicova, Thomas Ingeman-Nielsen

Projektering i permafrostområder (New 2012)

Det grønlandske bygningsreglement forholder sig ikke specifikt til byggeri på permafrost og i praksis benyttes ofte designmanualer fra Grønlands Tekniske Organisation – designmanualer som typisk er over 20 år gamle. Dette projekt fokuserer på at etablere en videnbase med erfaringer fra alle klodens "Cold Climate" områder, med henblik på at udarbejde state-of-the-art designmanualer til tidssvarende byggeri og konstruktioner i grønlandske permafrostområder. Hovedvægten vil ligge på vejkonstruktion, bygge- og funderingsteknik, samt konstruktion af lineær infrastruktur.

Supervisor: Thomas Ingeman-Nielsen, Ujarak Rosing Petersen (Inuplan A/S)

The effect of a hydropower tunnel in bedrock on permafrost distribution (New 2012)

In Ilulissat the hydropower plant under construction will receive water from a freshwater lake through a bedrock tunnel in an area with continuous permafrost. The heat transported with the water and generated by the friction between water and walls is expected to affect and degrade permafrost around the tunnel. In this project you will assess the thermal regime in the bedrock before and after construction of the tunnel and assess the changes in permafrost distribution based on numerical modelling and laboratory measurements of rock properties.

Supervisor: Thomas Ingeman-Nielsen, Ujarak Rosing Petersen (Inuplan A/S)

Modeling and predicting recent and future permafrost degradation

With the present climate induced warming, permafrost is actively degrading in most areas of Greenland. Since permafrost in the fine-grained marine deposits of West Greenland is typically very ice rich, severe settling problems may occur upon thaw. This project focuses on constructing and calibrating a permafrost model for sites in the Kangerlussuaq and Sisimiut areas with the purpose of modeling the future development in ground temperature regime and predicting the fate of permafrost at the end of the present century. The theoretical/numerical development will be supplemented by field investigations on site, with sampling of permafrozen soils for laboratory investigations and in-situ measurement of thermal parameters for calibration of the model. **Supervisors:** Thomas Ingeman-Nielsen

Arctic energy efficient buildings

Indoor climate

Sustainable and healthy type house for Greenland (New 2012)

Houses in Greenland consume large amounts of energy and provide their occupants with poor indoor air quality. At the same time the space solution is not always optimal. The main purpose of this project is to design a house which will fulfill strict requirements on energy consumption and indoor environment and its initial costs will be reasonable at the same time. Solar gains, ventilation, heating and cooling are some of the issues to be solved within this project. Simulations, cost/benefit analysis, measurements or modeling are the tools to be used.

Supervisors: Martin Kotol, Carsten Rode, Janne Dragsted, Rasmus Nielsen

Ventilation system for Greenland (New 2012)

Houses in Greenland are not very well ventilated, which can cause health problems in the occupants and also damages of the construction due to condensation and mould. Right ventilation strategy which would be energy efficient and ensure that the indoor environment is good and comfortable is the issue to be solved within this project.

Supervisors: Martin Kotol

Moisture and mould growth in Greenlandic houses

Mould growth in buildings is a widespread problem, not only in Denmark but also in Greenland and has big consequences for both human health and economic. Several factors and conditions need to be present before moulds can establish themselves in a building: the spores, the nutrients and the moisture. The Greenlandic climate is very cold and dry, so what are the reasons for moisture problems inside Greenlandic buildings? Where do the mould spores come from – do the moulds really thrive in the harsh climate or are they imported with the building materials from Denmark? Are the Greenlandic moulds thriving only at very wet conditions, or can they also grow at more moderate moisture levels? Are the mould problems in Greenlandic building similar to those seen in Denmark with the same species of mould on similar building materials?

In this project you will examine different angles of the problem, e.g. its extent, reasons, and present solutions. The project will involve investigation into the reasons why water damage or high moisture content occur in some buildings. For instance, failures in the construction, inadequate building design, improper use of the buildings, or insufficient ventilation. You will use various measuring equipment to discriminate between the different reasons. The project will also include work with indoor moulds, but you need not have any microbiological background as it will be taught at the DTU Systems Biology. You will learn to study, detect and identify the most common mould species in the indoor environment. From this, you should be able to assert the nature of the problem

Supervisors: Birgitte Andersen – DTU Systembiologi, Carsten Rode

Indoor Air Quality in Greenlandic dormitories

There are several dormitories of different age in the town of Sisimiut. The aim of this project is to evaluate the indoor air quality in them.

Supervisors: Martin Kotol

Buildings energy and renovation

Building envelope characterization on a low-energy house in the Arctic (New 2012)

Keywords: Low-energy buildings, heat dynamics, time series analysis

You will be making experiments on a real-world but highly professional experimental setup to study how climate phenomena in the Arctic challenge low-energy buildings. It is important to do experiments with cooling and heating up a part of a test-house and analyzing the measurements to reach a thermal description of the building or part of it. Models can be based on either discrete-time dynamical statistical models or by formulating simple differential equations for the heat dynamics and fitting them to data. Then the models can be expanded as they are fitted to data, and more complex phenomena can be included in the description. The experimental setup can be controlled on-line.

The project is a cross-disciplinary between civil engineering and data analysis/statistics. Depending on your background, you will be supervised to meet the challenges that you may not be familiar with.

Supervisor: Philip Delff

Energy renovation of wooden type houses in Greenland (New 2012)

There is a potential and need for energy saving in standard family detached and semi-detached wooden houses in Greenland. This statement is based on studies of house construction compared with Building Regulation requirements and the spread of buildings over time. In the climatic conditions of Greenland, there is considerable potential for energy saving in houses due to their construction, shape and condition. We are working with the 11.453 (statistic 2007) wooden type houses in Greenland built before 2006 which are considered to have potential for energy renovation, out of which 6845 are located in Zone 1 (south of Polar Circle) and 4787 are located in Zone 2 (north of Polar Circle). These houses are more than half of the housing stock in Greenland.

We have data from some semidetached houses from earlier years and we have drawings of existing houses and suggestions to on how to make them airtight and how to renovate them.

We want students to continue this work and develop the renovation further in order to produce a total renovation plan for selected houses.

This year we will work with the detailing of the challenges in:

1. The crawlspaces
2. The installation of sewage tanks and water and there resistant to the cold weather
3. A ventilation system with heat recovery and the resistant to cold weather
4. Verification of load on the existing structure caused by the renovation.

Supervisor: Søren Peter Bjarløv

Investigation and retrofitting of an old type house ('The Blue House') in Sisimiut, Greenland (New 2012)

The 'Blue House' is a standard family detached house built by Panbo Huse A/S in 1985 in Sisimiut, Greenland. As an old building, it has many problems such as poor thermal comfort and high energy consumption, and therefore, the house has a potential to be retrofitted. The quality of the indoor climate of the house will be measured and tests such as blower door test, thermography testing will be carried out during the summer activity in Sisimiut. The aim of the project is a retrofitting proposal for the house. Contact: Jing Qu, Martin Kotol

Monitoring, measurements and modeling of energysystem in new dormitory in Sisimiut

A new, energy efficient, dormitory in Sisimiut has been taken into use in 2010. It is equipped with a monitoring system. In this project, the students should handle the data, make additional measurements and give conclusions on the function of the energy system in the dormitory. **Supervisors:** Martin Kotol, Jing Qu

Tourist huts:

The concept "sustainable Arctic tourist hut " contains elements of design – insulation , energy supply, water supply, waste and waste water treatment. A number of projects under this umbrella

are possible. The prototype of the tourist hut has been finished and its performance needs to be tested to see if it can survive in the arctic. **Contact:** Jing Qu

Arctic energy production

Hydropower

Hydropower in Uummannaq

The use of local hydropower is often an inexpensive and environmentally friendly approach to obtaining energy in remotely located areas. Before establishing a hydropower plant, some investigations are necessary, concerning precipitation, run-off and size and topography of the catchment area. In addition, the need for energy has to be determined. The investigations further include design of the power plant, i.e. water intake, pipeline, turbine and generator. **Supervisors:** Morten Holtegaard Nielsen

Micro hydropower in Uummannaq

The use of local hydropower is often an inexpensive and environmentally friendly approach to obtaining energy in remotely located areas. Before establishing a hydropower plant, some investigations are necessary, concerning precipitation, run-off and size and topography of the catchment area. In addition, the need for energy has to be determined. The investigations further include design of the power plant, i.e. water intake, pipeline, turbine and generator. A small (2000 W) hydropower plant including pipeline and so on is available for installation and demonstration purposes in Uummannaq. **Supervisors:** Morten Holtegaard Nielsen

Micro hydropower in Asaqutaq

In Asaqutaq a microhydropower plant in a small river will be installed. Theory and practice as for the use of the electricity is the main content of this project. **Supervisors:** Morten Holtegaard Nielsen

Solar power

The performance of evacuated tubular collector in Arctic (New 2012)

In the spring 2008 the solar heating system was installed on Knud Rasmussen High School. The solar heating system is based on both evacuated tubular solar collectors utilizing solar radiation from all directions and flat plate solar collectors. The flat plate solar collectors are in operation during days and the evacuated tubular solar collectors are in operation both days and nights as long as solar radiation is available. The project will focus on the performance of the evacuated tubular collectors determining the efficiency. The measured data will be analyzed in order to gain experience with the evacuated tubular collectors in the Arctic. **Supervisors:** Janne Dragsted, Simon Furbo.

Measuring station for global and diffuse radiation in Sisimiut – Preliminary project (New 2012)

Measurements of the solar radiation are important in Greenland and are most often carried out by ASIAQ. In Sisimiut however ASIAQ has decided to eliminate a measuring station and only collect data from their station at the airport in Sisimiut. This means that the measurements collected by Artek at the Knud Rasmussen High School and at the Engineering Dormitory Apissq is of great importance. The data collected here is the global and diffuse radiation with a SPN1 pyranometer. This pyranometer determines the diffuse radiation based on mathematical equations, whereas the standard way is either with a tracker or a shadow band. Both methods are costly and time consuming. The project will focus on a preliminary validation of the measurements from the SPN1 pyranometer against measurements of the diffuse radiation obtained with a shadow band. Also a preliminary investigation will be carried out to determine the possibility of establishing a permanent measuring station with diffuse radiation measured with a shadow band. **Supervisors:** Janne Dragsted, Simon Furbo.

Solar heating system at the new Engineering Dormitory Apisseq (New 2012)

The new Engineering Dormitory Apisseq in Sisimiut is fitted with a large solar heating system connected to both the domestic hot water and the space heating loop. The system consists of 38 evacuated tubular collectors mounted on the roof and two inter-connected storage tanks of each 2000 liters. The solar heating system will be equipped with a monitoring system. By means of this monitoring system the operation of the solar collectors can be followed and the thermal performance of the solar heating system can be determined. The project will focus on the measurements for the solar heating system. The measured data will be analyzed in order to gain experience with the solar heating system. Also a monitoring tool should be developed, improving future monitoring. **Supervisors:** Janne Dragsted, Martin Kotol, Simon Furbo.

Performance of the energy system at Ice Camp Eqi (New 2012)

Four new tourist huts were constructed at Ice Camp Eqi at glacier Eqi in 2011. The concept for the hut is sustainability. The huts have individual solar heating systems with an evacuated tubular collector and storage tank for domestic hot water and space heating. Also each hut has 14 PV-modules which are connected to 14 24V batteries. The huts serve as back-up for one another in terms of the electricity. The project will focus on the performance of the solar heating systems and the PV-systems. The measured data will be analyzed in order to gain experience and improve the systems if necessary. **Supervisors:** Janne Dragsted, Esben Larsen, Simon Furbo

Solar heating system at the Low Energy House

The Solar heating system at the Low energy house was installed in 2005. Originally it was designed as a domestic hot water system, but early investigation showed an excess of energy from the system. Therefore it was decided to improve the system with an additional buffer tank which was installed in the spring of 2011. The system was also connected to the space heating loop, so that it now is a solar combi-system, delivering energy both for domestic hot water and space heating. By means of this monitoring system the operation of the solar collectors can be followed and the thermal performance of the solar heating system can be determined. The project will focus on the measurements from the solar heating system. The measured data will be analyzed in order to gain experience with the solar heating system. The performance will be evaluated and compared with similar systems from Europe. Also a monitoring tool should be developed, improving future monitoring. **Supervisors:** Janne Dragsted, Simon Furbo, Philip Dleff.

The electric system in the solar heating system at Knud Rasmussen High school

In the spring 2008 the solar heating system was installed on Knud Rasmussen High School. The solar heating system is based on both evacuated tubular solar collectors utilizing solar radiation from all directions and flat plate solar collectors. The system has had two unexplained electrical failures, disabling the control system. The project will therefore focus on the control system and the electrical connections. The measured data will be analyzed in order to gain experience with the electrical system in a solar heating system. **Supervisors:** Esben Larsen, Janne Dragsted

Wind energy

Best practice in regards to wind power (New 2012)

A few wind turbines have been in use in Greenland for some years and there is interest in installing more wind turbines in remote locations, villages and towns. This project should start by collecting present experiences with the existing wind turbines as seen by the local community, installers and operators and municipality. Based on the Greenlandic experiences and other relevant information, suggestions to an appropriate legislation and best practice on how wind power can be implemented in Greenland should be made. Cooperation with Ilimmarfik (University of Greenland) could be relevant.

Supervisor: Kasper Jakobsen, Thomas Gaarde Madsen

Wind resource estimation and feasibility study Nanortalik (New 2012)

The project deals with wind resource estimation for the area around Nanortalik. There is a 6 years old climate station in the city and the last four years a 50m met mast has been in operation. The wind resources must be estimated from the collected data for the two masts, other metstations in the area, supplemented with the available model data.

The second part of the project is about siting, cost estimation and feasibility studies. In this part of the project the potential sites in the area, must be evaluated based on the total cost of energy. It involves cost estimations of e.g. turbines, foundations, grid connection, service roads, maintenance cost

The field part will involve meetings with the local authorities, power company, constructions companies etc. to collect the needed information's and installation of the needed instruments to collect supplementary data.

Supervisor: Kasper Jakobsen

Wind-diesel system with distributed heating, Nanortalik (New 2012)

The goal for the project is to develop a mathematical model of the energy system in Nanortalik and analyze the effect of introducing wind power in the system, find the limitations and the optimal installed capacity in the system. The system includes diesel generators with heat recovery, oil boilers, wind turbines and maybe electrical boilers. The study will be based on the wind resource data collected in the Vest-norden project and the consumption data from the local energy company Nukissiorfiit.

The field part of the project involves mainly studies of the system in collaboration with the local energy company, Nukissiorfiit.

Supervisor: Kasper Jakobsen

Wind resource estimation and feasibility study Qaqortoq (New 2012)

The project deals with wind resource estimation for the area around Qaqortoq. The wind resources must be estimated from meso-scale models or satellite data supplemented by the local heliport data.

The second part of the project is about siting, cost estimation and feasibility studies. In this part of the project the potential sites in the area, must be evaluated based on the total cost of energy. It involves cost estimations of e.g. turbines, foundations, grid connection, service roads, maintenance costs...

The field part will involve meetings with the local authorities, power company, constructions companies etc. and inspection of potential sites, grid connection points to collect the needed information's.

Supervisor: Kasper Jakobsen

Hydro-wind-Diesel system analyses, Qaqortoq (New 2012)

The goal for this project is to develop a model for the Qorlortorsuaq-Qaqortoq and Narsaq electrical power system and study if can be feasible to implement wind power.

The system consist today of a hydro power plant (2x3.8MW) and some diesel power plants. The electricity is mainly produced by the hydro power plant, but due to lack of water in the reservoir the diesel plants must run on regular basis. Some electrical boilers are installed in the district heating network in Qaqortoq and together with controllable electrical heating in Narsaq it makes the consumption more flexible.

The idea is to add wind power and maybe a pump storage installation to the system. This project will investigate the possibilities for wind power implementation in the system, based on the available consumption and production data for the different plants and towns.

The project can be extended to involve the district heating network, that consist of oil boilers, a waste plant and the electrical boilers.

The field part of the project involves mainly studies of the system in collaboration with the local energy company, Nukissiorfiit.

Supervisor: Kasper Jakobsen

Issues of wind energy in the cold climate (New 2012)

Wind energy in the Arctic is a challenging topic due to the harsh climate. Icing causes many problems, such as decreased performance of turbines with ice accumulation on the blades and excess vibration problems from uneven blade icing, or irregular shedding of ice from the blade. ARTEK has several meteorological masts in Greenland in order to investigate the possibilities of wind energy. The field work would cover the installation of new met masts and the maintenance of the already existing ones. An introduction to icing is provided during the spring semester, since there is no basic course in the topic at DTU.

Proposed projects for semester are:

1. Study the potential of icing in the areas of the existing met masts using the collected data
2. Investigate the effects of ice on the flow field around the blades based on the meteorological conditions of Greenland using CFD

Supervisor: Adriana Hudecz

Ice prevention of vertical axis wind turbine (New 2012)

The telecommunication stations in Greenland are situated along the coast line, usually in remote areas, where the necessary power for operation is provided by diesel generators. These are combined with renewable energy sources, such as solar panels and smaller vertical axis wind turbines. Due to the lack of sun and the snow cover during winter, wind turbines could be a good option to reduce the usage of diesel, but these turbines need to face with the harsh weather conditions, such as icing. Ice buildup on the blades can cause serious problems and production loss.

During the course, the vertical axis wind turbines will be studied in the Greenlandic environment. The different de-icing and anti-icing solutions and their energy demand will be investigated and compared. Different scenarios will be analyzed and a solution will be proposed.

An introduction to icing is provided during the spring semester, since there is no basic course in the topic at DTU.

Supervisor: Adriana Hudecz

[Geothermal energy](#)

Thermal properties of Greenlandic rocks (New 2012)

Recent interest in geothermal projects in Greenland have emphasized the need for accurate measurements of the thermal properties (thermal conductivity and heat capacity) of Greenlandic rocks, as well as estimates of the geothermal gradient in different areas of Greenland.

This project will focus on establishing a laboratory method for efficiently measuring the thermal (and other physical) properties of Greenlandic rocks. If possible, a deep borehole will be established in cooperation with The School of Natural Resources in Sisimiut, and equipped for measurement of temperatures in order to be able to calculate and monitor the geothermal gradient in the Sisimiut area. Drill cores from the borehole will be investigated in the laboratory, and a thermal ground model for the area developed. The project should include an evaluation of the feasibility of using geothermal methods in the Sisimiut area, either as geothermal extraction or as a storage facility.

Supervisor: Thomas Ingeman-Nielsen og Arne Villumsen

[Sustainable energy](#)

Mapping of energy consumption and potential for savings by small changes in Sisimiut

Jeg forestiller mig vi peger på 2 – 3 forskellige områder, hvor der generelt skal kigges på energiforbrug i driften af boligerne. Aqqartarfik blok 1-4 samt 5,6 og 15, altangangsblokke bygget i starten af 70erne. De er alle renoveret, nogen mere end andre, men dog renoveret. Alle ejet af Grønlands selvstyre. Qeqqi området 13 små opgange med 6 lejemål i hver og en del række huse, bygget i 80erne. Lille del ejet af Grønlands selvstyre og største delen ejet af Qeqqata Kommunia. Generelt for alle områder kunne vi

tænke os der kigges på Undercentraler, ventilationsanlæg, varmekabler, isolering af rør i krybekældre med mere. Fokus på de "små" ting i driften som vi har midler til at gøre noget ved. Der må selvfølgelig gerne kigges på energiforbrug som en helhed også, men umiddelbart er det de små ting, der er vigtige for os. Man kan sige vi ønsker forbedring af vores beslutningsgrundlag i hverdagen, når der skal skiftes en pumpe eller udføres en eller anden reparation. **Contact:** Carsten Rode

Surface water environment

Electrochemical remediation of harbour sediments (New 2012)

There is an increasing focus on the negative environmental impacts, human activities have on the Arctic environment. Harbours in the Arctic region are the final recipients of local/regional polluting activities in addition to the pollution caused by industrial activities in the harbours. Traditional clean-up technologies in Arctic harbours include dredging and subsequent disposal/stabilisation and there is a need for developing more remediation technologies that deal with Arctic challenges such as cold climate, infrastructure and logistics. Electrochemical remediation provides such a solution. This project involves undertaking electrochemical remediation tests of polluted harbour sediments from Sisimiut, and includes design and optimisation for improving clean-up levels. The project includes sampling of harbour sediments and characterisation tests of the sediments. There will also be possibility of comparing results of the remediation tests with case-study tests from Northern Norway and North West Russia.

Supervisors: Kristine Pedersen (UIT) and Pernille E. Jensen

Industrial harvesting of seaweed in Greenland

In contrast to the remainder North-Atlantic countries, no harvesting and processing of seaweed is going on in Greenland or the Faroe islands. Both Iceland and Northern Norway show substantial activity. Norway export for around 800 mio. kr. based on naturally growing harvested seaweed. The world market is around 40 billion kr. In this project the possibilities and potentials for development of a Greenlandic industry based on seaweed should be investigated. Supervisors: Pernille E. Jensen, Lis Bach, Jens Lyberth (CIU)

Heavy metals in Greenlandic seaweed

Cadmium and other heavy metals are known to accumulate in plant material in general. This is true for aquatic plants as well. The aim of this project is to investigate any relation between heavy metal content in aquatic plants and location. This could be locations in towns, in a settlement and reference values from an uninhabited area. If possible, also other biological matrices can be sampled, for example sea urchins and or mussels and in combination with passive samplers for metals. Comparison with uptake in passive samplers. In that way uptake in different organisms in relation to load can be assessed.

Supervisor: Pernille E. Jensen, Lis Bach.

Restoration of the Spejdersø in Sisimiut

A recent investigation showed that Spejdersøen in Sisimiut is seriously affected by contamination with phosphorous from grey wastewater. A model of the lake water and nutrient balance was made. It was assessed that the lake will disappear in only 60 years. Several parameters, however, need to be further investigated in order to suggest the most beneficial restoration method, i.e: what is the exact contribution of P from duck feeding and dog leavings? What is the natural concentration of P in lake sediment in Greenland? How much does the P concentration in the lake vary on a daily/monthly basis? What is the heavy metal concentration in the sediment? Which means of sediment removal exist in Sisimiut, and what would be the price of sediment removal? Where could sediment be placed after removal? How could they be dredged? Is it possible to change the water-flow through the lake and obtain a higher degree of mixing with the water from lake 3? Does new P-regulation in Denmark from 2013 also affect Greenlandic situation? Do anoxic conditions prevail on the lake bottom? What is the

actual fate of the P from gray wastewater led out in the neighborhood, how much is taken up by plants before reaching the lake? Could this uptake be enhanced somehow? **Supervisor:** Pernille E. Jensen

Oxidation of the bottom sediments in the bay by Sisimiut

Direct discharge of wastewater rich in organic material has resulted in oxygen depletion in some parts of the bay "Ulkebugten" by Sisimiut. Turnovers of the sediment occur regularly with malodorous in the town as a consequence. The aim of this project is to investigate whether it is possible to avoid the smelly turnovers by establishment of an aeration system. Calculations and evaluation of the applicability of the solution must be made. The municipality of Sisimiut has suggested an installation, which may be moved around in the bay e.g. a small raft, and pump driven by solar collector or a small windmill. Is this realistic?

Supervisors: Pernille E. Jensen

Geochemistry of heavy metals in sediment and pore water in 'Ulkebugten' by Sisimiut

Direct discharge of wastewater, which is rich in heavy metals (Cadmium and others), is polluting parts of the bay 'Ulkebugten' near Sisimiut. This project will focus on the identification of the present heavy metals and the analyses of their concentration as a function of depth in sediments and pore-water samples. These samples will be cored in a number of different locations in the bay to define the dimension of the polluted area. Method: pore water will be extracted right after coring (up to 1 meter) using a pore water filter press. In order to measure the heavy metal concentration, the resulting pore water and sediment samples will be analysed with an optical ICP at ARTEK. Moreover, the sediments will be categorized according to grain size and porosity at the laboratories in Sisimiut and ARTEK for future investigations (transport-reaction processes of heavy metals). **Student potential:** 1-2 groups of 2-3 students. **Supervisors:** Sandra Bollwerk, Morten Holtegaard Nielsen

Information Technology projects

Establishment of an ARTEK web GIS portal (New 2012)

The project involves establishment of a web GIS based approach to accessing ARTEK reports, experimental results and research publications. A new backend database should be established, supporting geocoding information, keywords, etc. for a variety of different materials. The database will be accessed by a web gis interface which allows for accessing information by geographical location (selection on a map) and/or keyword searches.

The intention is that all future ARTEK reports must be registered in the system by the future students themselves, and thus the system must include a userfriendly registration form and support for submitting additional material, such as pdf, xls or other data files.

Supervisor: Thomas Ingeman-Nielsen

Important information about participant fee and air ticket

Payment

The fee of 5.500 kr. for carrying out fieldwork in Greenland shall be paid to Ingrid Vernimmen or Niels Hoedeman at the Arctic Technology Centre. The fee has to be paid before we can book your ticket.

The fee includes:

- * flight from Copenhagen to your destination in Greenland and return
- * board and lodging in Greenland

DEADLINE for payment is Tuesday 6th of March 2012

How to pay

You can pay by bank transfer. Use the account details below:

Name of bank: Danske Bank

Registration no.: 4180

Account number: 42 63 97 20 07

Iban: DK5730004263972007

SWIFT code: DABADKKK

Important! Add the following text message to the transfer:

- Student number
- 25409, – E–92, 1191, – rejser øvrige udland

Remember to send a receipt of the payment to nih@byg.dtu.dk and Ingv@byg.dtu.dk

Your ticket will be booked immediately after we have received your payment and will be forwarded directly to your mailbox (your student-mail address).

Additional information regarding the air flight

We strive to obtain tickets for the august main group departing on Tuesday 31st of July and returning on Thursday 16th of August. Due to high season in August and generally limited capacity on the Air Greenland flights it is not always possible to get the entire group through on the preferred dates. Travel out/home 1 day before/after the scheduled dates is thus not unusual.

Delays/cancellations are frequent when traveling in Greenland. It is thus not recommendable to have other appointments / travel plans on the following 1-2 days after the return day to Copenhagen.

If you plan to travel on other dates than the official once – for example if you plan a private trip in Greenland either before or after the fieldwork period (which is usually very popular), this must be informed to your supervisor and Gunvor. The details regarding the itinerary must be presented to Niels and Ingrid for their acceptance before the ticket is booked i.e. before your payment.

We book restricted economy class tickets – which are neither refundable nor changeable. This means if you cancel your participation on the fieldtrip, the money as well as the ticket will be lost. You can decide to sign a cancellation insurance that will cover the price of the airfare in case you or a member of your close family should get seriously ill. This insurance cost 6 % of the price of the air ticket = approximately 60 EURO. Please notify when paying the fee if you want this insurance, since it needs to be taken out simultaneously with the booking.

Contact: Ingrid Vernimmen or Niels Hoedeman

Supervisors and other personnel

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