

Scientific report of the Polar ecology course – geosciences

Summer expedition 2015

Press release: September 8, 2015

The Polar Ecology Course – Geosciences was carried out in the area of Svalbard archipelago from 1st to 16th July and from 16th August to 4th September 2015. Fieldwork activities of students and instructors from the Masaryk University and the University Centre in Svalbard (UNIS) took place in remote area of Petuniabukta (Central Spitsbergen) with the use of the research station of the University of South Bohemia. The course was held under auspices of the EEA, the Norway Grants and the Masaryk University (Department of Geography) in collaboration with the UNIS. Similarly to previous years, one of the main objectives of the expedition team was the training of the students who carried out their research in the coastal zone of Petuniabukta and other localities selected for long-term monitoring of the Arctic eco- and geo-systems.

Geology and Geomorphology research group

Geology-geomorphology (GEO) research group performed their work on 01/07-16/07/2015. This group consist of three students (Jan Petřík, Barbora Procházková, Jiří Tomíček) and three instructors (Zbyněk Engel, Martin Hanáček, Slavomír Nehyba).



Research of the deltaic topset and foreset sediments, Mimerdalen (photo Jan Petřík)

The group focused on the following main activities:

- 1) The research of postglacial uplifted terraces to understand the depositional environment and palaeogeographic reconstruction of selected area during the Termination I and the Holocene. The selected area was the surrounding of the Pyramiden town and the Mimerdalen valley, because former research activities do not take place here beside the research undertaken during the Polar Ecology Course in 2013 and 2014.
- 2) Glaciological research on Bertilbreen, Elsabreen and Jotunfonna glaciers.
- 3) Research of the recent delta of the lately drained terminoglacial lake in the front of the Nordenskiöldbreen.



Ground penetrating radar survey for the assessment of the palaeodelta internal structure, Mimerdalen (photo Jan Petřík)

Research of glacio-marginal early Holocene delta was conducted west of the abandoned mining town of Pyramiden, which lies in the direct neighbourhood of the Petuniabukta. A detailed ground penetrating radar survey has been undertaken at this site. The exposures were cleaned and the most interesting parts of the sedimentary successions were described. Ground penetrating radar survey was carried out also at two localities in Mimerdalen, where sedimentary logging and paleontological research was realized as well.

Elsabreen was investigated in a detail using ground penetrating radar. Points for precise mass balance monitoring were measured on the Bertilbreen surface. Jotunfonna was preliminary surveyed for a future research planning.

Selected exposures were also described in the drained terminoglacial lake basin at the Nordenskiöldbreen to reconstruct the depositional history. The shape of sedimentary bodies was studied using ground penetrating radar. The lake area was mapped using an unnamed aerial vehicle (drone).

GEO research group has undertaken field excursions to the proglacial zone of Svenbreen (roche moutonnées, hummocky moraines), Hørbyebreen (supraglacial tills, esker facies), Ebbabreen (proglacial outwash fan) and Nordenskiöldbreen (roche moutonnées, fluted moraine).



Documentation of the exposure in deltaic sediments and fossil collection, Mimerdalen (photo Jan Petřík)

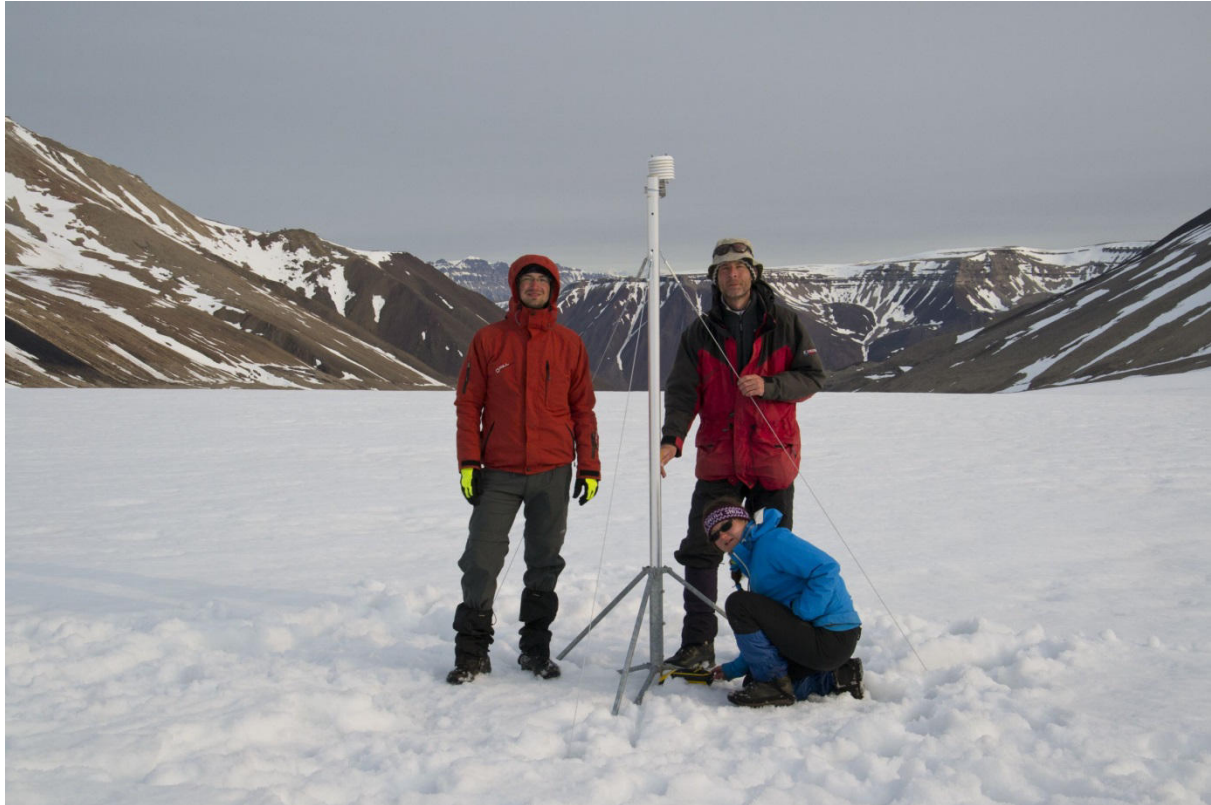
Climatology and Glaciology research group

The climatology and glaciology part of the Polar Ecology Course – Geosciences was attended by four students (Klára Ambrožová, Tereza Coufalová, Marek Lahoda, Vladimír Pískala) with guidance from two instructors (Kamil Láska, Zdeněk Stachoň).



Meteorological measurements and observations performed on Mumien Peak (photo Tereza Coufalová).

The main objectives of the group were meteorological measurements and observations of weather conditions and glaciological measurements on selected glaciers in the vicinity of the Petuniabukta. Simultaneously, service and repair of eight automatic weather stations (AWS) located in Petuniabukta area was carried out by the group members. Furthermore, the damaged parts of instruments and batteries with low-voltage were mended or changed, and year-long data were downloaded from the memory of all AWS. There were microclimate and ground temperature measurements of the active layer set up on a coastal vegetated terrace. In the following days the group executed the maintenance and calibration of instruments for incoming and reflected radiation measurements and established the measurements of air temperature conditions of the boundary layer on the western slope of Mumien Peak (770 m a. s. l.).



Maintenance of meteorological station on Bertilbreen (photo Tereza Coufalová).

The research activities of students and instructors were connected with the research topics and localities, which have been used for a long-time monitoring of the state and development of Arctic ecosystems and glacial environments since 2008:

1) The study of microclimatic conditions of tundra vegetation was performed on the western coast of the Petuniabukta. With the help of precise instruments, automatic measurements of radiation balance, surface temperature, thermal and moisture conditions of the permafrost active layer were conducted. The results will be used for evaluation of the effect of vegetation cover on the active layer conditions and its thickness.

2) The research of atmosphere boundary layer and the variability of air temperature field was based on the measurements and subsequent analysis of year-long data sets that were acquired from eight AWS situated in the deglaciated coastal area and the Hørbyebreen and Bertilbreen glaciers.

3) The monitoring of atmospheric conditions and evaluation of cloud cover was based on daily observations carried out by students, which included recording of present and past weather, cloud base height, fraction of cloud cover and horizontal visibility observation. Another part of the campaign was cloud genera and species recognition and photography of optical phenomena that will enlarge the existing Arctic Cloud Atlas, which is available on the website http://polar.prf.jcu.cz/clouds_atlas_high_cz.htm).

4) Investigation of glaciers and their spatial changes was focused on four glaciers located in the Petuniabukta area. There were differential GNSS measurements of the glacier surface, as well as position and height measurement of ablation stakes installed in previous years, performed on Bertilbreen, Ferdinandbreen and Elsabreen glaciers. The obtained data will provide basis for the calculation of areal and volumetric changes of the glaciers. Finally, a remote sensing survey of the marginal part of Nordenskiöldbreen using the unmanned aerial vehicle (drone) was undertaken in order to create an actual elevation map to study glacier fluctuation and mass loss changes as a result of air temperature rise in the Arctic.



Preparation for geodetic survey using the unmanned aerial vehicle (drone) on Nordenskiöldbreen glacier (photo Tereza Coufalová).

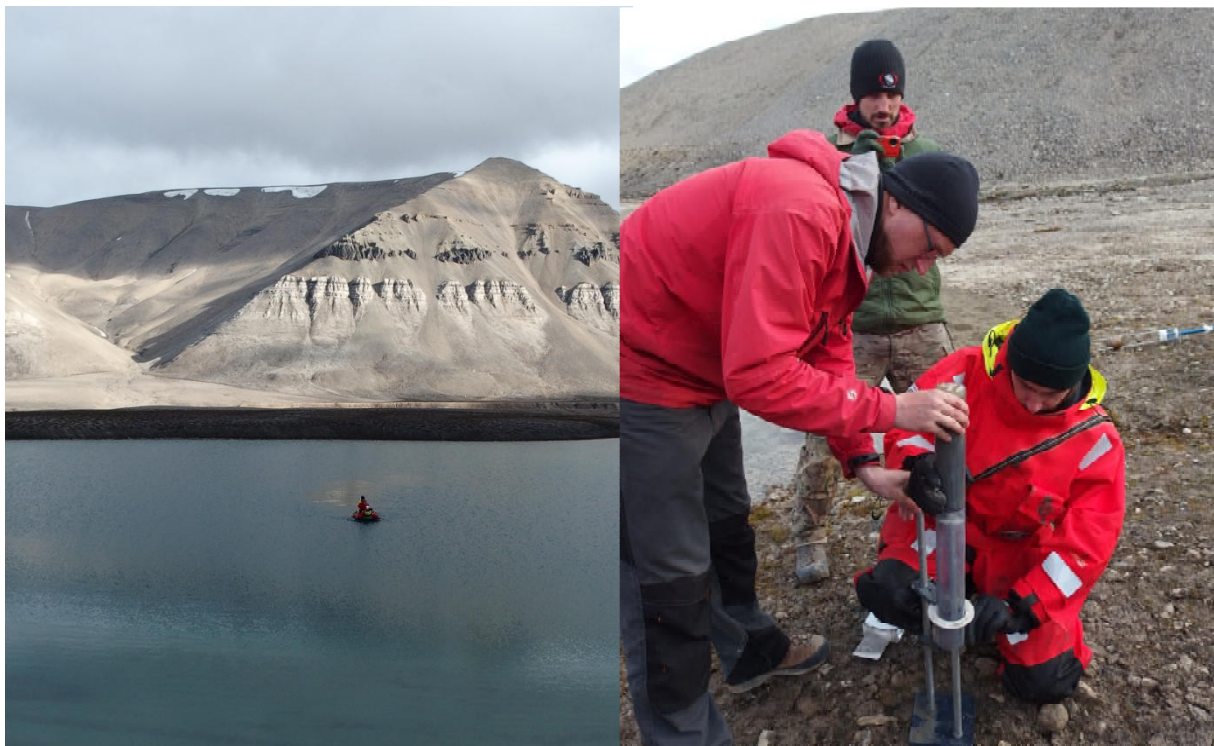
Hydrology and Limnology research group

Hydrological-limnological part of the Polar Ecology Course – Geosciences was held at the polar base of the University of South Bohemia in Petuniabukta, Svalbard from 16/08/2015 to 06/09/2015. One of the main objectives of the expedition team was to educate students and to carry out related research activities on the wider area of Petuniabukta, similarly to previous years. Attention was paid to streams and lakes, their biota and physical properties are long-term monitoring.

Hydrological-limnological (HYDRO-LIMNO) group consists of three students (Eva Hejduková, Lenka Ondráčková, Matěj Roman) and three instructors (Jan Kavan, Kateřina Kopalová, Daniel Nývlt). International students from the UNIS cooperated with the group.

The research activities of students and instructors based on topics and sites, on which the long-term monitoring of water regime of selected streams and the physical and chemical parameters of local lakes are undertaken since 2011. The group focused primarily on the following activities:

1) Holocene environmental changes recorded in lacustrine archives of the Garmaksla Lake and the lakes in the Mathiesondalen using multi-proxy research of lacustrine sediments. Biological material has been sampled in the Garmaksla Lake and the surrounding area to compare inter-annual changes in the presence of diatom and cyanobacterial communities. The geomorphological mapping of the lake catchment was carried out.



Coring and sampling of lacustrine sediments of the Mathiesondalen 3 Lake for the reconstruction of the Late Holocene environmental changes in a karst lake (photo Lenka Ondráčková).

2) Quantification of the bedload and suspended material transported in glacial streams of Elsabreen, Ferdinandbreen and Svenbreen during diverse discharge and water sampling for the assessment of its chemical composition.

3) The study of the recent biota in lakes and rivers undertaken within the long-term monitoring of the diversity of bacteria and non-vascular plants for the evaluation of their short-term changes, which began in the northern part of the Billefjorden in 2007.



Bedload sampling in a glacial stream of Elsabreen (photo Matěj Roman).

4) Multitemporal changes of the Bertilbreen and Elsabreen braidplains using total station surveying, differential GNSS measurements and scanning by the unmanned aerial vehicle (drone).



Elsabreen braidplain surface measurements using total station and differential GNSS instruments (photo Lenka Ondráčková).