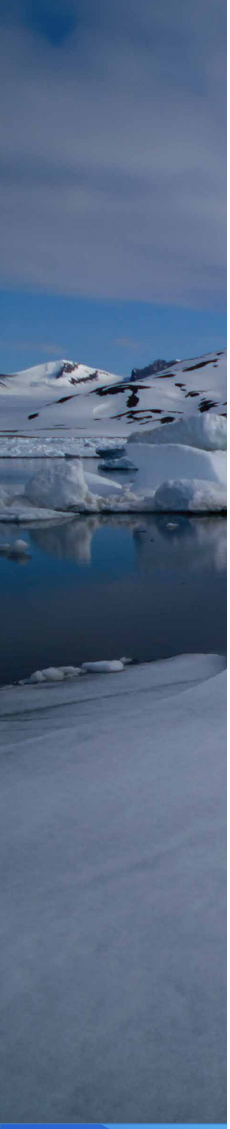
Department of the Polar and Marine Research



About

1. Variability of snow cover parameters in polar and mountainous areas

Dust in the snowpack and firn

Aeolian dust in glaciers of Spitsbergen: an environmental messenger and a player in global change processes. Multilateral (geochemistry, mineralogy, remote sensing) approach to identification of dust components deposited in glaciers of Spitsbergen, with applications to glaciostratigraphy, glaciotectonics, and back trajectory analysis of atmospheric circulation.

Snow cover in Sudety Mountains

A preliminary study of the snow cover accumulation patterns and its impact on vegetation (and vice versa) in the chosen areas of the Karkonoski National Park. The first step was done in September 2018: terrestrial laser scanning.

Modelling of snow water equivalent in the coastal tundra of Hornsund fiord

Methodology for estimation of snow water equivalent in Hornsund coastal zone using daily snow depth observations was developed. Set of regression models was optimized and calibrated for consecutive stages of snowpack accumulation and ablation. The proposed approach for estimation of snow water equivalent gave very promising results, with the coefficient of determination higher than 0.9 for both calibration and validation therefore it's assumed that method could be extended to other Arctic sites where snow water equivalent measurements are rare.

2. Glaciated catchment components modelling

Calving ice front investigated with LiDAR scanning

Using LiDAR and video data from 2013, from Greenwich Island, South Shetland Island, it was possible to determine how does reflectivity of an ice wall changes with time elapsed since calving event. Discovered brightening of the surface was interpreted as development of layer of weathered ice. A scientific article was published with the results.

Study of mass balance of a Chilean glacier with use of digital elevation models

Four digital models of surface relief (ASTER, SRTM, TanDEM-X DEM and an aerial laser scanning based one) were used to measure change of Universidad glacier in central Chile. In addition, performance of TanDEM-X DEM in glaciological work was assessed.

3. Hydrological and hydrochemical characteristics of glaciated and unglaciated catchments (AN, TW)

Diagnosis of the hydrology of a small Arctic permafrost catchment using HBV conceptual rainfall-runoff model

The relationships between temporal changes of active layer depth and hydrological HBV model parameters, together with variation in the catchment response. The influence of model simplification, correction of precipitation, and initial conditions on the modelling results was tested.

Aluminum export from Werenskiöldbreen, Svalbard, shows association with glacier-derived nutrients (SiO2, Fe)

The study aims to determine the relationship between the processes sourcing labile Al and glacier-derived labile nutrients (particularly Fe and Si) in glacierised basins.

Weather breakdown influence removal of invertebrates from cryoconite holes on an Arctic valley glacier (Longyearbreen, Svalbard)

The main goal of this research was to investigate any links between changes in weather conditions and short temporal changes in invertebrate densities on glaciers.

Spatial variations in air temperature and humidity over Hornsund fjord Spitsbergen)

This study deals with variations in air temperature and humidity in the region of the Hornsund fjord for the period from 1 July 2014 to 30 June 2015. Based on measurements at 11 sites, it was established that significant topoclimatic differences were dependent on height above sea level, substrate type, distance from the sea, exposition, atmospheric circulation and the ice conditions. The thermal and humidity conditions of individual sites are presented in relation to the weather conditions at the Polish Polar Station in Hornsund.

Factors controlling tidewater glacier front fluctuations in Svalbard - Hansbreen as an example

This research investigated seasonal and interannual fluctuations of the Hansbreen terminus in 23 years period. The data is mainly obtained from digitization of remote satellite imagery from a variety of sources. Then attempt to link the derived terminus fluctuations to various potential drivers (atmospheric and oceanographic) through correlation investigations. PDD+ and SST are used as proxies for surface melt (=subglacial discharge) and for fjord water temperature, respectively.

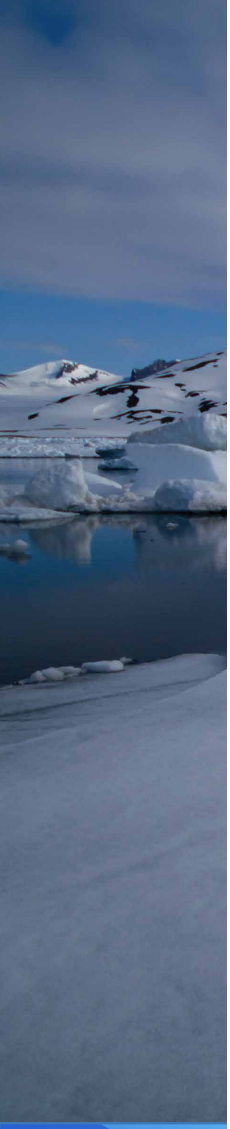
Climate changes related to SST trends in the North Atlantic, and long-term analysis of meteorological conditions in two fjords – Porsanger and Hornsund

Changes in the multiyear SAT (the air temperature 2 m above the ground), SST (sea surface temperature) and WS (wind speed) were studied on the basis of monthly Era-Interim reanalyses, as well as analyses of local differences between the two high-latitude fjords, based on data from three meteorological stations. Lakselv (L), Honningsvåg (Ho), and Hornsund (Hr).

4. Geophysical methods in marine environment studies in polar and analogue areas

•The development of methods for analyzing data from multibeam sonar and sediment profiler to determine the differences in the morphology of the bottom sediments and identification of bodies of young periglacial

•The use of passive acoustic monitoring of marine for determining the processes occurring in the icy Arctic fjords



5. Attempt to prediction of environmental change after Barents sea-Greenland sea ice-barrier breakup

We have studied changes of the coastal area in southern Svalbard with the glacier bridge between Torell Land and Sørkapp Land since the beginning of the 20th century. The results confirm the existence of a continuous subglacial depression below sea level (c. 40m deep) between Hornsund and the Barents Sea. If the retreat continues at the 2000–2015 average rate, the ice bridge between Hornsund and Hambergbukta will be broken sometime between 2055 and 2065 and the Hornsund strait will separate Sørkapp Land from the Spitsbergen Island. The work was completed and published in journal of the JCR list.

Personel

Head of the Department
Marek Lewandowski
Professor

Piotr Głowacki
Professor

Bartłomiej Luks
Adjunct

Mateusz Moskalik
Adjunct

Adam Nawrot
Adjunct

Tomasz Wawrzyniak
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Agata Goździk
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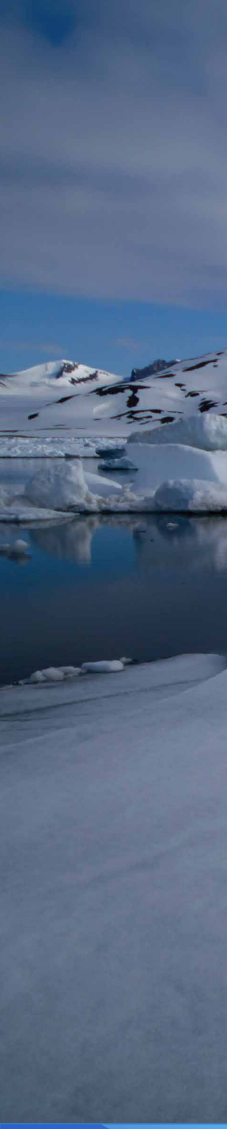
Julian Podgórski
Educator

Piotr Stankiewicz
Methodological adviser

Wojciech Piotrowski
Project Coordinator



Research Project

EDU-ARCTIC
A. Goździk | H2020 | 2016 -2019

ERIS
A. Goździk | Erasmus+ | 2016 -2018

ODYSSEY
A. Goździk | Erasmus+ | 2018 -2021

BRITEC
A. Goździk | Erasmus+ | 2018 -2021

INTERACT
W. Piotrowski | H2020 | 2017 -2019

SIOS (Svalbard Integrated Arctic Earth Observing System)
P. Głowacki | MNiSW | 2018 -2023

EU Polarnet
P. Głowacki | H2020 | 2015 -2020

INTAROS
P. Głowacki | H2020 | 2016 -2021

Snow Observation in Svalbard - SOS
B. Luks | SIOS/SIOS pilot project | 2018 -2018

Hindcasting and projections of hydro-climatic conditions of Southern Spitsbergen
T. Wawrzyniak | NCN | 2018 -2021

Spatial Distributions of Black Carbon and Mineral Dust in Air and Snow Surface Layers upon Svalbard Glaciers: BC-3D
A. Nawrot | Research Council of Norway SSF Svalbard Strategic Grant | 2018 -2020

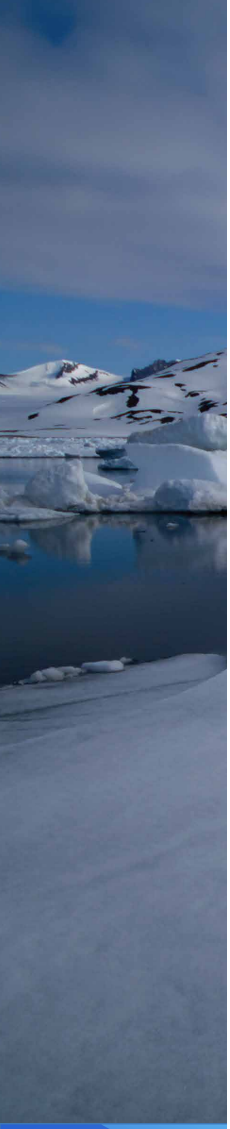
The impact of the sea ice conditions in the nearshore zone and shore ice on the wave propagation and coastal morphodynamics in polar regions on the example of south-western Spitsbergen - the analysis of processes, modeling, and prediction
M. Moskalik | NCN | 2014 -2018

Small-scale dynamics of Arctic coastal sediments: Isbjornhamna, Svalbard
K. Wojtysiak | Research Council of Norway, Svalbard Science Forum (SSF), Arctic Field Grant (AFG) | 2018 -2018

- Measuring the melt rate of glacier ice with underwater noise.
  O. Głowacki | Internal research project | 2017 -2019

- Measuring the melt rate of glacier ice with underwater noise.
  O. Głowacki | National Science Fundation (NSF) Early-concept Grants for Exploratory Research (EAGER) | 2018 -2020

- Relationship of permafrost with geomorphology, geology and cryospheric components based on geophysical research of the Hans glacier forefield and its surroundings. Hornsund, Spitsbergen.
  T. Wawrzyniak | NCN | 2017 -2020



PhD Students

Daniel Kępski | Poland
supporting supervisor: Bartłomiej Luks

Joanna Ćwiąkała | Poland
supporting supervisor: Mateusz Moskalik

Joanna Sziło | Poland
supervisor: Robert Bialik

Kacper Wojtysiak | Poland
supervisor: -

Julian Podgórski | Poland
supervisor: Piotr Głowacki

Instruments and facilities

Equipment

Rain gauges, Hanna multiparametric measurer, Water level, electrolitic conductivity and temperature automatic sensors; Autosampler; 2 Meteorological automatic stations Vaisala; Snow-bars; Harbortronics cameras; differential GPS; Valeport miniCTD; Niskin bootle; Sediment trapps; Muffle furnace; Transductor magnetometer GEOMAG i LEMI; Proton magnetometers; DI-fluxgate magnetometer; Induction magnetometer; Ionosonde; GPS signal scintillation monitor GSV4004; Seismometer STS-2; Logger MK-6; Atmospheric electricity sensors; 2 RBR wave sensors; Side Scan Sonar Wesmar 700; Oretech 3010 sediment profiler; CODA DA 100; 4 hydrophons with 2 Tascam registrator, RDI ADCP Sentienel 20;

Air sampling station AZA-1000; Total radiation measurer and UV measurer: CMP11, CMP21, UV S-E-T;

Insolation measurer CSD3; 4-component net radiometer CNR4; Cimel photometer; Ceilometer CHM-15k; Sky camera Fuji-Campbell, dGPS station (referencial); Terrestrial Laser Scanner, DJI Phantom 4 Pro drones (3pcs), DJI Mavic Air drone.

Laboratory

The Hornsund Polish Polar Station (Spitsbergen) is year-round laboratory for research in the following fields:

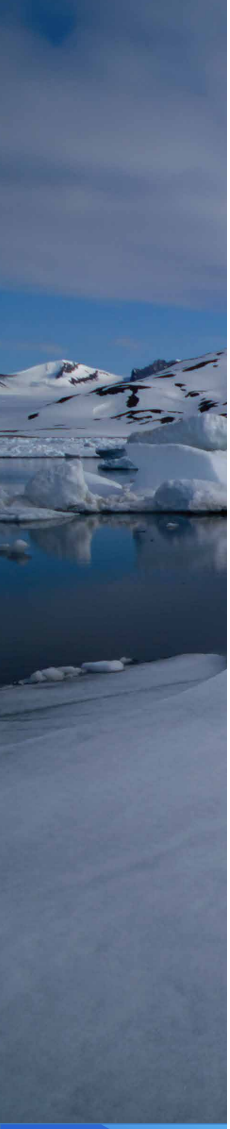
Meteorology. Data for forecasting and climatological purposes is collected at the Station. The Hornsund weather station works as part of the Norwegian station network and is registered by the WMO (World Meteorological Organisation) as number 01003. Basic meteorological parameters are measured and observed here systematically, 24 hours a day, pursuant WMO standards.

Seismology. The seismology station in Hornsund belongs to the international network of seismological observatories. It is the only station constituting part of the Polish seismological network but located outside Polish territory. The main purpose of the seismology lab in Hornsund is to continuously record local earth tremors caused by plate tectonics and glaciers.

Earth magnetism. Changes in elements of the Earth's natural magnetic field are continuously recorded at the Station. Due to its geographic location, the Hornsund observatory records some of the greatest changes in the Earth's magnetic field. They are approximately five times greater than those observed in Poland, for instance, so the results of this research are significant for scientists the world over. Since 2002, the Hornsund magnetic observatory has been part of the INTERMAGNET global research network.

Ionospheric research. The Station carries out long-term research on the structure of the ionosphere. This is aimed at determining the impact of particles and plasma originating from Solar flares on our planet.

Glaciology. The nearby Hans Glacier forms the object of glaciological research in the Hornsund region. Measurements are taken here to determine the mass balance and glacier change dynamics and, in addition, the depth of the snow cover is observed. This data is sent to the World Glacier Monitoring Service.



Atmospheric physics and optics. Observations of atmospheric phenomena include changes in the Earth's electric field, UV radiation and aerosol. This data is sent to the international AERONET network and to NASA.

Environmental research. The Station's chemical laboratory analyses the chemical composition of surface and precipitation waters. The purpose of this is to determine the biogeochemical processes occurring in them, as well as the quantities of pollutants reaching this region and depositing here, also of anthropogenic origin.

Apart from the research conducted as part of the Station's year-round research plan, in the spring and summer various groups of scientists pursuing their own scientific projects, conduct research – including in the fields of biology, geology, geodesy, geomorphology, glaciology and oceanology – in the Hornsund region. They then use the logistical and scientific facilities of the Station. The Polish Polar Station in Hornsund also participates in numerous scientific projects, both Polish and international.

Unique Polar Laboratory PolarPOL.
PolarPOL was appointed by the Minister of Science and Higher Education on February 26, 2011. It functions as a National Research Center in the framework of the Polish Road Map of Research Infrastructures and, at the same time, as a separate infrastructural unit of the Institute of Geophysics PAS.

The aim of the Laboratory is to develop technical facilities, as well as to expand the organizational possibilities of conducting multilateral scientific research in the Arctic. The laboratory strengthens Polish participation in the global network of research and monitoring of land and sea polar zones. It also consolidates the current scientific potential of Polish polar explorers. PolarPOL secures Poland's participation in international polar research, which is of fundamental importance to Poland's position in the sphere of foreign policy of the state. The task of PolarPOL is to use the results of basic research for application needs, among others in the field of submarine resources of raw materials, the use of marine biological resources and new shipping opportunities that are opening up, as well as tourist activities.

Research activity and results

Variability of snow cover parameters in polar and mountainous areas | Lewandowski, M., Nawrot, A., Luks, B.

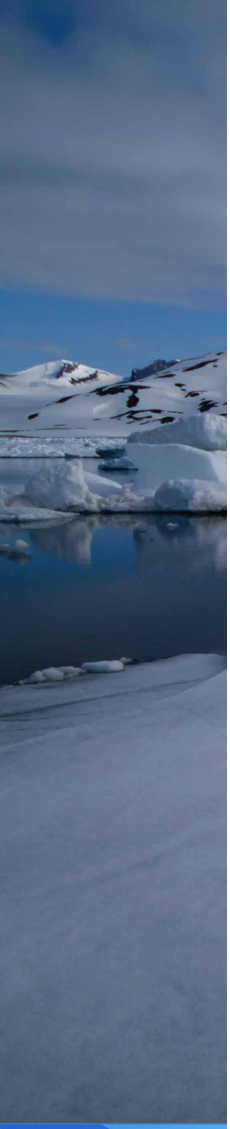
Dust in glaciers: project objectives, methodology and first results (accepted as a keynote presentation at IASC workshop).

Our knowledge on ice caps and ice sheets history, structure and physiochemical record increased significantly during the last decades due to research on ice cores, particularly in the framework of EPICA (European Project for Ice Coring in Antarctica) and GRIP (Greenland Ice Core Project) projects. However, paucity still exists about nature of solid phases impurities in snow, firn and ice. Ice caps and glaciers of Svalbard were frequently analyzed in terms of water-soluble ion chemistry record, but natural and artificial, micrometer-sized solid mineral (and amorphous) phases of aeolian origin, as well as organic particles transported by wind from distant sources, were not studied extensively so far. These particulates may be of different origin, potentially carrying important information about an impact of distant events and processes on the High Arctic environment.

The goal of this proposal is to describe an inventory of mineral (and amorphous) phases and biotic components of both natural and anthropogenic origin, residing in four glaciers of Spitsbergen. The pattern of impurities assemblages, recently deposited in snow and firn, will be traced stratigraphically, aiming at identification and correlation of coeval horizons. In general, the proposal is focused on potential usefulness of identified material for stratigraphic and environmental interpretations. Taking into account interdisciplinary research scope of this proposal, it is a first at such scale ever undertaken on Svalbard. Analysis of biogenic particulates, with the focus on cryoconite and glacial micro-fauna will also be performed in search of viable organisms of the glacial environment.

Research methodology.
Selected glaciers will be cored to depths of 2-3 m (shallow) and 9-10 m (deep), yielding 16 cores of total length about 50m, providing 200 samples of c. 1,5 kG each. Each sample will be weighed, melted and filtrated using membranes with 0.45 µm pore size. Dried residuum will be packed and distributed among cooperating laboratories, in order to identify mineral or amorphous phases and biogenic components. Analytical methods cover a wide spectrum of geochemical analyses, employing scanning microscopes (ASEM), mass spectrometry including of Nd, Hf, Sr , X-ray diffractometry and tomography, and nobel gas spectrometry. Results of geochemical isotope analyses on volcanic ash particles of Nd, Hf and 87Sr/86Sr, along with the K-Ar ages, will point to dust source area. Analyses of REE are also planned. Magnetic phases will be identified using a unique Micromag AGFM 2900-02 Alternating Gradient Force Magnetometer for measurements of magnetic hysteresis of very fine samples (up to 50 µg) in room temperature.

Expected impact on the development of science.
a) Dust distribution over the area under study for a last 8-10 years (for longer cores)



and 2-4 years (for shorter cores) years, as well as quantitative concentration (ng/g) of water-insoluble light-absorbing particulates in the snow cover and firn will contribute to better understanding of recent albedo variation.

b) Identified assemblages of particles will be traced horizontally (for the first time on Spitsbergen), attempting to establish horizons of reference, to trace differences in a pace of the glacier seasonal firn increments, validating existing models and giving a way to infer on internal glaciers dynamics, if compared to results similar studies in future.

c) Relative concentration of dusts from season to season may be considered a proxy in the source area environment (humid/warm vs. arid/cold).

d) A role of the black carbon particles, whatever origin, as a climate forcing agent over Svalbard will be estimated based on their concentration.

e) Concentration of anthropogenic phases will be estimated as well.

f) Back trajectory analysis of atmospheric circulation as well as isotope geochemistry methods will point to the dust components source area.

Results obtained in 2018.

First results of chemical analyses are promising for this project. Detrital residuals were obtained from five cores of c. 1 m long, acquired from different glaciers, Residuals show a wide spectrum of mineral phases with a strong potential to the environmental interpretation (Fig. 1, 2). Within a frame of a pilot study, two samples were selected to recognize mineral phases of the dust present in different glaciers. Quartz and K feldspar are predominating the mineral inventory of each sample (ca. 70 % of the dust material). Phases of zircon, monazite and rutile are present in both of them. Sample SIC4 (Fig. 1) is characterized by the presence of BCP. These particles will be of the great importance to recognize historic record of anthropogenic activities in the area. Sample RIC3 (Fig. 2) from the Recherchebreen glacier contains significant amount of Fe oxide, pyrite and most probably micrometeorite.

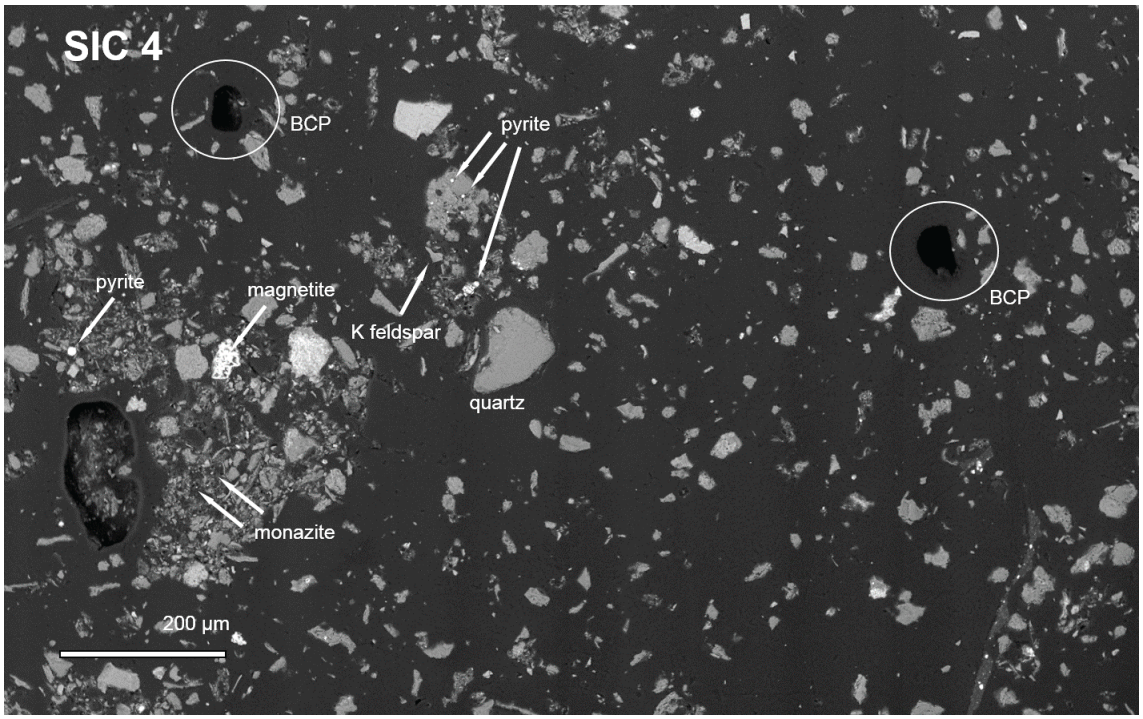


Figure 1: Secondary electron image of uncoated dust sample SIC 4 from Storbreen. SEM; BCPs are shown circled. Courtesy Dr Monika Kusiak

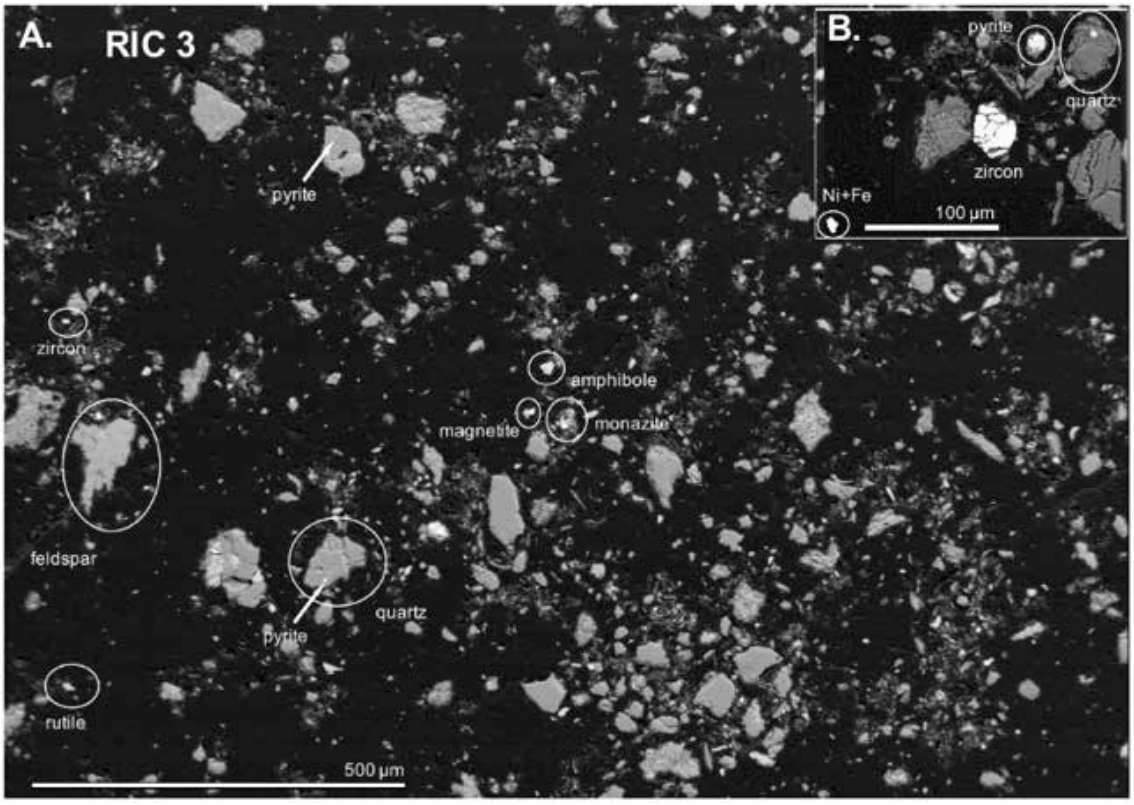
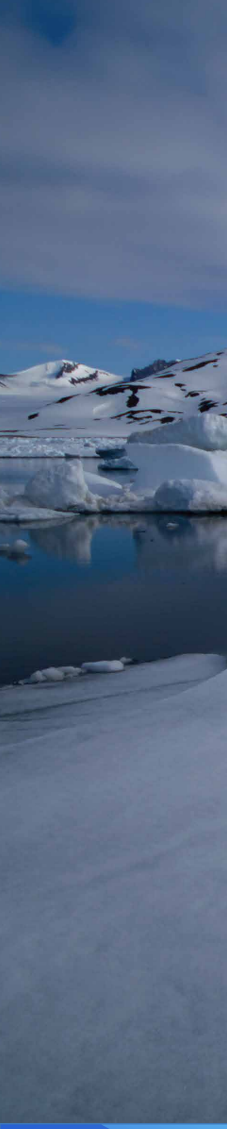


Figure 2: Back scattered electron (BSE) image of the dust sample from Recherchebreen. Micrometeorite (?) and a zircon grain are seen in the sector B. Courtesy Dr Monika Kusiak



Glaciated catchment components modelling | Podgórski, J., Głowacki, P.

The work in the task involves processing of digital observational data – sourced from field measurements with laser scanner, satellite imagery and global digital elevation models. Computer programming in Matlab and Python languages allows to draw meanigngful results and conclusions from large volumes of data. The objective of the task is to investigate dynamics of components of glaciated catchments, particularly changes of glacial cover. This is to give new insight into processes occurring in these environments.

The work is conducted in cooperation with two foreign institutions: Centro de Estudios Cientificos, Valdivie, Chile, and Université du Québec à Trois-Rivières, Trois-Rivières, Canada. Michał Pętlicki and Christophe Kinnard, from the two places respectively, are strongly involved in scientific work on the task.

In the year 2018 one scientific article was published in a peer-reviewed journal listed on the A list of the Ministry of Science and Higher Education of Poland: Cold Regions Science and Technology (Impact factor: 1.92) (Podgórski et al 2018). The paper describes an empirical model linking changes in reflectivity of a front of a tidewater glacier with time elapsed since a calving event happened. The work based on field data obtained by Michał Pętlicki on Greenwich Island, South Shetland Islands, Antarctica in 2013. The reflectivity has been measured with use of a terrestrial laser scanner, while calving events were registered with use of a video camera. These observational data were processed with help of Matlab programming language to arrive at an exponential form of the relationship (Fig. 1).

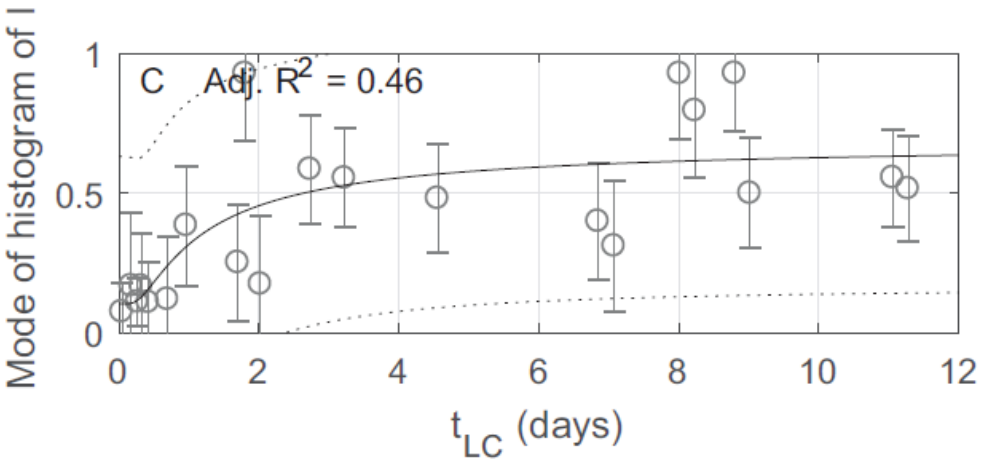


Figure 1: Exponential function fitted to the dataset of mode of reflection intensity histogram (vertical axis) and time since the last calving event (tLC, horizontal axis). Increase of the values indicates brightening of the ice surface

Brightening of glacial ice with time since a calving event revealed it to the elements was found, an unexpected result. It was proposed, that formation of a layer of weathered ice on the ice cliff surface is responsible for the phenomenon. Description of the process of ice cliff weathering in quantitative terms is a scientific innovation brought by the paper.

Most of the work during the year was dedicated to investigation of geodetic mass balance of Universidad glacier, located in central Chile. TanDEM-X DEM digital elevation model, obtained from the German Space Agency in 2017 in a call for proposals, was the centerpoint of these efforts. This project had two objectives: one was to determine mass balance of the glacier in question in the 21st century, while the other was to ascertain how useful the new TanDEM-X DEM is for glaciological work. Three other elevation models were used in the study: SRTM and ASTER DEM are global datasets showing surface relief in 2000 and 2003, respectively. In addition an aerial laser scanning (ALS) based elevation model served as ground reference and accurate representation of surface elevation in 2013. The four models were compared to each another and measures of TanDEM-X DEM quality and Universidad glacier change were computed.

Both goals have been achieved. TanDEM-X DEM was shown as a high-quality dataset, well suited for glaciological change detection study. Its accuracy relative to the ALS-based DEM is 0.02+/-3.48 m. in the study area, a score better, than that of the older ASTER and SRTM. Discontinuities and noise was found in TanDEM-X DEM on steep slopes surrounding the glacier, but these had little to no impact on the mass balance results.

Universidad glacier has been shown to lose mass in nearly all its parts, with exception of limited accumulation in the highest parts of its accumulation zone. Particularly strong ablation was noted in the tongue of the glacier, where bands of debris are thick enough to hinder ablation and led to formation of troughs and ridges (Fig. 2). Overall the glacier has been losing 0.44+/-0.08 m of water equivalent per year between 2000 and 2013.

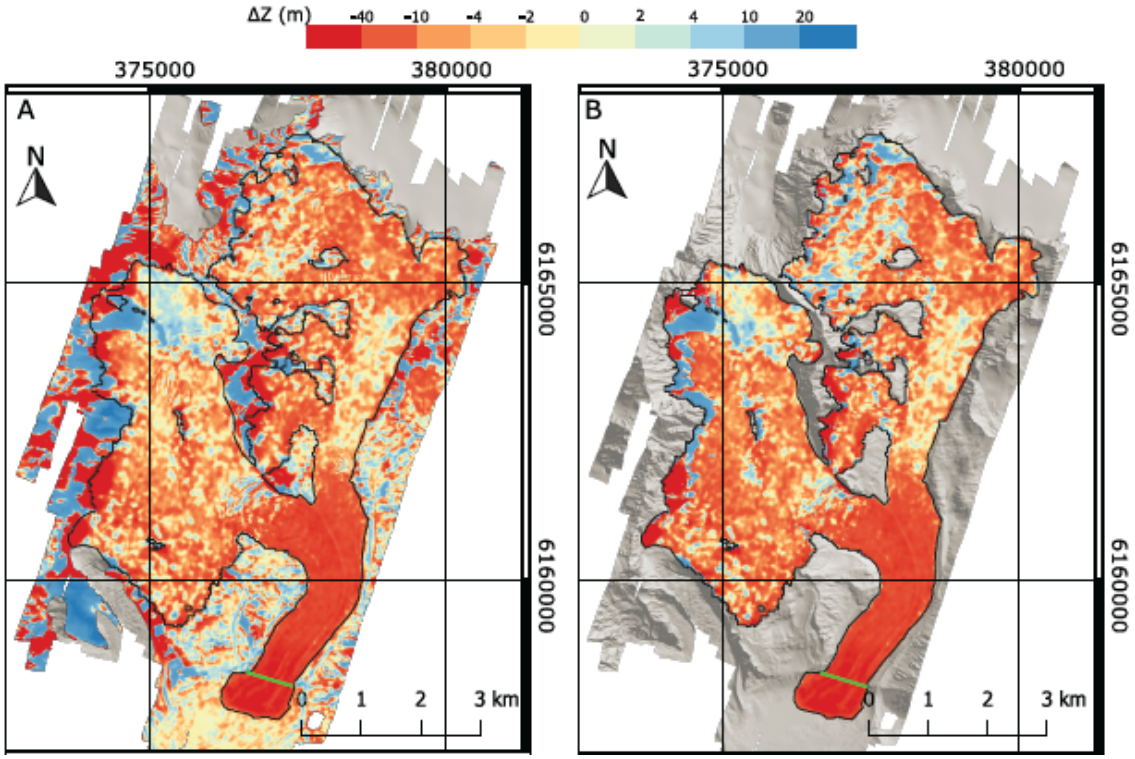
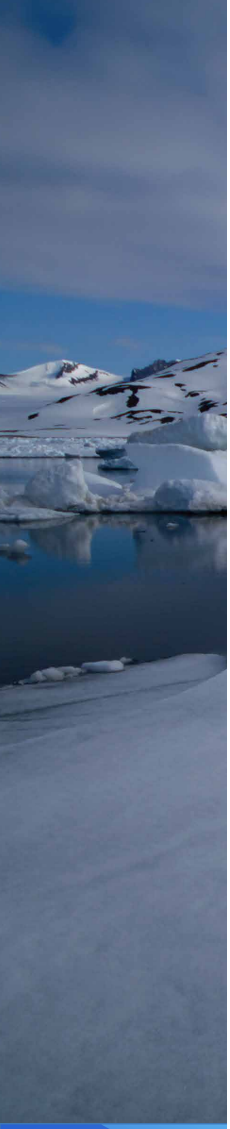


Figure 2: Maps of difference of surface elevation between 2000 (SRTM DEM) and 2013 (ALS DEM on Panel A and TanDEM-X DEM on Panel B). Red colour indicates strong lowering of surface and thus ice loss. Blue colour indicates thickening - result of ice accumulation or vertical movement of ice



A manuscript of a scientific article summarizing the results of this part of the task was written and prepared for publication. It was accepted for publication in Remote Sensing, a peer-reviewed journal (Impact Factor 3.4). Revised version of the manuscript has been submitted close to the end of the year and the final decision on publication is pending now.

References:

Podgórski, J., Pętlicki, M. and Kinnard, C. (2018). Revealing recent calving activity of a tidewater glacier with terrestrial LiDAR reflection intensity. Cold Regions Science and Technology, 151, pp.288-301. doi: https://doi.org/10.1016/j.coldregions.2018.03.003

Hydrological and hydrochemical characteristics of glaciated and unglaciated catchments

Osuch M., Wawrzyniak T., Nawrot A. | 2018 |Diagnosis of the hydrology of a small Arctic permafrost catchment using HBV conceptual rainfall-runoff model. Hydrology Research, https://doi.org/10.2166/nh.2019.031

General warming is observed across Svalbard Archipelago and corresponds to increases in ground temperatures. Changes in active layer thickness over Arctic and permafrost regions have an important impact on rainfall-runoff transformation. Permafrost thaw and changes in active layer thickness due to climate warming alter how water is routed and stored in catchments, and thus impact both surface and subsurface processes. The overall aim is to examine the relationships between temporal changes of active layer depth and hydrological model parameters, together with variation in the catchment response. The analysis was carried out for the small unglaciated catchment Fuglebekken, located in the vicinity of the Polish Polar Station Hornsund on Spitsbergen. For hydrological modelling, the conceptual rainfall-runoff HBV model was used. The model was calibrated and validated on runoff within subperiods. A moving window approach (3 weeks long) was applied to derive temporal variation of parameters. Model calibration, together with an estimation of parametric uncertainty, was carried out using the Shuffled Complex Evolution Metropolis algorithm. This allowed the dependence of HBV model parameters on active layer thickness to be analysed. Also, we tested the influence of model simplification, correction of precipitation, and initial conditions on the modelling results.

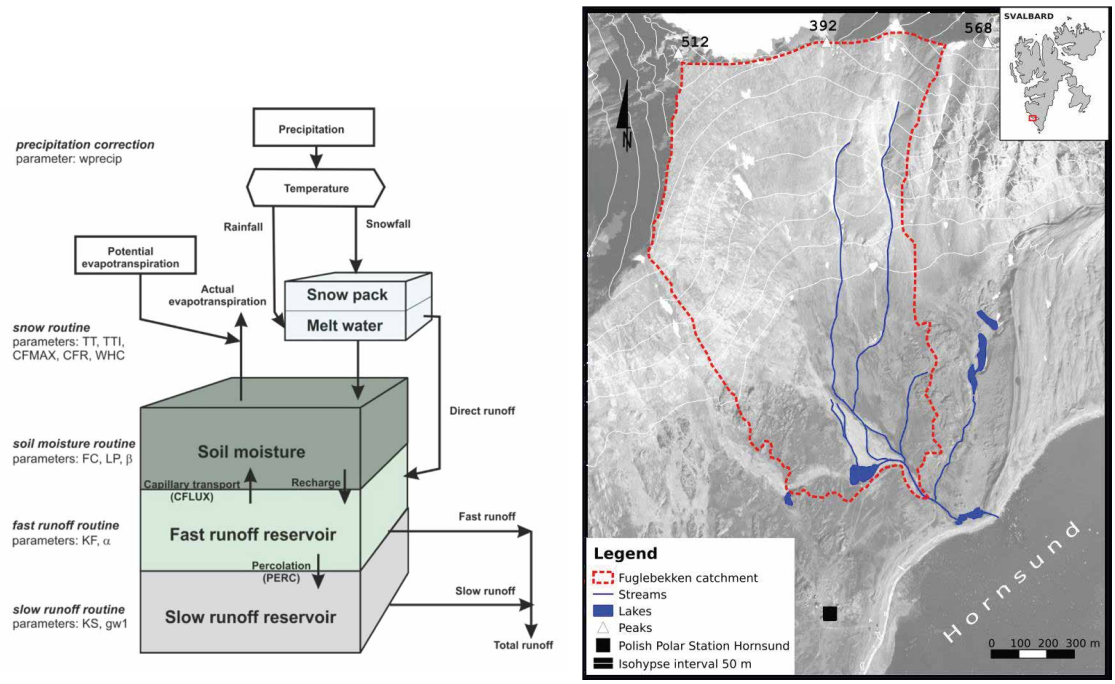


Figure 1: A structure of the HBV model applied in this study.

Hydrological and hydrochemical characteristics of glaciated and unglaciated catchments

Araźny A., Przybylak R., Wyszyński P., Wawrzyniak T., Nawrot A., Budzik T. 2018. Spatial variations in air temperature and humidity over Hornsund fjord (Spitsbergen) from 1 July 2014 to 30 June 2015. (Geografiska Annaler series A Physical Geography. doi.org/10.1080/04353676.2017.1368832)

Based on measurements at 11 sites in the region of the Hornsund fjord (Fig. 1), it was established that significant topoclimatic differences were dependent on height above sea level, substrate type, distance from the sea, exposition, atmospheric circulation and the ice conditions.

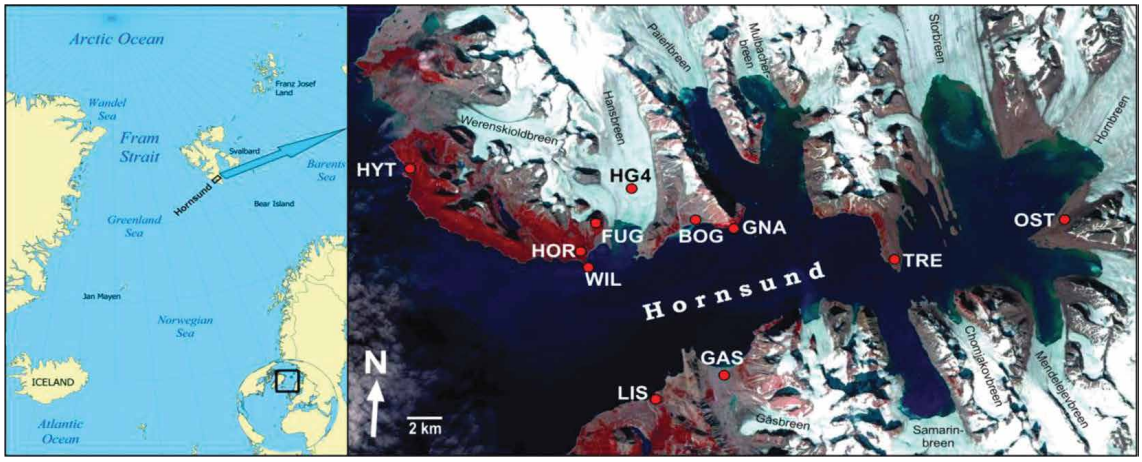


Figure 1: . Location of meteorological sites. Based on the Landsat 8 image (2 August 2016).

The thermal and humidity conditions of individual sites are presented in relation to the weather conditions at the Polish Polar Station in Hornsund (HOR). In the period from 1 July 2014 to 30 June 2015, the warmest annual mean air temperature (T) occurred at Hyttevika (HYT), and the coldest on the summit of Fugleberget (FUG), respectively, +1.1^{0}C and -3.7^{0}C relative to HOR. Meanwhile, relative humidity (RH) differs from HOR values most strongly on FUG, where it is greater by an average of 14%. Atmospheric circulation and ice cover were shown to have a significant impact on thermal and humidity conditions. The greatest spatial variations in T (3.0 ^{0}C) in Hornsund region (between HOR and FUG) occurred in winter during anticyclonic advection from the northern sector. The greatest difference in RH (20%) relative to HOR occurred in FUG in autumn during cyclonic advection from the eastern sector. The E-W thermal and humidity gradients along the fjord are more pronounced when sea ice is present. Differences in T and RH between the sites located in the inner (TRE) and outer parts of the fjord (HG4 and HYT) rose by about 2.0-2.5 ^{0}C and 7-9%, respectively.

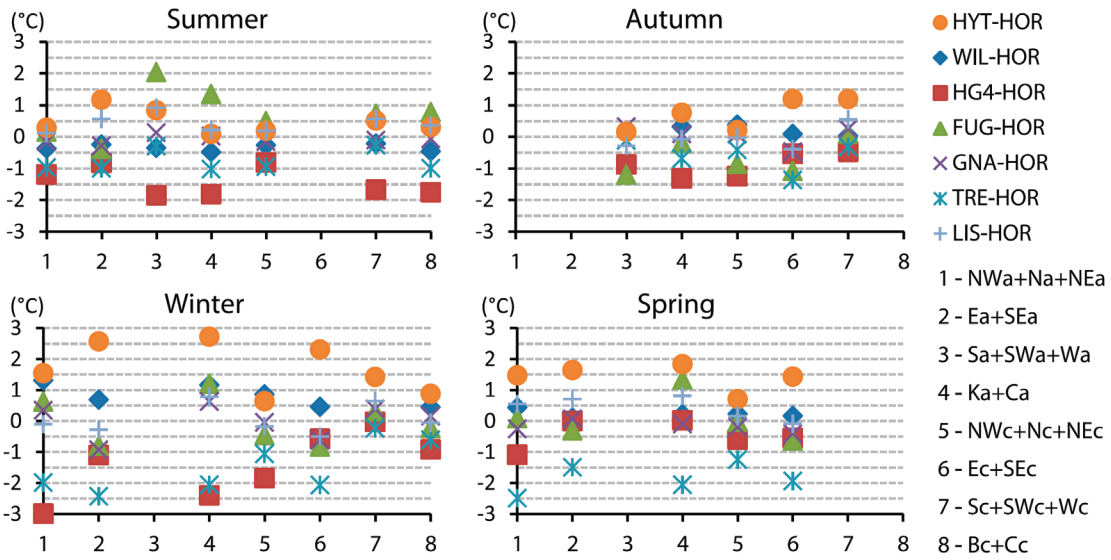
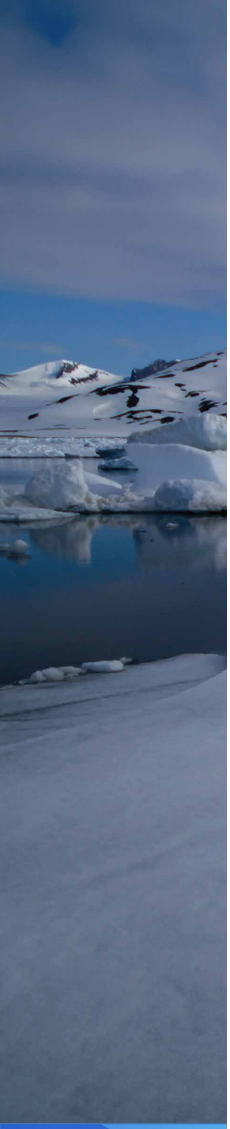


Figure 2: Mean differences of air temperature (°C) between HOR and other measurement sites in the area of the Hornsund fjord for combined types of atmospheric circulation in particular seasons in the period July 2014–June 2015.



Submarine geomorphology at the front of the retreating tidewater glaciers (Hansbreen, Recherchebreen).

Ćwiąkała J., Moskalik M., Wojtysiak K., Giżejewski J. | 2018 | Hansbreen tidewater glacier, Hornsund fjord, southwest Spitsbergen. (more in: doi: 10.1080/17445647.2018.1441757)

A 1:10,000 scale bathymetric map as well as 1:20,000 scale backscattering and geomorphological maps of two bays Isbjørnhamna and Hansbukta in the Hornsund fjord (Spitsbergen) present the submarine relief that was primarily formed during and after the retreat of the Hansbreen tidewater glacier. Geomorphological mapping was performed using multibeam bathymetric data and seismoacoustic profiling. The identified landforms include two types of transverse ridges interpreted as terminal and annual moraines, flat areas that are depressions filled with glaciomarine sediments, iceberg-generated pits and ploughmarks, pockmarks and fields of megaripples. Most of the identified landforms are genetically related to the retreat of Hansbreen since the termination of the Little Ice Age at the beginning of the twentieth century. Although Hansbreen has been speculated to be a surge-type glacier, no evidence of surging was identified in the submarine landform assemblage, which is in accordance with the absence of historically documented surges for that period.

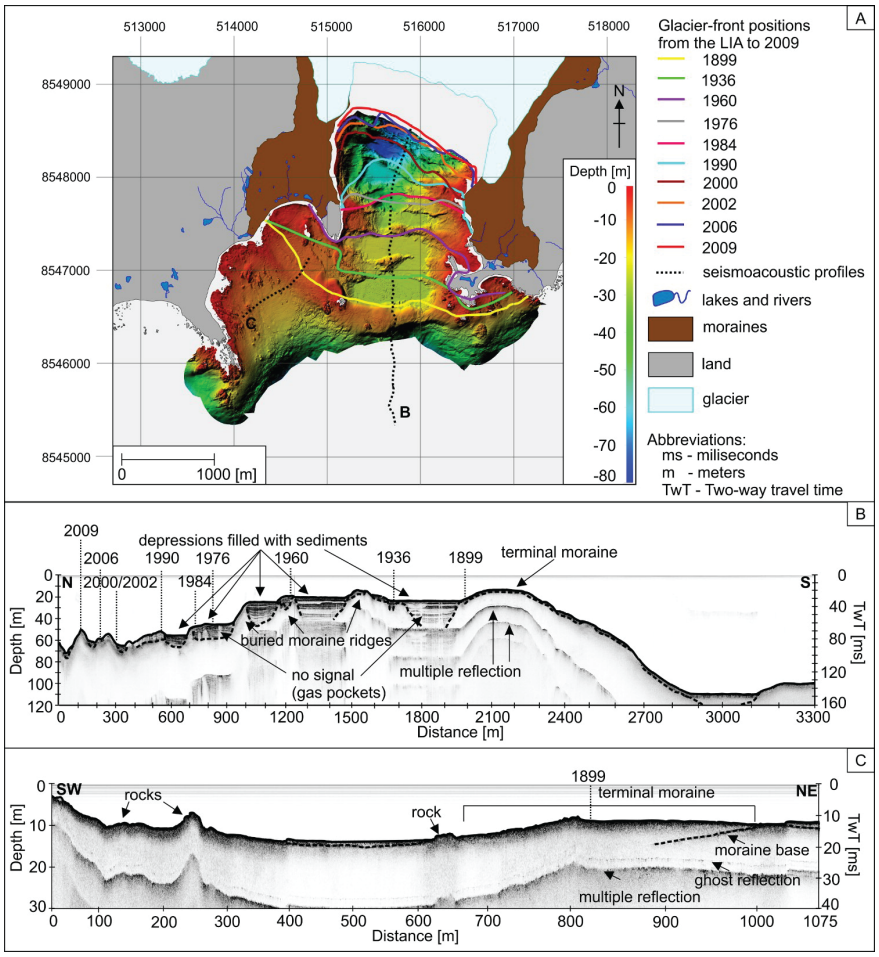


Figure 1: (A) Bathymetric map of Isbjørnhamna and Hansbukta with marked glacier-front positions for selected years and the locations of the seismoacoustic profiles. (B) Seismoacoustic profile with interpretation in Hansbukta; (C) Seismoacoustic profile with interpretation in Isbjørnhamna. The numbers (years) provided in (B,C) refer to glacier-front positions. The distance scales on (B,C) differ

Submarine geomorphology at the front of the retreating tidewater glaciers (Hansbreen, Recherchebreen)

Moskalik M., Ćwiąkała J. | 2018 | Morphological characterization of Recherchefjorden (Bellsund, Svalbard) using marine geomorphometry (more in doi. 10.24425/118740)

Geomorphological research based on geomorphological mapping seeks to identify the origins and age of forms as well as to describe the process that created or transformed a particular form. One of the most important aspects of this study is the morphometry and morphology of the landscape. This also applies to the submarine areas, and issues related to marine geomorphometry. Bathymetric data used in this study were obtained from the measurements of the Norwegian Hydrographic Service and measurements conducted by the authors. Its main goal was: to determine the bathymetry of the Recherchefjorden (Bellsund, Svalbard), establish morphometric parameters for the analysis of the morphology of the bottom. The boundaries of zones, related to the specific character of bottom geomorphology linked with geological structure, tectonics and, in particular, the impact of glacial system, was delineated. The sets of landforms (areas) were distinguished based on the morphometric analysis resulting from the determined parameters: slopes, its aspects, curvatures and Bathymetric Position Index. Basically, this areas are concentrated in two zones: the main Recherchefjorden and its surroundings. The delimitation also takes into account the origins and location of theme in relation to the glacial systems. On this basis, moraine areas were distinguished. They are linked with the Holocene advances of two glaciers, Renardbeen and Recherchebreen, mainly during the Little Ice Age. They constitute boundary zones between areas with different morphometric parameters: outer fjord and inner fjord. Moreover, taking into account geology and terrestrial geomorphology it was possible to describe paraglacial processes in this area.

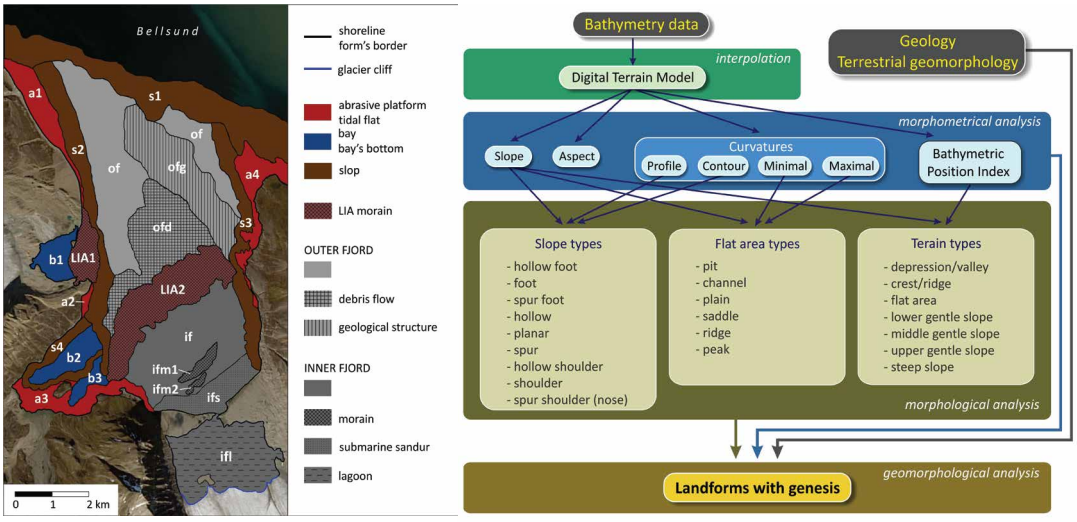
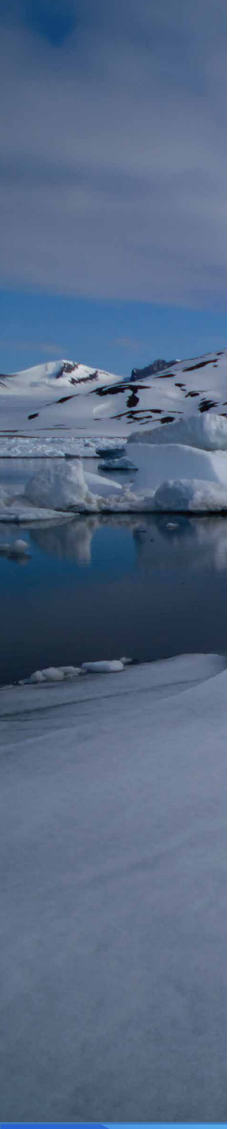


Figure 1: Sets of landforms obtained through morphometric study and Diagram of the steps of data processing and measurement results.



Submarine geomorphology at the front of the retreating tidewater glaciers (Hansbreen, Recherchebreen)

Głowacki O., Moskalik M. | 2018 | The Intensity, Directionality, and Statistics of Underwater Noise From Melting Icebergs (more in doi. 10.1029/2018GL077632)

Freshwater fluxes from melting icebergs and glaciers are important contributors to both sea level rise and anomalies of seawater salinity in polar regions. However, the hazards encountered close to icebergs and glaciers make it difficult to quantify their melt rates directly, motivating the development of cryoacoustics as a remote sensing technique. Recent studies have shown a qualitative link between ice melting and the accompanying underwater noise, but the properties of this signal remain poorly understood. Here we examine the intensity, directionality, and temporal statistics of the underwater noise radiated by melting icebergs in Hornsund Fjord, Svalbard, using a three-element acoustic array. We present the first estimate of noise energy per unit area associated with iceberg melt and demonstrate its qualitative dependence on exposure to surface current. Finally, we show that the analysis of noise directionality and statistics makes it possible to distinguish iceberg melt from the glacier terminus melt. Recent studies have demonstrated that impulsive underwater noise produced by tiny air bubbles released from melting glacier ice is a spectacular signal of the changing planet. A direct link between the melt rate and related noise would provide a first tool to study subsurface melting in a direct way. However, to make it possible, at first we need to better understand the properties of these sounds. To address this issue, we investigate intensity, directionality, and statistics of the melt noise. The results prove that icebergs can be automatically detected and tracked using several acoustic receivers immersed in water. Moreover, we provide the first estimate of acoustic energy produced by melting icebergs.

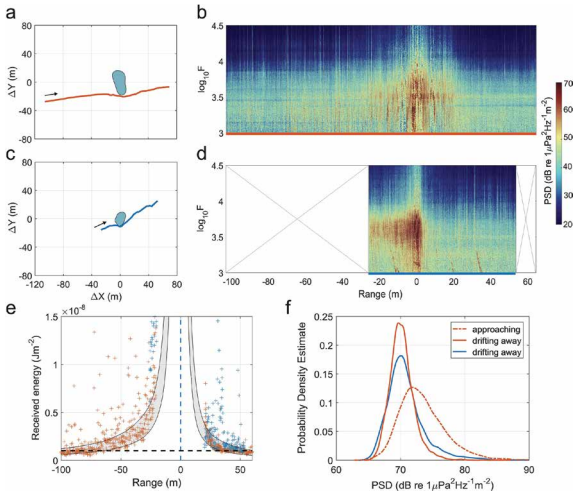
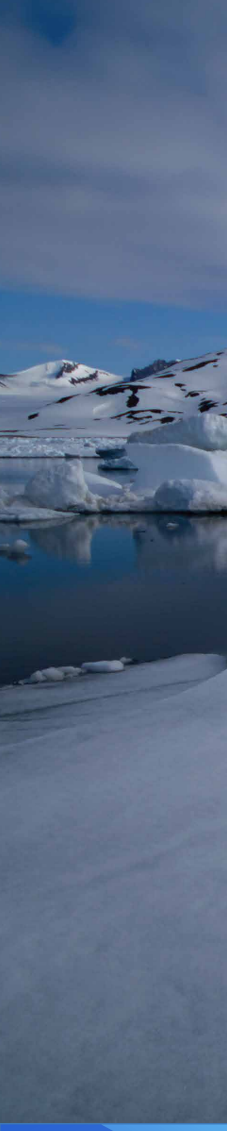


Figure 1: Comparison between acoustic emission of icebergs 1 and 5, tracked during deployments 20150606/1 (red) and 20150606/4 (blue), respectively. Upper panels show geometry of the experiments (a, c) and frequency dependence of power spectral density estimates per square meter of submerged ice area in relation to the distance between the boat and icebergs (b, d). Lower panels present received energy per square meter versus range (e), and probability density estimates of power spectral density per square meter, scaled to 1 m from the melting ice (f). Gray shaded area denotes transmission loss computed using Bellhop model for source frequency changing from 1 to 10 kHz and depths of 1 to 6 m. The data segment contaminated with a bearded seal call, visible between 32 and 36 m at plot (d), was removed before determining the probability density estimates of noise power.

Submarine geomorphology at the front of the retreating tidewater glaciers (Hansbreen, Recherchebreen)

Moskalik M., Ćwiąkała J., Głowacki O., Wojtysiak K. | 2018 | Spatiotemporal changes in the concentration and composition of suspended particulate matter in front of Hansbreen, a tidewater glacier in Svalbard (more in doi. j.oceano.2018.03.001)

Tidewater glaciers supply large amounts of suspended particulate matter (SPM) and freshwater to fjords and affect oceanographic, sedimentological and biological processes. Our understanding of these processes, is usually limited to the short summer season. Here, we present the results of a one-year-long monitoring of the spatial variability in SPM characteristics in a context of oceanographic and meteorological conditions of a glacial bay next to Hansbreen, a tidewater glacier in Hornsund (southern Spitsbergen). The observed range of SPM concentrations was similar to ranges measured in other sub-polar glaciated fjords, especially in Svalbard. The major source of SPM is the meltwater discharge from the glacier. The maximum water column-averaged SPM concentrations did not correlate with peaks in freshwater discharge and were observed at the beginning of the autumn season, when the fjord water transitioned from stratified to fully mixed. The observed spatiotemporal variations in the total SPM, particulate organic matter (POM) and particulate inorganic matter (PIM) are likely controlled by a combination of factors including freshwater supply, water stratification and circulation, bathymetry, the presence of sea ice, biological productivity and sediment resuspension. During the ablation season, the SPM maximum concentrations were located within the upper water layer, whereas during the winter and spring, the greatest amounts of SPM were concentrated in deeper part. Thus, typical remote sensing-based studies that focus on SPM distributions may not reflect the real SPM levels. POM and PIM concentrations were correlated with each other, during most of the time suggesting that they may have a common source.



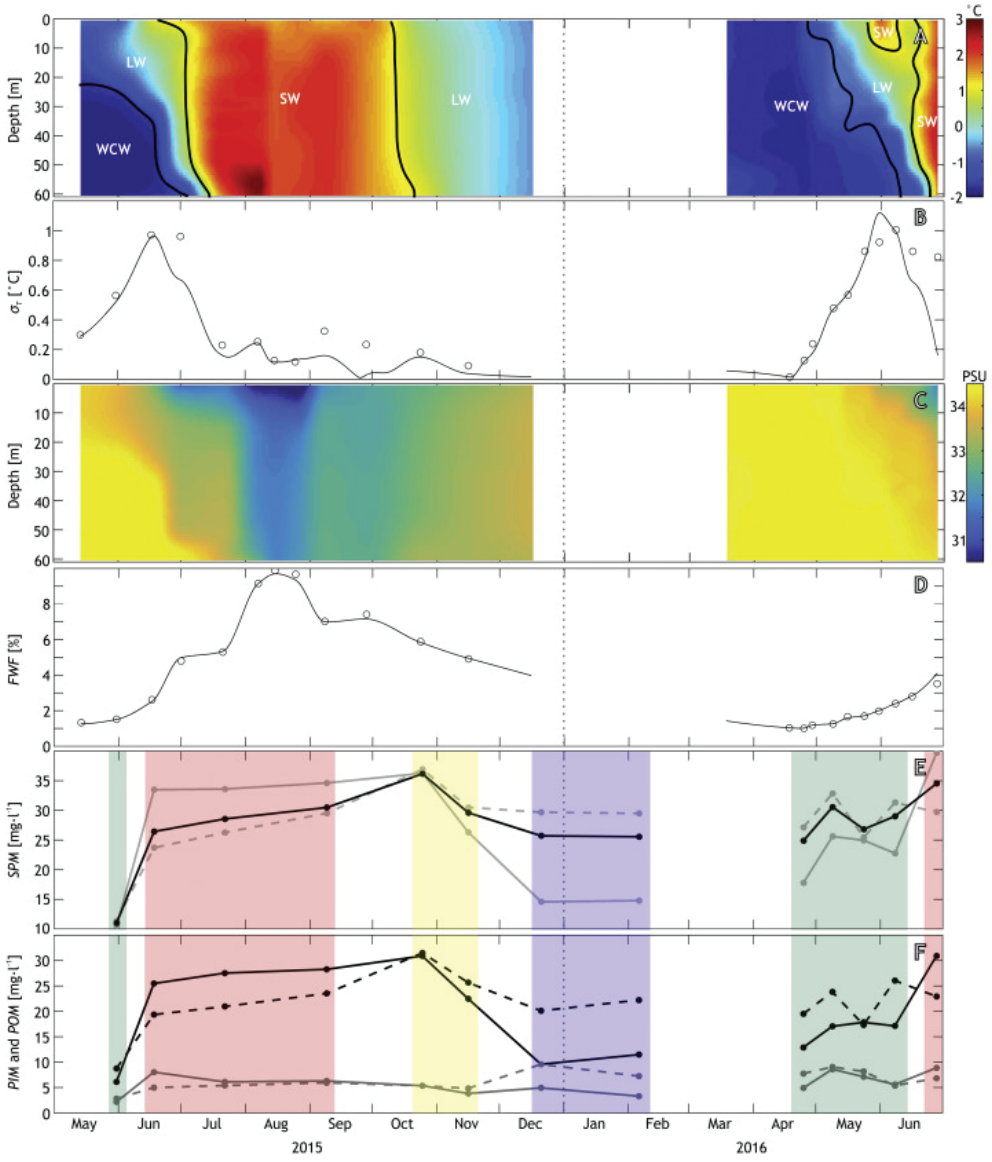


Figure 1: Annual changes in the oceanographic conditions and mean interpolated suspended particle matter (SPM) concentration and composition data. (A) Interpolated water temperature depth profile changes over time. The abbreviations refer to water mass types. WCW – winter-cooled water, LW – local water, and SW – surface water (see text for details); (B) standard deviations of water temperature (σT) from interpolated (black line) and measured (black circles) values; (C) interpolated water salinity depth profile changes over time; (D) the freshwater fraction (FWF) calculated from interpolated (black line) and measured (black circles) values; (E) the mean concentration of SPM from interpolated data over the total water column (black line), its surface concentration (grey line) and deeper subsurface concentration (dashed grey line). The surface part of the water column refers to the layer from the surface to a depth of 10 m, and deep water refers to the layer from 20 to 50 m below surface; (F) average concentrations of the interpolated particulate inorganic matter (PIM – black lines) and particulate organic matter (POM – grey lines) within the surface (solid lines) and deeper subsurface (dashed lines) parts of water. The time intervals coloured on (E) and (F) represent measurements assigned to the spring (green), summer (red), autumn (yellow), and winter (blue) seasons.

Submarine geomorphology at the front of the retreating tidewater glaciers (Hansbreen, Recherchebreen)

Wojtysiak K., Moskalik M. | 2018 | Wind wave climate of west Spitsbergen: seasonal variability and extreme events (more in doi. j.oceano.2018.01.002)

Waves are the key phenomenon directly influencing coastal morphodynamics. Facing insufficient observations, wind wave climate of the west coast of Spitsbergen can be characterized on the basis of the modelled data. Here we have used the results of spectral wave models: Wave Watch III (WW3) hindcast and WAM in ERA-interim (ERAi) reanalysis. We have observed the presence of seasonal cycle with difference of up to 1 m between significant wave heights in summer and winter. In wave-direction analysis we have noticed the southwestern swell component of remarkably narrow width, thus we expect unidirectional swell impact on the coastline. Extreme events analysis revealed that storms occur mainly in winter, but the most energetic ones (significant wave height of up to 9.5 m) occur in spring and autumn. We have identified positive trends in storms' frequency (2 storms per decade) and storms' total duration (4 days per decade) on the south of the study area. More storms can result in the increase of erosion rate on the south-western coasts of Spitsbergen, but this change may be highly dependent on the sea ice characteristics. Wave heights of wind sea and swell are correlated with the relevant atmospheric circulation indices, especially the North Atlantic Oscillation. In the recent decade, the correlation is stronger with WW3 than with ERAi data, at some locations explaining over 50% (over 30%) of the total variance of wind sea (swell) wave heights. In ERAi data, the relationship with circulation indices seems sensitive to the length of the analysis period.

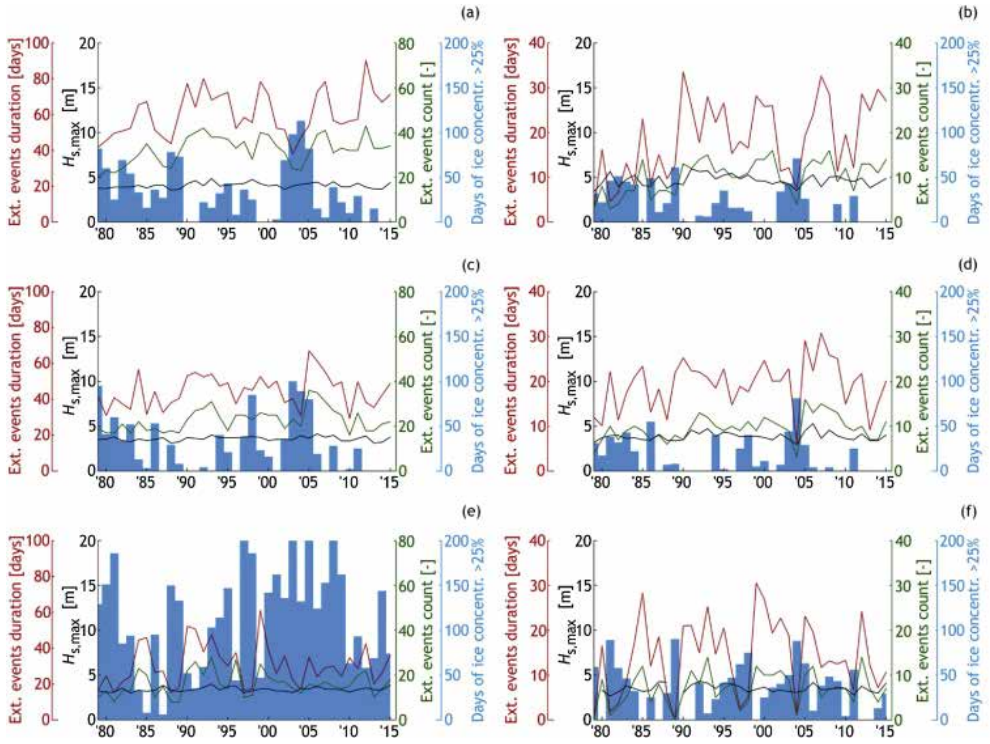
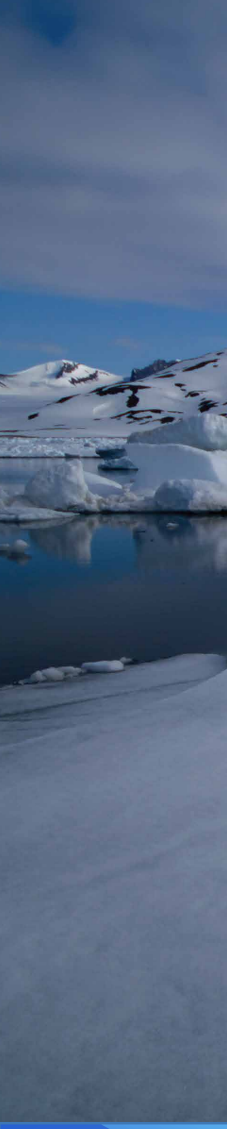


Figure 1: Extreme event parameters calculated from ERAi dataset for annual (a, c, e) and winter (DJF) (b, d, f) for points on south (a, b), centre (c, d) and north (e, f) part of Spitsbergen. Individual variables have separate y-axes to enable easy absolute value readout. Please note that the scales differ between annual and winter charts.



Attempt to prediction of environmental change after Barents sea-Greenland sea ice-barrier breakup

Grabiec M., Ignatiuk D., Jania J.A., Moskalik M., Głowacki P., Błaszczyk M., Budzik T., Walczowski W. | 2018 | Coast formation in an Arctic area due to glacier surge and retreat: The Hornbreen–Hambergbreen case from Spistbergen (Earth Surface Processes and Landforms doi.org/10.1002/esp.4251)

Glaciered coasts undergo faster geomorphic processes than unglaciated ones. We have studied changes of the coastal area in southern Svalbard with the glacier bridge between Torell Land and Sørkapp Land since the beginning of the 20th century. The existence of a continuous subglacial depression beneath the Hornbreen–Hambergbreen glacier system has been debated since the 1960s, with inconclusive results. In this study we assess both the subglacial topography and the bathymetry of Hornsund Fjord and Hambergbukta bay. This included ~40 km of radar surveys over the glacial system and sea depth sounding. The extent of the glaciers from maps and satellite images together with digital terrain models and surface elevation data based on GPS profiling were used to analyse geometry changes of the glacier surfaces. The results confirm the existence of a continuous subglacial depression below sea level (c. 40 m deep) between Hornsund and the Barents Sea. The Hornbreen-Hambergbreen system has changed in shape over the past century, reflecting its dynamic origin and activity, also exemplified by the sequential surges identified since 1899. There was a pre-surge build-up event of Flatbreen causing a surge and subsequent lowering of the Hornbreen-Hambergbreen frontal parts by the 1960s. After, the entire surface lowered, albeit with a delay in the Hornbreen terminal zone. Since the year 2000, Hornbreen terminus has retreated at an average rate of 106 m a−1; ~50% faster than that of Hambergbreen. If the retreat continues at the 2000–2015 average rate, the ice bridge between Hornsund and Hambergbukta will be broken sometime between 2055 and 2065 and the Hornsund strait will separate Sørkapp Land from the Spitsbergen island. The processes and events described in this study, particularly the effects of the glacier surge, may provide a model for changes likely to occur in other coastal glaciated regions experiencing rapid change.

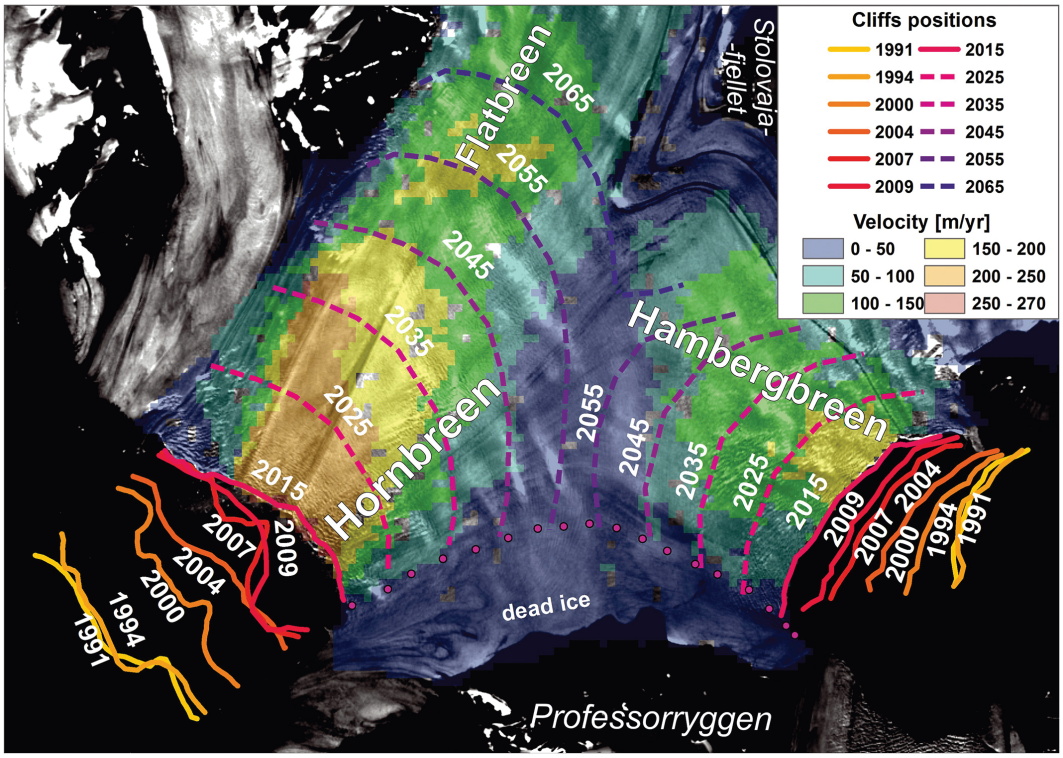


Figure 1: The extent of Hornbreen and Hambergbreen in the period 1991–2015 (continuous lines) and the retreat scenario for 2025–2065 (dashed lines). Background image Landsat 8 (2015–09-17) with clearly visible foliation indicating the direction of ice movement. Ice surface velocity map for the period 1–13 October 2015 from Sentinel-1.

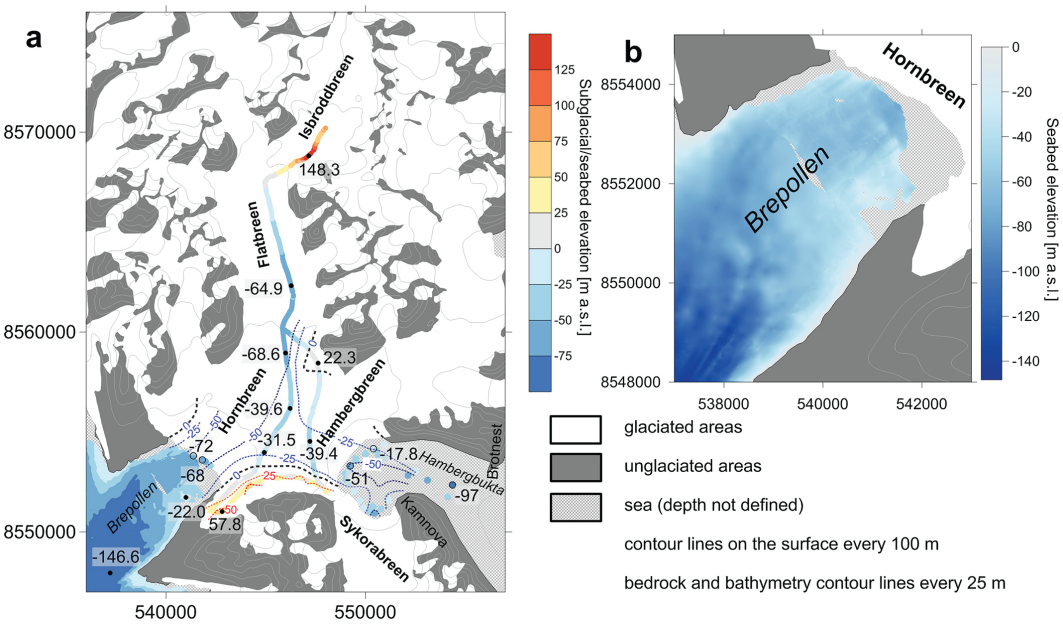
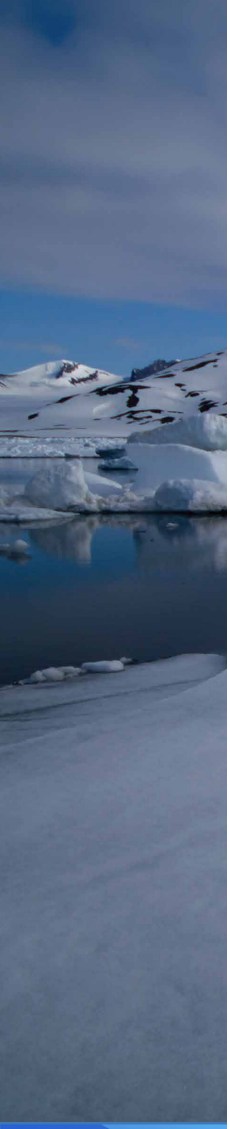


Figure 2: Glacial bed along the GPR profiles from 2013 and 2014, depth of Hambergbukta (a) and inner Brepollen bathymetry (b). Selected depths and points marked. The dashed line represents probable contours of the subglacial topography and isobaths in Hambergbukta.



Science communication and education

Goździk, A. | Research and education cooperation example: educational packages of ERIS project.

One very promising model of learning designs is the model of Research and Education Cooperation activities. ERIS project proposes exploitation of research results in school practice. ERIS is EU funded project (ERASMUS+) aiming to increase the interest of pupils in lower and upper secondary schools in science, and the choice of a scientific career. Thanks to the development, pilot implementation and dissemination of educational packages and methodological materials, research results will be exploited in the education systems of at least 3 European countries: Poland, Romania and France.

ERIS packages are dedicated to various topics, e.g.: glaciers, earthquakes, geomagnetism, meteorology in the Arctic, UV radiation, etc. They use freely available research databases or results published online, which may be analyzed by pupils with the help of instructions prepared by scientists. The packages include materials for teachers to work with pupils during classes or extracurricular activities. They contain worksheets for pupils and guidance for teachers. 30 packages were tested in schools in Poland, Romania and France. The results of evaluation studies are presented and discussed. Teachers found packages interesting and useful for school practice. They found the tasks for pupils rather difficult, as it was a challenge for pupils to apply a new approach, which wasn't taught at schools before. Pupils could not solve tasks in a schematic ways, which they often use when solving typical school exercises, and it might have caused difficulties. However, challenging tasks are developing interest and engagement. ERIS packages and proposed teaching approach may be considered as an efficient way of increasing pupils' interest in science and scientific topics.

National packages were tested in lower and upper secondary schools in partners' countries. Subsequently, English versions of packages were prepared and freely proposed to European secondary schools (not only in partners' countries). Each package was tested by at least 5 groups of students.

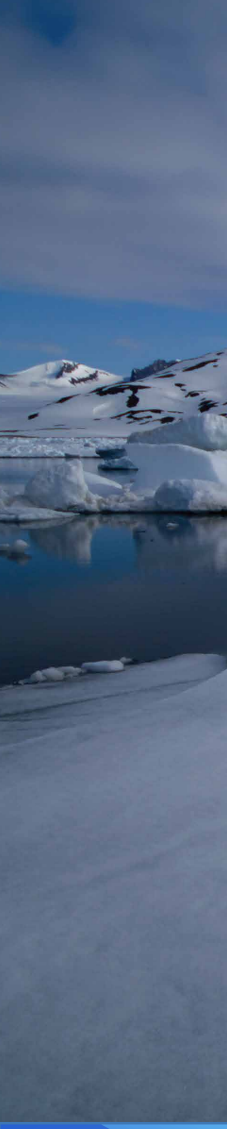
For each package online lessons were conducted by scientists, who prepared educational materials for packages. After lessons teachers and pupils were encouraged to work additionally with worksheets prepared for each package. Subsequently, they could have filled in the survey dedicated to the materials in the package. This survey contained some statistical questions (type of school, age of pupils, subject taught by a teacher, who participated in testing), four content questions (about importance of the topic, transparency of materials, sufficient explanations and level of difficulty), and two fields for suggestions. The results are based on 32 surveys obtained from teachers from secondary schools in Poland, who tested ERIS packages in Polish. Teachers declared that packages contain important educational materials (definitely yes: 81%, rather yes: 19%). They assessed the materials included in the packages as clear and transparent (definitely clear: 59%, rather clear: 41%). They also found

explanations and instructions for the tasks sufficient (definitely sufficient: 59%, rather sufficient: 41%). Teachers assessed materials included in the packages as generally difficult (very difficult: 3%, rather difficult: 56%, rather easy: 41%).

The second step of the evaluation was dedicated to the assessment of the general impact of proposed materials and methods on pupils' skills and interests. This survey was conducted by each partner institution after finishing of testing packages in national languages in Poland, Romania and France. Teachers were requested to assess how many students developed the ability to apply research methods in solving problems in the field of mathematics and natural sciences, and number of students, who developed skills of analytical and synthetic thinking. Moreover, they were also assessing the number of students, whose interest in scientific topics increased.

The results are based on 44 surveys obtained from teachers from secondary schools in Poland (18 surveys), Romania (23 surveys) and France (3 surveys), who tested ERIS packages in national languages. Teachers worked with 44 groups of students. Total number of students, who tested the packages was 1054 (356 students from Poland, 631 students from Romania and 67 students from France).

The results from the surveys show that the impact of the project on students skills and interest in scientific topics is significant. Teachers declared that for 70% of their students, who tested the packages, they observed increase of the ability to apply research methods in solving problems in the field of mathematics and natural sciences. They assessed that 70% of their students developed skills of analytical and synthetic thinking, with a slight difference between upper and lower secondary schools (result for lower secondary schools students is 71%, for upper secondary schools students – 69%). Moreover, teachers observed significant increase of students' interest in scientific topics. They declared that for 72% of their students interest increased. Some differences between younger and older students were observed. Students from lower secondary schools got more interested than those from upper secondary schools (73% compared to 70%).



Seminars and teaching

Seminars and lecture outside of the IG PAS

T. Wawrzyniak | *How can Arctic and Antarctic research engage students to STEM education?* | Invited lecture
Federal University of Minas Gerais | Belo Horizonte, Brasil

A. Goździk et. al. | Webinars
High Schools all over the World

Teaching

T.Wawrzyniak | *Introduction to geology and physical geography* | Warsaw School of Information Technology

Completed PhD thesis defense

D. Kępski | *Wpływ rzeźby i pokrycia terenu na rozkład przestrzenny i dynamikę zmian pokrywy śnieżnej na tundrze w okolicy Polskiej Stacji Polarnej na Spitsbergenie* | Supervisor: K. Migała, B. Luks (supporting supervisor)

J. Ćwiąkała | *Zapis recesji uchodzącego do morza lodowca Hansa w świetle badań geofizycznych, geomorfologicznych i sedymentologicznych w zatokach Isbjørnhamna i Hansbukta, Hornsund, południowy Spitsbergen* | Supervisor: W. Szczuciński, M. Moskalik (supporting supervisor)

J. Sziło | *Wpływ recesji lodowców na rzeźbę obszaru i warunki hydrologiczne zachodniego wybrzeża Zatoki Admiralicji (Wyspa Króla Jerzego)* | Supervisor: R. Bialik

Visiting scientists

Arko Olesk | Tallin University, Baltic Film, Media, Arts and Communication School | Tallin, Estonia

Michał Pętlicki | Centro de Estudios Cientificos | Valdivia, Chile

Flavio Justino | Universidade Federal de Viçosa | Viçosa, Brazil

Meeting, workshop conferences and symposia

XXVIII Seminarium Meteorologii i Klimatologii Polarnej | Sosnowiec Polska
P. Głowacki | CLIMEV – nowe narzędzie badawcze dla badań atmosfery w rejonach polarnych | oral

FARO Annual Meeting 2018 | Davos, Szwajcaria
P. Głowacki | History of FARO | oral

International Conference POLAR 2018 | Davos, Szwajcaria
P. Głowacki, W. Sielski | The Hornsund Polish Polar Station, Spitsbergen, Svalbard – Access and infrastructure | oral

L. Leppänen, J. I. López Moreno, A. Nadir Arslan, P. Dagsson Waldhauserova, C. Fierz, D. Finger, L. Holko, B. Luks, C. Marty, G. Picard, R. Pirazzini, A. Sensoy Sorman, A.Arda Sorman | Results from COST ES1404 Action for Harmonization of Snow Measurements in Europe | poster

C.Larose, E. Barbaro, M. Björkman, J-C. Gallet, J. Kohler, K. Koziol, B. Luks, T. Martma, T. V. Schuler, A. Spolaor, C. Zdanowicz | Lessons learned from interdisciplinary snow research in Svalbard | poster

Svalbard Science Forum Meeting | Longyearbyen, Norway
P. Głowacki | Polish research activity plan in 2018 at Svalbard | oral

INTAROS Annual Meeting 2018 | Helsinki, Finlandia
P. Głowacki | WP7 – Dissemination and outreach (Update of the first 12 months of activity & plan for the future proposals | oral

T. Wawrzyniak | Unique long time meteorological data series collected at the Polish Polar Station Hornsund on Spitsbergen | oral

W cieniu COP24 – w Centrum Studiów Polarnych | Sosnowiec, Poland
P. Głowacki | Polarna szkoła doktorska a szkoła życia | oral

A. Goździk| "EDU-ARCTIC – atrakcyjne nauczanie bez granic" | oral

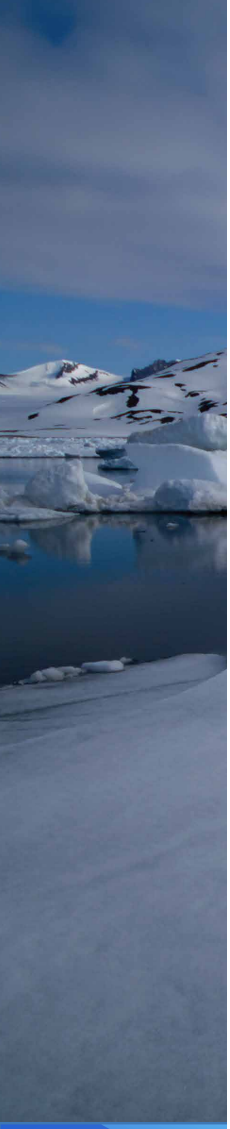
SnowHydro – International Conference on Snow Hydrology | Heidelberg, Niemcy
Kępski D., Luks B., Migała K., Uszczyk A., Westermann S., Budzik T. | Evolution of snow cover stratigraphy during ablation period in High Arctic tundra environment (SW Spitsbergen) | oral

IGS Cryosphere and Biosphere | Kyoto, Japonia
D.Kępski, B. Luks, M. Osuch, A. Dobler, K. Migala, S. Westermann, T. Budzik, T. Wawrzyniak | Snow cover development in a High - Arctic coastal tundra environment: present state and predictions for the future | oral

Towards a better harmonization of snow observations, modeling and data assimilation in Europe | Budapeszt, Węgry
J.I. Lopez-Moreno, L. Leppänen, B. Luks, L. Holko, A. Sanmiguel-Vallelado, E. Alonso-González, D. C. Finger, G. Picard, K. A. Gillemot, R. S. Azzoni, C. Marty, A. Soncini, P. Dagsson-Waldhauserova, A. S. Sensoy, A., A. Sorman, A.Nadir Arslan | Differences on snow density and snow water equivalent estimation using different snow tubes: instrumental bias, variability induced by observers and influence of snow and terrain conditions | oral

B. Luks, M. Osuch | Modelling snow water equivalent in the coastal zone of Hornsund fiord | poster

Konferencja MATLAB 2018 | Warszawa, Polska
J. Podgórski | „Badanie odbiciowości lodu lodowcowego przy pomocy LiDARu" | oral



EGU General Assembly | Wiedeń, Austria
Szczuciński W., Dominiczak A., Forwick M., Apolinarska K., Goslar T., Moskalik M., Woszczyk M. | Warming-controlled glaciers retreat and enhanced carbon burial – is there a negative feedback effect? - summary of multidisciplinary study in fjords of Svalbard | poster

The International Symposium on The Cryosphere in a Changing Climate 5th Symposium APECS-Brazil | Belo Horizonte, Brazylia
Wawrzyniak T., Goździk A., Głowacki P.| "How can Arctic and Antarctic Research engage students in STEM education?" | oral

Harmosnow Workshop on Snow Chemistry Monitoring | Kolm Saigum, Sonnblick, Austria
Nawrot A., Luks B., Kozioł K., Stachnik Ł. | Snow monitoring led by Polish Polar Station Hornsund | workshop

Nordic Water 2018 | Bergen, Norway
Osuch M., Nawrot A., Wawrzyniak T., Piotrowski A.P. | Water temperature modelling of small high arctic stream (Fuglebekken, SW Spitsbergen) | -

Sympozjum Polarne | Poznań, Polska
Lewandowski, M., Nawrot A. | Polish Polar Station Dobrowolski – past, present and future | oral

The 8th Global Friend-Water Conference | Pekin, Chiny
Wawrzyniak T., Osuch M., Nawrot A. | The influence of permafrost degradation on runoff generation in small arctic unglaciated catchment (Fuglebekken, Spitsbergen) | -

M. Osuch, T. Wawrzyniak | Projections of hydro-climatic conditions in small arctic unglaciated catchment Fuglebekken (SW Spitsbergen) | -

„Permafrost thermal state in Svalbard 2016-2017 (PermaSval)" SIOS | The University Centre in Svalbard (UNIS)
M. Osuch, T. Wawrzyniak | "State of permafrost in Hornsund area, SW Spitsbergen" | -

Krajowe Warszataty Scientix | IGF PAN, Warszawa
A. Goździk | "Co project Scientix oferuje polskim nauczycielom" | oral

Druga Krajowa Konferencja Scientix | IGF PAN, Warszawa
A. Goździk | "Scientix w pigułce" | oral

Światowe Forum Wody – Konferencja PAN | Polska Akademia Nauk, Warszawa
A. Goździk | "Wybrane inicjatywy z zakresu edukacji środowiskowiej I wodnej" | oral

9th International Conference "Education, Research & Development" | Elenite, Bułgaria
A. Goździk | EDU-ARCTIC competitions as an effective way to increase interest in STEM' | oral

Societal relevance of polar research | Instytut Oceanologii PAN, Sopot
A. Goździk | "What do youngsters know about the Arctic – results of the EDU-ARCTIC survey" | oral

Dzień Informacyjny Programu SWAFS Horyzont 2020 | Krajowy Punkt Kontaktowy Programów Badawczych, Warszawa
A. Goździk | "EDU-ARCTIC – doświadczenia koordynatora projektu" | oral

Publications

M. Moskalik, J. Ćwiąkała, 2018, Morphological characterization of the Recherchefjorden (Bellsund, Svalbard) using marine geomorphometry; POLISH POLAR RESEARCH

M. Lewandowski, K. Birkenmajer, 2018, Professor Krzysztof Pawel Krajewski (1955-2017) geologist, polar explorer, mountaineer and a good fellow In Memoriam; POLISH POLAR RESEARCH

J. Podgórski, M. Pętlicki, C. Kinnard, 2018, Revealing recent calving activity of a tidewater glacier with terrestrial LiDAR reflection intensity; COLD REGIONS SCIENCE AND TECHNOLOGY

P.Zagórski, O. Głowacki, W. Szczuciński, K.Wojtysiak, M. Moskalik, A. Dominiczak, 2018, Spatiotemporal changes in the concentration and composition of suspended particulate matter in front of Hansbreen, a tidewater glacier in Svalbard; Oceanologia

M.Pętlicki, 2018, Subglacial Topography of an Icefall Inferred From Repeated Terrestrial Laser Scanning; IEEE Geoscience and Remote Sensing Letters

W.Szczuciński, J.Giżejewski, K.Wojtysiak, M.Moskalik, J.Ćwiąkała, M. Forwick, 2018, Submarine geomorphology at the front of the retreating Hansbreen tidewater glacier, Hornsund fjord, southwest Spitsbergen; Journal of Maps

B. Luks, D. Kępski, 2018, The influence of abiotic factors on the growth of two vascular plant species (Saxifraga oppositifolia and Salix polaris) in the High Arctic; CATENA

O. Głowacki, M. Moskalik, 2018, The intensity, directionality, and statistics of underwater noise from melting icebergs; GEOPHYSICAL RESEARCH LETTERS

K.Kozioł, 2018, The interaction between bacterial abundance and selected pollutants concentration levels in an arctic catchment (southwest Spitsbergen, Svalbard); SCIENCE OF THE TOTAL ENVIRONMENT

K.Wojtysiak, M.Moskalik, 2018, Wind wave climate of west Spitsbergen: seasonal variability and extreme events; Oceanologia

S. Mazur, P. Krzywiec, M.Malinowski, M. Lewandowski, P. Aleksandrowski, M.Mikołajczak, 2018, On the nature of the Teisseyre-Tornquist Zone; Geology, Geophysics & Environment

Sziło J., Bialik R.J., 2018, Recession and ice surface elevation changes of Baranowski Glacier and its impact on proglacial relief (King George Island, West Antarctica); Geosciences

Sziło J., Bialik R.J., 2018, Grain size distribution of bedload transport in a glaciated catchment (Baranowski Glacier, King George Island, W Antarctica); Water

Araźny A., Przybylak R., Wyszyński P., Wawrzyniak T., Nawrot A., Budzik T., 2018, Spatial variations in air temperature and humidity over Hornsund fjord (Spitsbergen) from 1 July 2014 to 30 June 2015.; Geografiska Annaler series A Physical Geography

Chapters

C. Kinnard, S. MacDonell, M. Pętlicki, C. Mendoza Martinez, J. Abermann, R. Urrutia, 2018, Mass Balance and Meteorological Conditions at Universidad Glacier, Central Chile; Andean Hydrology