UNIVERSITY OF LATVIA
FACULTY OF GEOGRAPHY AND EARTH SCIENCES

79th International Scientific Conference of the University of Latvia

Quaternary Geology and Geomorphology

THE DEVELOPMENT OF THE STUDIES OF CONTEMPORARY GLACIERS AT THE UNIVERSITY OF LATVIA

Kristaps Lamsters
Jānis Karušs

LATVIAN EXPEDITIONS TO POLAR AND SUBPOLAR REGIONS

Since 2014 scientists from the University of Latvia have conducted seven scientific expeditions in Iceland, Greenland and Antarctica focusing on geophysical studies combined with remote sensing (glacier thickness, structure and subglacial topography) of modern glaciers.

Iceland 2014

Iceland 2015

Iceland 2017

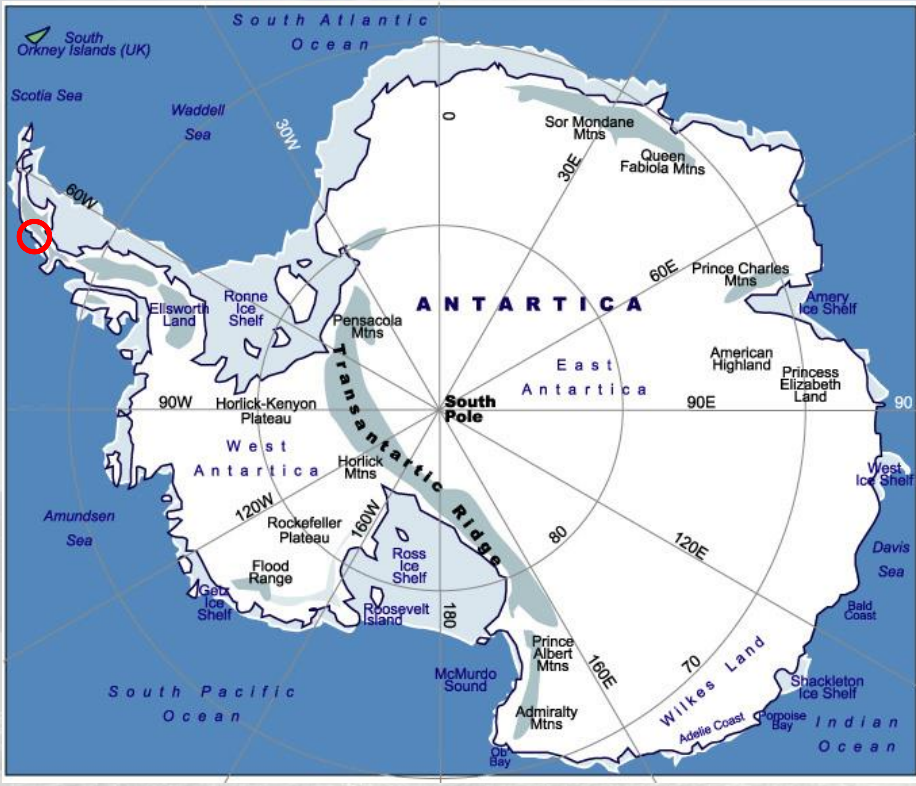
Iceland 2018

Greenland 2016

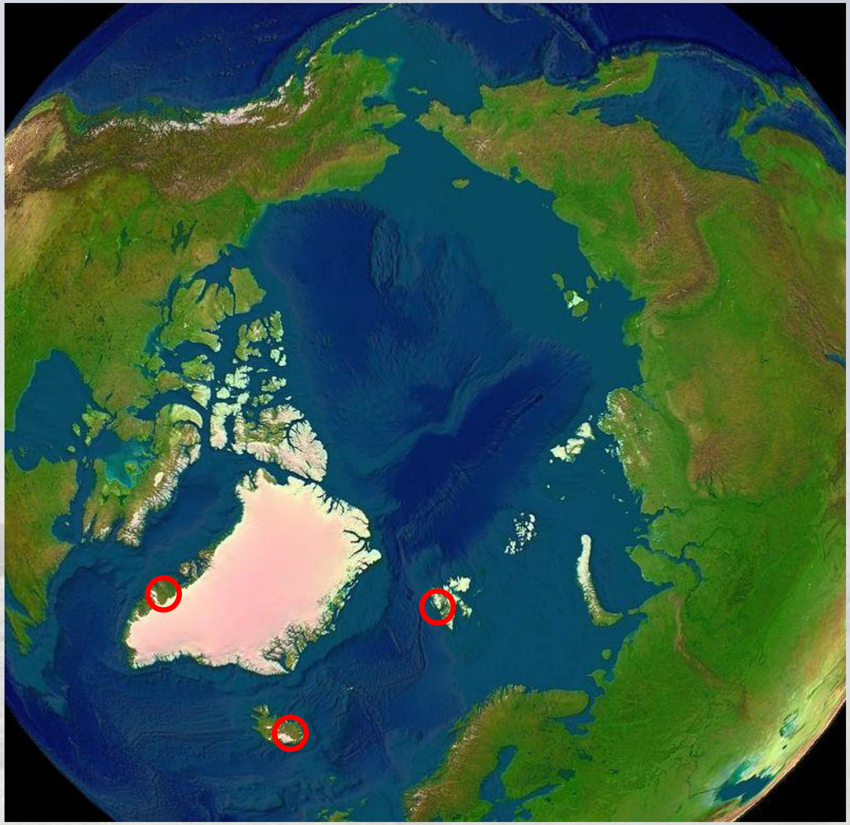
Antarctica 2018

Svalbard 2018

LATVIAN EXPEDITIONS TO POLAR AND SUBPOLAR REGIONS



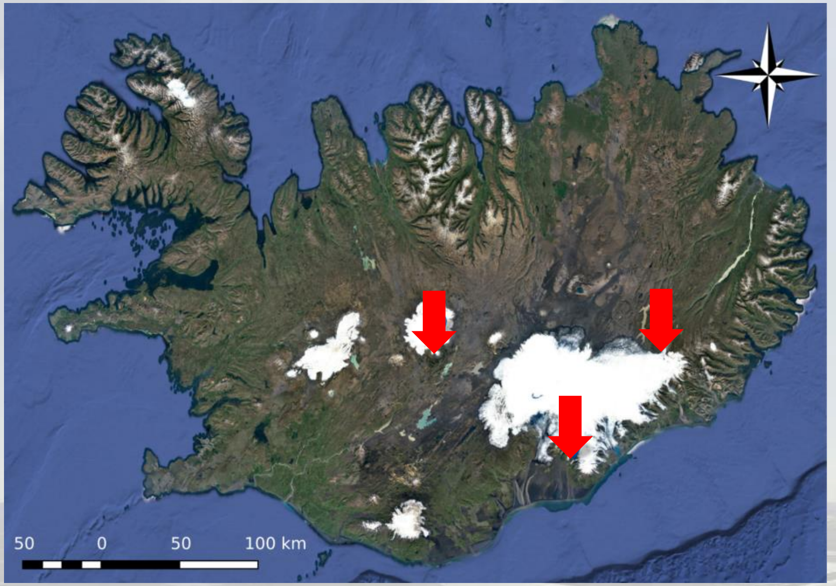
Expedition in Antarctica

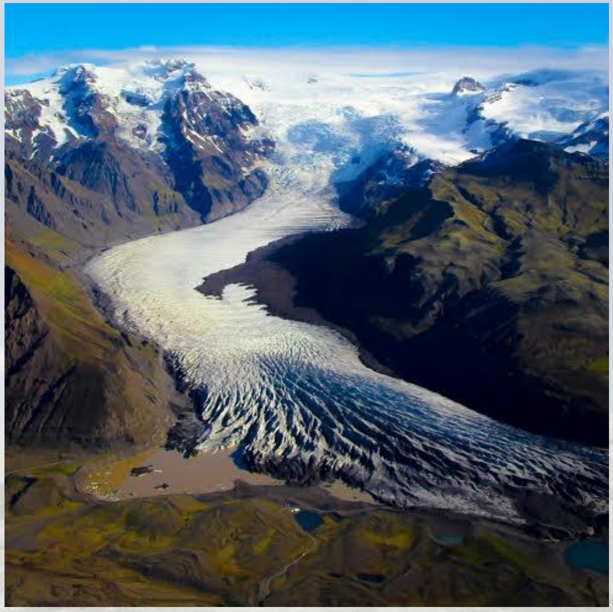


Expeditions in the Arctic

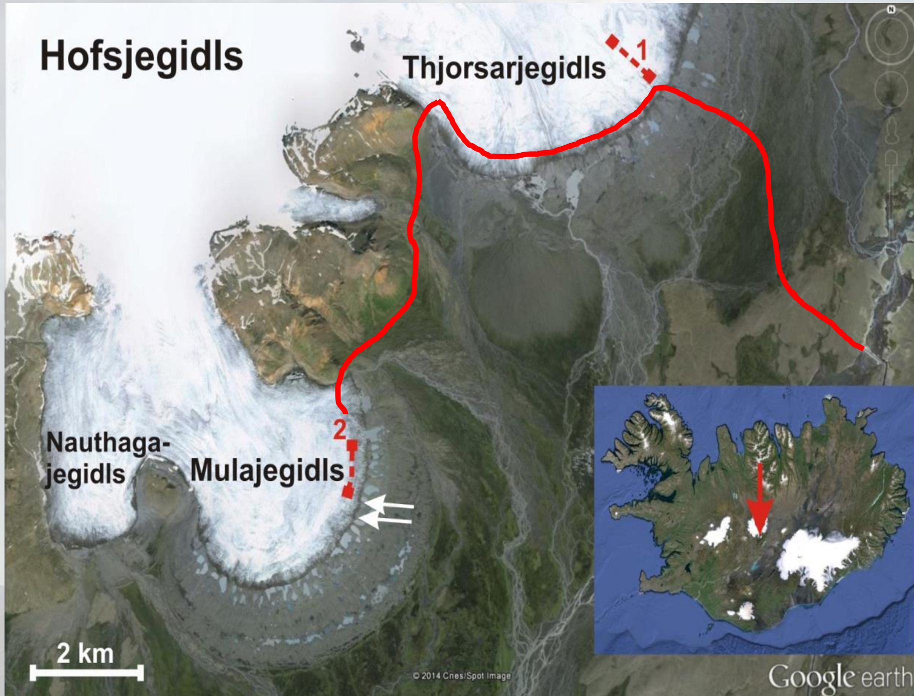
EXPEDITIONS TO **ICELAND** – 2014, 2015, 2017, 2018

Studies were performed on outlet glaciers of Hofsjokull and Vatnajokull ice caps.

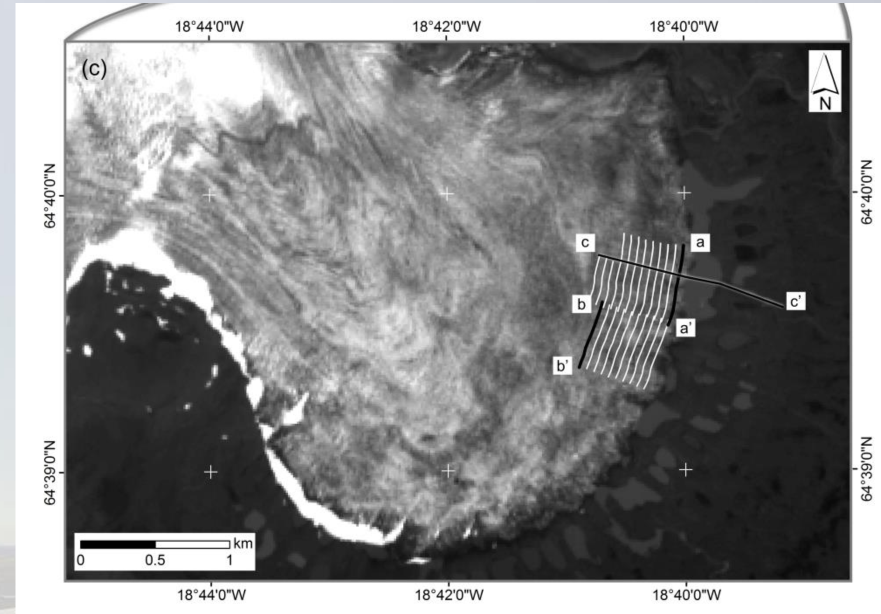




1. EXPEDITION, ICELAND



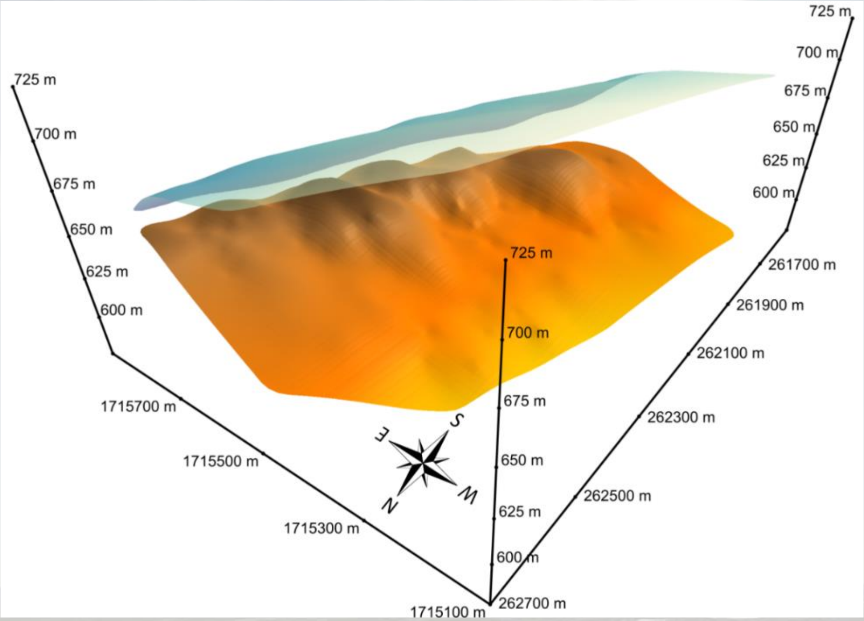
2. EXPEDITION, ICELAND



GPR measurements were performed with GPR Zond 12-e and 38 and 75 MHz antennas.

Fieldwork on Mulajokull

RESULTS OF GPR SURVEYS, ICELAND, 2015

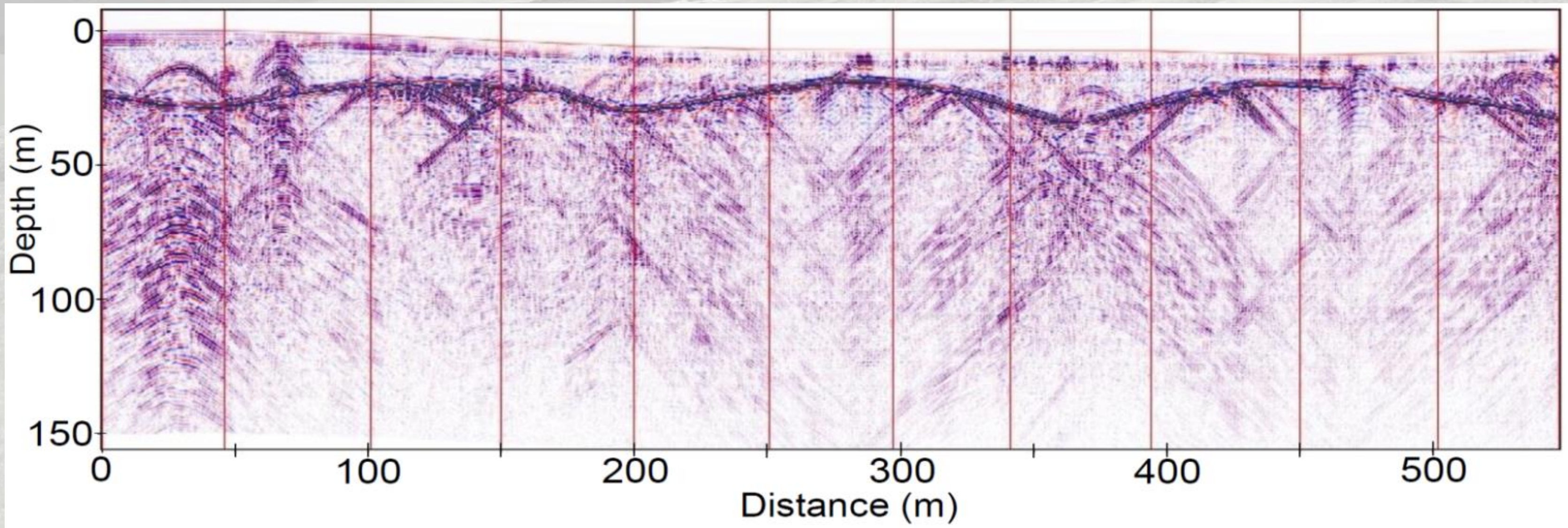



Polar Science 10 (2016) 470–475
Contents lists available at ScienceDirect
Polar Science
journal homepage: https://www.evise.com/profile/#/JRNL_POLAR/login

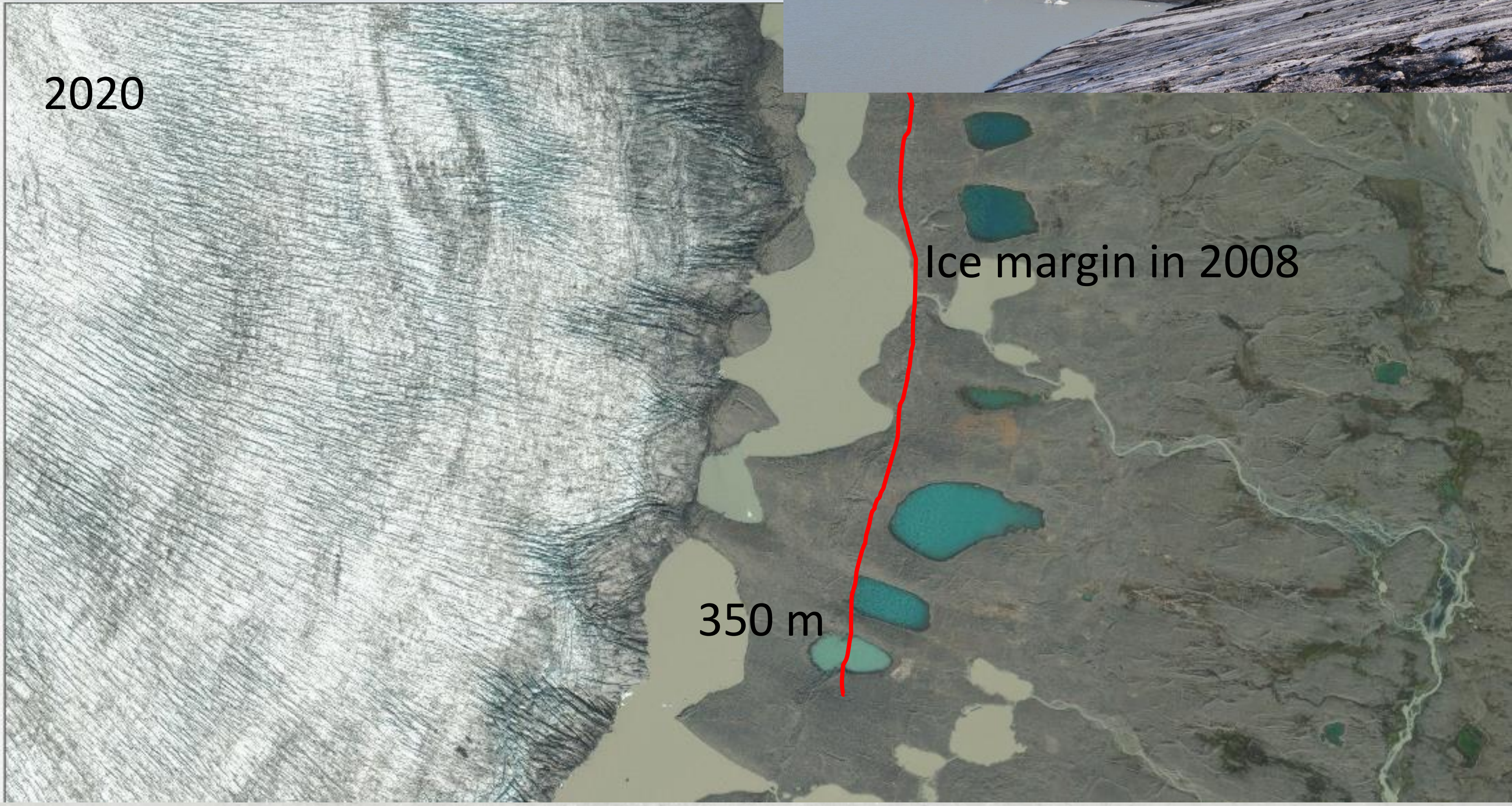
Detailed subglacial topography and drumlins at the marginal zone of Múlajökull outlet glacier, central Iceland: Evidence from low frequency GPR data

Kristaps Lamsters*, Jānis Karušs, Agnis Rečs, Dāvids Bērziņš
Department of Geography and Earth Sciences, University of Latvia, Rainis Boulevard 19, LV-1586, Rīga, Latvia

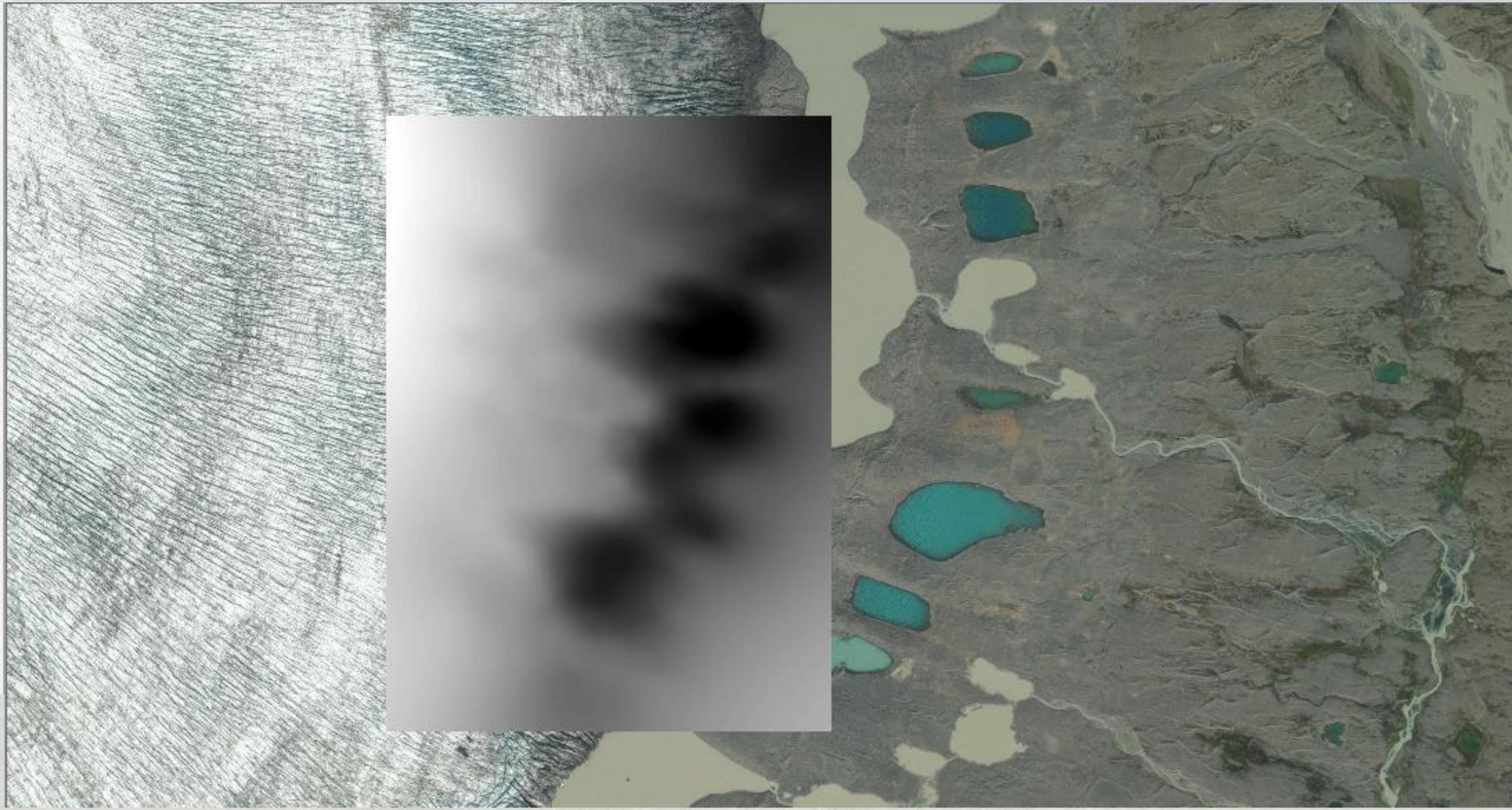
3D model of the Mulajokull glacier surface and subglacial topography.



DRUMLINS



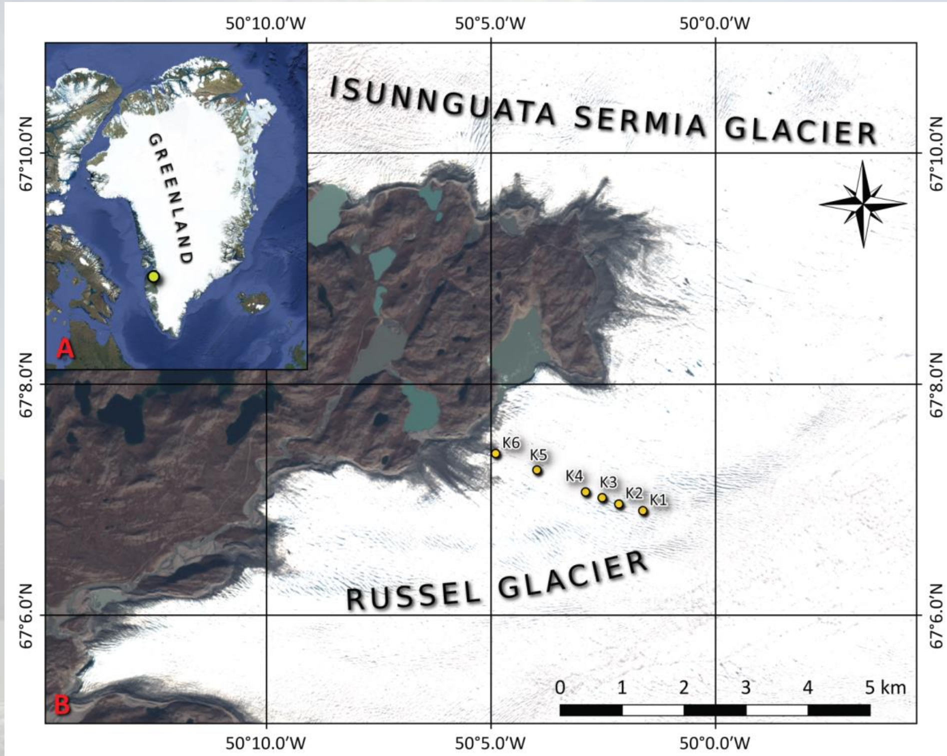
2008/2020



EXPEDITION TO **GREENLAND** – 2016

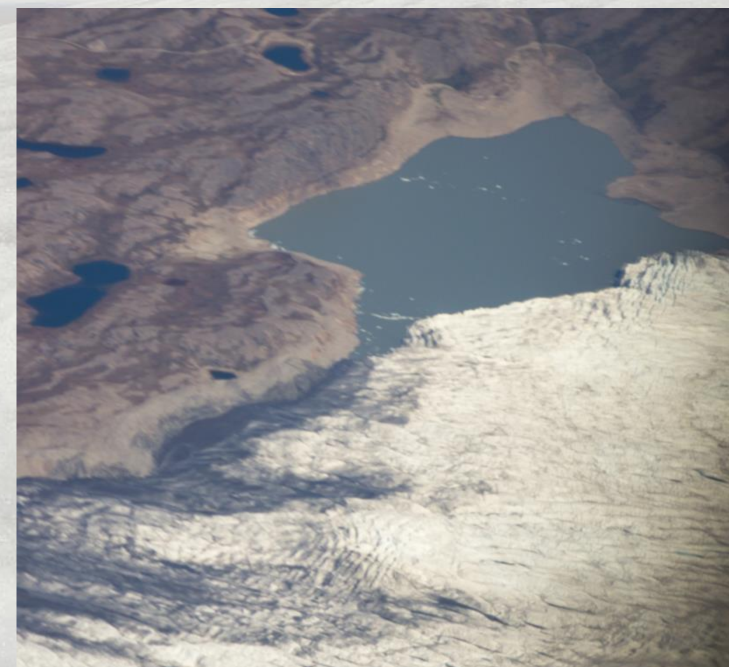
EXPEDITION TO **GREENLAND** – 2016

Studies were performed on the Russell glacier, SW Greenland.



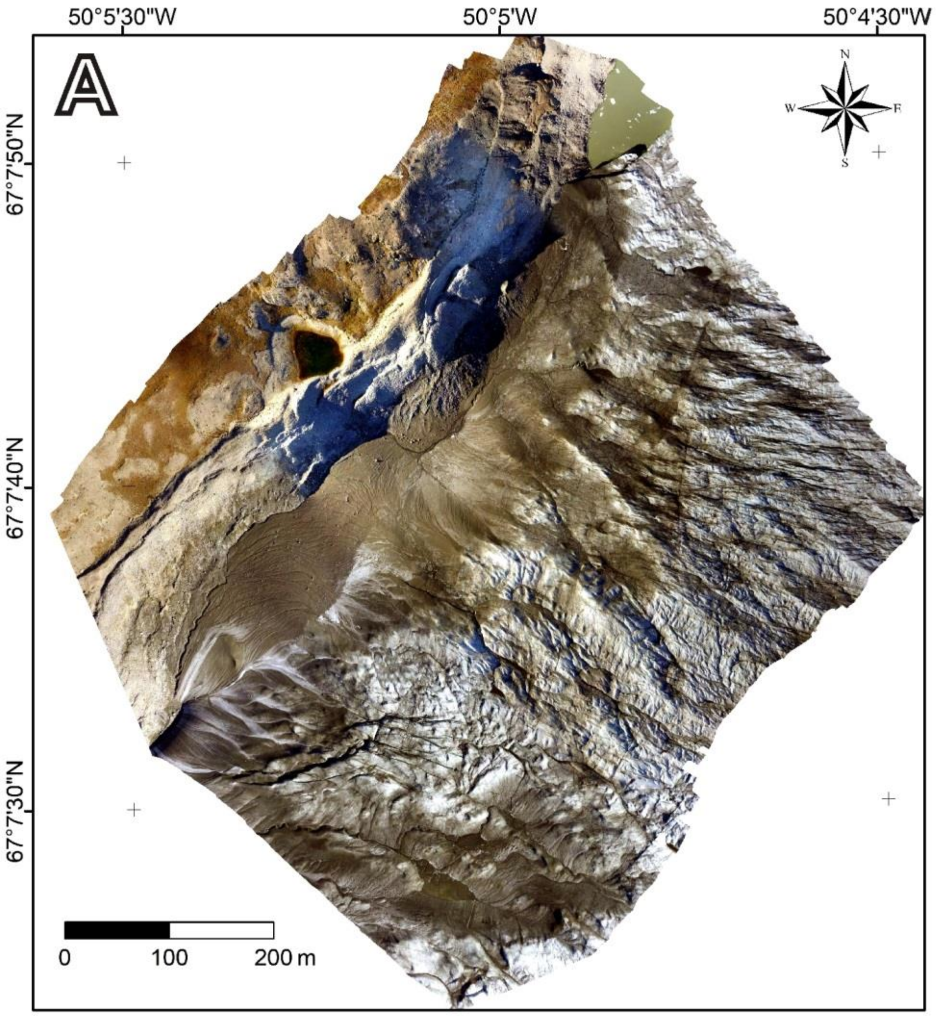
During expedition, GPR measurements combined with UAV survey were performed. Possible englacial route of meltwater generated from the draining of proglacial lake durign outburst floods were determined.

Samples from ice, glacial lakes, soil and sediments were taken and analysed.

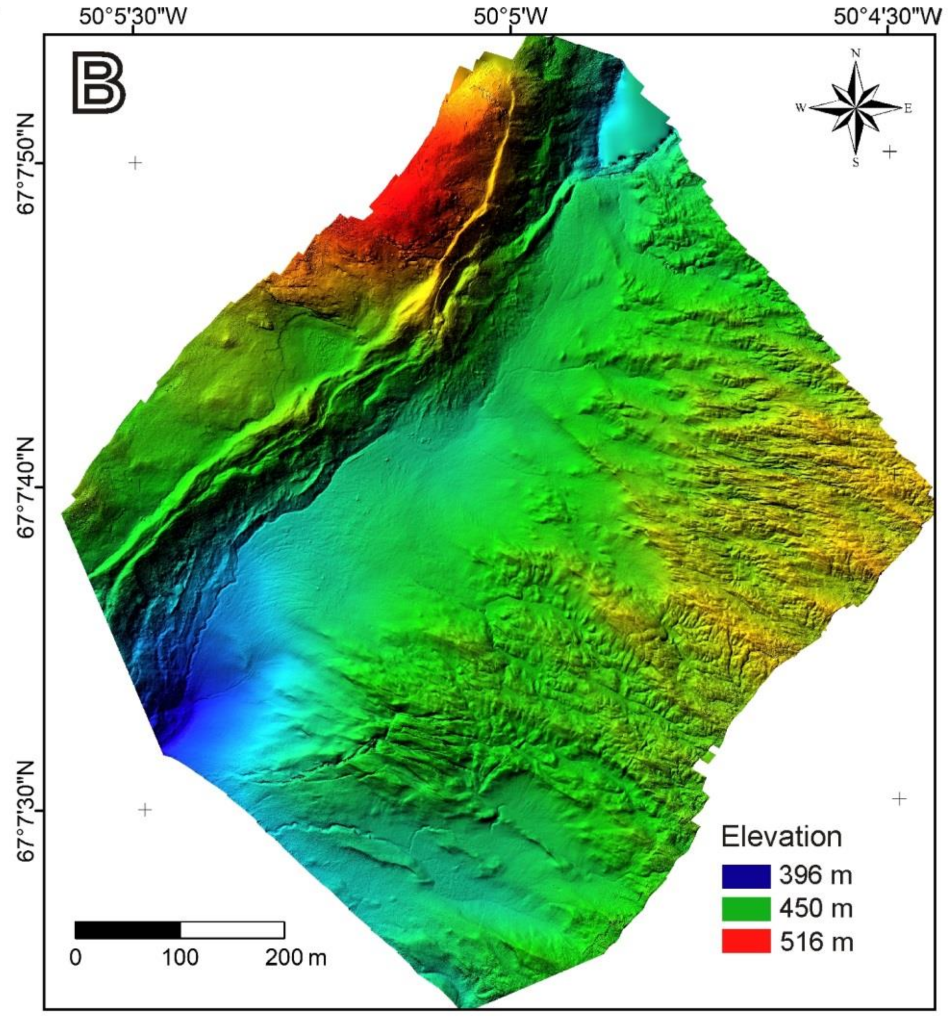


Greenland - results

Orthophoto map

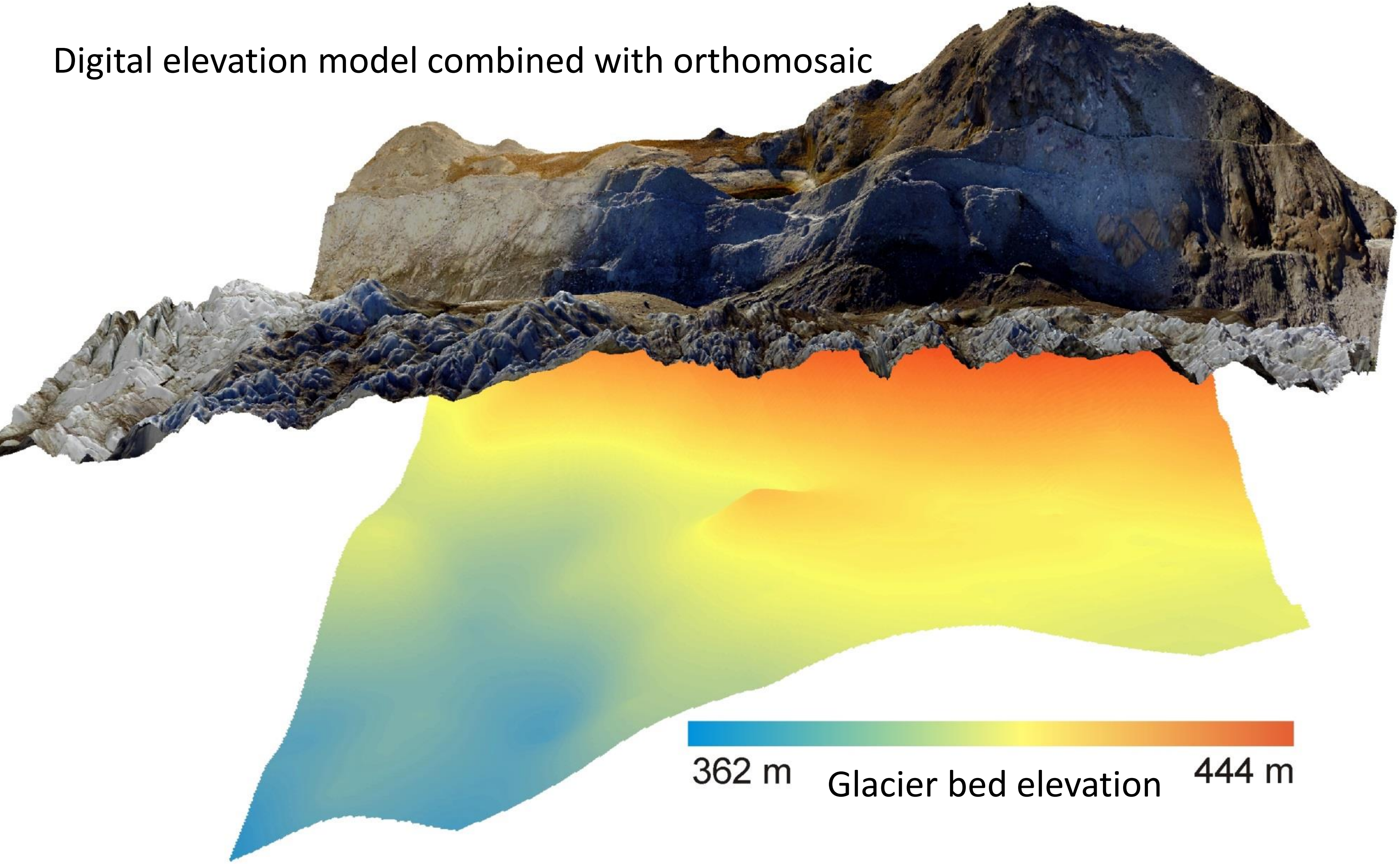


Digital elevation model

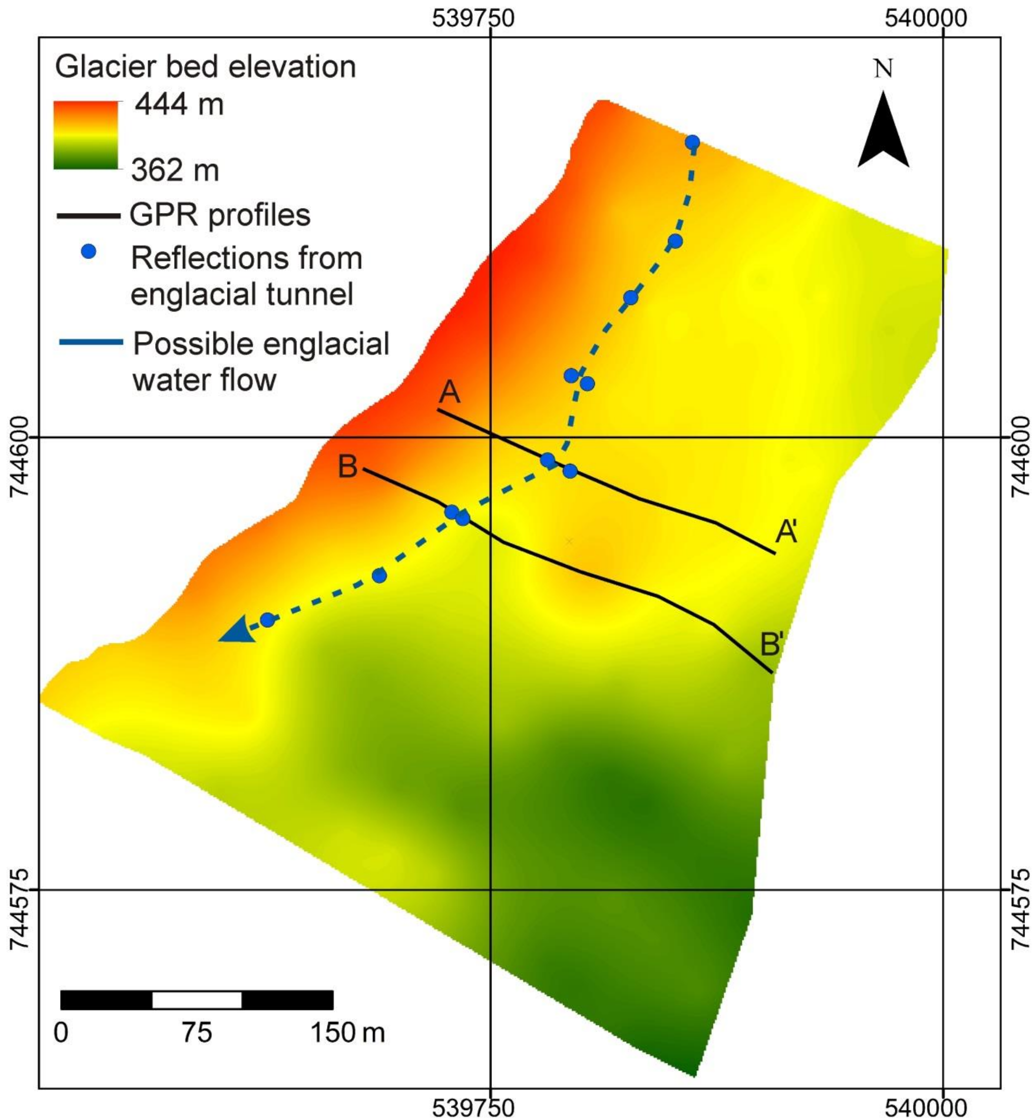


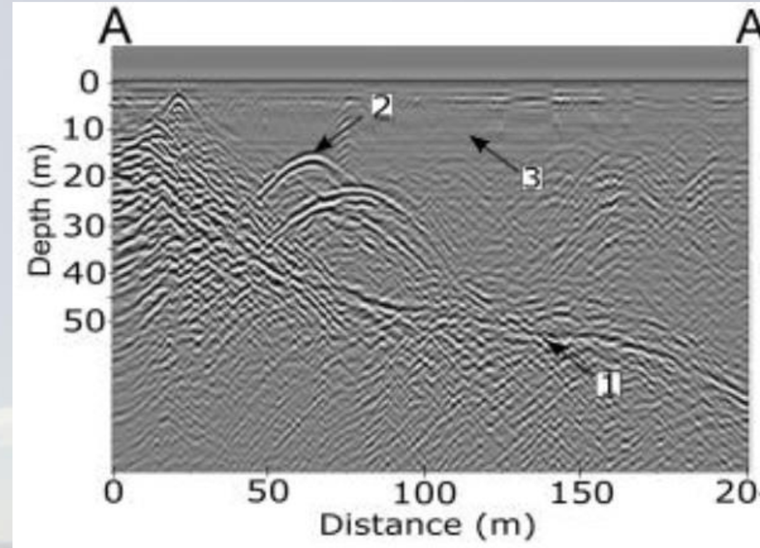
Greenland - results

Digital elevation model combined with orthomosaic



Greenland - results





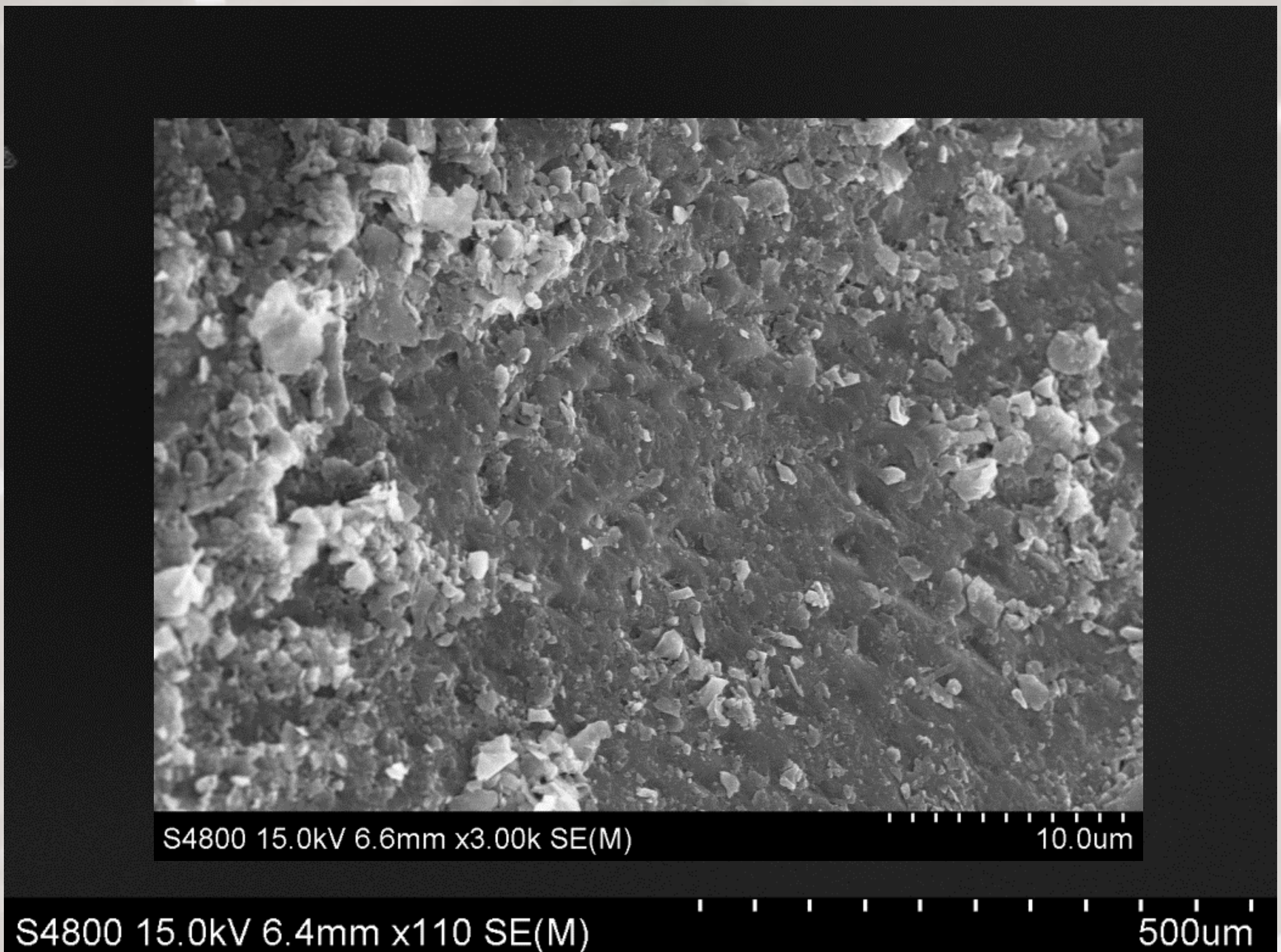
Radar image A-A'. 1-glacier bed; 2-englacial conduit; 3-radar-transparent layer.

ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume V-2-2020, 2020
XXIV ISPRS Congress (2020 edition)

HIGH-RESOLUTION SURFACE AND BED TOPOGRAPHY MAPPING OF RUSSELL GLACIER (SW GREENLAND) USING UAV AND GPR

K. Lamsters[1,*], J. Karušs[1], M. Krievāns[1], J. Ješkins[1]

Main findings: 1) a warm-based ice margin with the radar-transparent layer in the upper 15 m interpreted as a piezometric surface.
2) englacial conduit parallel to the ice margin as a remnant of a larger conduit active during jökulhlaups in 2007 and 2008.


S4800 15.0kV 6.6mm x3.00k SE(M)
10.0um
S4800 15.0kV 6.4mm x110 SE(M)
500um

BALTICA Volume 30 Number 2 December 2017: 63–73
http://dx.doi.org/10.5200/baltica.2017.30.08

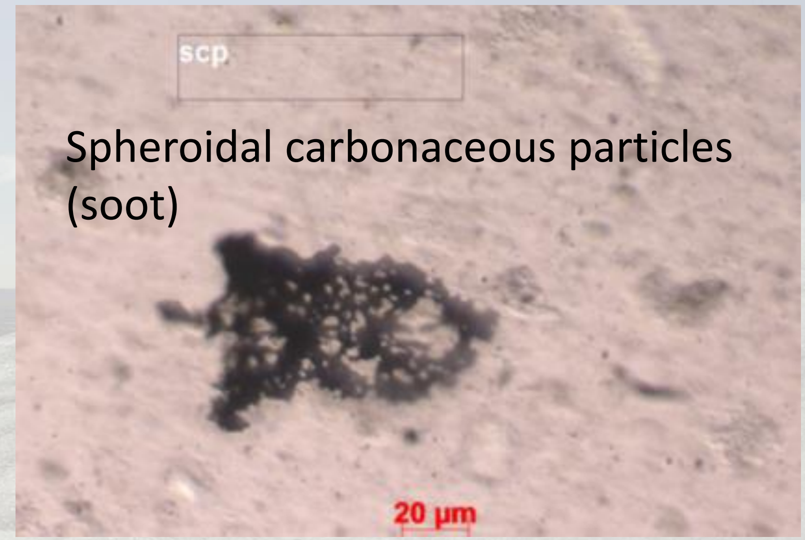
Fine-grained quartz from cryoconite holes of the Russell Glacier, southwest Greenland – a scanning electron microscopy study

Edyta Kalińska-Nartiša, Kristaps Lamsters, Jānis Karušs, Māris Krievāns, Agnis Rečs, Raimonds Meija

POLISH POLAR RESEARCH
vol. 38, no. 3, pp. 265–289, 2017 doi: 10.1515/popore-2017-0018

Quartz grain features in modern glacial and proglacial environments: A microscopic study from the Russell Glacier, southwest Greenland

Edyta KALIŃSKA-NARTIŠA[1, 2*], Kristaps LAMSTERS[3], Jānis KARUŠS[3], Māris KRIEVĀNS[3], Agnis REČS[3] and Raimonds MEIJA[4]

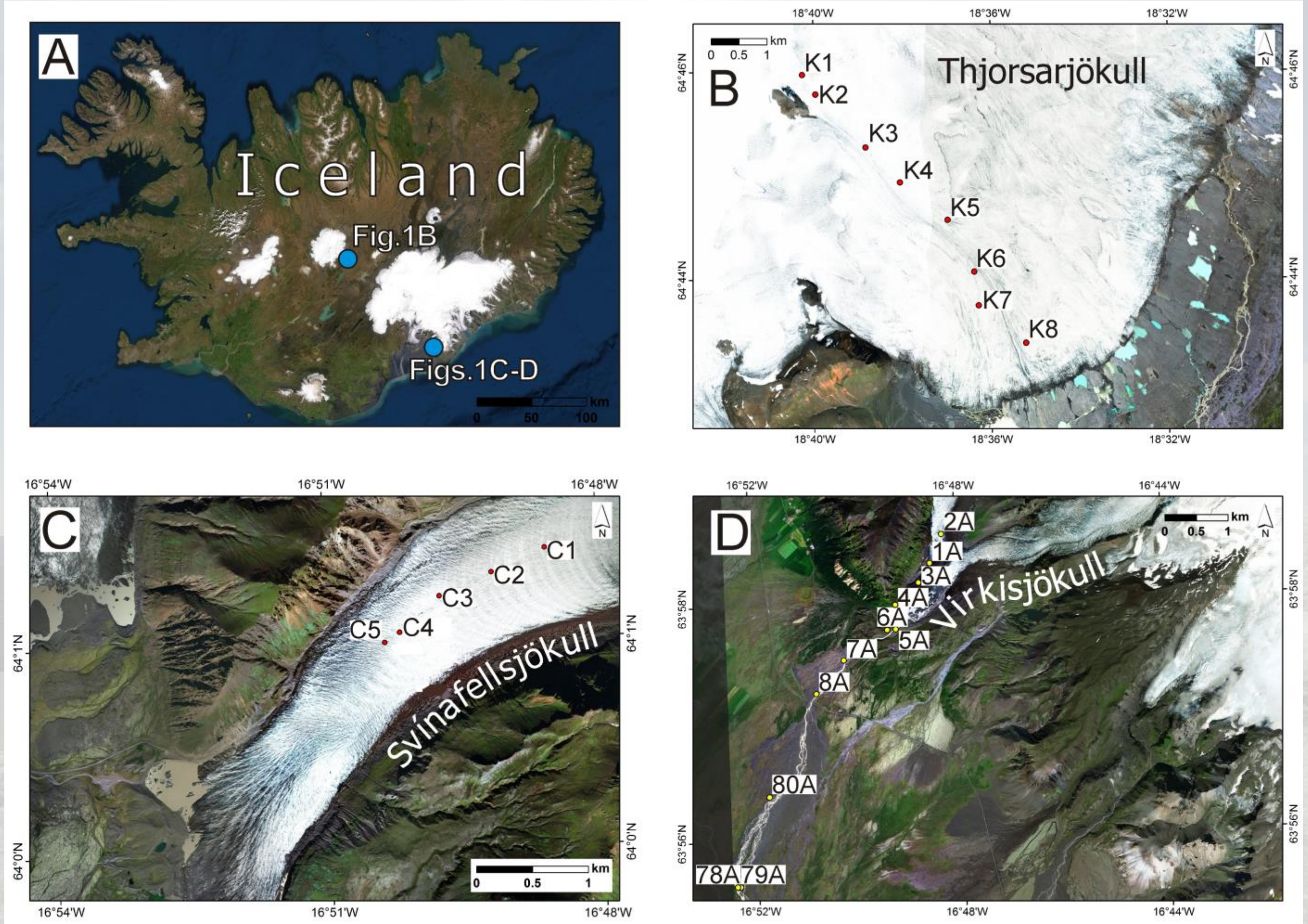


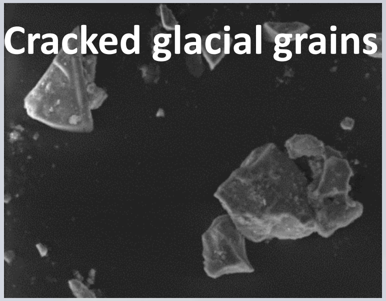
BALTICA Volume 31 Number 2 December 2018: 115–124
https://doi.org/10.5200/baltica.2018.31.11

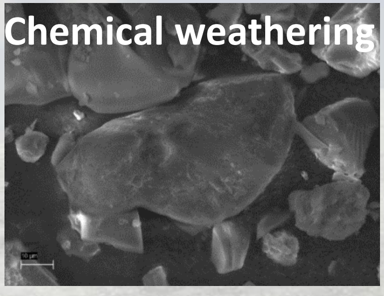
Spheroidal carbonaceous particles in cryoconite sediment on the Russell glacier, Southwest Greenland

Normunds Stivrins, Kristaps Lamsters, Jānis Karušs, Māris Krievāns, Agnis Rečs

ICELAND - 2017





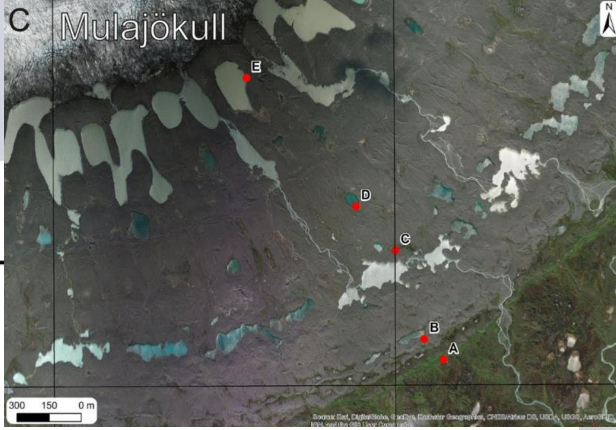


SEM images of quartz grains

Edyta Kalińska, Kristaps Lamsters, Jānis Karušs, Māris Krievāns, Agnis Rečs, Jurijs Ješkins

Does glacial environment produce glacial mineral grains? Pro- and supra-glacial Icelandic sediments in the microtextural study. Submitted to Quaternary International.

ICELAND - 2017



Polar Biology (2020) 43:2085–2099
https://doi.org/10.1007/s00300-020-02770-8

ORIGINAL PAPER

Bacterial and archaeal community structure in benthic sediments from glacial lakes at the Múlajökull Glacier, central Iceland

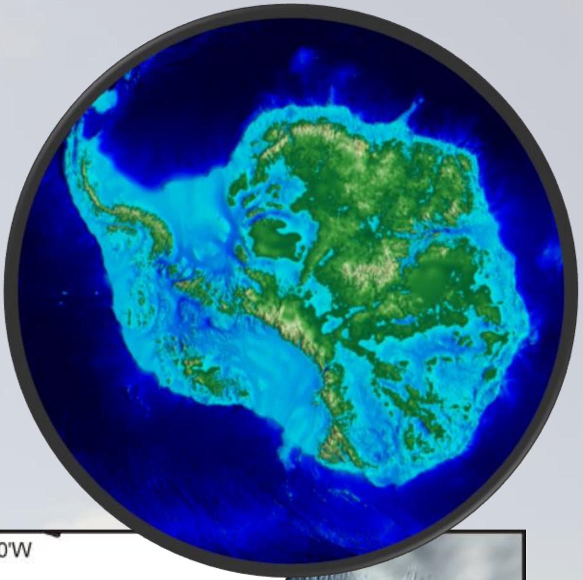
Kristaps Lamsters[1] · Monta Ustinova[2] · Līga Birzniece[2] · Ivars Silamiķelis[2] · Julia Gaidelene[3] · Jānis Karušs[1] · Māris Krievāns[1] · Raimonds Kasparinskis[1] · Dāvids Fridmanis[2] · Olga Muter[3]

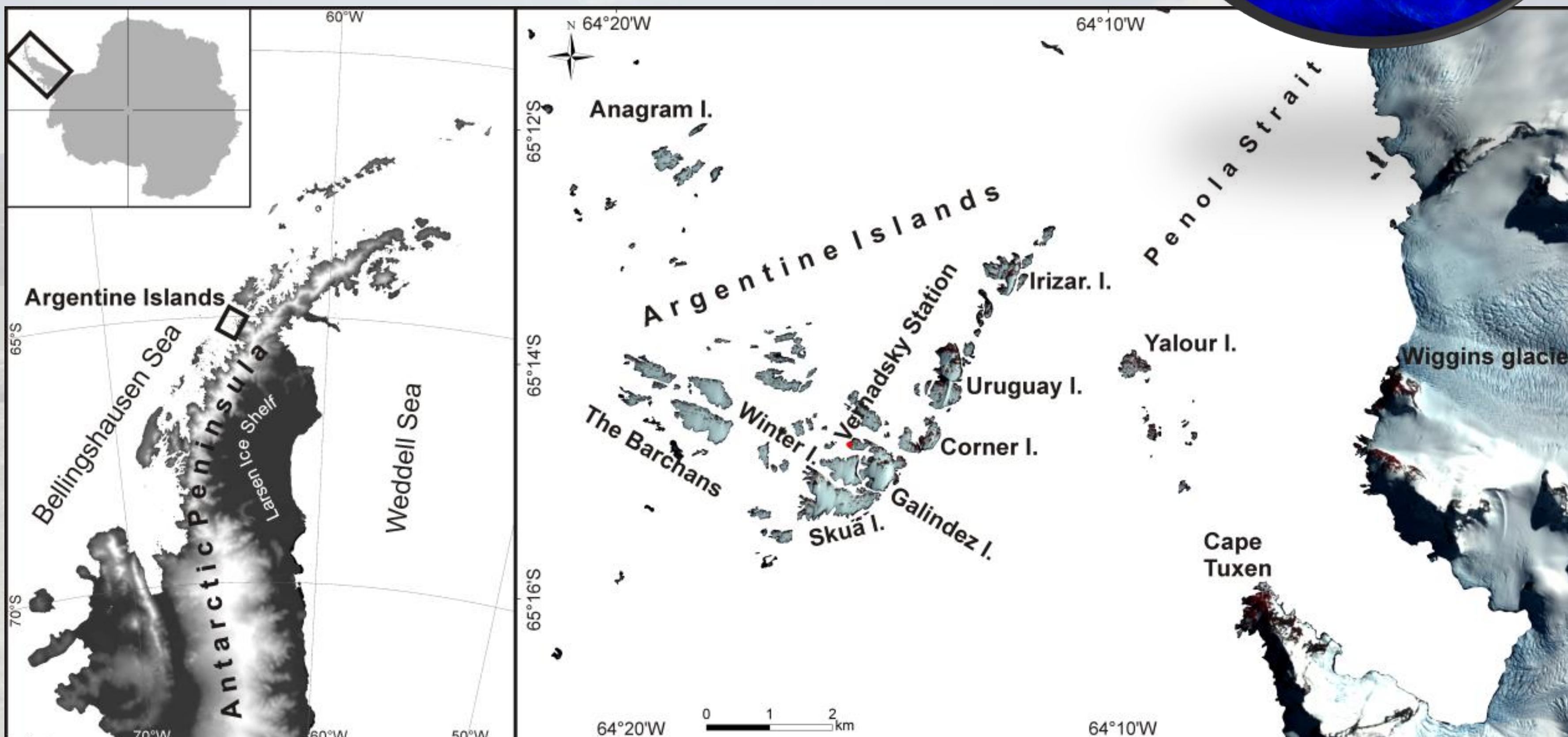
Received: 28 January 2019 / Revised: 3 November 2020 / Accepted: 4 November 2020 / Published online: 10 November 2020

Abstract
Glacial lakes and their sediments are highly sensitive temporal markers of environmental variability. The combination of particular geographical conditions with climate changes makes the Múlajökull lakes an appropriate model for revealing some site-specific and common relationships in psychrophilic microbial ecology. The aim of this study was to evaluate the taxonomic and functional diversity of microbial community structures in five glacial lake sediments situated at different distances from the glacier, i.e., 50 m to 1750 m from the ice margin. The Shannon diversity indices varied in the range from 1.99 to 2.94 (with the lowest in C sample) tested by EcoPlates™ and from 1.69 to 1.89 at the phylum level (with the lowest in A sample) tested by the shotgun metagenomic sequencing, respectively. An inter-sample comparison was also conducted. Overall, six bacteria phyla (Proteobacteria, Cyanobacteria, Bacteroidetes, Actinobacteria, Verrucomicrobia and Planctomycetes) and one microalgae phyla (*Bacillariophyta*) were detected in five lake sediments tested at abundancy that exceeded 1%. Obtained data brings new knowledge related to the cold biosphere on the local and global Earth systems.

ANTARCTICA - 2018

The Argentine Islands are located approximately 7 km of the west coast of Graham Land, Antarctic Peninsula and include the Barchans, Galindez, Winter, Skua, Grotto, Corner, Uruguay, Irizar, Fanfare, Leopard, Black, Forge Islands, Three Little Pigs and some small islands and rocks (Admiralty chart 3575).





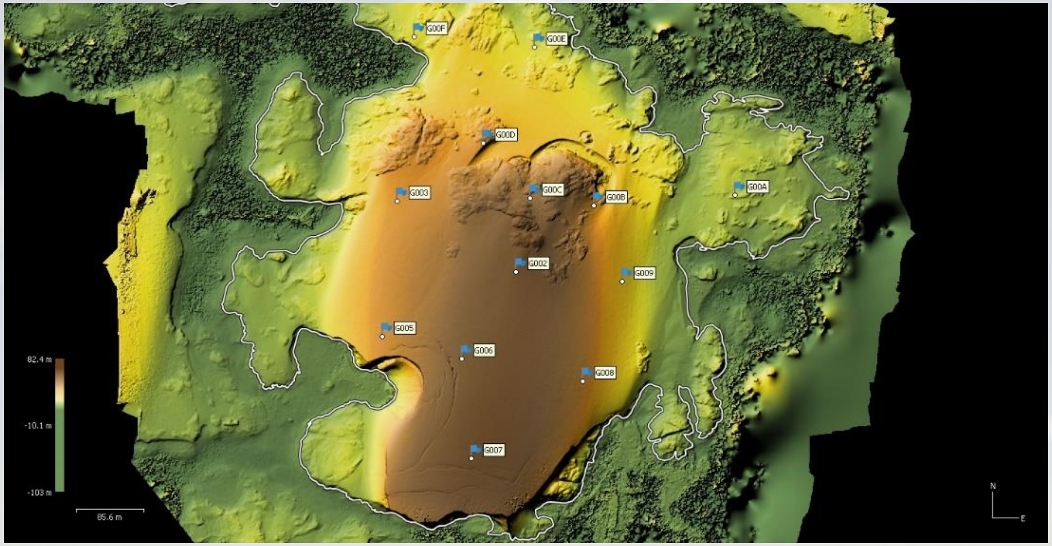
STUDY AREA

Argentine Islands February 2018

Galindez Island, March 2018

Barchan, February 2018

METHODS: AERIAL MAPPING WITH UAV



14 ground control points (GCP) with dimensions of 35 x 35 cm were used on each island on average.

For the UAV surveys, DJI Phantom III Advanced quadcopter was used.

UAV ground control points were measured with GNSS receiver Magellan ProMark 3.

RESULTS

Antarctic Science 31(6), 332–344 (2019) doi:10.1017/S0954102019000452

Subglacial topography and thickness of ice caps on the Argentine Islands

JĀNIS KARUŠS [1], KRISTAPS LAMSTERS [1], ANATOLII CHERNOV [2,3], MĀRIS KRIEVĀNS [1] and JURIJS JEŠKINS [1]

JOURNAL OF MAPS
2020, VOL. 16, NO. 2, 335–347
https://doi.org/10.1080/17445647.2020.1748130

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Science

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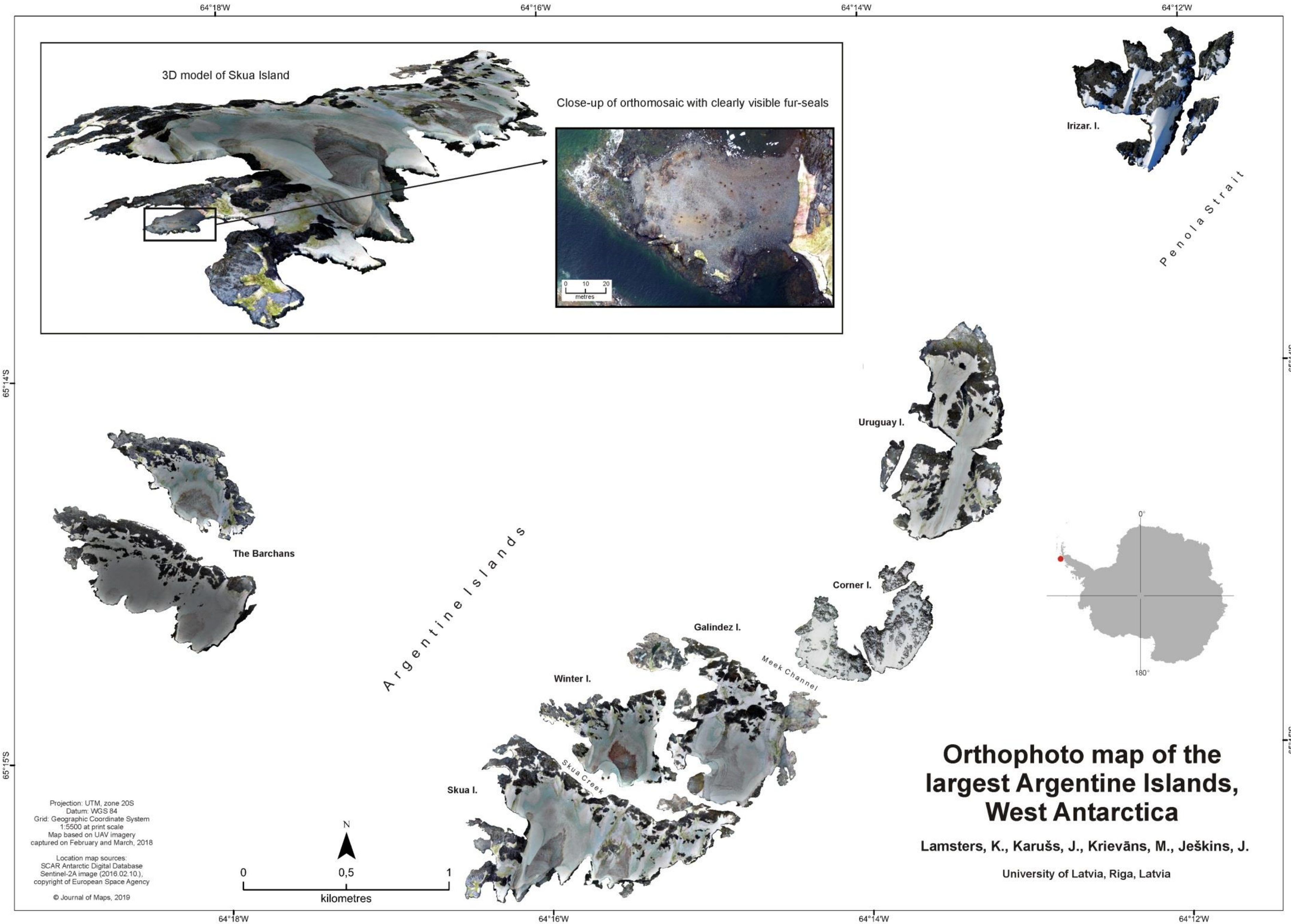
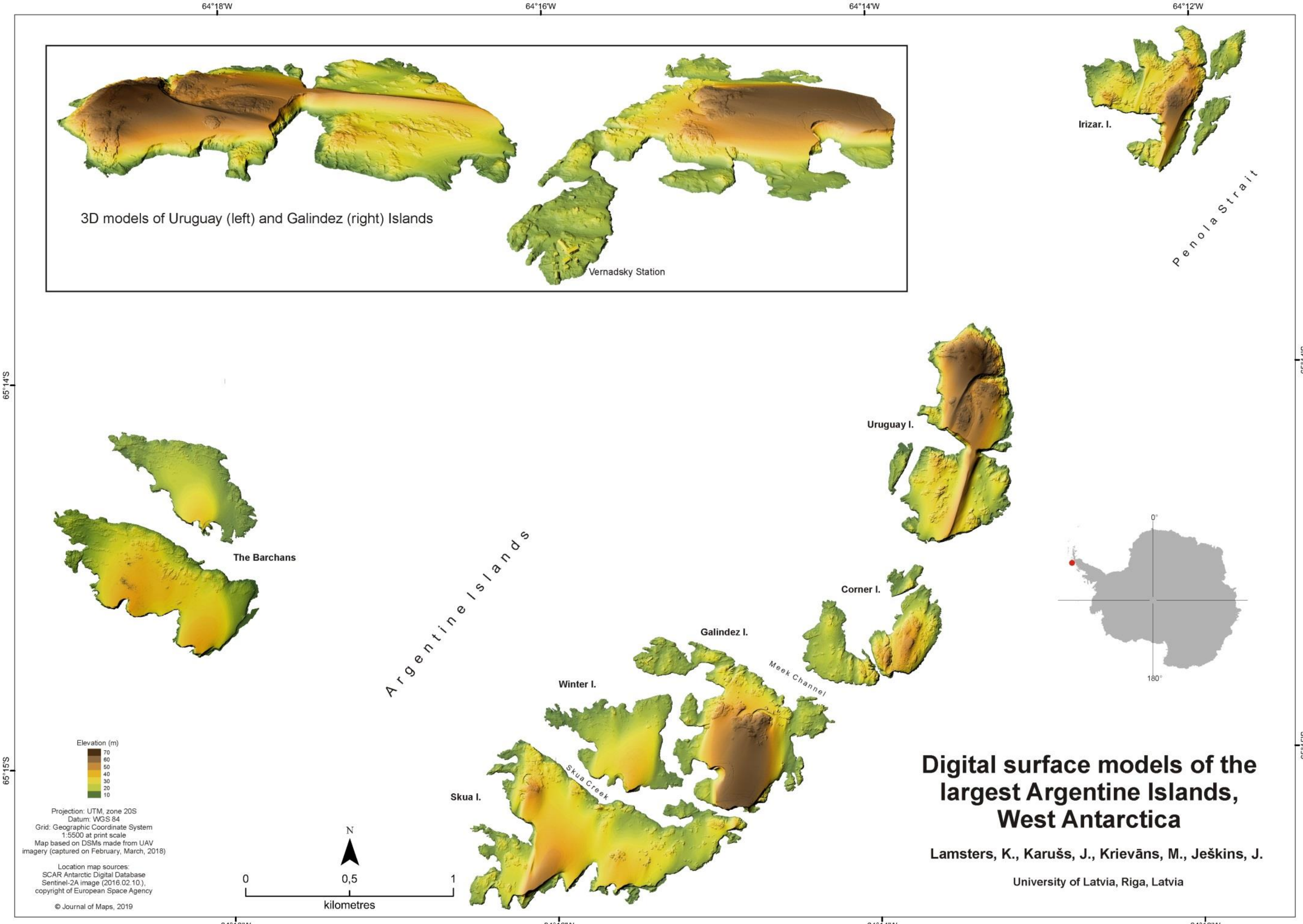
High-resolution orthophoto map and digital surface models of the largest Argentine Islands (the Antarctic) from unmanned aerial vehicle photogrammetry

Kristaps Lamsters, Jānis Karušs, Māris Krievāns and Jurijs Ješkins



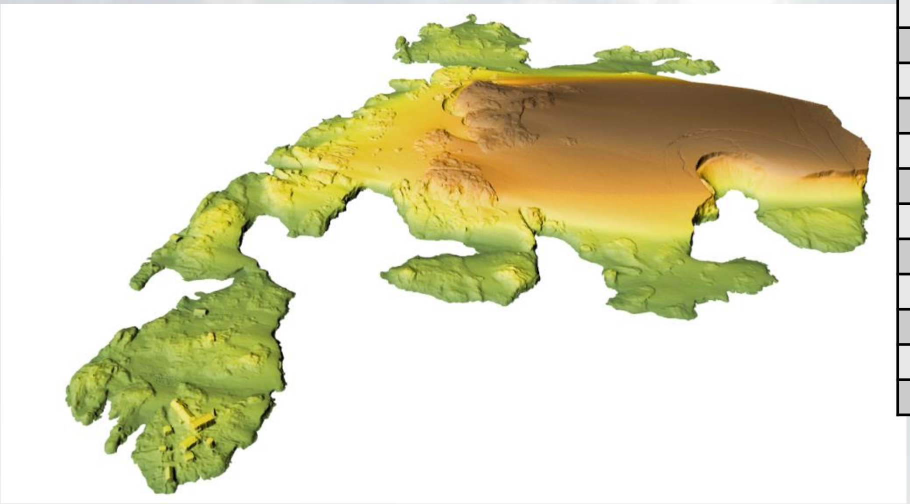
Orthophoto map of the largest Argentine Islands, West Antarctica
Lamsters, K., Karušs, J., Krievāns, M., Ješkins, J.
University of Latvia, Riga, Latvia
3D model of Skua Island
Close-up of orthomosaic with clearly visible fur-seals
0 10 20
metres
Irizar. I.
Penola Strait
Uruguay I.
The Barchans
Argentine Islands
Corner I.
Galindez I.
Meek Channel
Winter I.
Skua Creek
Skua I.
0°
180°
64°18'W
64°16'W
64°14'W
64°12'W
65°14'S
65°15'S
N
0
0,5
1
kilometres
Projection: UTM, zone 20S
Datum: WGS 84
Grid: Geographic Coordinate System
1:5500 at print scale
Map based on UAV imagery
captured on February and March, 2018
Location map sources:
SCAR Antarctic Digital Database
Sentinel-2A image (2016.02.10.),
copyright of European Space Agency
© Journal of Maps, 2019



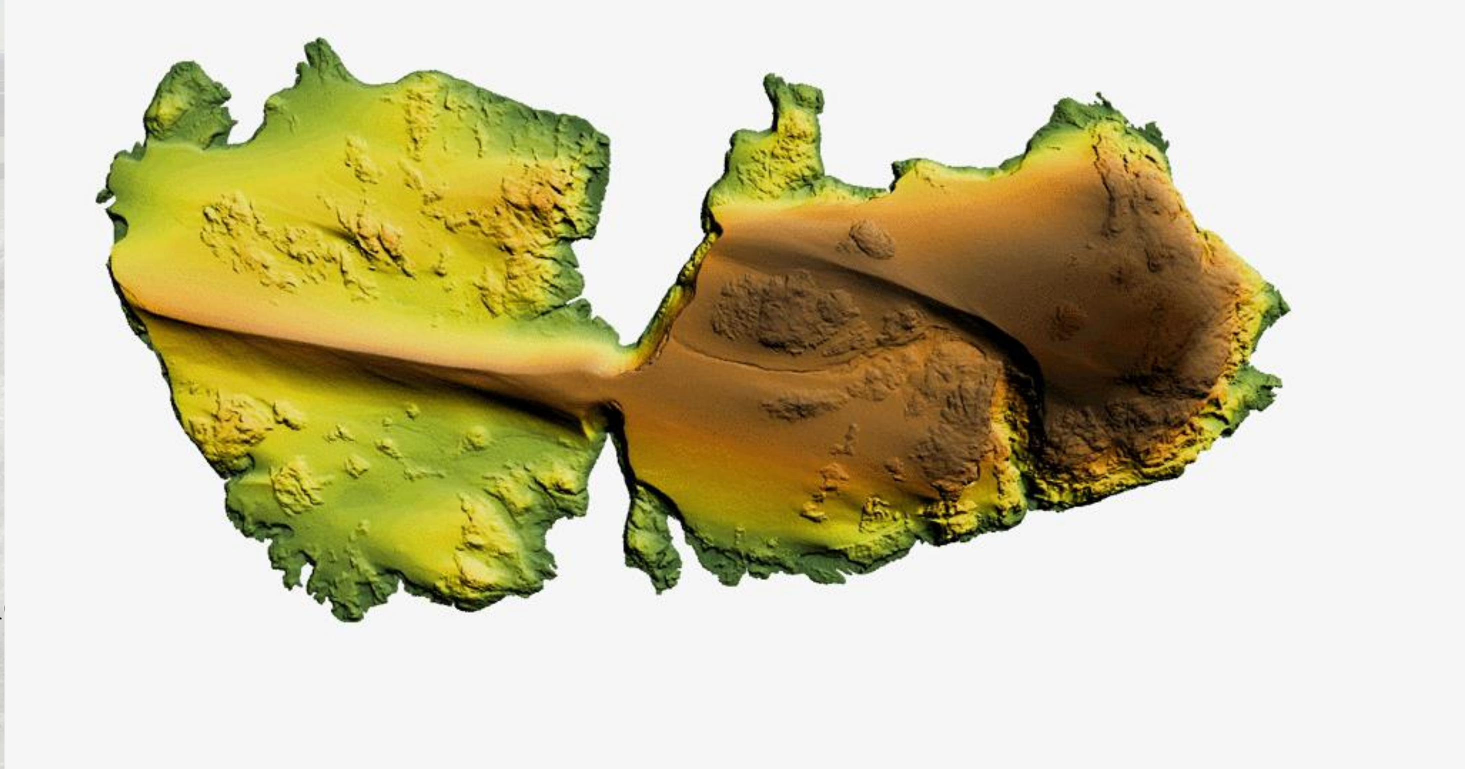
64°18'W
64°16'W
64°14'W
64°12'W
3D models of Uruguay (left) and Galindez (right) Islands
Vernadsky Station
Irizar. I.
Penola Strait
65°14'S
Uruguay I.
The Barchans
Argentine Islands
Corner I.
Galindez I.
Meek Channel
Winter I.
Skua Creek
Skua I.
0°
180°
65°15'S
Elevation (m)
70
60
50
40
30
20
10
Projection: UTM, zone 20S
Datum: WGS 84
Grid: Geographic Coordinate System
1:5500 at print scale
Map based on DSMs made from UAV
imagery (captured on February, March, 2018)
Location map sources:
SCAR Antarctic Digital Database
Sentinel-2A image (2016.02.10.),
copyright of European Space Agency
© Journal of Maps, 2019
N
0
0,5
1
kilometres
Digital surface models of the largest Argentine Islands, West Antarctica
Lamsters, K., Karušs, J., Krievāns, M., Ješkins, J.
University of Latvia, Riga, Latvia

3D MODELS OF ISLANDS

Island	*Max elevation, m	*Min elevation, m	Relative height, m	Area, km²	Perimeter, km
Barchan (southern)	35.90	11.71	24.19	0.330	4.435
Barchan (northern)	31.36	11.37	19.99	0.176	3.337
Galindez	65.27	14.05	51.22	0.362	6.331
Irizar	59.31	12.54	46.77	0.229	4.525
Skua	48.06	11.24	36.82	0.553	6.911
Uruguay	79.08	11.73	67.35	0.367	4.535
Winter	36.58	10.79	25.79	0.174	3.379
Corner (western)	33.74	13.45	20.29	0.079	1.854
Corner (eastern)	47.53	13.58	33.95	0.090	1.777
Corner (northern)	27.35	13.27	14.08	0.015	0.723
Average	46.42	12.37	34.05	0.238	3.780



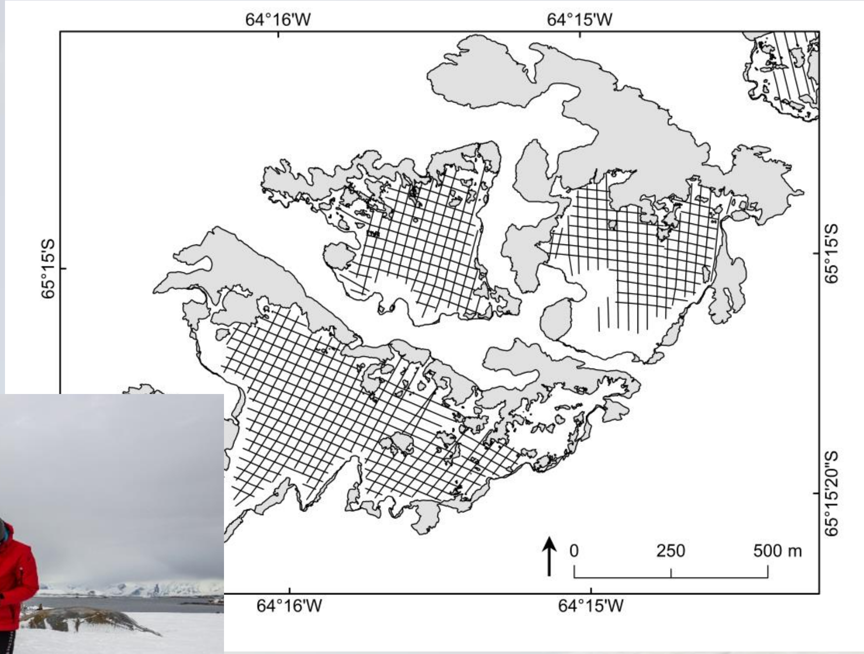
Galindez Island



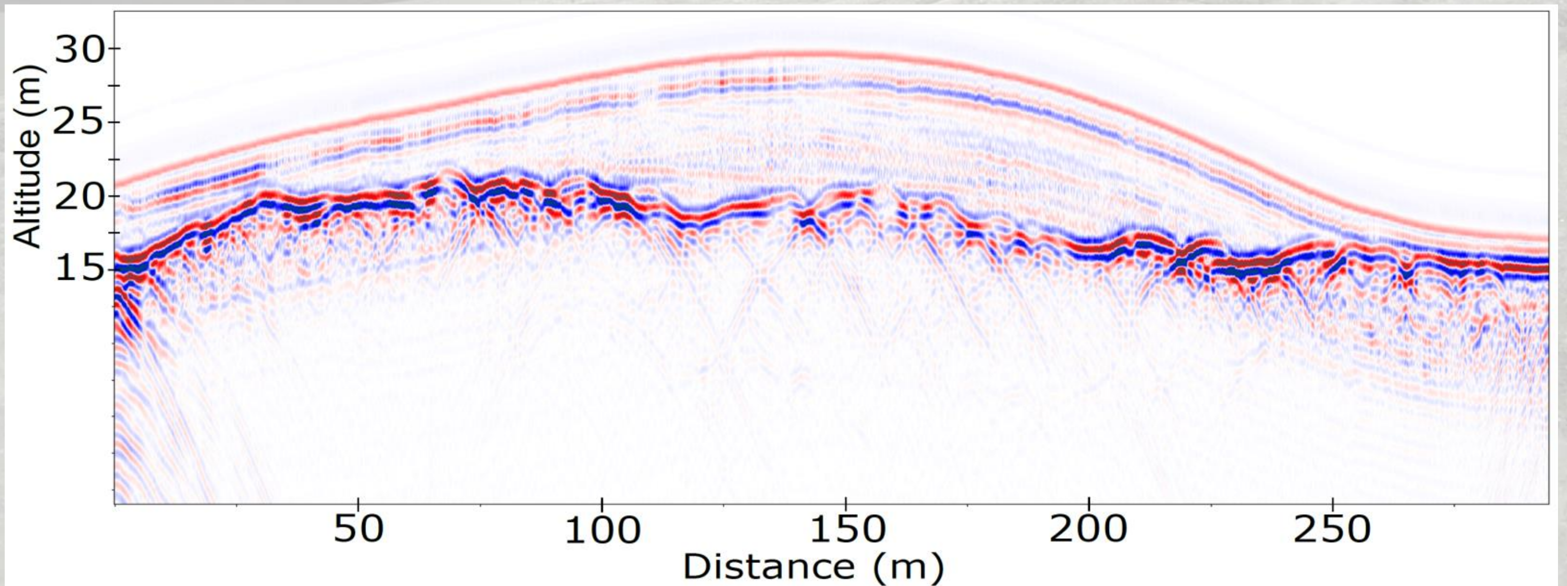
Uruguay Islan

Ice thickness/structure measurements

GPR operators with two GPR systems – Zond 12-e with 75 MHz antenna and VIY3-300 with 300 MHz antenna.



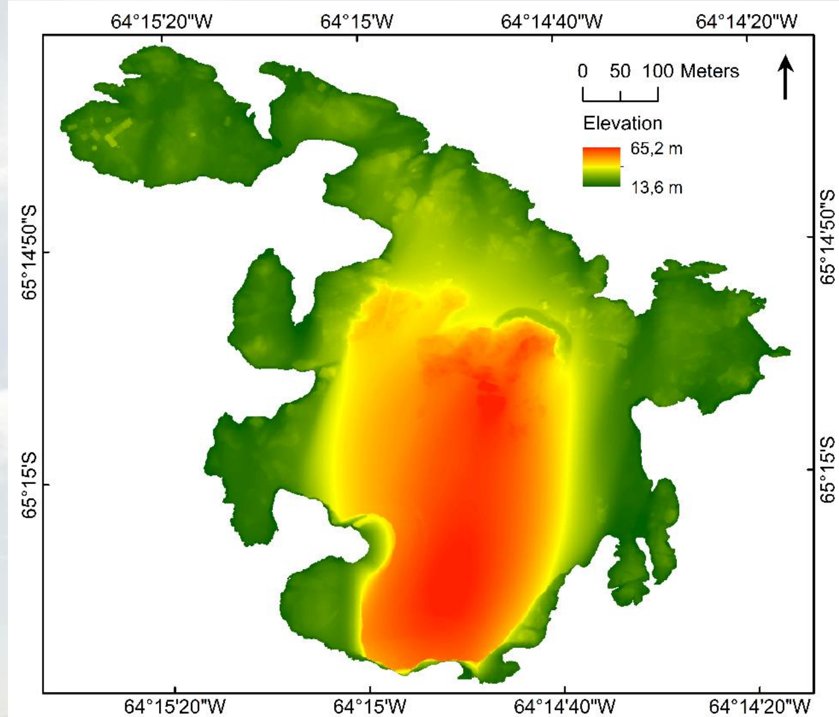
GPR profile grid on three islands.



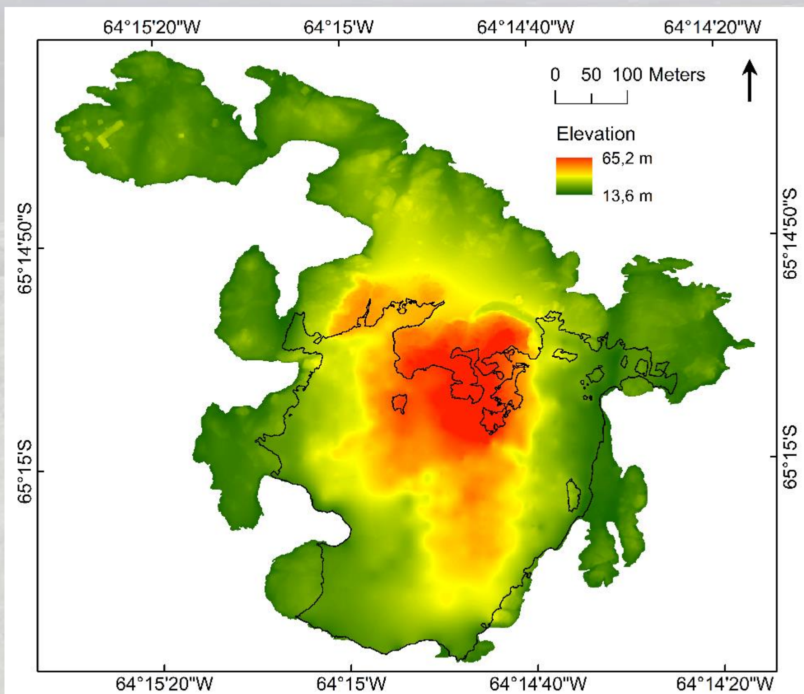
Northern Barchan Island ice cap

GALINDEZ ISLAND

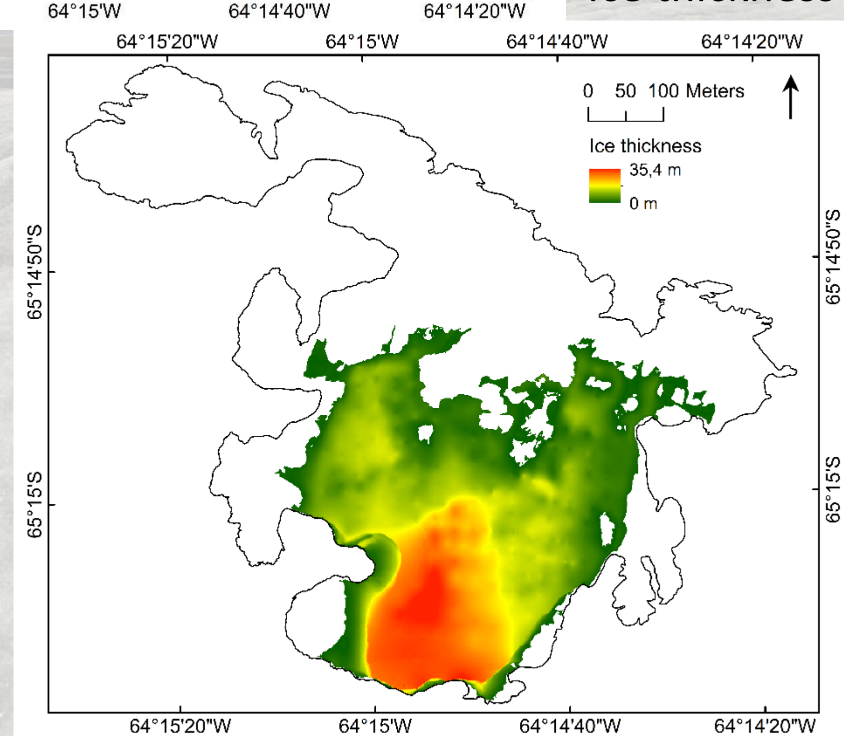
Surface elevation model



Subglacial topography

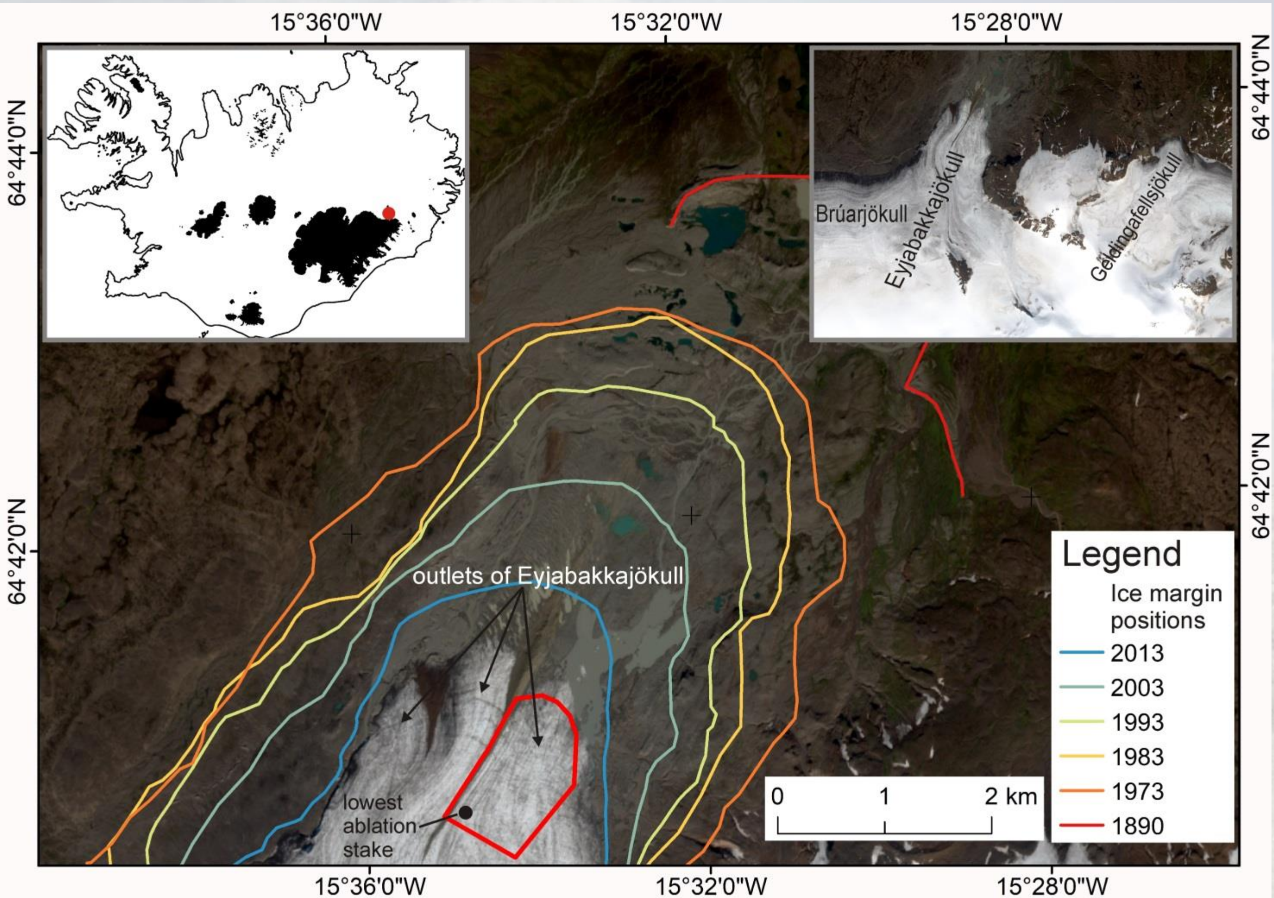


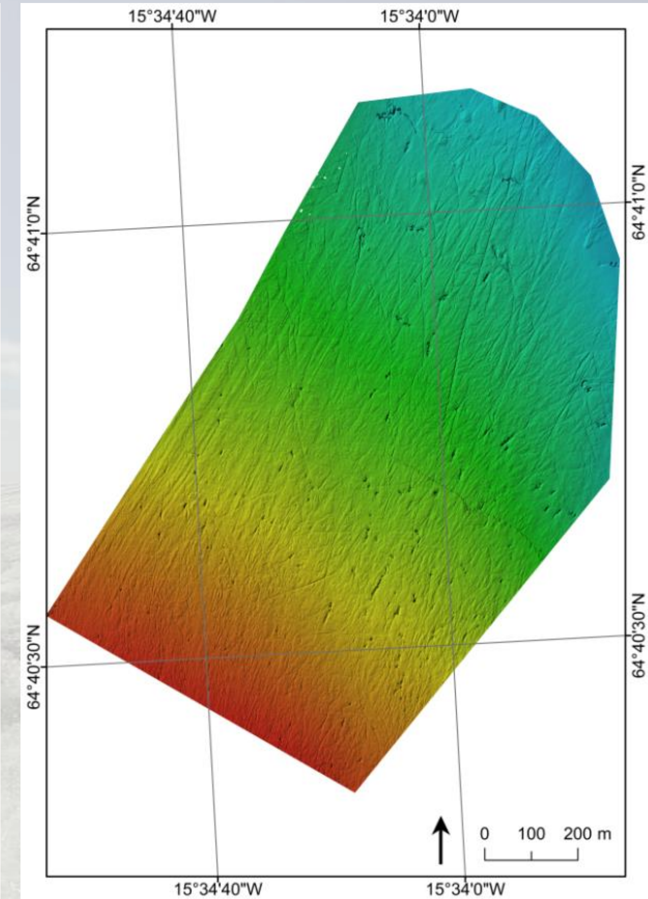
Ice thickness



SUBGLACIAL TOPOGRPAHY OF URUGUAY ISLAND

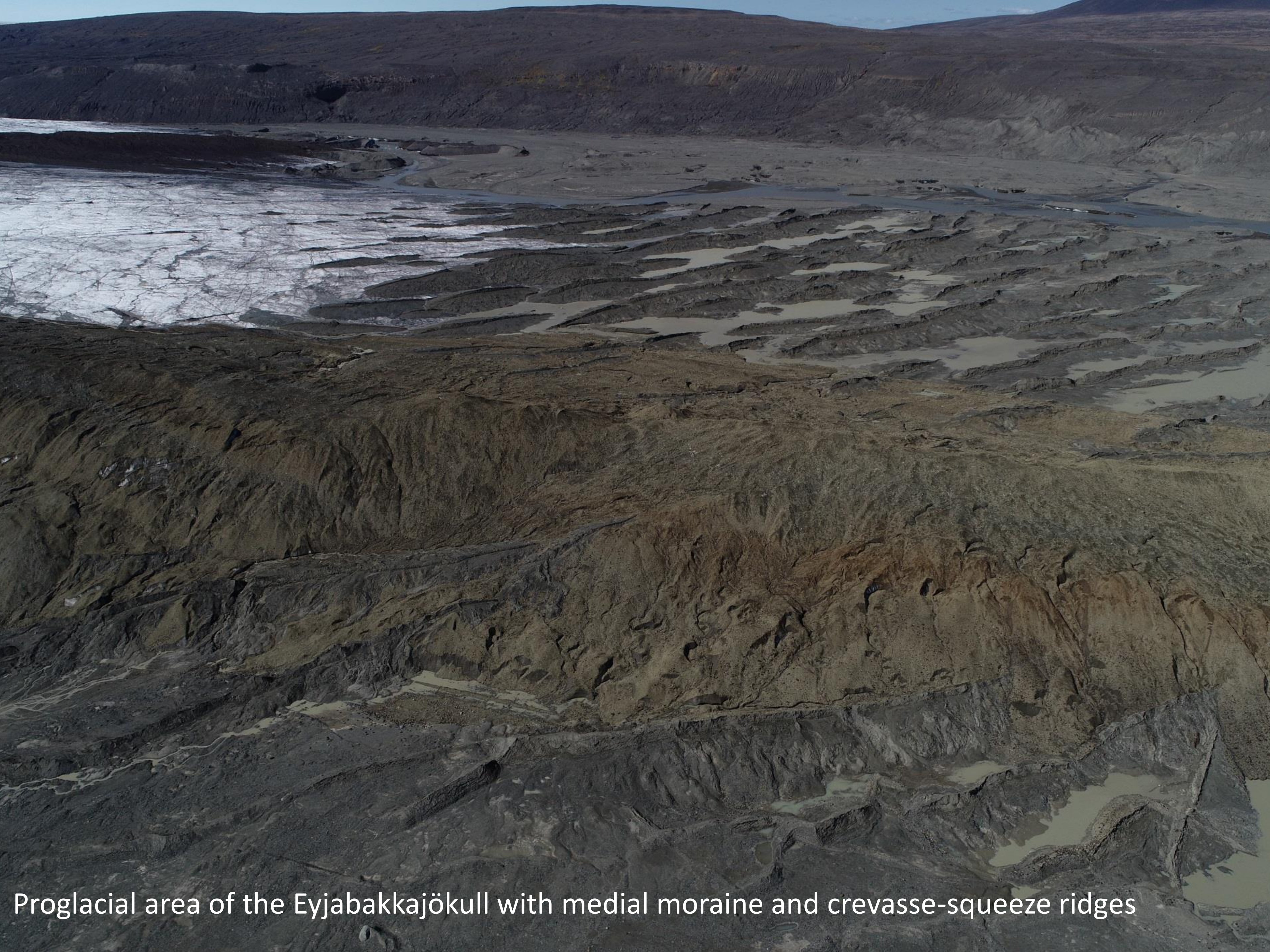
Iceland – 2018 - Eyjabakkajokull





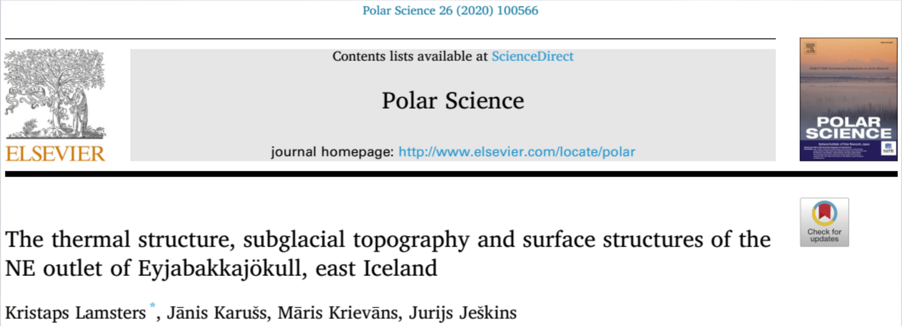
Sattelite images (Landsat) were used to establish retreat history of Eyjabakkajokull since 1973 (Lamsters et al., 2020).

Obtained DEM.



Proglacial area of the Eyjabakkajökull with medial moraine and crevasse-squeeze ridges

Iceland – 2018 - Eyjabakkajokull



Polar Science 26 (2020) 100566

Contents lists available at ScienceDirect

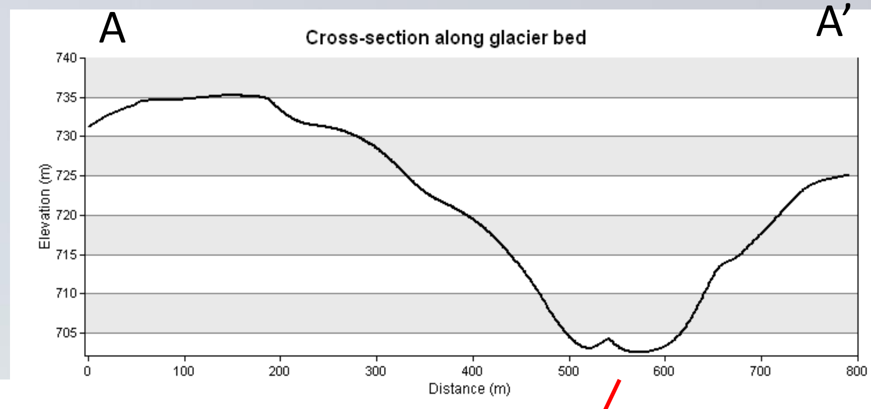
Polar Science

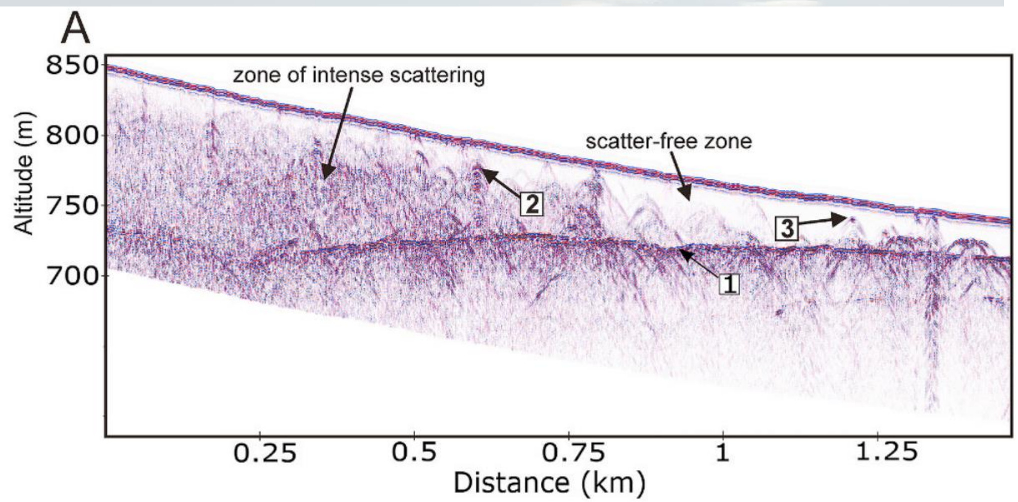
journal homepage: http://www.elsevier.com/locate/polar

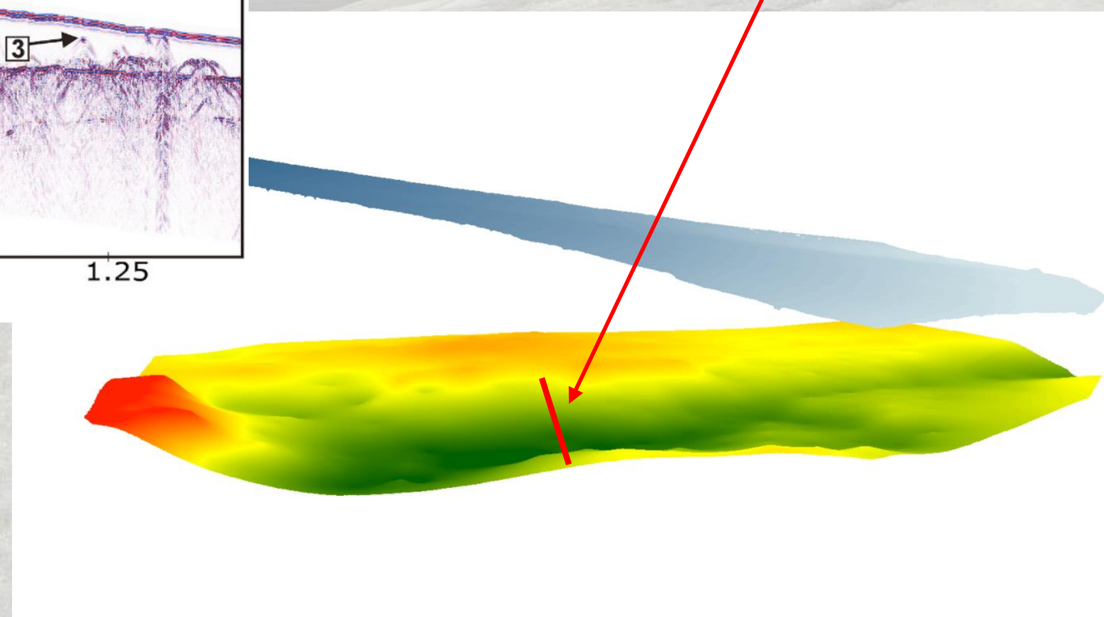
ELSEVIER

The thermal structure, subglacial topography and surface structures of the NE outlet of Eyjabakkajökull, east Iceland

Kristaps Lamsters *, Jānis Karušs, Māris Krievāns, Jurijs Ješkins

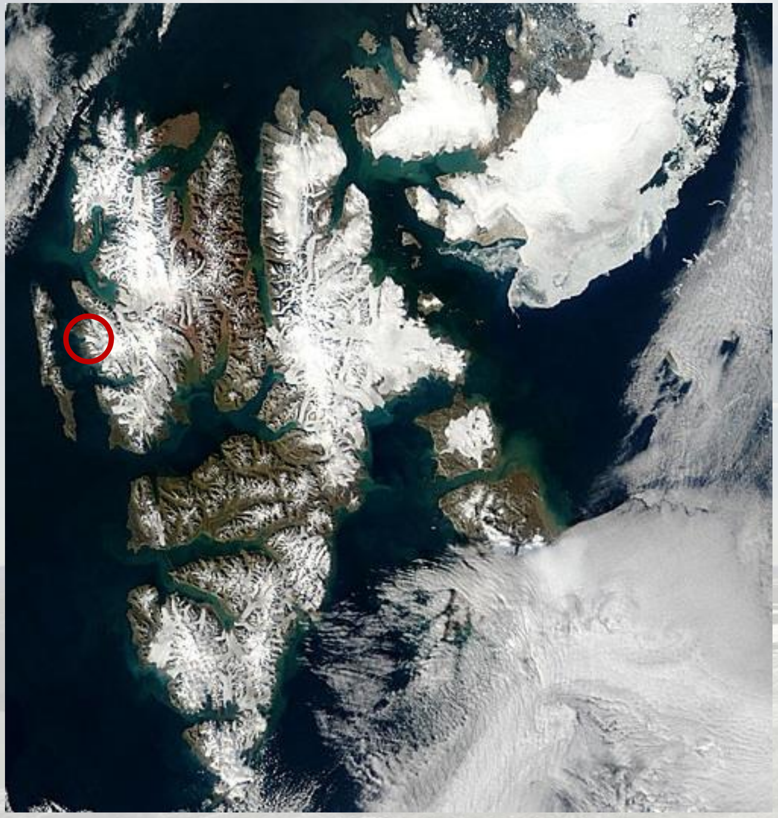




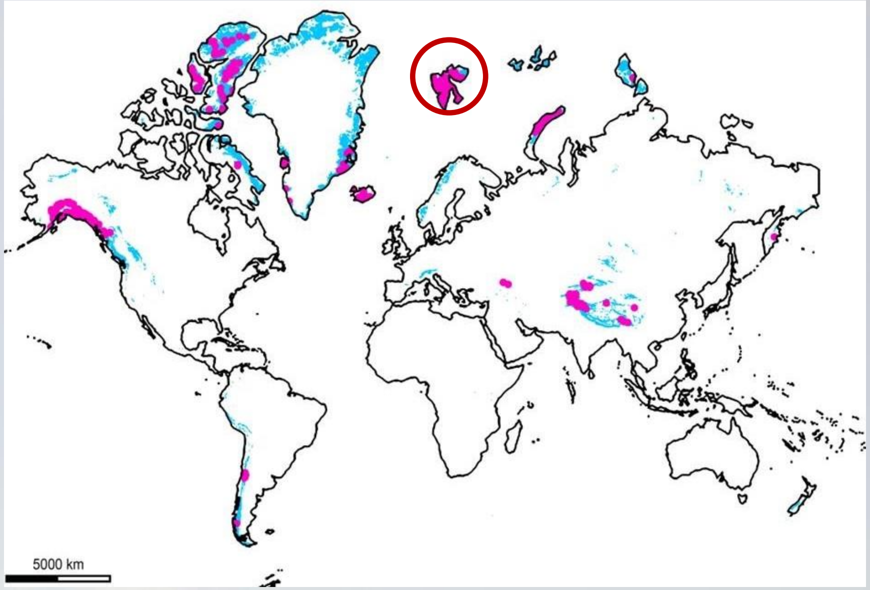


Subglacial topography of the NE outlet of Eyjabakkajökull.

SVALBARD



Terra satellite image of Svalbard: Ice cap of Austfonna on Nordaustlandet (top right), highland icefields on the main island.



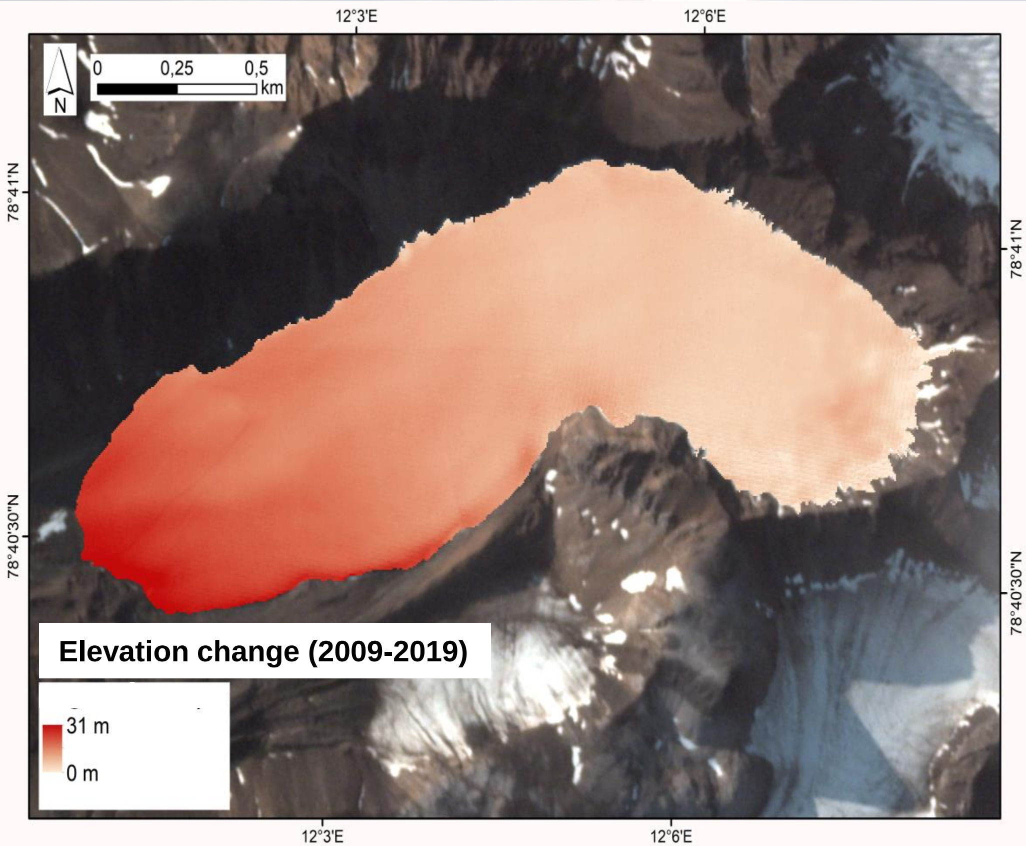
Surging glaciers around the globe

Waldemarbreen outlet glacier, W Spicbergen, 2019.

SVALBARD, 2019

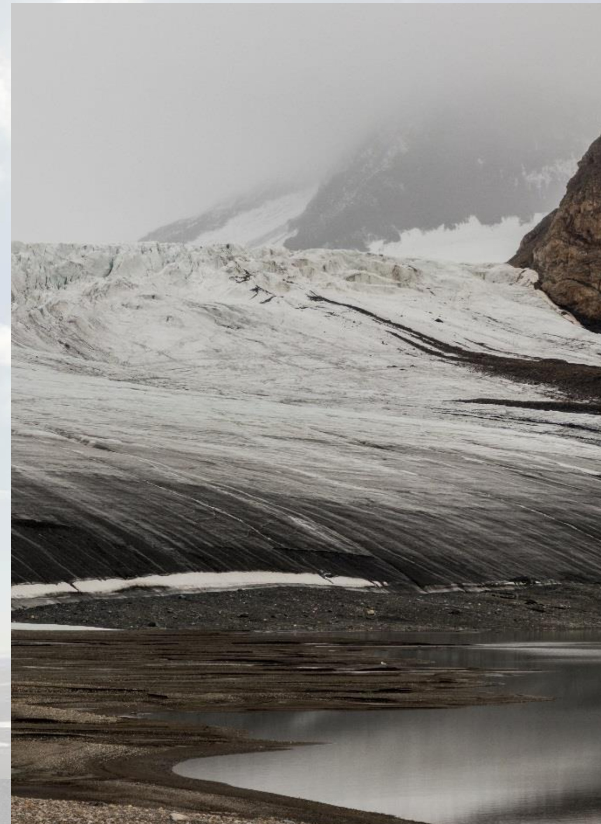
Polar station of the Nicolaus Copernicus University in Toruń (Poland)

Glacier studies in Svalbard



Using elevation data from Arctic DEM and DEM made from UAV photogrammetry, the elevation change of Waldemarbreen glacier in Svalbard has been evaluated between 2009 and 2019.

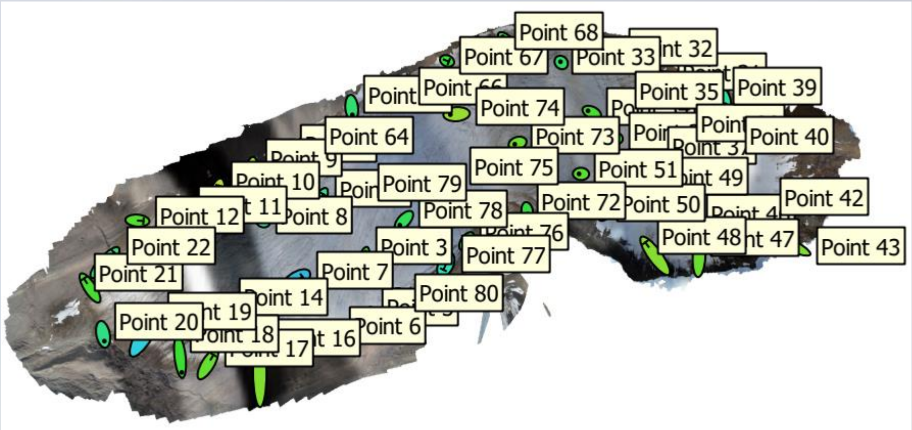
Waldemarbreen glacier, 2019

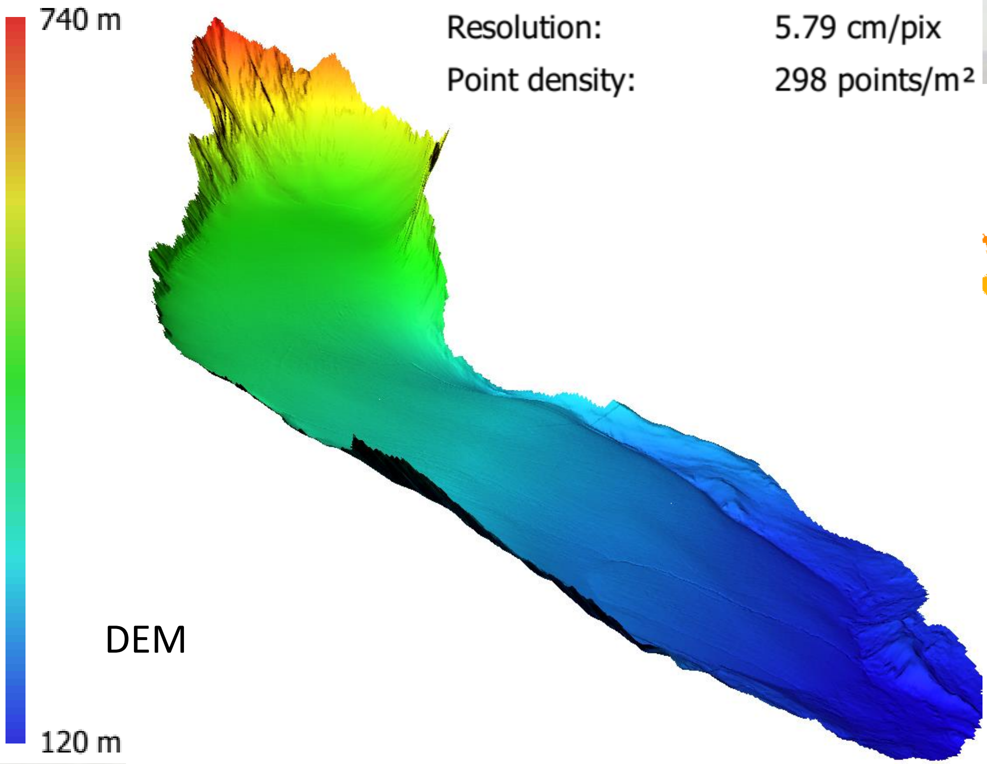

SVALBARD: WORKING ENVIRONMENT

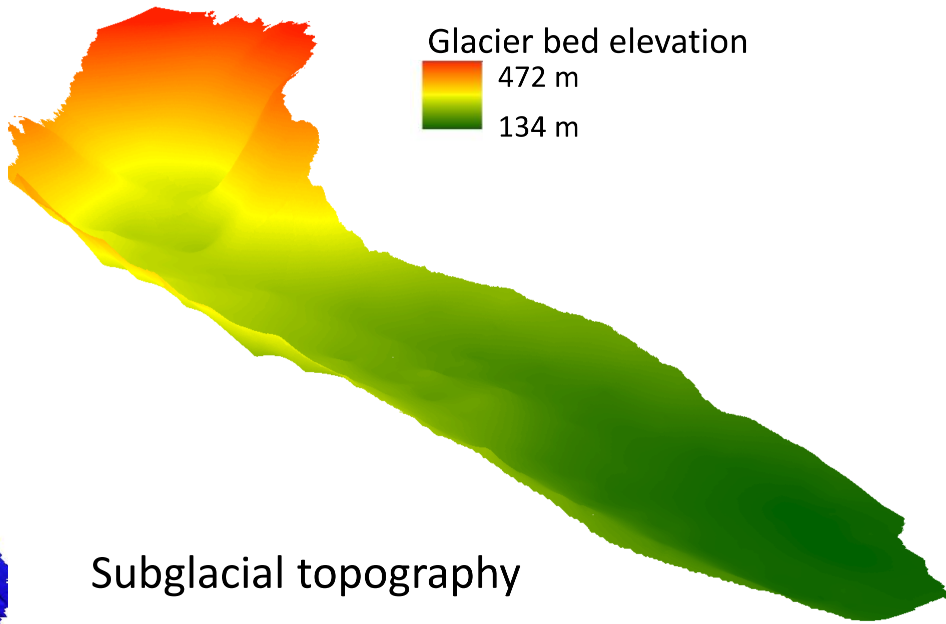
SURVEYS OF WALDEMARBREEN

Number of images:	4,309	Camera stations:	4,306
Flying altitude:	116 m	Tie points:	26,480,336
Ground resolution:	2.9 cm/pix	Projections:	104,574,762
Coverage area:	4.18 km²	Reprojection error:	0.483 pix

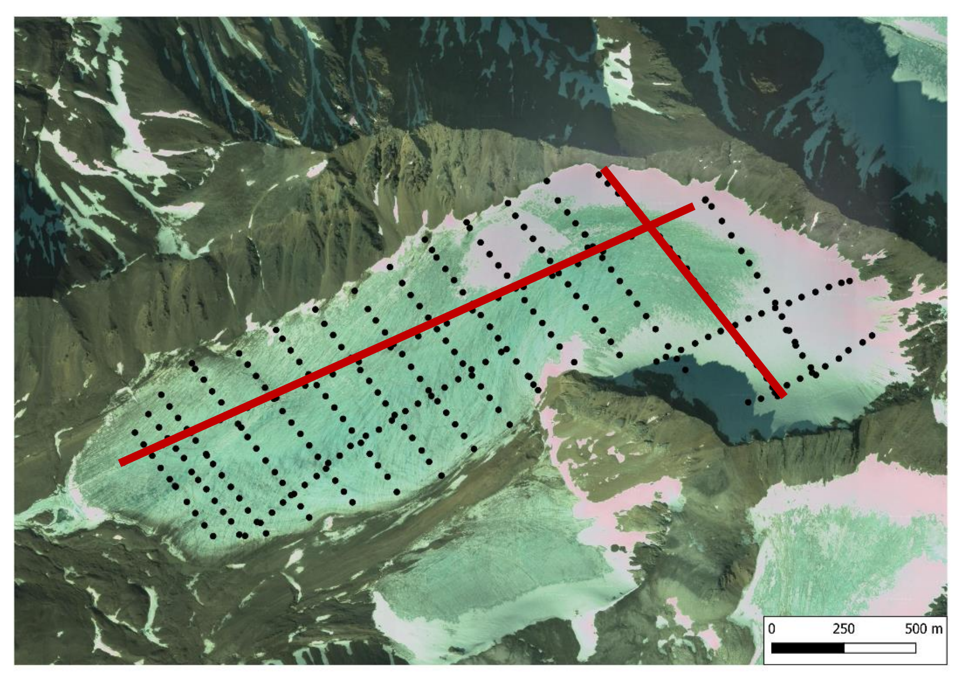


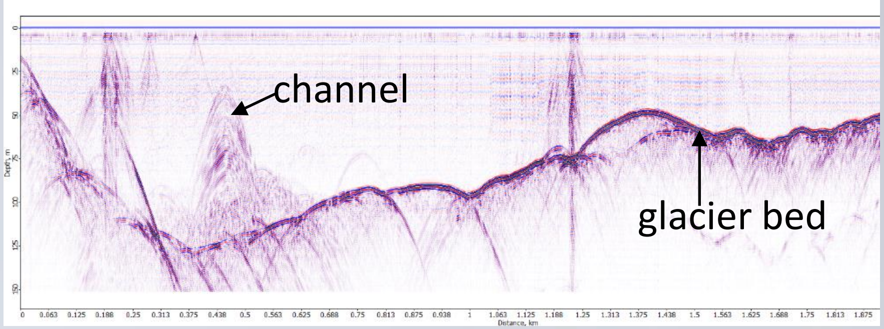
Resolution:	5.79 cm/pix
Point density:	298 points/m²

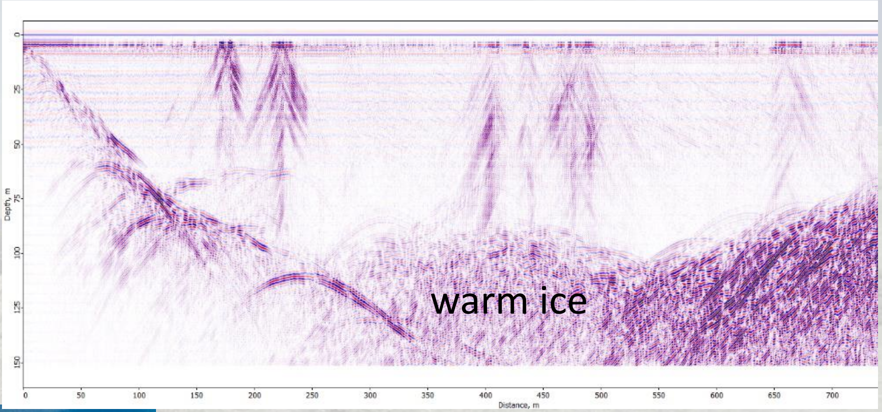




SVALBARD: GEOPHYSICAL STUDIES OF WALDEMARBREEN



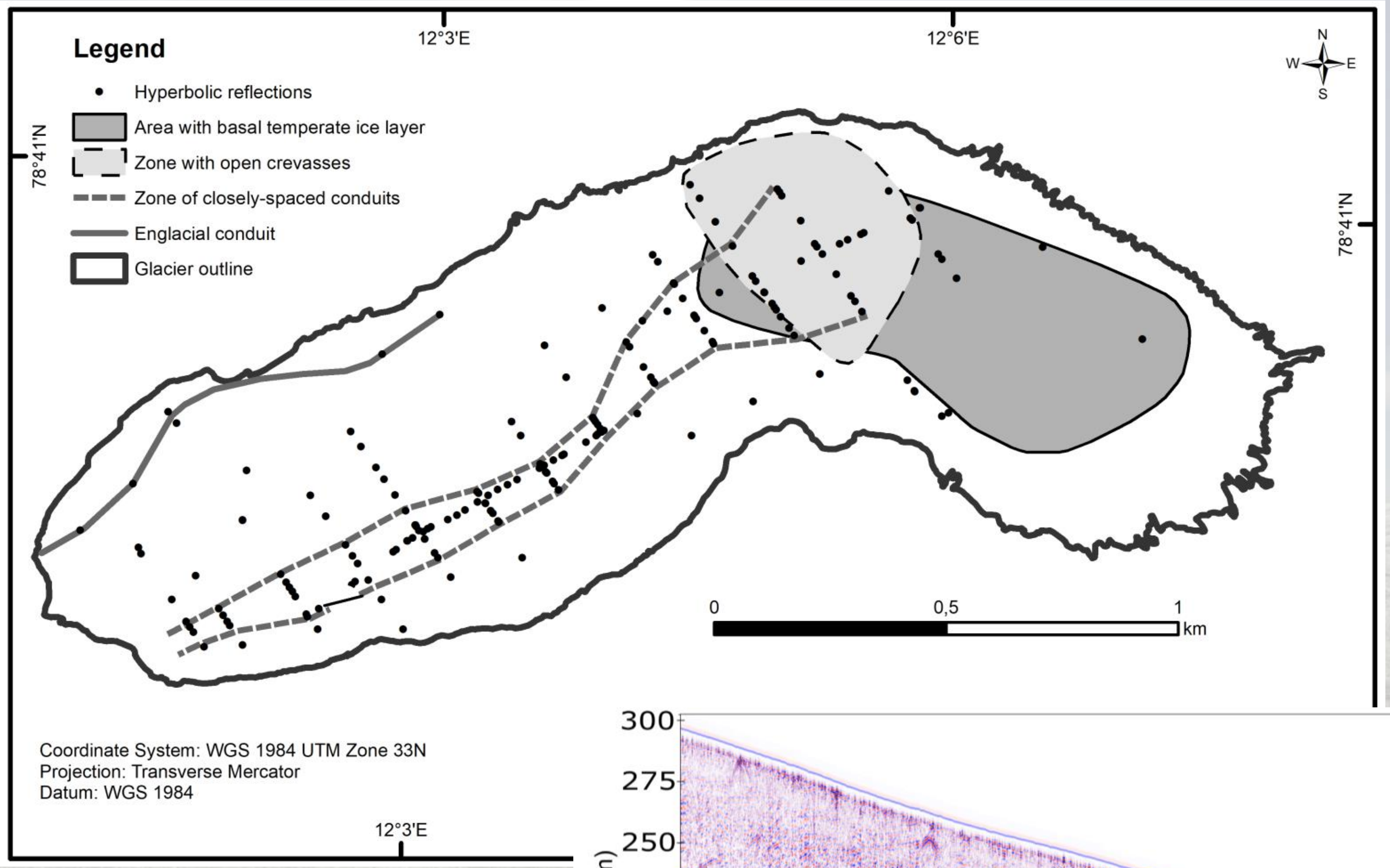


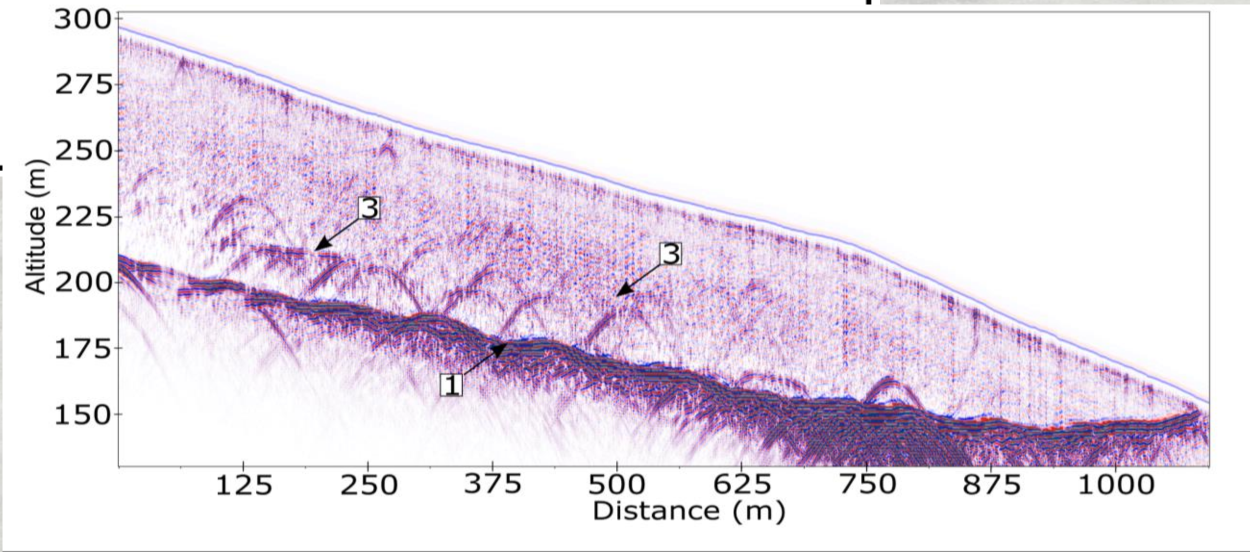


GPR images show the boundary between the glacier bed and ice, englacial conduits and warm ice zone suggesting that Waldemarbreen is a polythermal glacier.

The highest part of Waldemarbreen - accumulation area with the thickest and warmest ice. Note people in the middle of picture.

DRAINAGE SYSTEM OF WALDEMARBREEN





PERSISTENT ORGANIC POLLUTANTS IN SVALBARD

Over 250 samples taken from Kaffiøyra plain, Forlandsundet sound (Greenland sea) and four glaciers (Waldemarbreen, Irenebreen, Agnorbreen and Elisebreen).

Main sample types: glacial melt water, seawater, vegetation, animal feces, soil samples, cryoconites, sediments, atmospheric particles, passive sampling devices in water.

CRYOCONITES

ANIMAL FECES

SOIL

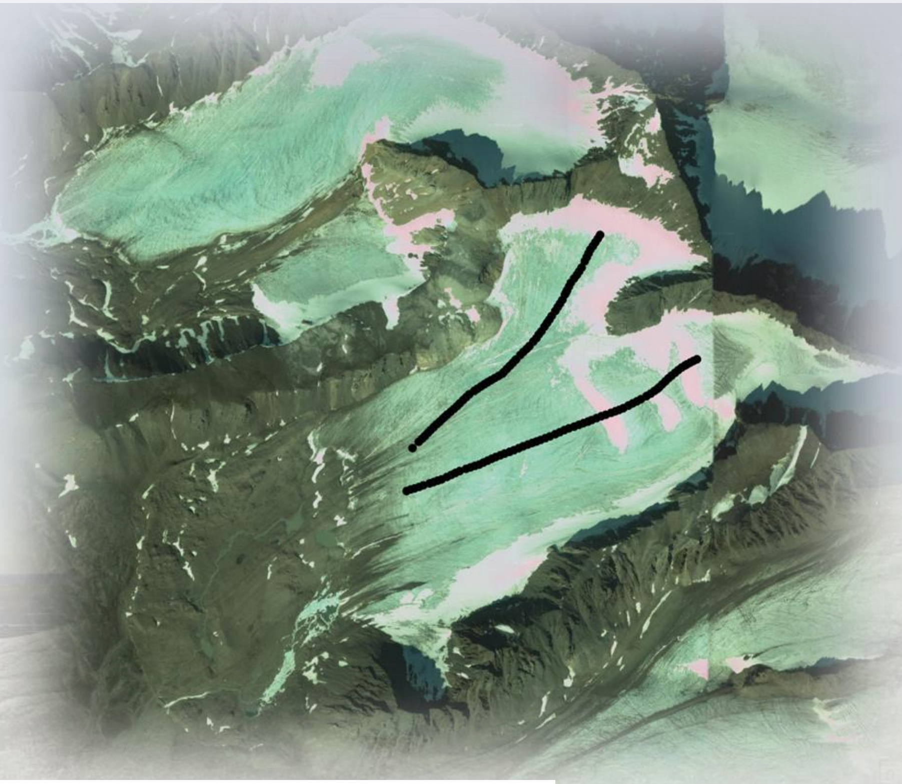
Persistent Organic Pollutants (POPs) are **toxic chemicals** that **adversely effect human health and the environment** around the world. POPs are **transported by wind, water, and food cycles**. Because they are resistant to environmental degradation, **they can persist for long periods of time in the environment**, **accumulate**, and **pass through the food chain**.

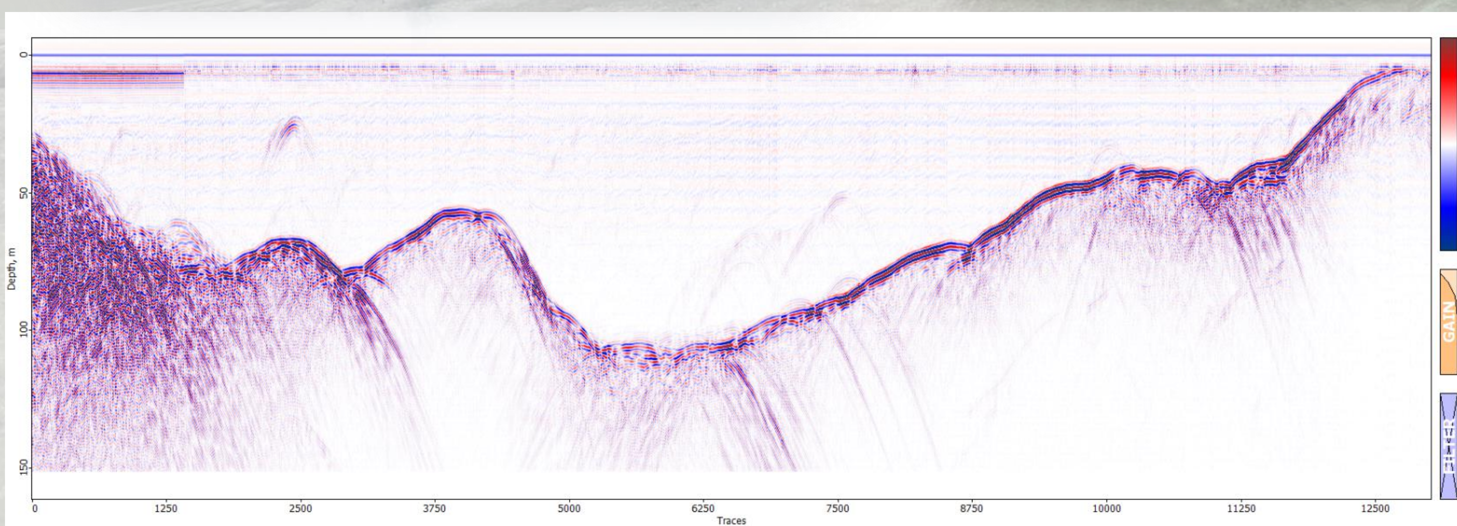
BIOR
PĀRTIKAS DROŠĪBAS, DZĪVNIEKU VESELĪBAS UN VIDES ZINĀTNISKAIS INSTITŪTS

Ingus Pērkons, researcher, Institute of Food Safety, Animal Health and Environment "BIOR"

FUTURE PLANS - 2021

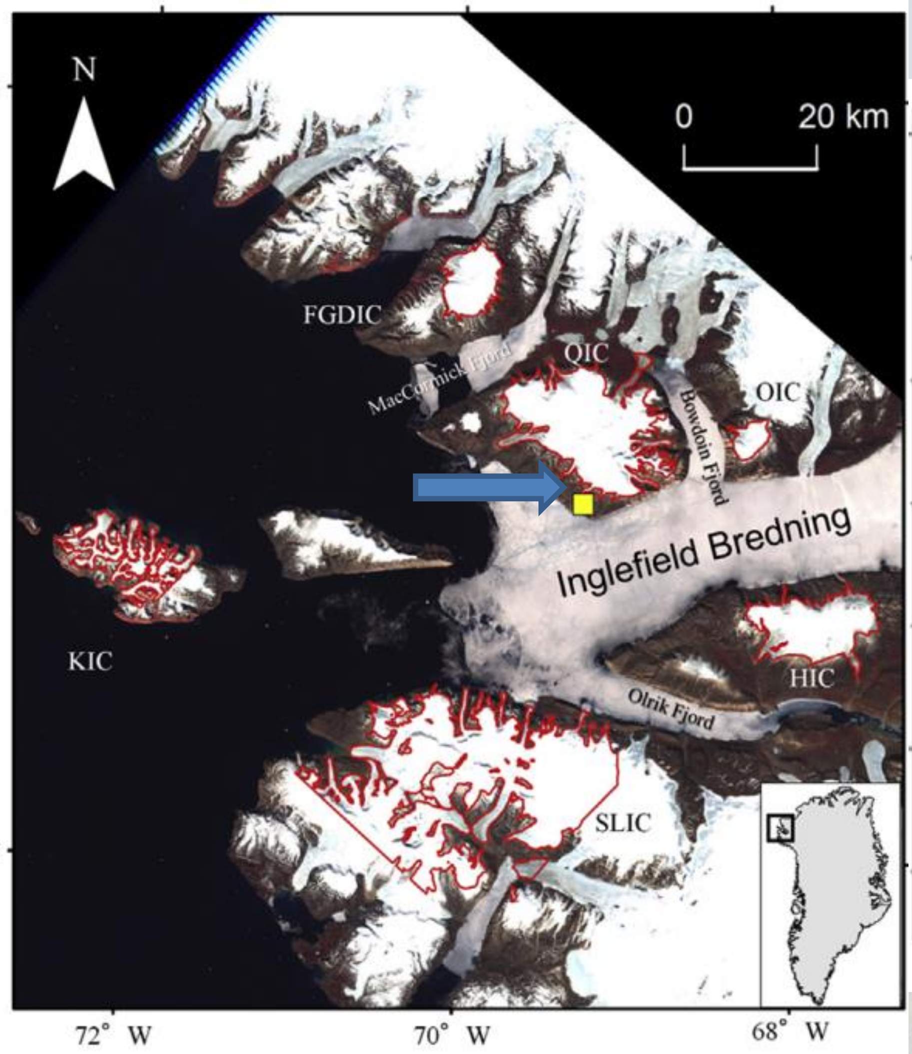
Svalbard - Irenebreen

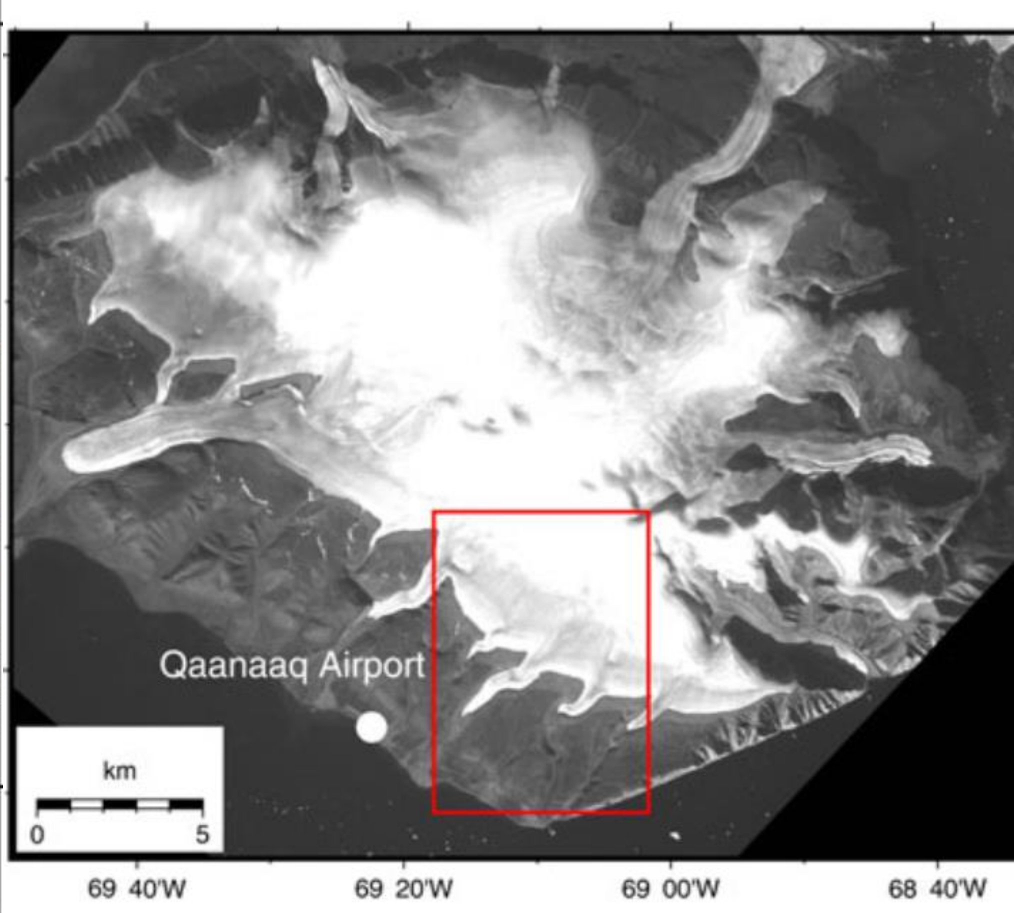




FUTURE PLANS - 2021

Qaanaaq Ice Cap, northwestern Greenland





Thank you for your attention!

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