

# Systematized in-situ monitoring of peripheral glaciers in Greenland

- and the relevance for global glacier mass change assessments

**Signe Hillerup Larsen (Researcher at GEUS)**

Alexandra Messerli (Asiaq), Kirsty Langley (Asiaq), Michele Citterio (GEUS),

Bernhard Hynek (GeoSphere), Simon de Villiers (HVL), Jacob Clement Yde (HVL), Anders Bjørk (KU) and Robert Fausto (GEUS)



GEUS



Western Norway  
University of  
Applied Sciences



~20.300 peripheral  
glaciers in Greenland



Map source: QGreenland

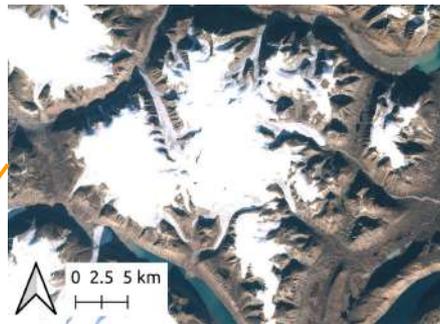
Lyngmarksbræen



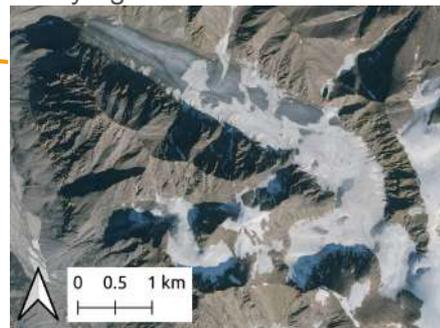
Qassinguit sermiat



A.P. Olsen Ice Cap



Freya glacier



Mitivakkat Glacier



Map source: QGreenland

# Zackenberg Ecological Research Station



A.P. Olsen Ice Cap



Freya glacier



GEUS

PROMICE|GC-NET



Map source: QGreenland

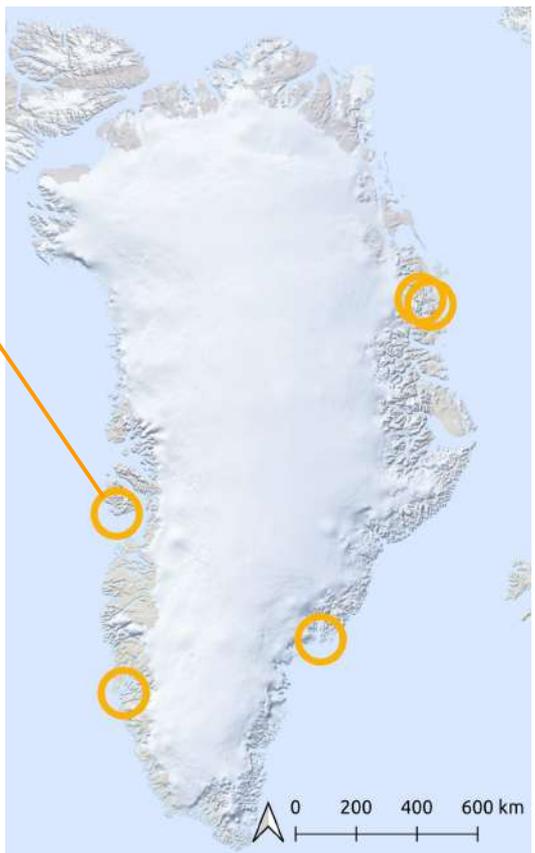
Glaciological monitoring from  
2008 to present

Contact:

Signe Hillerup Larsen (GEUS)  
Bernhard Hynek (GeoSphere Austria)

# Arctic Station

Lyngmarksbræen



Glaciological monitoring  
from 2017 to present  
Contact:  
Michele Citterio (GEUS)



Arctic Station



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Map source: QGreenland

# Nuuk Ecological Research Station

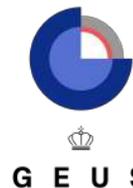
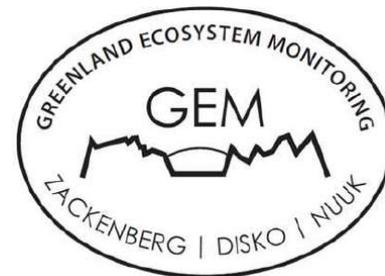


Qassinnguit sermiat



Map source: QGreenland

Glaciological monitoring  
from 2017 to present  
Contact:  
Alexandra Messerli (Asiaq)



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# Sermilik Scientific Research Station

## The Sermilik Scientific Research Station

The Sermilik Scientific Research Station provides a logistic base for ongoing glaciological, hydrological and geomorphological investigations of the Mittivakkat Glacier and its catchment.



## Sermilik-Forschungsstation in Grönland

Die Mittivakkat-Gletscher hat einen maßgeblichen Einfluss auf das Klima in Europa. Die Grönland-Region in der Region stärken und hat mit der Universität Graz, die Forschungsstation-Sermilik im Osten Grönlands gemeinsam zu betreiben.



Map source: QGreenland

Glaciological monitoring  
from 1996 to present

Contact:

Simon de Villiers (HVL)  
Jacob Clement Yde (HVL)



**SDU**

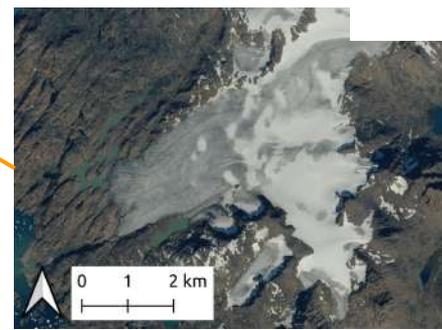
University of  
Southern Denmark

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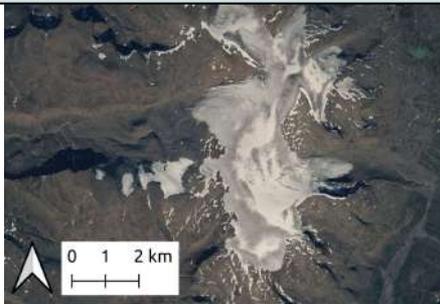
G E U S

Mittivakkat Glacier

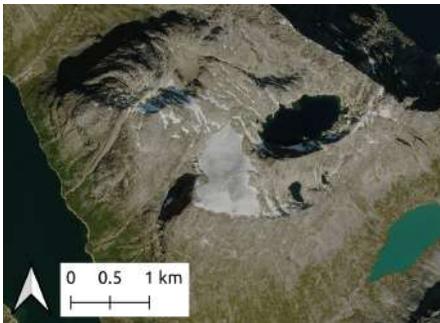


# Systematized in-situ monitoring of peripheral glaciers in Greenland

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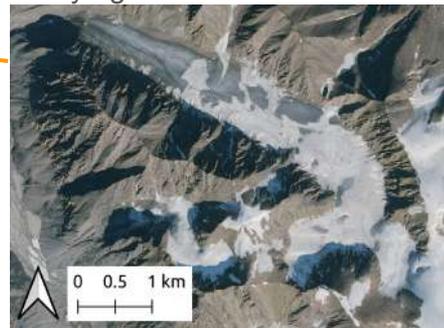


Map source: QGreenland

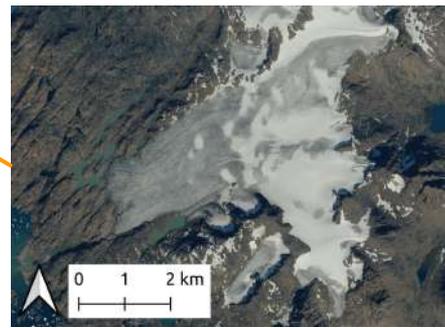
A.P. Olsen Ice Cap



Freya glacier

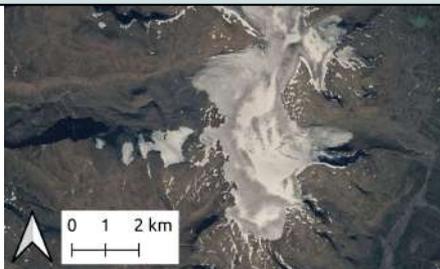


Mittivakkat Glacier



## Systematized Systematic in-situ monitoring of peripheral glaciers in Greenland

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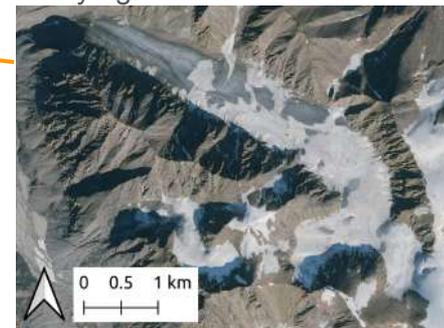
Qassinnguit sermiat



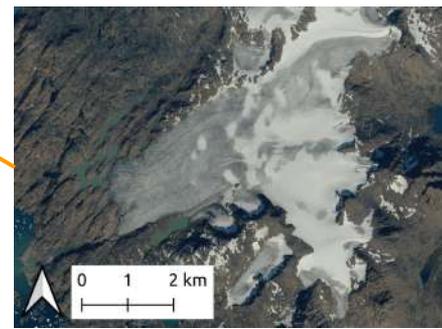
A.P. Olsen Ice Cap



Freya glacier



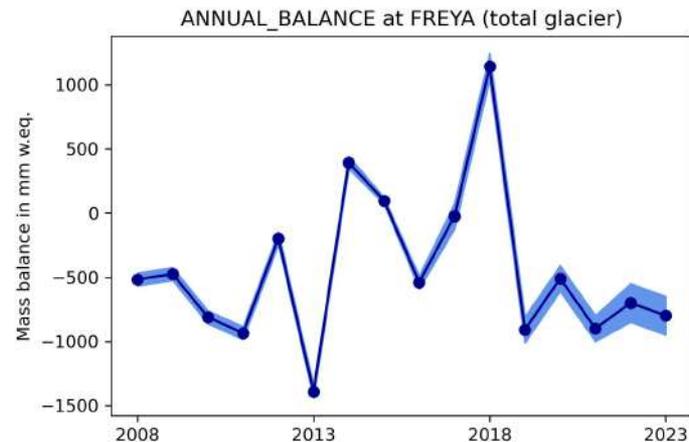
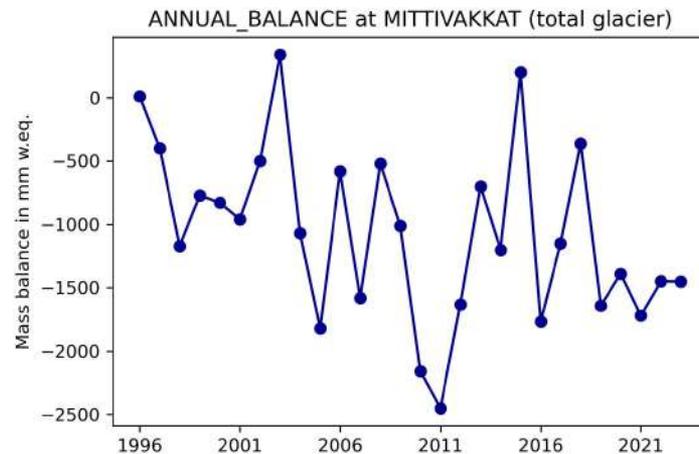
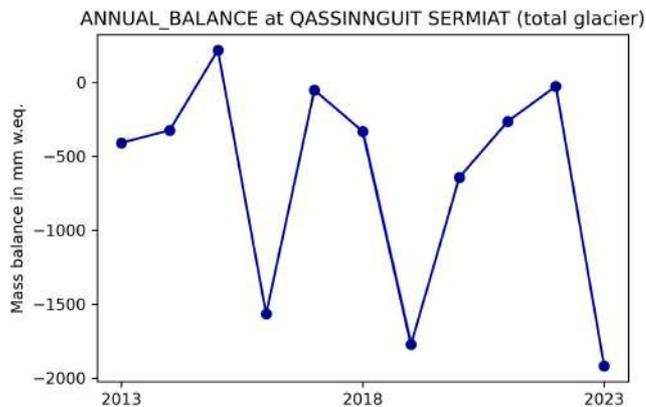
Mittivakkat Glacier



Map source: QGreenland

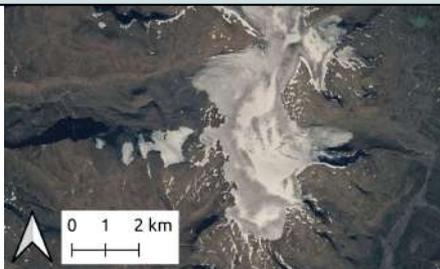
~~Systematized~~ Systematic in-situ monitoring of peripheral glaciers in Greenland  
- and the relevance for global glacier mass change assessments

WGMS FoG database: A route to global glacier mass change assessments



**Systematized Systematic** in-situ monitoring of peripheral glaciers in Greenland

- and the relevance for global glacier mass change assessments



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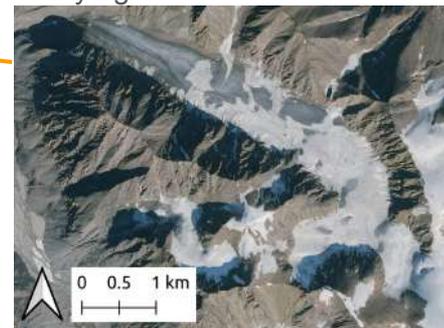


Close to research stations but still very far away

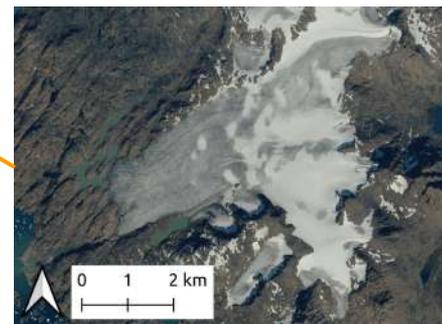
A.P. Olsen Ice Cap



Freya glacier



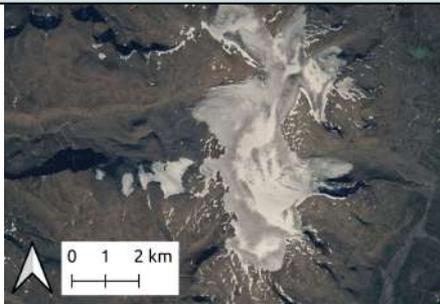
Mittivakkat Glacier



Map source: QGreenland

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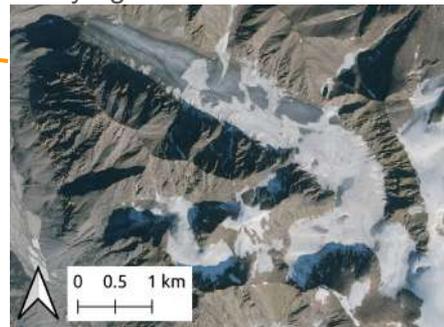


Close to research stations but still very far away

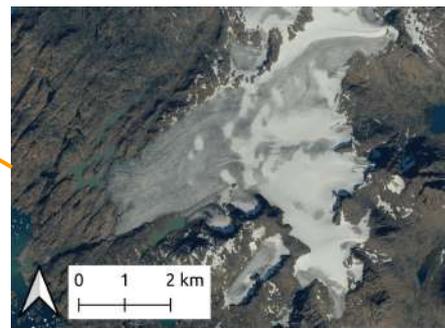
A.P. Olsen Ice Cap



Freya glacier



Mittivakkat Glacier



Map source: QGreenland

## **Systematized** in-situ monitoring of peripheral glaciers in Greenland

- and the relevance for global glacier mass change assessments

## All five glaciers have one thing in common: **Standardized Automatic Ablation and Weather Stations**

Transmitting hourly:

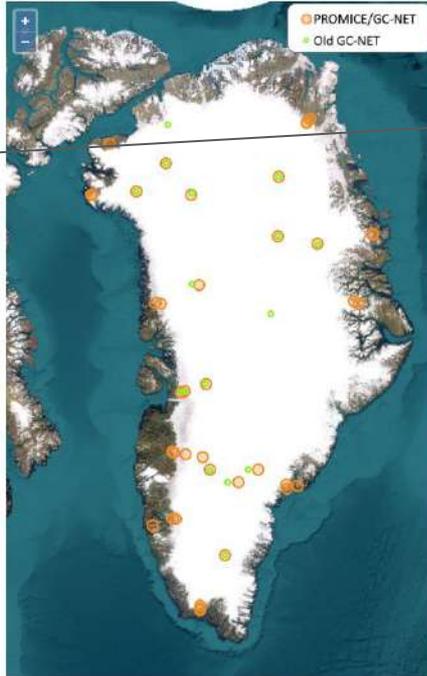
- Snow height
- Precipitation
- Ice surface lowering (ice ablation)
- Ice/firn temperature up to 10 m depth
- Various climate variables

Into **PROMICE** | **GC-NET** workflow

Standardized, consistent,

Anchored at GEUS: large-scale production benefits





Click a station or zoom the map

Name	Timestamp (GMT)	Temperature	Wind speed	Solar radiation
KAN_L	23-08-2024 11:00	3.0 °C	3.9 m/s	127.2 W/m <sup>2</sup>
UPE_U	23-08-2024 11:00	1.0 °C	1.9 m/s	174.3 W/m <sup>2</sup>
CP1	23-08-2024 11:00	-6.5 °C	7.7 m/s	207.8 W/m <sup>2</sup>
UPE_L	23-08-2024 11:00	3.8 °C	4.5 m/s	87.7 W/m <sup>2</sup>
PIU_U	23-08-2024 11:00	0.6 °C	3.0 m/s	65.1 W/m <sup>2</sup>
ING_1	30-12-2024 23:00	-37.2 °C	0.0 m/s	1.2 W/m <sup>2</sup>
DY2	23-08-2024 11:00	-3.2 °C	8.2 m/s	195.9 W/m <sup>2</sup>
KPC_LUV3	23-11-2056 23:00	-30.1 °C	0.0 m/s	-0.5 W/m <sup>2</sup>
NUK_L	23-08-2024 11:00	5.3 °C	2.8 m/s	27.7 W/m <sup>2</sup>
KPC_U	23-08-2024 10:00	-4.0 °C	2.5 m/s	-380.3 W/m <sup>2</sup>
KPC_L	23-08-2024 11:00	0.5 °C	2.3 m/s	661.8 W/m <sup>2</sup>
THU_L	23-08-2024 10:00	0.9 °C	2.2 m/s	70.2 W/m <sup>2</sup>
KAN_B	23-08-2024 11:00	0.6 °C	1.0 m/s	48.9 W/m <sup>2</sup>
TAS_L	23-08-2024 11:00	4.6 °C	4.1 m/s	322.3 W/m <sup>2</sup>
QAS_L	23-08-2024 11:00	4.5 °C	0.8 m/s	42.5 W/m <sup>2</sup>
THU_L2	23-08-2024 11:00	1.2 °C	4.3 m/s	80.5 W/m <sup>2</sup>
ZAC_L	23-08-2024 11:00	3.8 °C	5.9 m/s	575.5 W/m <sup>2</sup>
SDL	23-08-2024 13:00	10.6 °C	5.7 m/s	388.4 W/m <sup>2</sup>

Another route to global surface mass balance assessments

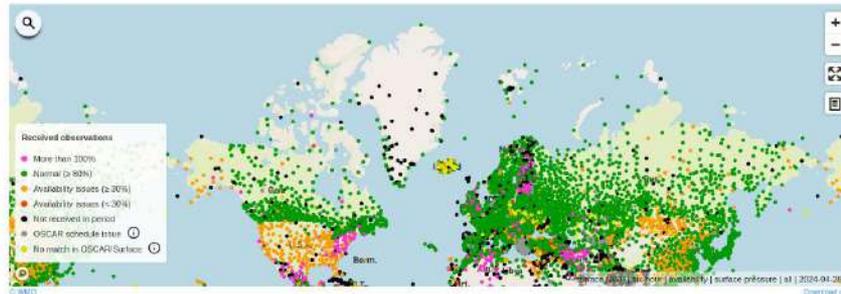
- ❑ WMO: Weather forecast,
- ❑ Reanalysis: ERA6, Copernicus Arctic Regional Reanalysis (CARRA)

WIGOS Data Quality Monitoring System

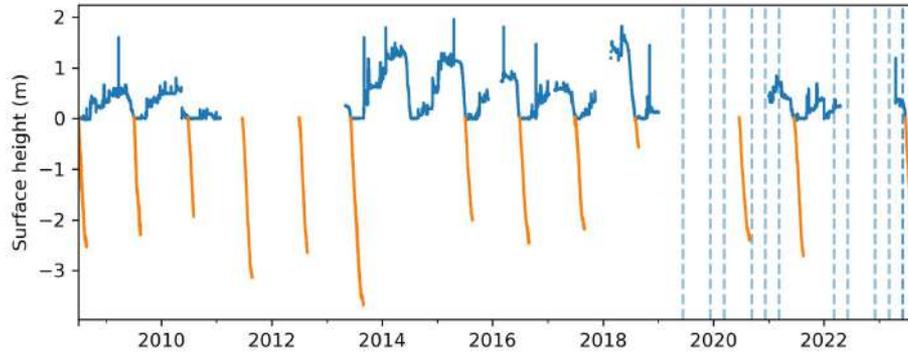
Monitoring Database status About

Availability of surface land observations (global NWP)

Type of period: All-time | Monitoring category: availability | Variable: surface pressure | Monitoring center: All | Date: 2024-05-28 | Surface period: 100% (100%)



# Continuous, in-situ, automatic ablation observations



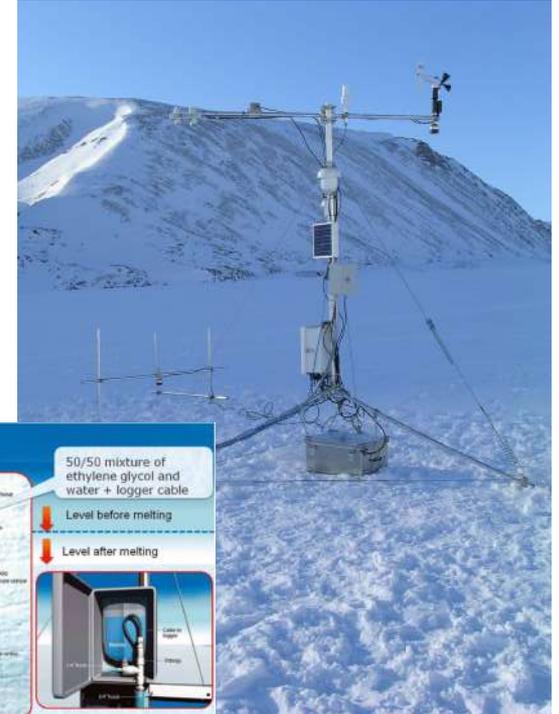
Freely available at

<https://dataverse.geus.dk/>

And for GEM sites

<https://data.g-e-m.dk/>

Underused dataset  
for global mass  
balance  
assessments?

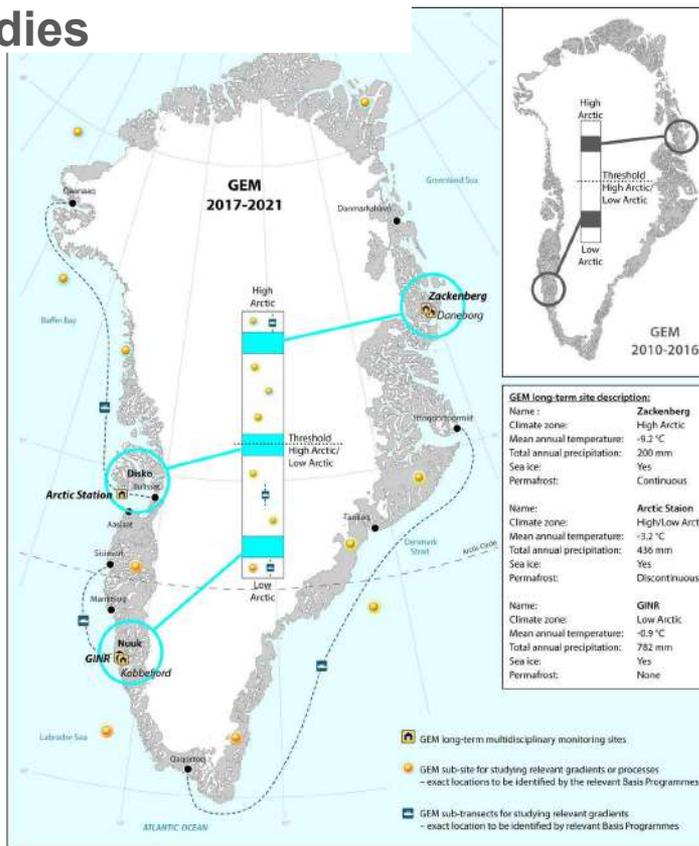


# Alternative routes to global mass change assessments: **Process studies**

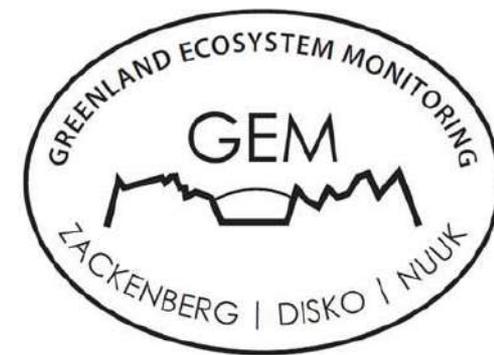
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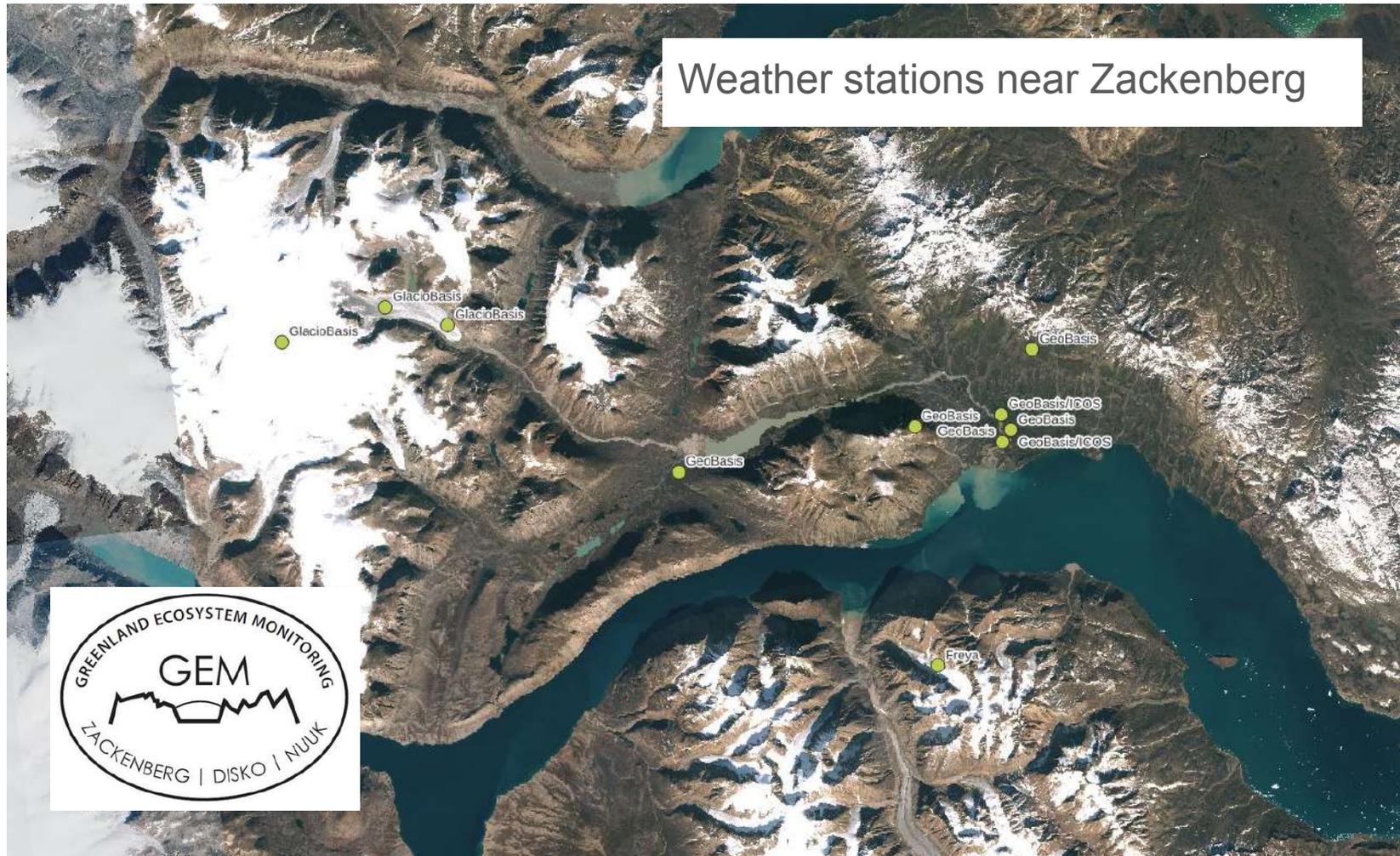
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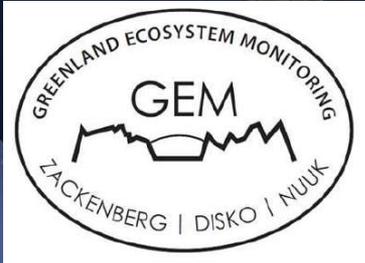
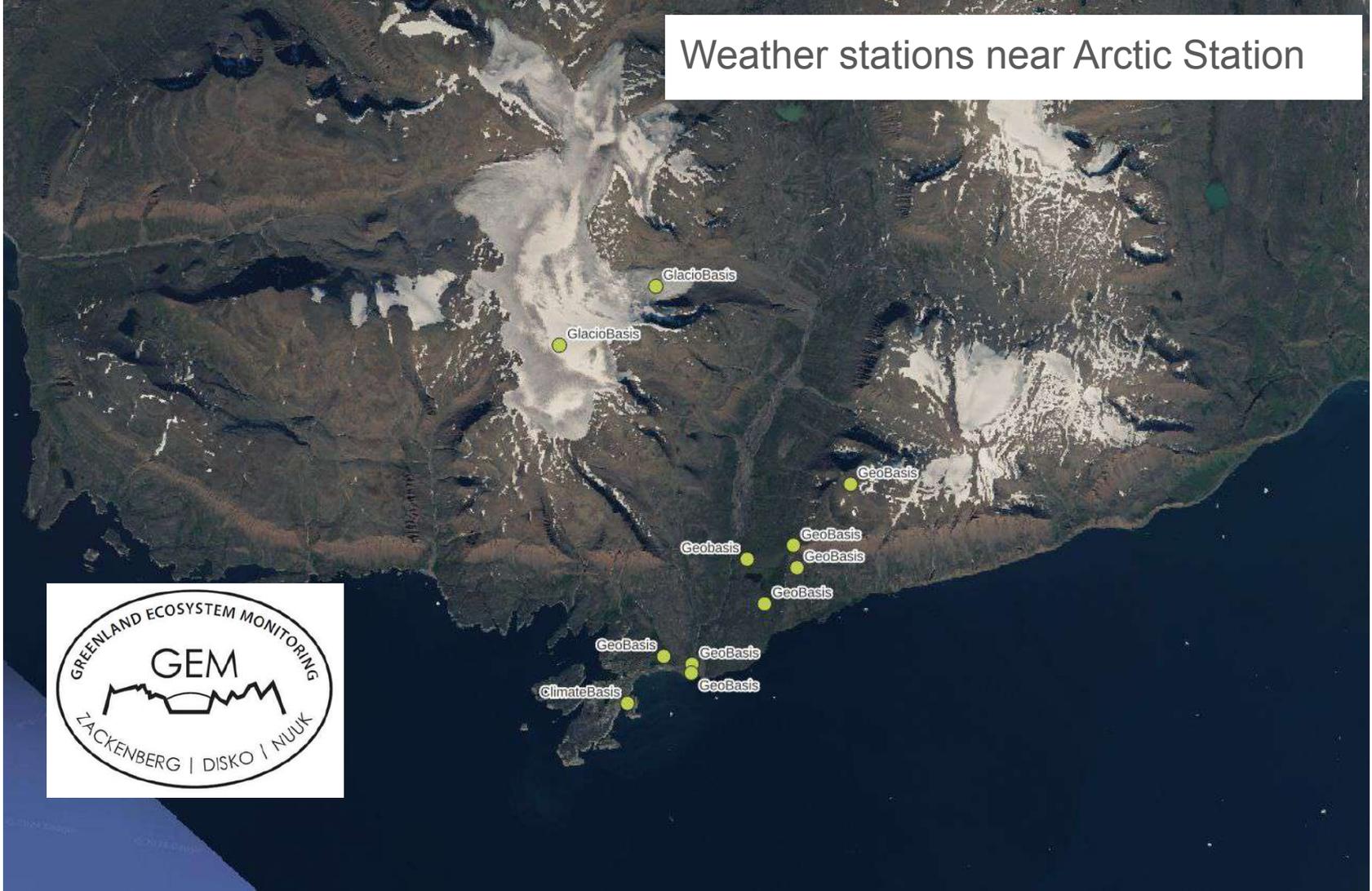
A.P. Olsen Ice Cap



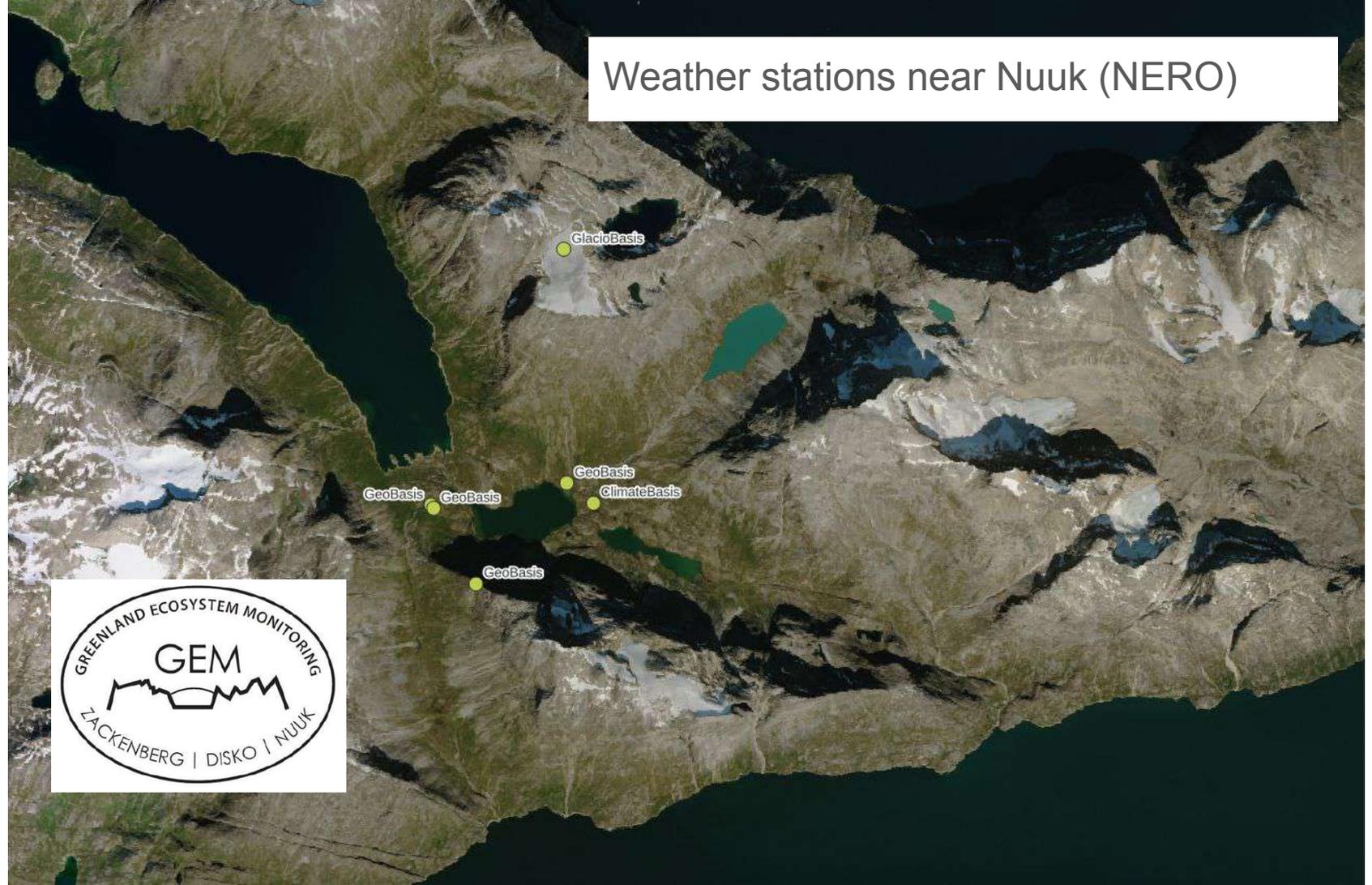
# Weather stations near Zackenberg



# Weather stations near Arctic Station



## Weather stations near Nuuk (NERO)

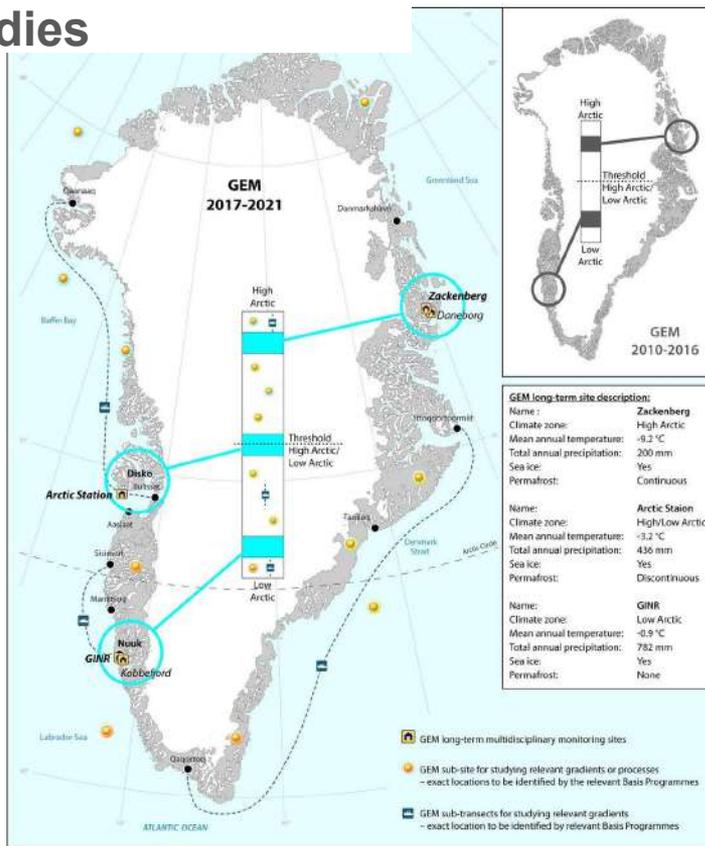


# Alternative routes to global mass change assessments: **Process studies**

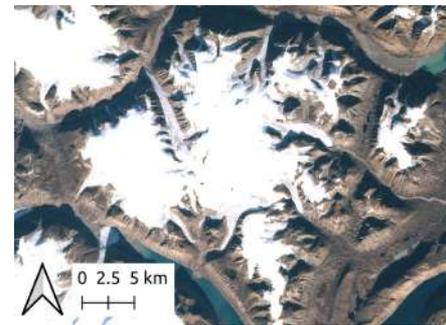
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A.P. Olsen Ice Cap



- Meteorological observations
- Hydrometric stations
- Marine ecosystem
- ...

# Routes to global mass change assessments

- WGMS FoG database
- Sharing climate data with forecasters and re-analysis
- Possibility for process studies
- Freely available ice ablation observations

But is the data fully used?

# Advances, highlights, challenges and gaps

We have systematic monitoring of the peripheral glaciers, but:

- is the data fully used?
- How do we ensure the continuation of these important time series?

Future efforts should focus on using the data we have, and ensuring the continued monitoring of the peripheral glaciers via more **coordinated efforts with long time funding**.

# Thank you for your attention!

<https://dataverse.geus.dk/>

[https://wgms.ch/products\\_fog/](https://wgms.ch/products_fog/)

<https://data.g-e-m.dk/>



GEUS Dataverse > Nature and climate > Programme for Monitoring of the Greenland Ice Sheet (PROMICE) and the Greenland Climate Network (GC-Net) >

Contact Share

Automatic weather stations (AWS) data from both the accumulation area (two boom product) and the ablation area (one boom product) on the Greenland ice sheet. Please download the data with the highest edition number for the latest developments and data.

Search this dataverse... Advanced Search

1 to 4 of 4 Results

GC-Net Level 1 historical automated weather station data  
Jul 17, 2024

Steffen, K.; Vandecrux, B.; Houtz, D.; Abdalad, W.; E D.; Heilig, A.; Hubert, A.; Iosifescu Enescu, I.; Johns Naderpour, R.; Moldoch, N.P.; Pedersen, A.Ø.; Pierre Schneebli, M.; Sampson, K.; Starkweather, S.; Steff Level 1 historical automated weather station data", I

world glacier monitoring service  
wgms  
under the auspices of: ISC (WDS), IUGG (IACS), UNEP, UNESCO, WMO

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**GEM**  
Greenland Ecosystem Monitoring

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On this website you find all the [datasets](#) published by Greenland Ecosystem Monitoring (GEM). You can readily start exploring the website and find datasets. Once you wish to download a dataset you will need to [create a user account](#). We are here to assist you if needed, with [documentation](#) and [email support](#).