

GEM



Greenland Ecosystem Monitoring

Centennial scale environmental change at key arctic observational sites

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EGU 2020

Pan-Eurasian EXperiment (PEEX) – Observation, Modelling and Assessment in the Arctic-Boreal Domain



The GEM framework

ClimateBasis Programme

The GEM ClimateBasis Programme studies climate and hydrology providing fundamental background data for the other GEM programmes.



GeoBasis Programme

The GEM GeoBasis Programme studies abiotic characteristics of the terrestrial environment and their potential feedbacks in a changing climate.



BioBasis Programme

The GEM BioBasis Programme studies key species and processes across plant and animal populations and their interactions within terrestrial and limnic ecosystems.



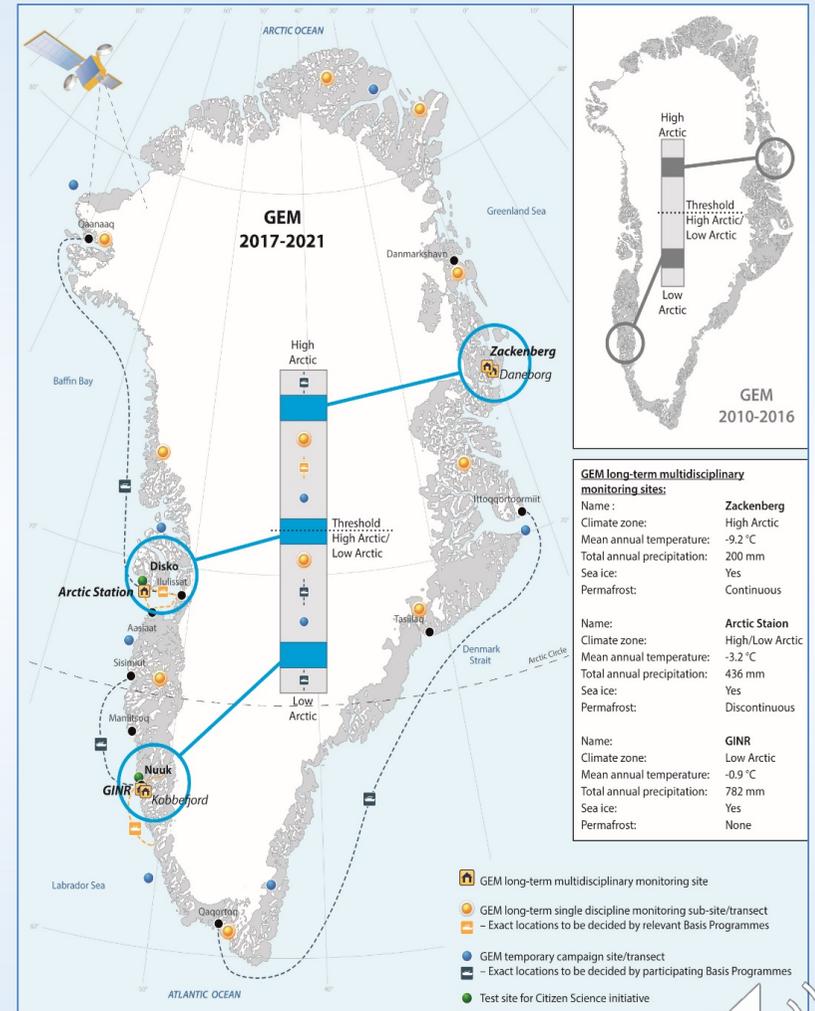
MarineBasis Programme

The GEM MarineBasis Programme studies key physical, chemical and biological parameters in marine environments.

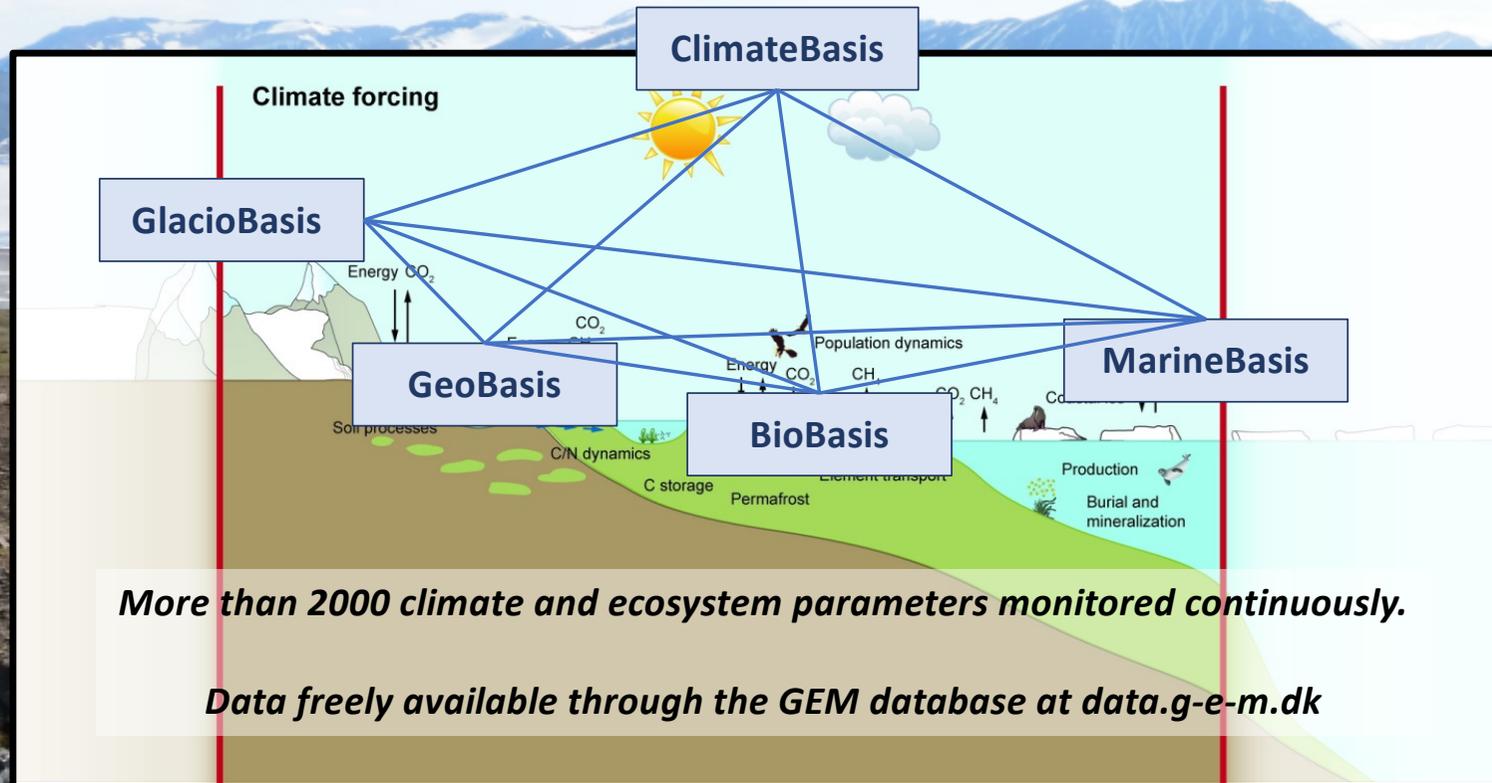


GlacioBasis Programme

The GEM GlacioBasis Programme studies ice dynamics, mass balance and surface energy balance in glaciated environments.



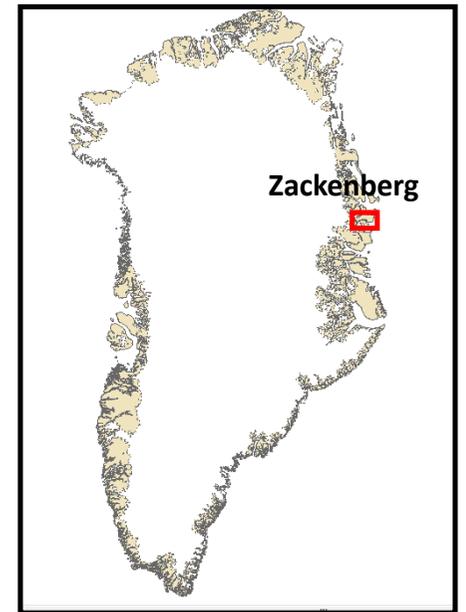
Greenland Ecosystem Monitoring



Zackenbergl Research Station

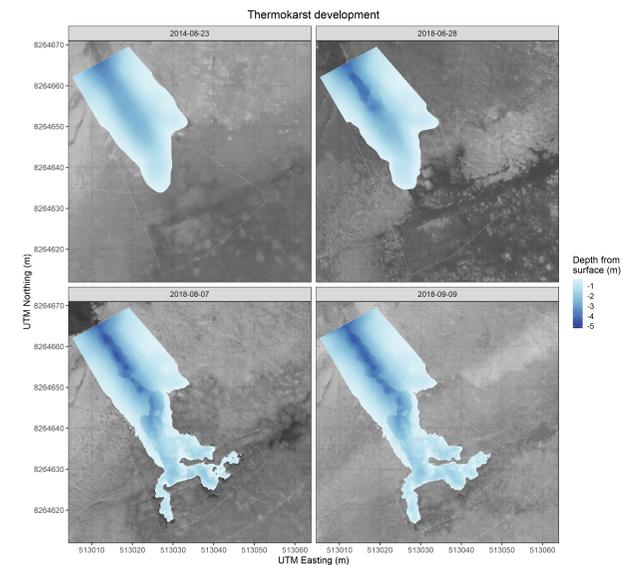
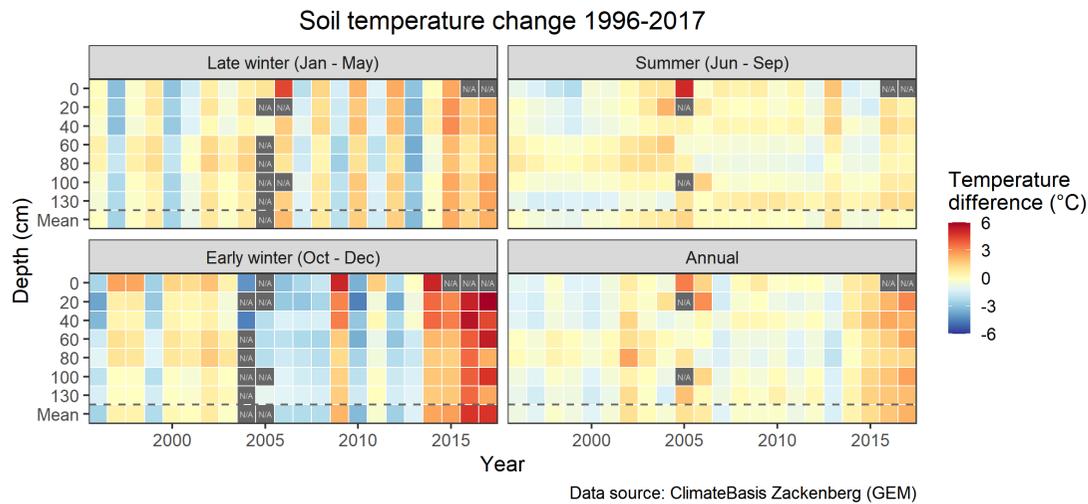
- High arctic environment underlain by continuous permafrost, northeast Greenland
- Long-term mean annual T: $-8.9\text{ }^{\circ}\text{C}$, precip: 270 mm
- Subject of continuous ecosystem monitoring since 1996

Photo by Konsta T. Punkka 2017



Temperature records for the past 25 years show NE Greenland soil temperatures are warming down to 130 cm depth in particular in early winter.

This makes the permafrost vulnerable to rapid thermokarst erosion in response to extreme snowmelt conditions as observed in 2018.

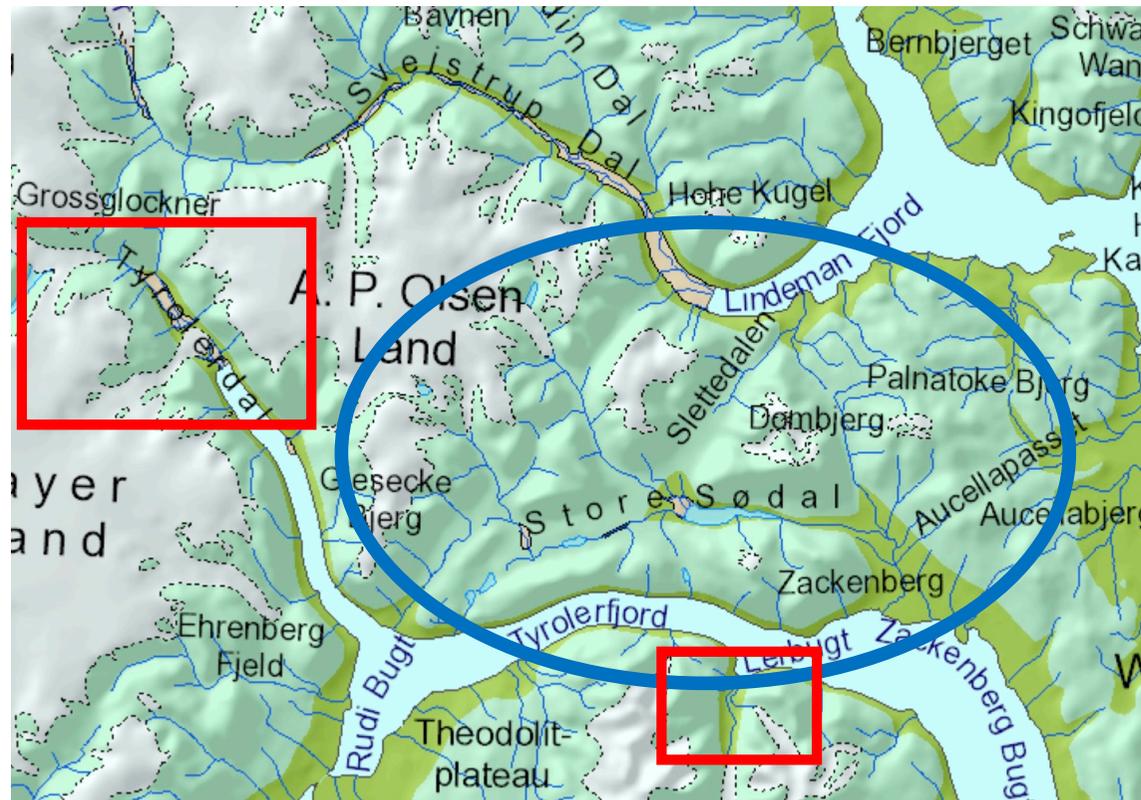
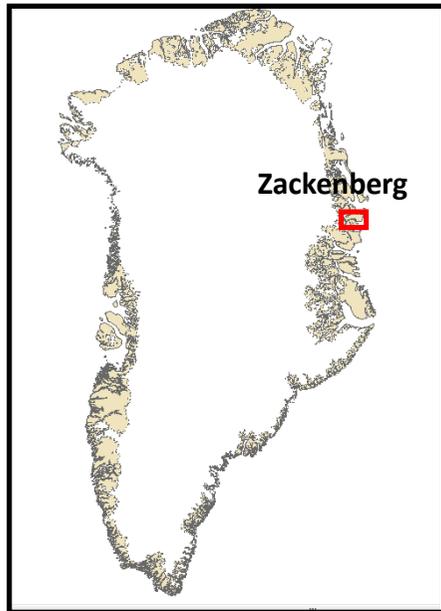


Christensen et al. *Ecosystems*, in press



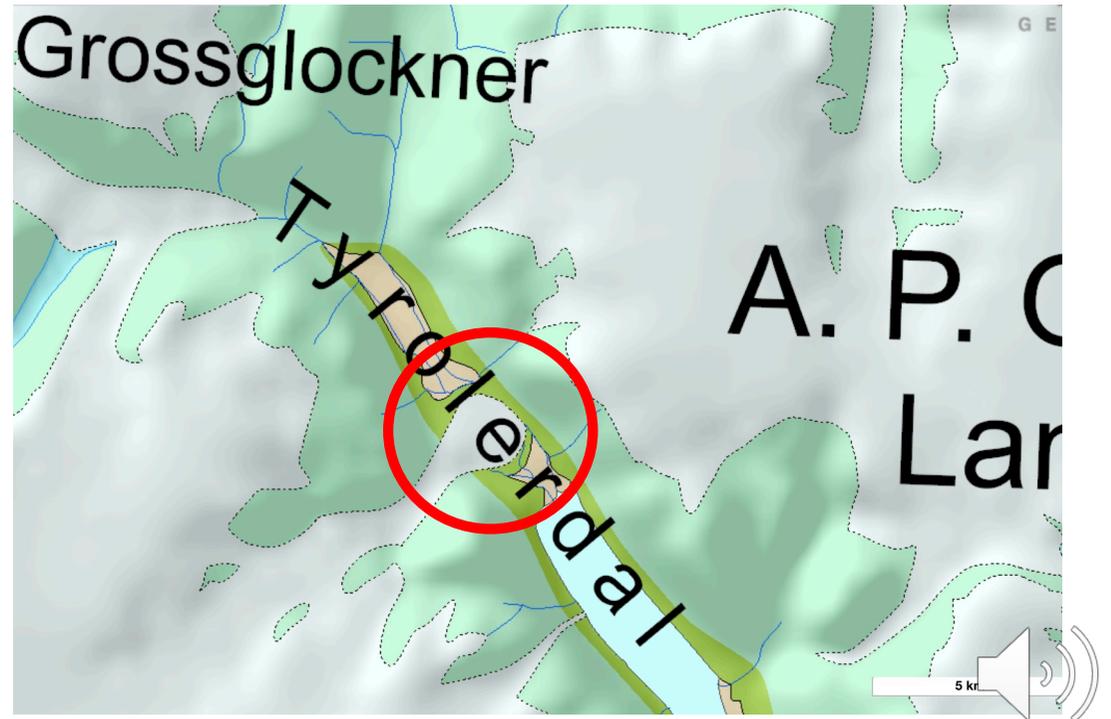
Historical records 1930s and 1940s

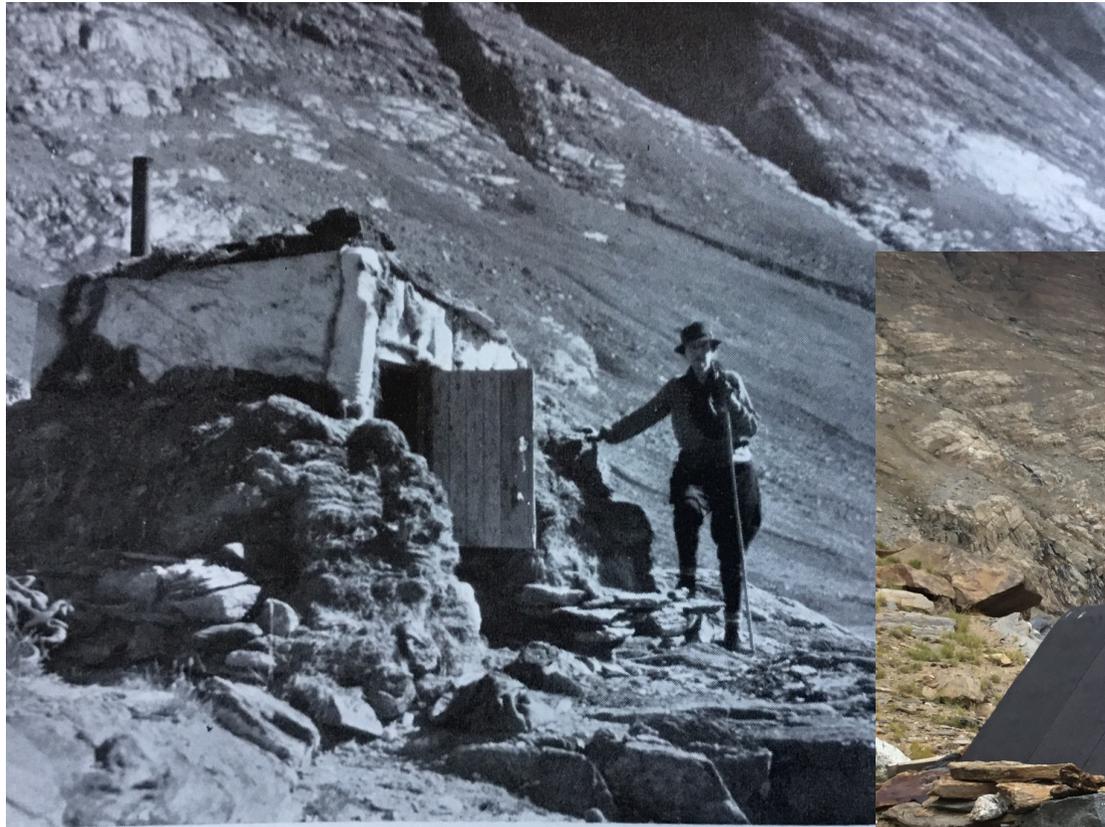
Main modern day monitoring area since 1996





Louise A. Boyd
NE Greenland expeditions
1931 - 1938





Louise A. Boyd, August 1937

PhD student Johan Scheller, August 2019

FIG. 23—The author in front of skin-covered hut at the head of Tyroler Fi



Kløft glacier

2 August 1937 and 16 August 2019



Photo: Louise A. Boyd



Photo: Torben R. Christensen



Freya glacier
August 1939 and 2018



Photo: HW Ahlmann

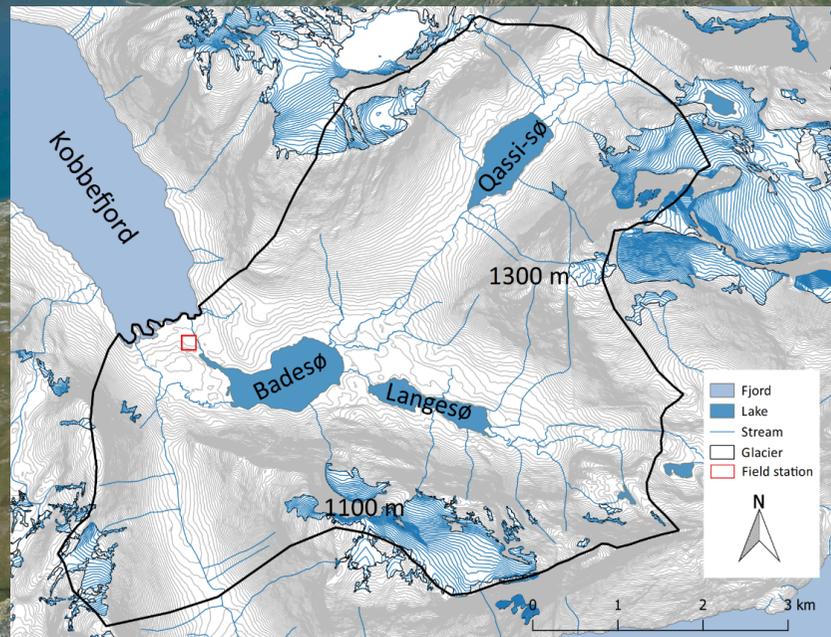
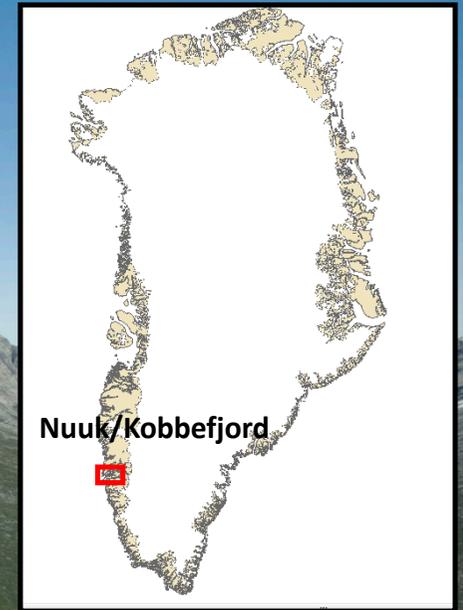


Photo: Jakob Abermann



Nuuk/Kobbefjord

Average temperature, Annual	-0,1 °C
Average temperature, March	-8,2 °C
Average temperature, July	10.6 °C
Average annual precipitation	Ca. 800 mm
Subject of continuous ecosystem monitoring since 2007	



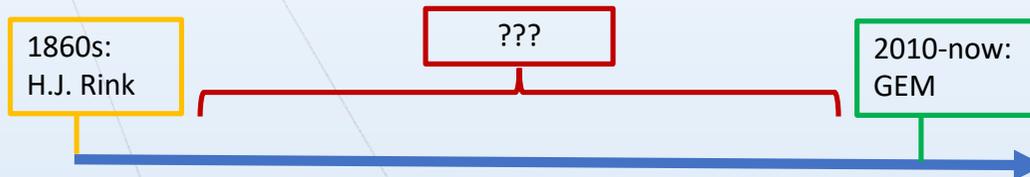
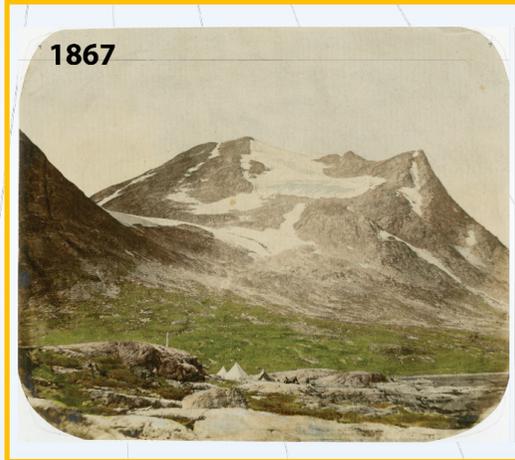


Back to the Future

H. J. Rink 1860s

Camera monitoring since 2010

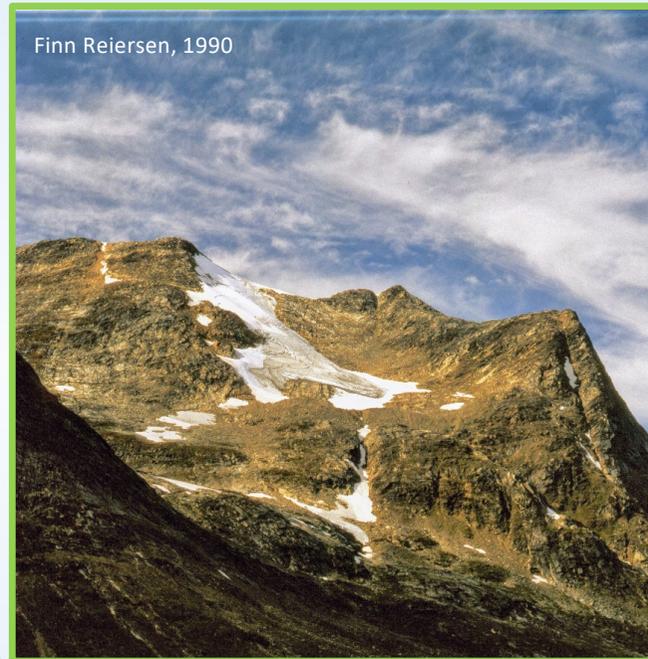
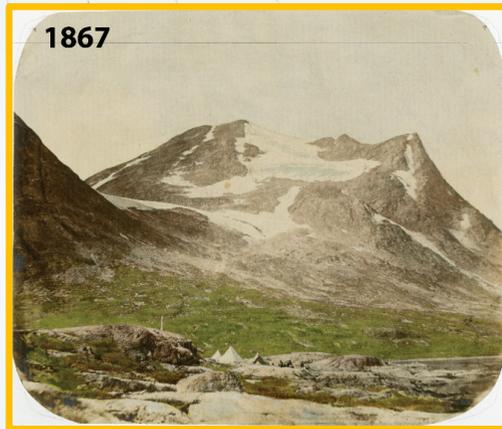
Repeat photography 2018





Back to the Future

Public announcement



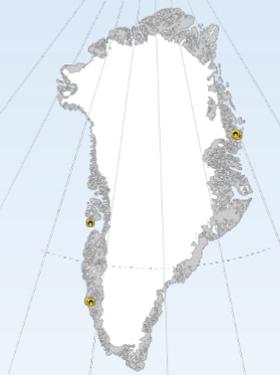
1860'erne:
H.J. Rink

???

1973-1990:
Privatfotos

2010-nu:
GEM





Conclusions

- Historical documentation offer an anchor in time for present day high frequency observational monitoring efforts
- The information provided is pivotal for evaluation of trends in time in particular with respect to non-linearities, step-changes or transient trends in present day data.
- It is time-consuming to obtain but an intriguing community effort beyond natural science alone.

Thank you

