Observing the oceanic heat flux toward retreating outlet glaciers in NE-Greenland

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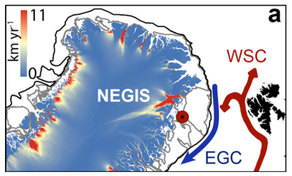
INTRO

- In recent years, the outlet glaciers of the **Northeast Greenland Ice Stream (NEGIS)** have undergone major changes leading to increased mass flux from the ice sheet into the ocean.
- Glacier thinning & retreat has been attributed to **increasing ocean temperatures**.
- **This study** shows first ocean temperatures measured at **Zachariæ Isstrøm** and time series of heat flux below the **79 North Glacier.**

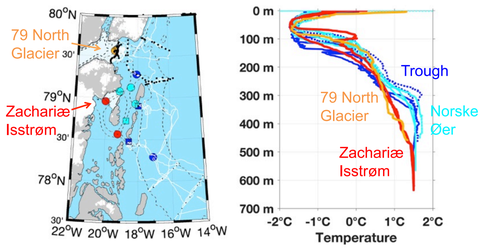


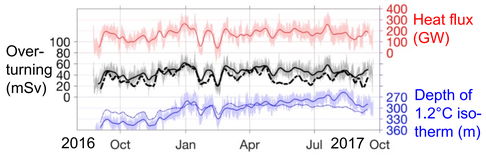
DATA

- Bathymetry from multi-beam surveys
- Hydrography from ship-lowered, helicopter-based and moored CTDs
- Velocities from moored ADCPs

RESULTS

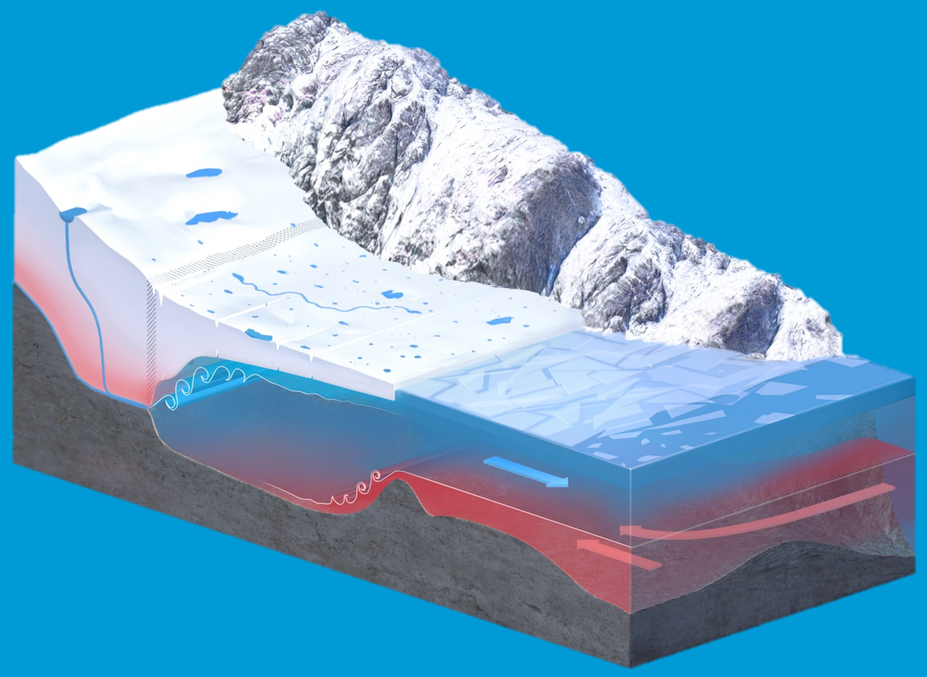
- **1°C-warm waters** of Atlantic origin at 300 to 600-m depth are in direct contact with the calving front of **Zachariæ Isstrøm**.





- **Topography-control** implies that the heat supply below the **79 North Glacier** is critically determined by **large-scale hydrographic variations** on the continental shelf.
- Variability on weekly timescales can be explained by **topographic Rossby waves** propagating towards the coast.

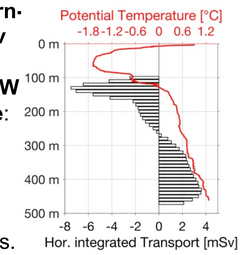
Local topography controls the ocean **heat supply** to retreating outlet glaciers in NE-Greenland, namely **Zachariæ Isstrøm** and the **79 North Glacier**.

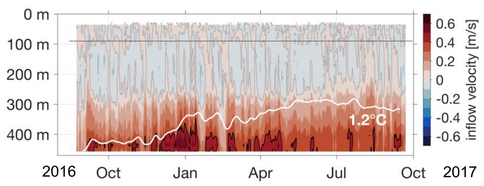


ADDITIONAL INFORMATION

Overturning below the 79 North Glacier

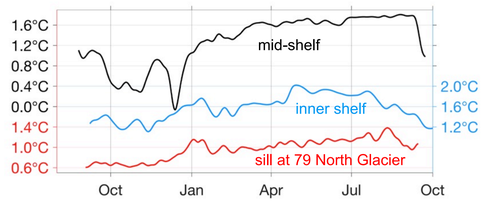
- Atlantic waters flush the cavity below the 79 North Glacier (residence time of **150 days**) causing high basal melt rates.
- Annual mean **overturning** rate: **42 ± 12 mSv**
- Annual mean **heat** transport: **166 ± 64 GW**
- Mean basal **melt rate**: **10 ± 4 m/yr**
- Outgoing **glacially modified** waters are **0.9°C cooler** than ingoing Atlantic waters.





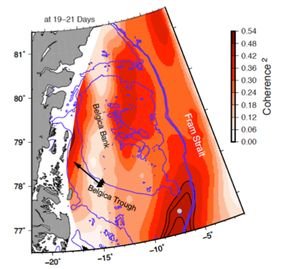
Temperature Timeseries

- Temperatures **increased simultaneously** over the entire **shelf** in winter 2016/17.



Ekman Pumping

- Dispersive **topographic Rossby waves** with a period near 20 days propagate along Norske Trough to the coast.
- The wave is generated by **Ekman pumping** over the **shelf break**.



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