Greenland Ice Sheet-Ocean Interaction:
process-based understanding of the 79 North Glacier melt.

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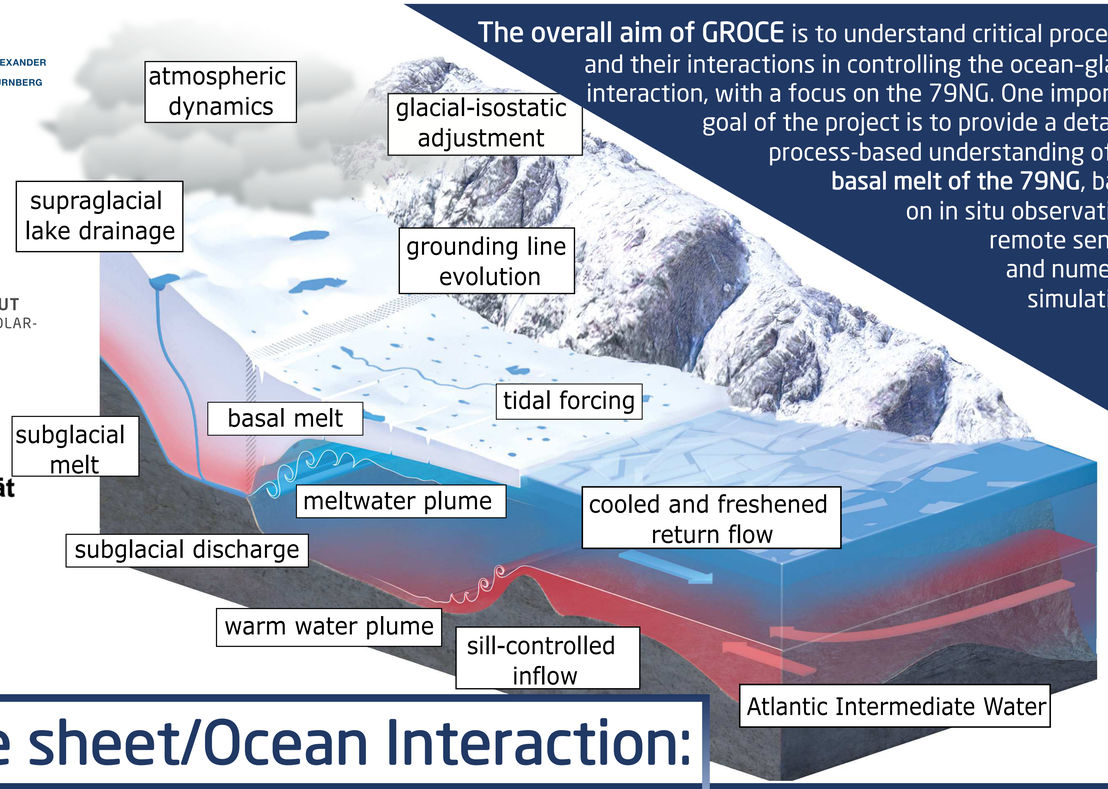
Projektträger Jülich Forschungszentrum Jülich

Torsten Kanzow[1], Angelika Humbert[1], Monika Rhein[2], Ben Marzeion[2], Mirko Scheinert[3], Martin Horwarth[3], Matthias Braun[4], Thomas Mölg[4], Hans Burchard[5], Jürgen Kusche[6]
& many others

The overall aim of GROCE is to understand critical processes and their interactions in controlling the ocean-glacier interaction, with a focus on the 79NG. One important goal of the project is to provide a detailed, process-based understanding of the **basal melt of the 79NG**, based on in situ observations, remote sensing and numerical simulations.



Surface mass balance

4 FAU FRIEDRICH-ALEXANDER UNIVERSITÄT ERLANGEN-NÜRNBERG

use deep learning to detect supraglacial lakes from satellite data, map the temporal variability of the lake volumes

assess a critical resolution for climate models to represent key atmospheric processes, focusing on drivers of supraglacial lake development

Ice sheet/Ocean interaction

1 AWI ALFRED-WEGENER-INSTITUT HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

investigate the causes and temporal evolution of the melt rates at the base of the 79NG, by considering ocean and glacier forcing

Peripheral Glaciers

2 Universität Bremen

test the sensitivity of peripheral glacier projections in terms of mass balance and melt to the spatial resolution of forcing data

Basal meltwater in the ocean

describe spatial distribution of submarine meltwater by measuring concentrations of low soluble noble gases like Helium (He) and Neon (Ne)

Mass balance

3 TECHNISCHE UNIVERSITÄT DRESDEN

separate processes contributing to ice-mass changes, especially ice dynamics and surface processes, by means of ground-based GNSS observations and satellite gravimetry and altimetry

Meltwater plume dynamics

5 Leibniz-Institut für Ostseeforschung Warnemünde IOW

use a fjord and a plume model to investigate the spatial distribution of submarine melt and assess the importance of ice base morphology in controlling basal melting

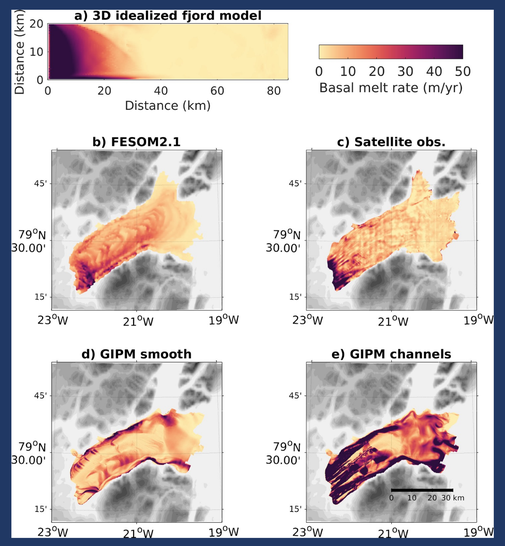
Meltwater effects on the ocean

6 universitätbonn

Simulate large scale, near-ocean surface impact of Greenland meltwater using an ocean-sea ice general circulation model

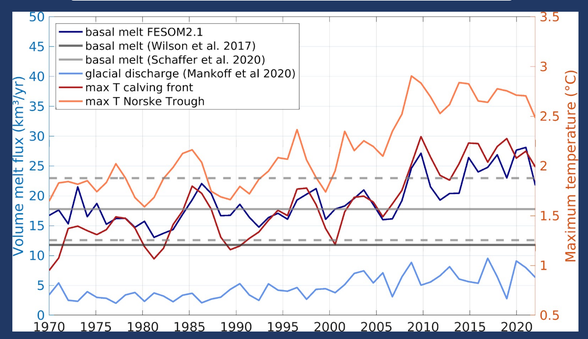
Ice sheet/Ocean Interaction: near-field to far-field

Good agreement between basal melt simulations



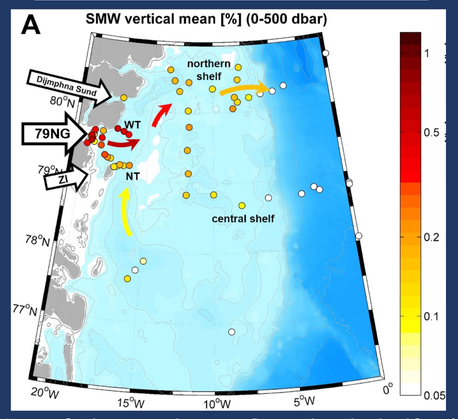
Basal melt rate of the 79NG from a) the fjord model (Reinert et al.), b) the ocean-sea ice model, c) satellite observations (Wilson et al. 2017), and the 2D plume model using d) smooth ice base topography and e) synthetic channels (Mohammadi-Aragh et al.).

Ocean temperature dominates basal melt evolution



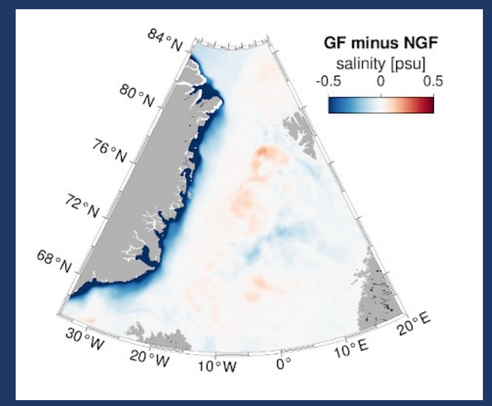
Simulated annual mean basal melt rate and maximum AIW temperature at the calving front and in central Norske Trough from the sea ice-ocean model FESOM2.1, and subglacial discharge from Mankoff et al. (2020).

Meltwater signature decays towards shelf break



Map of the northeast Greenland shelf with noble gas-based, vertically averaged meltwater fractions from the uppermost 500 dbar (data from expedition PS100, 2016).

Strong near-coastal impact of freshwater runoff



Difference between simulated surface salinity from a FESOM run with Greenland freshwater runoff (GF) and a control run without runoff (GF). The time period is 1993-2016.