WARM OCEAN INFLOW TOWARD THE HELMHEIM-SERMILIK GLACIER-FJORD SYSTEM IN A HIGH RESOLUTION MODEL STUDY

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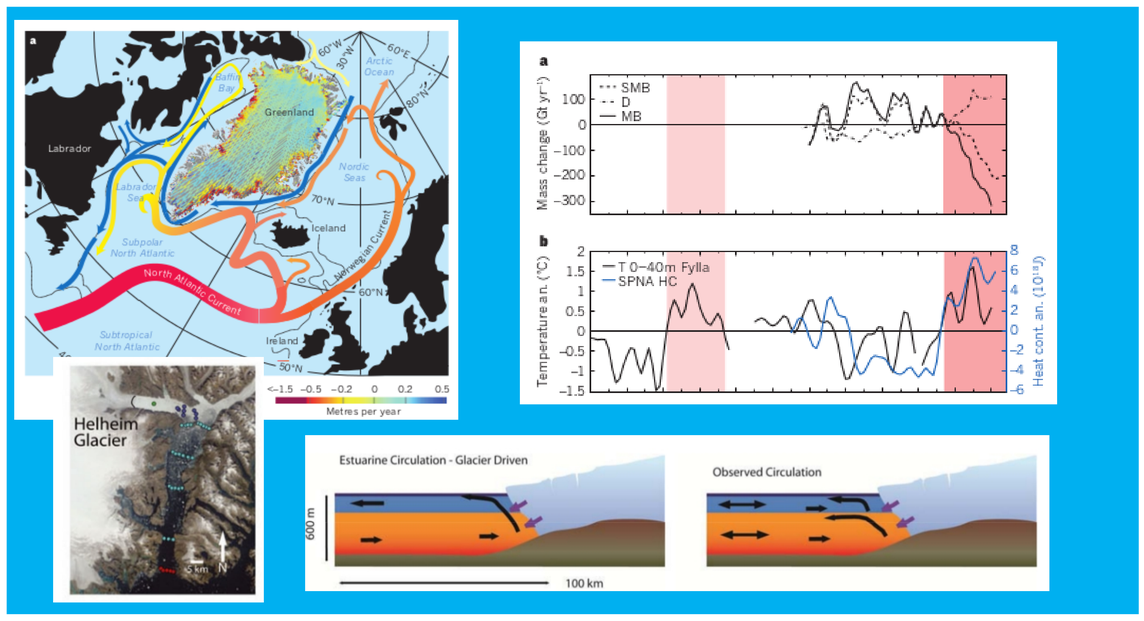
Introduction

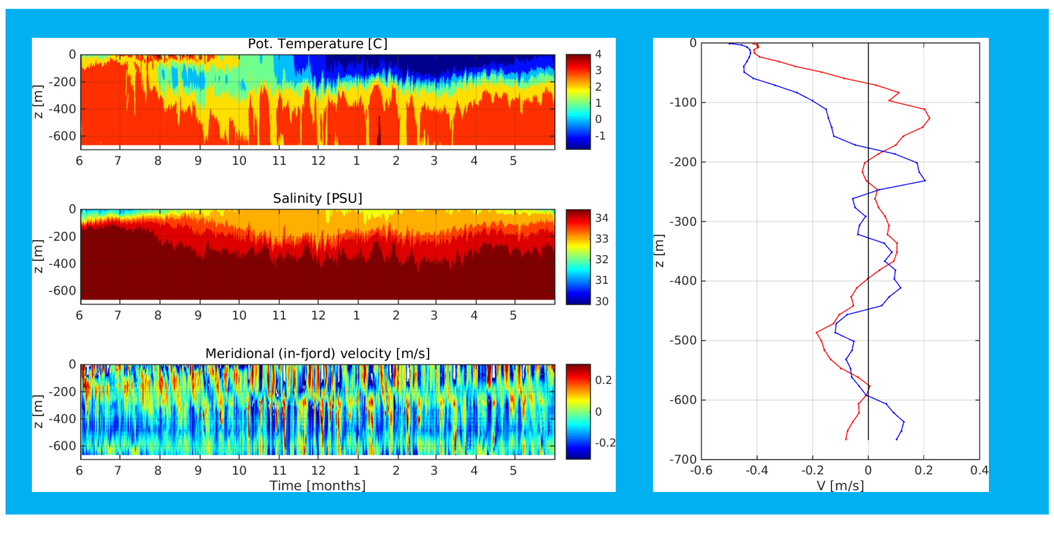
Submarine melting of Greenland's glaciers is essential for the ice sheets mass balance and is also a plausible trigger for their recent acceleration, which contributed to doubling Greenland's contribution to sea-level rise. The observations show that the glacial fjords are regularly ventilated by warm waters of Atlantic origin likely contributing to the glacier melting. The pathways of Atlantic Waters and processes governing their advection toward the glaciel fjords are poorly sampled and understood.

We use a one year simulation from a high resolution ocean model (dx=2km, dz=15m) and a Lagrangian particle code to study pathways and variability of the warm Atlantic inflow toward the Helmheim-Sermilik glacier fjord system.

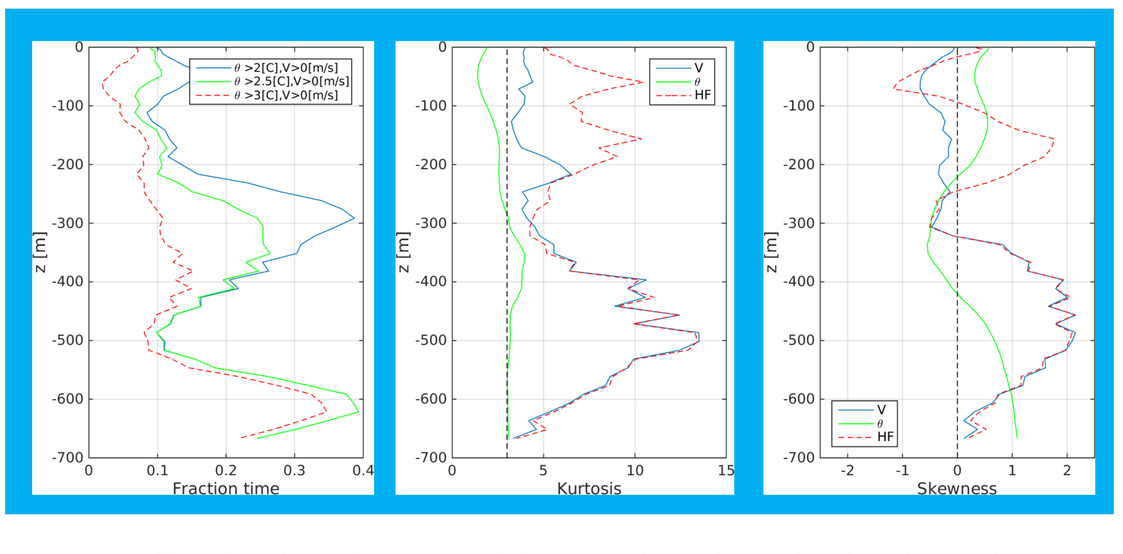


Results

1. MODELED OCEANIC CONDITIONS NEAR THE FJORD MOUTH AND THE VARIABILITY OF THE WARM ATLANTIC INFOW INTO THE SERMILIK FJORD

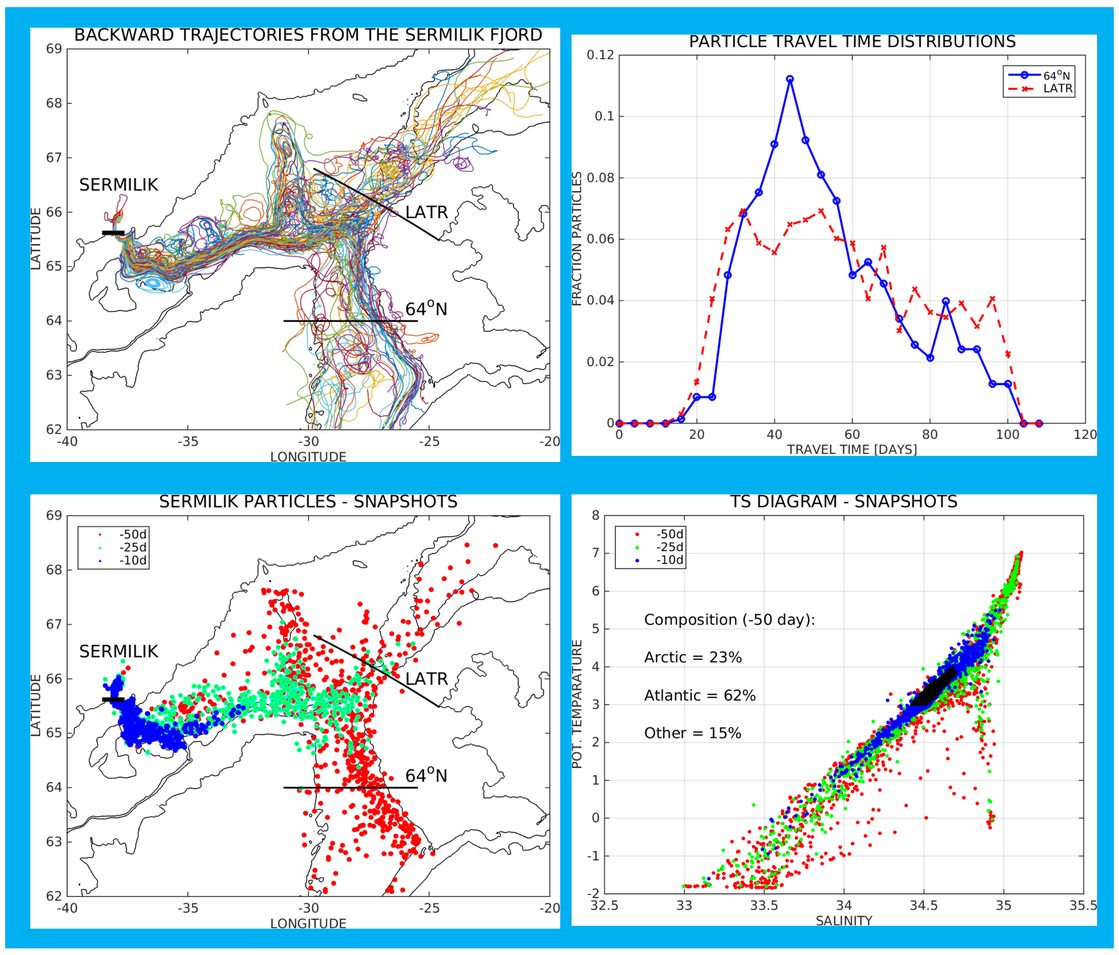


Modeled oceanographic conditions at the fjord mouth. Left: Yearly time series of temperature, salinity and velocity showing short pulses (1-5 days) of warm Atlantic inflow at different depths. Right: Two snapshot velocity profiles showing inflow layering at 50-200m vertical length scale.



Vertical profiles of the intermittent warm inflow statistics. Left: The fraction of time when the warm inflow at ab given depth occurs, for different inflow definitions. Kurtosis (Middle) and Skewness (Right) of the velocity, temperature and heat flux time series.

2. LAGRANGIAN PATHWAYS AND PROPERTY TRANSFORMATION



Results from 1854 particles back-traced from the Sermilik fjord mouth. Top left: Particle trajectories from the warm Irminger Current and the cold East Greenland Current. Top right: Travel time distributions to the 64N and the Latrabjarg (LATR) sections. Bottom: Snapshots of particle positions in geographical coordinates (left) and in property space (right).

Summary and Conclusions

- The model reproduces the vertically layered warm Atlantic Water inflow into the Sermilik fjord which has been inferred from observations.
- The inflow is intermittent, occurs in form of pulses on (1-5) daily time scales, and is intensified in winter.
- The Lagrangian particles unravel two main advective pathways into the Sermilik fjord: 1) warm Atlantic waters of the Irminger Current (about 60% contribution) and 2) cold Polar Waters of the East Greenland Current (about 25% contribution).
- A high temporal (sub-daily) and spatial (15m in vertical) model resolution is essential for capturing the high-frequency, small-scale warm inflow events into the Sermilik fjord.
- We are currently investigating local processes governing the Atlantic inflow into the fjord (wind forcing, ice extent, internal dynamics).

Kontakt

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