



Observations and modelling of water masses and heat transport at a retreating tidewater outlet glacier (NE Greenland, 81 °N)

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Accelerated mass loss from the Greenland Ice Sheet (GIS) and reduced sea ice cover change salinity and temperature in coastal water masses around Greenland. Feedbacks between changing water masses and the melting of tidewater outlet glaciers from GIS, therefore, have to be better understood before ongoing changes can be explained. Ice-ocean interaction has been shown to be a major component in the heat balance in front of tidewater outlet glaciers in many places around Greenland. However, few observations near outlet glaciers have been made from the northern coast towards the Arctic Ocean, that has remained nearly permanently ice covered. We present the first open-water hydrographic observations along the terminus of a tidewater outlet glacier from Flade Isblink Ice Cap, an independent glacier from GIS situated at the northeastern part of Greenland. The terminus is located in the outer part of a large fjord complex associated with Independence fjord, Hagen fjord and Denmark fjord and connects the shelf with the GIS through marine and land-terminated glaciers. The region is characterized by a relatively large change of the seasonal freshwater content of ~ 2 m of freshwater, and solar heating in the short (~ 1 month) open water period results in a surface layer temperature above 1 °C. Observations close to the terminus supported that it was a floating ice shelf with near-glacial subsurface temperatures at the freezing point, and sea ice retreat and the duration of the open water period were shown to have a significant influence on the local heat balance, i.e. melt of ice, in front of the glacier. The potential influence from the regional wind-induced circulation and heat transport across the shelf was finally analyzed by a 3D-primitive equation model (COHERENS) of a section of the northeastern shelf. These results are discussed and related to the observed retreat of the tidewater outlet glacier since the late 1970s.

References

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