Geophysical Research Abstracts
Vol. 15, EGU2013-9894, 2013
EGU General Assembly 2013

Investigating flow sensitivity of Greenland outlet glaciers using a time-evolving calving model in Elmer FEM.

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It is becoming increasingly evident that the marine margins of the Greenland Ice Sheet (GIS) are highly sensitive to local and regional scale climate change, with significant changes in mass balance occurring on sub-decadal timescales. The majority of this mass loss is hypothesised to have been triggered at the termini of calving glaciers. Recent studies suggest that increased calving rate is being driven through some combination of increased submarine undercutting, increased surface hydrofracturing, and changes in the strength and seasonal duration of sikussak. This project aims to improve understanding of these physical processes, in order to better predict how the GIS will respond to future climate change. Two glaciers in the Uummannaq region, Store Gletscher and Rink Isbræ, have been modelled in 2D using the Finite Element modelling package "Elmer FEM". The model produces a time-evolving solution to the coupled Navier-Stokes/heat equations; this allows the dynamic response of these glaciers to external forcing at their termini to be investigated. Furthermore, the model includes a water-depth calving criterion, and is able to simulate realistic calving events, and the subsequent stress/dynamic response of the glacier. Preliminary results suggest that both sikussak backstress and submarine undercutting may represent significant factors in calving terminus stability.