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The meltwater lubrication feedback, impact of the melt season duration.

Basile de Fleurian (1) and Petra Langebroek (2)

(1) UiB and Bjerknes centre, Center for Climate Research, Bergen, Norway (basile.defleurian@uib.no), (2) NORCE & Bjerknes Centre for Climate Research

Over the recent years, temperatures over the Greenland ice sheet have been rising leading to an increase in surface melt. Projections show that this augmentation of surface melt will continue in the future and spread to higher elevations. An increase in the availability of meltwater at the surface of the ice-sheet will likely lead to larger volumes of water reaching the ice-sheet base where it has a strong impact on its dynamics. However, the various observations performed over the last decade have not yielded a clear answer regarding the effect of an increase of meltwater availability on ice dynamics, with studies arguing for an acceleration with higher meltwater production and others advocating a deceleration under the same forcing. The use of coupled models introducing both the ice dynamic and subglacial hydrology components can now help to understand the complex interactions at play between these two systems.

In this study, I apply the Ice Sheet System Model (ISSM) to a synthetic glacier which geometry is similar to the one of a Greenland ice sheet land terminating glacier. The Double Continuum Approach is used to compute the water pressure at the base of the glacier and effectively couple the meltwater production to the ice dynamics. The model is forced through a simple temperature distribution and a Positive Degree Day model to allow to capture both elevation, and meltwater lubrication feedback. The magnitude but also the duration of the melt season are varied to take into account the variations that were observed in recent years in Greenland and provide further understanding on the interaction between the subglacial hydrology and ice dynamics. Of particular interest is the evolution of the distribution of the efficient and inefficient component of the subglacial drainage system and their different response to the distribution of melt during the year.