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The control of ice-marginal processes on the transient response of the Greenland Ice Sheet

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Recent observations on the Greenland ice sheet have revealed highly dynamic variations of marginal ice discharge. Over the last 10 years, these have contributed to almost half of the total mass loss. In order to influence the evolution of the ice sheet on a centennial time scale, these marginal variations need to be transmitted inland. One of the potential processes is longitudinal stress transmission. To study this phenomenon we compare two versions of a three-dimensional thermomechanical ice sheet model. One of them is based on the shallow ice approximation neglecting influences of longitudinal stresses inherent in the governing force balance. For the other, these stresses are explicitly included using a higher-order Blatter-Pattyn type of core. Apart from this treatment of the force balance equation both models are identical.
The focus of this comparison is to find out whether such stress transmission can influence the transient behaviour of the Greenland ice sheet over the next few centuries. For this purpose it is required to set up global warming experiments that enable a clean comparison. In addition we aim to include crucial processes at the ice margin that are likely affected by future climate change such as ice calving and bed lubrication.