



## **Investigating the conditions for large ice-sheet instabilities**

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It is now often accepted that Heinrich events are associated with internal oscillations of the Northern hemisphere ice sheets leading to periodical large surges of ice in the ocean. However, no consensus has yet been obtained about the origin of these oscillations. These large-scale surges likely occur with large basal sliding leading to fast flowing ice streams. In sediment zones, this process is favoured by strongly reduced basal dragging. However, due to the buttressing effect of the ice shelves, underneath basal melting may also play a significant role in the production of ice surges. In this study, we investigate the ability of a 3D thermo-mechanical ice-sheet model including representations of both grounding and floating ice, to produce instabilities of the Laurentide ice sheet. A series of tests has been conducted to analyze the role of the presence of soft-saturated sediment, the amplitude of basal sliding in grounded areas and the amplitude of basal melting under the ice shelves.