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Physically-based oscillations of the Laurentide under glacial conditions.

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The climate during the last glacial period was far from stable. Evidence has shown the presence of layers of ice-rafted debris (IRD) in deep sea sediments, which have been interpreted as quasi-periodic episodes of massive iceberg calving from the Laurentide Ice Sheet (LIS). Several mechanisms have been proposed, yet the ultimate cause of these events is still under debate. In fact, one of the main sources of uncertainty and diversity in model response is the choice of basal friction law. Therefore, it is essential to determine the impact of this feature in glacial transport and erosion, deposition of sediments and ice streams among others. We herein study the effect of a wide range of basal friction parameters and laws under glacial conditions over the LIS. In addition, the impact of the thermodynamic state of the ice is taken into account by means of two independent procedures: a two-valued friction coefficient approach and an active basal hydrology. The aim is to determine under what conditions, if any, physically-based oscillations are possible in a three-dimensional hybrid ice-sheet model. Increasing our understanding of both basal friction laws and basal hydrology will improve not only reconstructions of paleo ice dynamics but also help to constrain the potential future evolution of current ice sheets.