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Large-scale ice discharge events in a pure ice sheet model

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The 3-D ice sheet model of Marshall and Clarke, which includes both dynamics and thermodynamics, is used to successfully simulate millennial-scale oscillations within an ice sheet under steady external forcing. Such internal oscillations are theorized to be the main cause of quasi-periodic large-scale ice discharges known as Heinrich Events, which were observed during the last glacial period. An analysis of the mechanisms associated with multi-millennial oscillations of the Laurentide Ice Sheet, including the initiation and termination of sliding events, is performed. The analysis involves an examination of the various heat sources and sinks that affect the basal temperature, which in turn determines the nature of the ice sheet movement. The ice sheet thickness and surface slope, which affect the pressure melting point and strain heating, respectively, are found to be critical for the formation and development of fast moving ice streams, which lead to large iceberg calving.