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Greenland ice-stream dynamics: short-lived and agile?

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Reliable knowledge of ice discharge dynamics for the Greenland ice sheet via its ice streams is essential if we are to understand its stability under future climate scenarios as well as their dynamics in the past, especially when using numerical models for diagnosis and prediction. Currently active ice streams in Greenland have been well mapped using remote-sensing data while past ice-stream paths in what are now deglaciated regions can be reconstructed from the landforms they left behind. However, little is known about possible former and now defunct ice streams in areas still covered by ice. Here we use radio-echo sounding data to decipher the regional ice-flow history of the northeastern Greenland ice sheet on the basis of its internal stratigraphy. By creating a three-dimensional reconstruction of time-equivalent horizons, we map folds deep below the surface that we then attribute to the deformation caused by now-extinct ice streams. We propose that locally this ancient ice-low regime was much more focused and reached much farther inland than today's and was deactivated when the main drainage system was reconfigured and relocated southwards. The insight that major ice streams in Greenland might start, shift or abruptly disappear will affect our approaches to understanding and modelling the past or future response of Earth's ice sheets to global warming. Such behaviour has to be sufficiently reproduced by numerical models operating on the mid- to longer-term timescales to be considered adequate physical representations of the naturally occurring dynamic behaviour of ice streams.