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Modelling the palaeo grounding-line retreat dynamics of the Uummannaq Ice Stream in Western Greenland.

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We aim to understand what controlled the retreat pattern of the Uummannaq Ice Stream (UIS) during the last deglaciation. The ice stream was grounded close to the continental shelf edge at the Last Glacial Maximum, and retreated rapidly after 14.8 ka. Cosmogenic nuclide exposure dating on Ubekendt Island at the convergence zone of multiple feeder ice streams show that the ice surface thinned progressively and that the island became ice-free by ca. 12.4 ka. The ice stream then collapsed over the next 1-1.6 kyrs and the ice stream separated into a series of distinct inland arms. However, it is currently unclear what controlled the nonlinear retreat pattern identified in the Uummannaq system.
We test the hypothesis that the geometry of the landscape strongly conditions the rate of retreat of the UIS. In order to do this, we constrain a numerical model of ice stream retreat using the marine geophysical data and measurements of sediment strength on the continental shelf. The model has the capability to dynamically and robustly simulate grounding line-retreat behaviour over millennial timescales. We simulate the retreat of the UIS grounding line into the northernmost Rinks system and conduct sensitivity tests to explore its response to a range of forcing patterns. The model is initialised at a steady-state LGM configuration and is subjected to a series of retreat perturbations forced by either rising sea-level, enhanced melting at the ice-ocean interface, or warming climate. We compare the simulated dynamic behaviour of the UIS against the terrestrial record of ice stream retreat to determine why retreat during the last deglaciation was nonlinear.