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# Multi-millennial variability in Greenland Ice streams: Simulations with CISM2.1

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The ice streams and outlet glaciers of the Greenland Ice sheet (GrIS) are dynamic active parts of the ice sheets; with the recent accelerated contribution to global sea level rise attributed to retreat and thinning from many marine-terminating outlet glaciers. For example, across the Northern margin the outlet glaciers have been seen to be retreating, and increasing in speed. (Hill, et al, 2017). Over longer time scales geomorphological evidence from previously glaciated regions, such as below the Laurentide Ice Sheet (Stokes, Nature, 2016) highlighted the very spatial dynamic nature of the paleo ice streams. In this study, we aim to investigate the variability, both spatially and temporally of the GrIS ice streams and outlet glaciers to try and understand the mechanisms that control the ice stream formation and stability.

We perform an ensemble of sensitivity experiments using the new updated version 2.1 of Community Ice sheet model (CISM) for the Greenland ice sheet, at a 4kmx4km resolution. In all simulations, we force the ice sheet with the surface mass Balance (SMB) taken from $RACMO_2$.3 with the aim of recreating a steady-state present day ice sheet.
There have been a number of improvements since version2 which we will adopt: a higher-order velocity solver 'vertically integrated approximation to the Stokes flow law' taken from Goldberg, 2011; the introduction of a new pseudo-plastic power law sliding scheme, that relates changes in the basal shear stress to the till yield stress and a pseudo-plastic flow law exponent and finally a simple model of basal hydrology which is used to calculate the changes in till yield stress. This basal hydrology model relates changes in rheology of subglacial sediments (defined by a till friction angle) to changes in basal water pressure to produce a till yield stress that varies both in space and time.
This new sliding law and basal hydrology model have a number of user-defined parameters that we explore including the till friction angle and pseudo-plastic flow law exponent,