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# Investigating seasonal variations in the distribution of basal sliding under a High Arctic polythermal glacier

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Seasonal variations in ice motion have been observed at several ice masses across the High Arctic, including the Greenland Ice Sheet. However, potential variations in ice motion and their possible driving mechanisms are not currently incorporated in models investigating the response of High Arctic ice masses to predicted climate warming. Here, we use a three-dimensional finite-difference flow model, constrained by field data, to investigate seasonal variations in the distribution of basal sliding under the predominantly cold John Evans Glacier, Ellesmere Island, Canada. Our results suggest that hydrologically forced seasonal speed-ups or 'spring-events' in the lower glacier have only a minimal impact on upglacier dynamics through longitudinal coupling. Indeed, the modelling suggests that *glacier-wide* basal sliding is required to replicate all seasonal velocity fields including the lowest winter velocities, even where previous radio-echo sounding measurements suggest ice should be cold-based. We suggest that where this occurs, basal motion is facilitated by patches of a very thin, warm basal interface, perhaps a remnant of colder climate/thicker ice conditions and maintained by refreezing of basal water and/or additional supraglacial heat inputs provided each summer. The limited extent of longitudinal coupling suggests that at John Evans Glacier, significant glacier-wide speed up events will only occur where the forcing mechanisms are glacier-wide, not localised. Such findings may have implications for the rate at which other ice masses can respond dynamically to increased surface meltwater production in response to predicted global warming.