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Greenland land-terminating glaciers velocity trends during the last two decades

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Ice losses from the Greenland Ice Sheet have been increasing in the last two decades, leading to a larger contribution to the global sea level rise. Roughly 40% of the contribution comes from ice-sheet dynamics, mainly regulated by basal sliding. The sliding component of glaciers has been observed to be strongly related to surface melting, as water can eventually reach the bed and impact the subglacial water pressure, affecting the basal sliding.

The link between ice velocities and surface melt on multi-annual time scale is still not totally understood even though it is of major importance with expected increasing surface melting. Several studies showed some correlation between an increase in surface melt and a slowdown in velocities, but there is no consensus on those trends. Moreover those investigations only presented results in a limited area over Southwest Greenland.

Here we present the ice motion over many land-terminating glaciers on the Greenland Ice Sheet for the period 2000 - 2020. This type of glacier is ideal for studying processes at the interface between the bed and the ice since they are exempted from interactions with the sea while still being relevant for all glaciers since they share the same basal friction laws. The velocity data was obtained using optical Landsat 7 & 8 imagery and feature-tracking algorithm. We attached importance keeping the starting date of our image pairs similar, and avoided stacking pairs starting before and after melt seasons, resulting in multiple velocity products for each year.

Our results show similar velocity trends for previously studied areas with a slowdown until 2012 followed by an acceleration. This trend however does not seem to be observed on the whole ice sheet and is probably specific to this region's climate forcing.

Moreover comparison between ice velocities from different parts of Greenland allows us to

observe the impact of different climatic trends on ice dynamics.