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Quantifying the mass loss of peripheral Greenland glaciers and ice caps (1958-2014).

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Since the 2000s, mass loss from Greenland peripheral glaciers and ice caps (GICs) has accelerated, becoming an important contributor to sea level rise. Under continued warming throughout the 21st century, GICs might yield up to 7.5 to 11 mm sea level rise, with increasing dominance of surface runoff at the expense of ice discharge. However, despite multiple observation campaigns, little remains known about the contribution of GICs to total Greenland mass loss. Furthermore, the relatively coarse resolutions in regional climate models, i.e. 5 km to 20 km, fail to represent the small scale patterns of surface mass balance (SMB) components over these topographically complex regions including also narrow valley glaciers.

Here, we present a novel approach to quantify the contribution of GICs to surface melt and runoff, based on an elevation dependent downscaling method. GICs daily SMB components at 1 km resolution are obtained by statistically downscaling the outputs of RACMO$_2$.3 at 11 km resolution to a down-sampled version of the GIMP DEM for the period 1958-2014. This method has recently been successfully validated over the Greenland ice sheet and is now applied to GICs.

In this study, we first evaluate the 1 km daily downscaled GICs SMB against a newly available and comprehensive dataset of ablation stake measurements. Then, we investigate present-day trends of meltwater production and SMB for different regions and estimate GICs contribution to total Greenland mass loss. These data are considered valuable for model evaluation and prediction of future sea level rise.