

Project acronym: UHDEM-glac

Project title: New insights into ablation processes from ultra-high resolution DEMs of glacier surface changes

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Discipline: Earth Sciences & Environment

Station(s): Sermilik Research Station, Greenland

The glaciers and ice sheets are contributing faster, sooner, and more significantly to sea level rise than previously anticipated. For most glaciers, the main control of this mass loss is surface mass balance (SMB), e.g. changes in accumulation or ablation. Here, we would like to investigate the role of supraglacial streams in the ablation budget, which is neglected in the main SMB reconstructions (RACMO, MAR). Supraglacial streams evolve via thermal erosion, incising more rapidly (10 cm/day) than surrounding ice. However, few ground measurements have been made so far. With the increasing production of high-resolution DEMs from satellite and airborne sensors, new possibilities for remote sensing of mass balance processes emerge. Recent fieldwork involving repeat DEM production over the Mittivakkat glacier have shown a substantial portion of the total melt on the glacier surface originates from thermal erosion in the supra-glacial meltwater streams. With this project, we wish to further explore this initial findings to ultimately quantify the role of supraglacial streams in the total ablation budget. Our main research method will be the generation of ultra-fine DEMs (5-10 cm accuracy) from aerial photos. Collection of high precision GCPs is essential for our study and for that we will bring multiple dGPS stations to set up in the field. Finally, the evolution of the supraglacial streams due the thermal erosion, as well as the global ablation budget, will be estimated by DEM differentiation. We expect that, during two weeks field campaign, the erosion in the stream will reach about one meter for the largest streams, which largely above the expected accuracy of the produced DEMs (~5-10 cm). Our DEM time series will be completed by ground measurement of the flow and temperature of few supraglacial streams in order to constrain the link between the stream size/slope/temperature and the observed erosion. For safety and efficiency reasons we need to divide us up into two teams of two researchers. One team will deploy and collect ground control points (GCPs) and coordinates, while a second team will undertake flying operations. Furthermore, glacial traverses requires teams of minimum two persons for safety reasons.