

# Drone survey of Qaanaaq Glacier, northwestern Greenland, for precise DEM construction and for mapping supraglacial streams

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Greenland is currently influenced by rapidly warming climate in the Arctic, which causes melt and retreat of glaciers situated along the coast. To better understand processes driving the glacier change, we have studied Qaanaaq Ice Cap in northwestern Greenland since 2012. As a part of the field campaign in the summer 2022, we conducted drone observations over Qaanaaq Glacier, an outlet glacier of the ice cap. The survey took place for seven days between July 14 and August 11. A drone (DJI phantom4pro V2.0) was operated at 120 m above the glacier to take images with a resolution of 33 mm per pixel, and with overlap of 70% to the flying direction and sidelap of 65%. Six painted wooden plates were distributed around the glacier and surveyed with kinematic GNSS positioning to improve the accuracy of the drone survey. Repeated surveys were carried out at elevation of 720 m a.s.l. over an area of 914000m<sup>2</sup> to monitor the change in the glacier surface features. 677 images were acquired during each of six surveys. The images clearly indicate the evolution of supraglacial streams, which are considered to be important for ice melt as well as glacier hydrology. Lower reaches of the glacier were surveyed on 10 August to generate a DEM covering an area of 1336000 m<sup>2</sup>. The photographs were processed with software Metashape to generate an orthorectified mosaic image and construct a DEM with a resolution of 26 mm. This DEM will be compared with surface elevation data previously obtained by in-situ GPS survey and satellite remote sensing to quantify the mass loss of the glacier over the last decades.

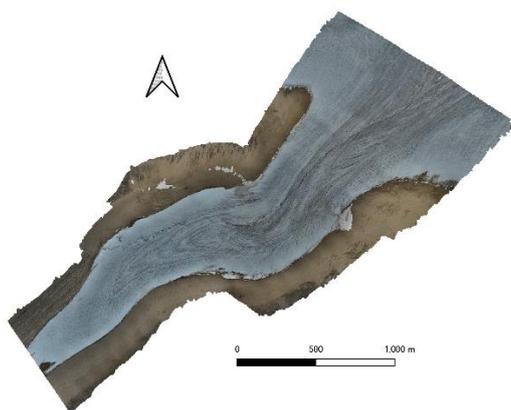


Figure 1. Orthorectified mosaic image of Qaanaaq Glacier.

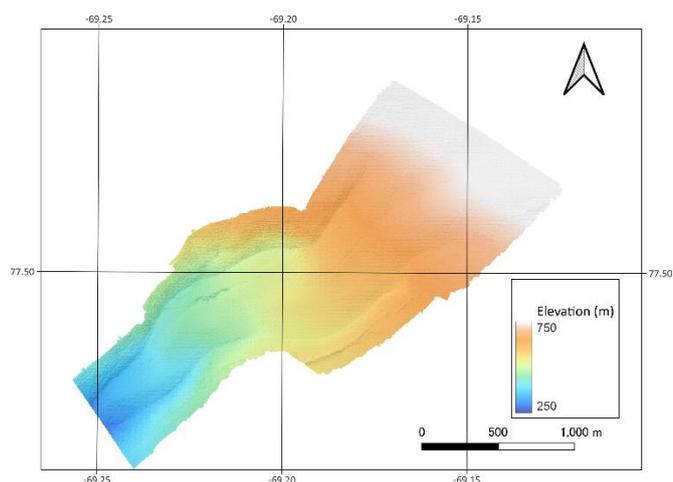


Figure 2. DEM of Qaanaaq Glacier constructed from the drone survey.