SURFACE AND BED TOPOGRAPHY MAPPING OF FOXFONNA & RIEPERBREEN GLACIER, SVALBARD, 1936-2020

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The dwindling volume of Arctic small-size (<30km^2) glaciers and icecaps provide valuable proxy information about the state of climate over more remote areas. Unmanned Aerial Vehicles (UAVs) photogrammetric reconstructions (3,552 images in September 2020) and Ground-Penetrating Radar (GPR) profiles (40.31km in April 2021) of Foxfonna & Rieperbreen glacier on Svalbard reveal that the total glacier extent is 6.46 km^2 and about 55.08% of the areal extent has been lost since 1936. Comparisons to elevation data obtained from historical aerial photography indicate total mean surface elevation change is -20.50 ± 11.31m from 1961 to 2020, with a constantly accelerating rate of negative elevation change per year. Besides, A total of 56.68% of the ice volume has been lost over 60 years between 1961 and 2020. The presence of scattering zone in the radargram of lower Foxfonna showed a possible area of temperate ice close to the head of the glacier, up to 20 m thick and beneath approximately 100 m of ice. In contrast, the rest of the glacier system was entirely cold. The temperate ice was found to have formed recently, which may be related to the heavily crevassed zone in the uppermost part of lower Foxfonna, and the introduction of surface meltwater during an extreme melt year on the Foxfonna icecap. Thrusting features in Rieperbreen's radargram revealed a historical surge, which was also indicated by surrounding landforms and historical elevation change. Both Foxfonna and Rieperbreen accumulation areas are too low to take advantage of any positive mass change from the ongoing precipitation increase. The linear extrapolation of estimated ice volume per year suggests that Foxfonna and Rieperbreen will be almost non-existent by the 2050s. These invaluable sources of additional information may be critical in predicting the future prospects of the high Arctic small-size glaciers, which may not exist in the near future.