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Ground penetrating radar (GPR) measurements at Mittivakkat Gletscher, Southeast Greenland

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Here, we present ground penetrating radar (GPR) measurements conducted on the surface of Mittivakkat Gletscher in Southeast Greenland (the only long-term mass balance observed glacier in Greenland) and estimate the change in ice volume over an 18 year period. Between a previous direct volume survey in 1994 and the new GPR survey in 2012, the glacier has changed its volume from 2.02 $\pm$ 0.10 to 1.50 $\pm$ 0.08 km3 while the study area has decreased from 17.6 to 15.8 km2. These results are in accordance with the cumulative mass loss observed by long-term mass balance measurements (1995/1996 – 2011/2012) at Mittivakkat Gletscher and confirms that the glacier is in severe climatic disequilibrium (AAR = 0.17). The observed volume-area scaling exponent γ and coefficient c are outside the range of global scaling parameters, but are sensitive to small uncertainties. As Mittivakkat Gletscher is generally considered as representative of glaciers in Southeast Greenland, these findings could indicate that a regional volume-area scaling approach would provide a more accurate total glacier volume estimate for Greenland than using parameters given by global scaling relationships.