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Area and volume changes from Greenland's longest-observed local glacier, Mittivakkat Gletscher, and surrounding glaciers

S. H. Mernild (1), N. T. Knudsen (2), and J. C. Yde (3)

(1) Los Alamos National Laboratory, Computational Physics and Methods (CCS-2), Los Alamos, United States (mernild@lanl.gov), (2) Department of Geology, Aarhus University, Denmark , (3) Sogn og Fjordane University College, Sogndal, Norway

Glaciers and ice caps are indicators of ongoing climate changes. Warming in the Arctic during the past several decades has caused local glaciers and ice caps to thin and retreat. Few mass-balance observations are available in Greenland to quantify area and volume losses and determine the extent to which these glaciers and ice caps are out of equilibrium with present-day climate. Here, we present mass balance records since 1995 and volume observations for the Mittivakkat Gletscher (17.6 km2; 65°41 N, 37°48 W), Southeast Greenland: the only local glacier in Greenland for which there exists long-term observations of both surface mass balance and glacier front fluctuations. Front observations were first made in 1931, taken by the British Arctic Air Route Expedition, 1930–1931, indicating continuous glacier recession since 1931 of about 1300 meters. Since 1995, mean values of observed net balance was -0.97 m w.e. The measurements show that 14 out of 16 balance years have a negative balance, and two balance years have a slightly positive balance. The cumulative mass balance since 1995 is -15.0 m w.e., corresponding to a volume loss of about 13% of the total glacier ice volume determined in 1994. Also, the Mittivakkat Gletscher (26.3 km2 in 2011) area extent has diminished about 22% since 1986 – close to the mean area exposure of 27±24% for glaciers and ice caps in Southeast Greenland. Since 1986, five GIC melted away in the Ammassalik area, and one would therefore expect that GIC might melt substantially within the 21st century under ongoing climate warming.