

Decadal variations of the land-based ice margin in Northwest Greenland

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We investigate changes in the land-based ice margin in Northwest Greenland where the Nunatarssuaq Ice Cap (NIC) connects with the Greenland Ice Sheet (GIS) at about 76°55' N and 66°58' W. The ice margin in this area terminates as a near-vertical ice cliff of between 9 and 33 m. We take advantage of several decades of data of the ice margin geometry. During the years 1954-1957 and in 1965 a US American research group lead by R. Goldthwait performed multi-disciplinary studies which build the starting period of our change assessment. We compare the cliff morphology of the mid-1950s and the mid-1960s from these authors with a digital elevation model (DEM) derived with photogrammetric methods from 1985 and recent satellite and observational data from various time-steps. While cliff position experienced a net-advance between the 1950s and today that likely occurred slower in the beginning of the period and sped up some time between the 1960s and 2012, we observe a recent stagnant or retreating phase. Today, ice thickness at the cliff front is similar to the 1950s. Given a marked thinning since 2012, we hypothesize that along with the advance there may have been an advective thickening before 2012. Compared to similar elevations at the adjacent Greenland Ice sheet, we find significantly weaker thinning rates at NIC. Decadal changes in ice thickness derived from DEMs and historical sources correlate with decadal air temperature anomalies and support a thickening of the front followed by a marked thinning.