



Albedo decline for peripheral glacier to the Greenland Ice Sheet

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Albedo is one of the parameters that governs energy availability for snow and ice surface ablation, and subsequently the surface mass balance conditions of temperate glaciers and ice caps (GIC). Here, we document snow and ice albedo changes on Mittivakkat Gletscher in Southeast Greenland, the only local glacier in Greenland for which there exist long-term observations of surface mass-balance conditions. The MODerate Imaging Spectroradiometer (MODIS MCD43A3) albedo product was used to estimate glacier surface snow and ice albedo conditions, verified against observed in-situ automatic weather station albedo measurements. The analysis reveals negative mean trends in the MODIS-derived albedo during an end-of the mass balance year period covering 14 years from year 2000. The significant decline in mean glacier-wide albedo of 0.10 is likely caused by darkening of the glacier surface. This finding supports the hypothesis that glacier surface albedo at the end-of the mass balance year contains a valuable signal related to annual mass balance conditions, and probably leading to positive feedbacks causing accelerated glacier mass loss. The drop in albedo not only occurred for local GIC in Greenland, but is consistent with recent observation-based studies of the Greenland Ice Sheet.