



Decreasing clouds drive mass loss on the Greenland Ice Sheet

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The Greenland ice sheet (GrIS) has been losing mass at an accelerating rate since the mid-1990s. This has been due to both increased ice discharge into the ocean and melting at the surface, with the latter being the dominant contribution. This change in state has been attributed to rising temperatures and a decrease in surface albedo. Here we show, using satellite data and climate model output, that the abrupt reduction in surface mass balance since about 1995 can be largely attributed to a coincident trend of decreasing summer cloud cover. Satellite observations show that, from 1995 to 2009, summer cloud cover decreased by $0.9\% \pm 0.28\%.\text{yr}$. Model output indicates that the GrIS surface mass balance has a sensitivity of -5.4 ± 2 Gt per percent reduction in summer cloud cover, due principally to the impact of increased shortwave radiation over the low albedo ablation zone. The observed reduction in cloud cover is strongly correlated with a state shift of the North Atlantic Oscillation, suggesting that the enhanced surface mass loss from the GrIS is driven by synoptic-scale changes in Arctic-wide atmospheric circulation.