Area changes of Greenland marine terminating glaciers

Abstract

The dynamic mass loss of marine terminating glaciers is responsible for approximately half of the mass loss from the Greenland ice sheet in recent years but though the glaciers are expected to retreat in a warming climate their sensitivity to changes in di↔erent climate parameters is not well known. The marine terminating glaciers are very dynamic and an acceleration and thinning has been observed several kilometers inland following an initial retreat of the front.

In this study the area changes of 42 marine terminating Greenland outlet glaciers are measured from 2000 to 2013 by manually digitizing the front using 15-30 m resolution satellite images in the visual and near-infrared range. Using the yearly average area changes of the glaciers their sensitivity to changes in Sea Surface Temperature (SST), Sea Ice Concentration (SIC) and surface melt is studied.

Most of the glaciers are found to be retreating during the measurement period though a few have remained stable. An average rate of area change of -2.83 km2 per year is found. The internal correlation between the area changes of the di↔erent glaciers are calculated and it is found that, in general, there is very little correlation. However, for the southeastern glaciers some correlation is found.

Comparing average glacier area change with SST, SIC and surface melt a correlation is found for all parameters. Dividing the glaciers into four main regions it is found that glaciers from different parts of Greenland are sensitive to di↔erent climate parameters.
The glaciers in northwest Greenland show a strong signi cant correlation with surface melt all along the Greenland coast. The southwest and southeast glaciers both show a signi cant correlation with SST along the southeast and southernmost west coast. The southeast glaciers also show a signi cant correlation with SIC but it is not found for the southwestern glaciers. No signi cant correlation was found for the northeastern glaciers.