

Recent Changes in the Greenland Ice Sheet as Seen from Space

Dorothy K. Hall
Cryospheric Sciences Branch
NASA / GSFC
Greenbelt, Md. 20771

Abstract of Invited Seminar

Many changes in the Greenland Ice Sheet have been reported in the recent scientific literature and have been attributed to various responses of the ice sheet due to regional (and global) warming. Because melting of the ice sheet would contribute ~7 m to sea-level rise, the lives and habitat of hundreds of millions of people worldwide would be directly and indirectly affected if continued ice-sheet melting occurs. As mean-annual global temperatures have increased, there has been an increasing focus on studying the Greenland Ice Sheet using available satellite data, and numerous expeditions have been undertaken.

Regional “clear-sky” surface temperature increases since the early 1980s in the Arctic, measured using Advanced Very High Resolution Radiometer (AVHRR) infrared data, range from $0.57 \pm 0.02^\circ\text{C}$ to $0.72 \pm 0.10^\circ\text{C}$ per decade. Arctic warming has important implications for ice-sheet mass balance because much of the periphery of the Greenland Ice Sheet is already near 0°C during the melt season, and is thus vulnerable to more extensive melting if temperatures continue to increase. An increase in melting of the ice sheet would accelerate sea-level rise, an issue of increasing concern to billions of people worldwide. The surface temperature of the ice sheet has been studied in even greater detail using Moderate-Resolution Imaging Spectroradiometer (MODIS) data in the six individual drainage basins as well as for the ice sheet as a whole. Surface-temperature trends in the decade of the 2000s have not been strong, according to the MODIS measurements.

In addition to surface-temperature increases over the last few decades as measured by AVHRR, other changes have been observed such as accelerated movement of many of Greenland’s outlet glaciers and sudden draining of supra-glacial lakes. Decreasing mass of the ice sheet since (at least) 2002 has been measured using Gravity Recovery and Climate Experiment (GRACE) data, along with an build-up of ice at the higher elevations and a decrease of ice at the lower elevations as measured using airborne Lidar and Ice, Cloud and Land Elevation Satellite (ICESat) data.

The seminar will address the above issues using a variety of NASA satellite data and ground observations.