

A Climate-Data Record (CDR) of the “Clear-Sky” Surface Temperature of the Greenland Ice Sheet

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Abstract

We have developed a climate-data record (CDR) of “clear-sky” ice-surface temperature (IST) of the Greenland Ice Sheet using Moderate-Resolution Imaging Spectroradiometer (MODIS) data. The CDR provides daily and monthly-mean IST from March 2000 through December 2010 on a polar stereographic projection at a resolution of 6.25 km. The CDR is amenable to extension into the future using Visible/Infrared Imager Radiometer Suite (VIIRS) data.

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 ± 0.02 to 0.72 ± 0.10 °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 rapid melting if temperatures continue to increase. An increase in melting of the ice sheet would accelerate sea-level rise, an issue affecting potentially billions of people worldwide. The IST CDR will provide a convenient data set for modelers and for climatologists to track changes of the surface temperature of the ice sheet as a whole and of the individual drainage basins on the ice sheet. The daily and monthly maps will provide information on surface melt as well as “clear-sky” temperature. The CDR will be further validated by comparing results with automatic-weather station data and with satellite-derived surface-temperature products.