NEWS

2006 Greenland Ice Sheet Snowmelt From Spaceborne Microwave Brightness Temperatures

Brightness temperatures over the Greenland ice sheet, as measured by the Special Sensor Microwave Imager radiometer (SSM/I) aboard the U.S. Air Force Defense Meteorological Satellite (DMSP) Program's F13 satellite, have now been released (available at ftp://sidads.colorado.edu/pub/DATASETS/brightness-temperatures/easegrid/ssmi/). These data support the quantification of the number of snow melting days in 2006 (Figure 1a) and the 2006 melting days anomaly (e.g., the difference between 2006 melting days and the average number of melting days between 1988 and 2005; Figure 1b). Updated results are fundamental to long-term trend analyses of snowmelt extent and duration.

The 2006 melting index (e.g., the number of melting days × melt extent) follows the trend derived from the analysis of 1988–2005 data, and ranks seventh when using the 19.35-gigahertz data (with 2005, 2002, 1998, 2004, 1999, and 2003 having a greater melting index). The 2006 melting index ranks fifth when using the 37-gigahertz data, which are more sensitive to surface processes (with 1998, 2002, 2005, and 2004 having a greater melting index).

Maps of melting days, shown in Figure 1, are obtained by applying a recently proposed technique using the differences between nighttime and daytime passes to 19.35-gigahertz brightness temperatures [*Tedesco,* 2007]. In 2006, snowmelt extended above 2000 meters for a considerable number of days (even >10 days in some locations), with those areas located along most of the west coast (A1), the southeast (A2), and northeast (A3) of Greenland experiencing the maximum number of melting days (Figure 1a).

Negative anomaly values (e.g., the number of melting days in 2006 is less than the average number for the period 1988–2005) are observed along some areas of the west coast, at low elevations (Figure 1b). Positive anomaly values occur along the east coast at low altitudes, in some locations along the west coast (e.g., B1), and along the northeast coast (B2). Also, the 2006 anomaly map reveals that snow in most of the southern areas melted for a period of 5 or even 10 days (lighter shades of grey) longer than the average, even at high altitudes (B3).

The scientific tools at our disposal for linking the snowmelt extent and duration derived from passive microwave observations and ice sheet processes (such as glacial sliding by migration of surface water to the ice-bedrock interface) still need to be refined. However, the data presented here show a clear pattern, where areas with positive melting anomaly values are consistent with patterns of mass loss and surface temperature trends derived from other satellite missions, such as the Gravity Recovery and Climate Experiment (GRACE) and the Moderate Resolution Imaging Spectroradiometer (MODIS) on the Terra and Aqua satellites.

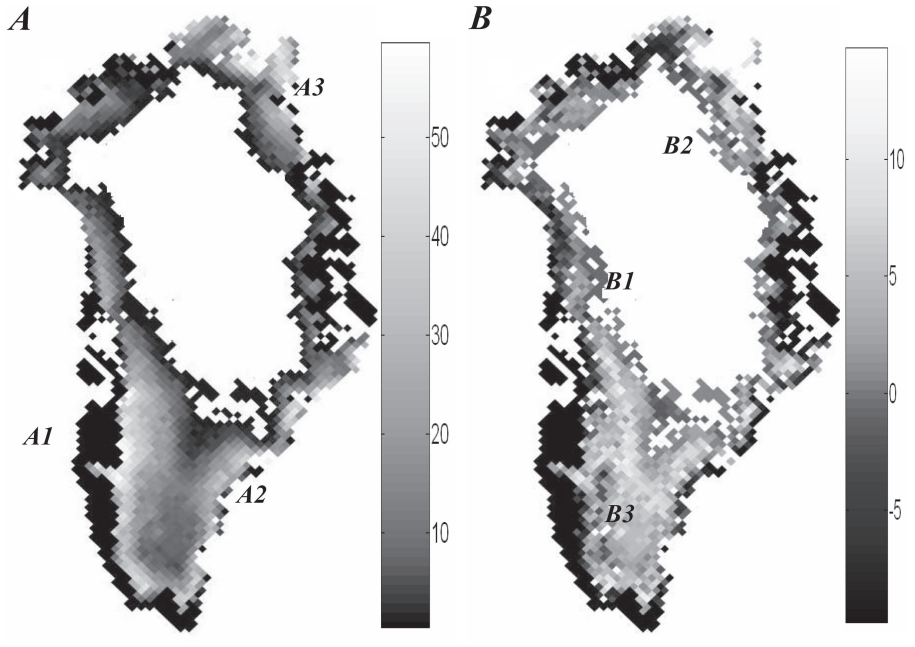

Fig. 1. (a) Number of snow melting days over the Greenland ice sheet in 2006. The axis on the scale represents days of melting. (b) 2006 melting days anomaly. The axis on the scale represents the number of days that melting in 2006 deviated from the snow day count averaged between 1988 and 2005.

Reference

Tedesco, M. (2007), Snowmelt detection over the Greenland ice sheet from SSM/I brightness temperature daily variations, *Geophys. Res. Lett., 34*, L02504, doi:10.1029/2006GL028466.

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