MODIS Snow Cover (MOD 10)

Product Description

Global snow cover (including over ice on large, inland water bodies) will be mapped daily and as 8-day composites over the Earth's land surfaces at 500-m resolution using an algorithm called SNOMAP (Hall *et al.*, 1995, Klein *et al.*, 1998). A global, daily snow cover map will be an at-launch MODIS product. Snow cover, with its high albedo, is a key parameter of the global energy balance, reflecting much of the incident solar radiation back to space. Snow cover of the Northern Hemisphere is currently mapped by NOAA on a daily basis, but the accuracy of the maps has been difficult to determine, in part because a variety of techniques has been used to map snow cover over the 34-year period during which the maps have been produced.

Additionally, snow/cloud discrimination is difficult and often impossible using the current NOAA sensors because of the available bands. MODIS bands will allow automatic snow/cloud discrimination, and, in conjunction with the MODIS cloud mask (MOD 35), will allow automated snow mapping. The MODIS 8-day-composite snow cover product is designed to provide snow-cover persistence statistics for each pixel so that users can determine how long the snow has been on the ground during the compositing period. This is especially important during the transition seasons.

Research and Applications

Large, inland water bodies such as the Great Lakes, are often ice-covered during the winter months, and navigation during part of the winter is a significant problem. NOAA data are currently used to map ice cover on the Great Lakes, but discrimination between snow/ice and cloud is a problem. Additionally, ice cover on lakes can be an important climate indicator, as the dates of freeze-up and break-up are influenced by meteorological conditions. A trend toward earlier break-up, for example, could signify a warming as has been observed in some areas (e.g., Comb, 1990). Thus, it is important to measure ice conditions on large lakes over an extended period of time in order to detect trends as well as for operational uses over the short term.

Data Set Evolution

SNOMAP has a considerable heritage. It is based on the normalized difference of a visible and a short-wave-infrared band. This technique has been used, since at least 1978, to map snow from aircraft (Kyle *et al.*, 1978). Since the mid-1980s, it has been used to map snow using Landsat data on the drainage-basin scale (Dozier, 1989). The SNOMAP algorithm has been enhanced by incorporating the normalized difference vegetation index (NDVI), to map the snow cover in denser forests than was possible with the original algorithm (Klein *et al.*, 1998).

Global snow cover has also been mapped using passive-microwave data at a resolution of about 50 km (Foster and Chang, 1993). While these data allow snow mapping through cloud cover, passive-microwave data do not provide a resolution that is suitable for detailed snow mapping. Basin-scale mapping is required for hydrological modeling, and, in particular for snowmelt-runoff calculations, which are essential for hydroelectric-power generation and for water-supply forecasts in the western U.S. and in many other parts of the world. The expected use of passive-microwave and MODIS snow cover data together should yield information on snow extent and snow-water equivalent (Salomonson *et al.*, 1995). Snow cover data are also needed for general circulation modeling.

Suggested Reading

Comb, D.G., 1990.

Dozier, J., 1989.

Foster, J.L., and A.T.C. Chang, 1993.

Hall, D.K. *et al.*, 1995.

Klein *et al.*, 1998.

Kyle, H.L. *et al.*, 1978.

Salomonson, V.V. *et al.*, 1995.

MODIS Snow Cover Summary

Coverage: Global, daytime

Spatial/Temporal Characteristics: 500 m/daily; 500 m/8-day composite; 1/4°/daily and 8-day composite

Key Geophysical Parameters: Snow cover, lake-ice cover

Processing Level: 2, 3 (mapped)

Product Type: Standard, at-launch

Maximum File Size: 23 MB (Level 2), 12 MB (Level 3)

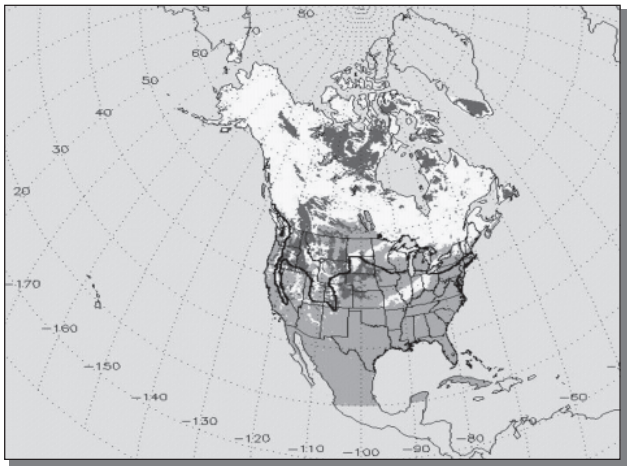
File Frequency: 288/day (Daily Level 2); 333/day (Daily Level 3), 333/8-day (8-day Level 3)

Primary Data Format: HDF-EOS

Additional Product Information: http://snowmelt.gsfc.nasa.gov/MODIS_Snow/modis.html

DAAC: National Snow and Ice Data Center

Science Team Contact: D. Hall



MODIS "Browse" Product (5-km resolution) showing the Maximum Snow Cover (white) in North America composited for the 8-day period March 5-12, 2000. Dark gray indicates clouds, and the black line represents the average March snowline as determined from NOAA/NESDIS snow cover maps for the years 1966-1998.