ECV T05

SNOW COVER

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THE IMPORTANCE OF SNOW

Snow can cover up to 50 percent of the Earth's land surface during the Northern Hemisphere winter. It has major effects on surface albedo and energy balance, and modifies the overlying atmospheric thickness and surface temperature. Snow characteristics, such as thickness, seasonal and interannual variability and snow-cover duration, affect permafrost thermal state, the depth and timing of seasonal freeze and thaw of the ground, as well as ablation of glaciers, ice sheets and sea ice.

The snow water equivalent (SWE) of the snow pack is important for hydrological modelling and runoff prediction. Snowmelt plays a major role in seasonal energy exchanges between the atmosphere and ground, affecting soil moisture and runoff, and thereby water resources. Snowfall as a fraction of total precipitation is important in hydroclimatic models and in monitoring climate change.

CONTRIBUTING TO BASELINE GCOS OBSERVATIONS

Snow depth is measured once daily at weather stations, but is rarely reported over the Global Telecommunications System (GTS). However, global snow depth data are available from the WMO-GTS Synoptic Reports for stations that do report that code group in real time (see: ftp://ftp.ncdc.noaa.gov/pub/data/globalsod).

Snowfall is not differentiated in 6-hourly and daily precipitation measurements at weather stations, although precipitation type is reported in the synoptic weather code. Snow cover is mapped routinely by satellites. NOAA-NESDIS provides operational hemispheric products; NASA develops hemispheric research products.

SWE is determined at snow courses (North America) or along snow transects (Russia) at about 15–30 day or 10-day intervals, respectively. The data are in agency archives and many are not digitized, European data are especially difficult to access (due to cost and other restrictions).

AVAILABLE ANALYSIS PRODUCTS

Snow cover extent

- Daily Northern Hemisphere extent maps exist since May 1999 and gridded data (1024 by 1024 box grid, ca. 25 km) monthly statistics (frequency, anomaly) for the Northern Hemisphere, North America and Asia. Also available is the Interactive Multisensor Snow and Ice Mapping System (IMS) Daily Northern Hemisphere Snow & Ice Analysis (IMS link below).
- The Northern Hemisphere EASE-Grid Weekly Snow Cover and Sea Ice Extent product, combines snow cover and sea ice extent at weekly intervals since 1978, and snow cover alone for October 1966 to October 1978. Data are provided in a 25-km equal area grid (NSIDC EASE- Grid).
- Moderate Resolution Imaging Spectroradiometer (MODIS) products include level-2 swath data at 500-m resolution, gridded daily and 8-day composites at 500-m resolution, and daily and 8-day global maps. MODIS snow cover data are based on a mapping algorithm that employs a Normalized Difference Snow Index (NDSI).

Global snow depth

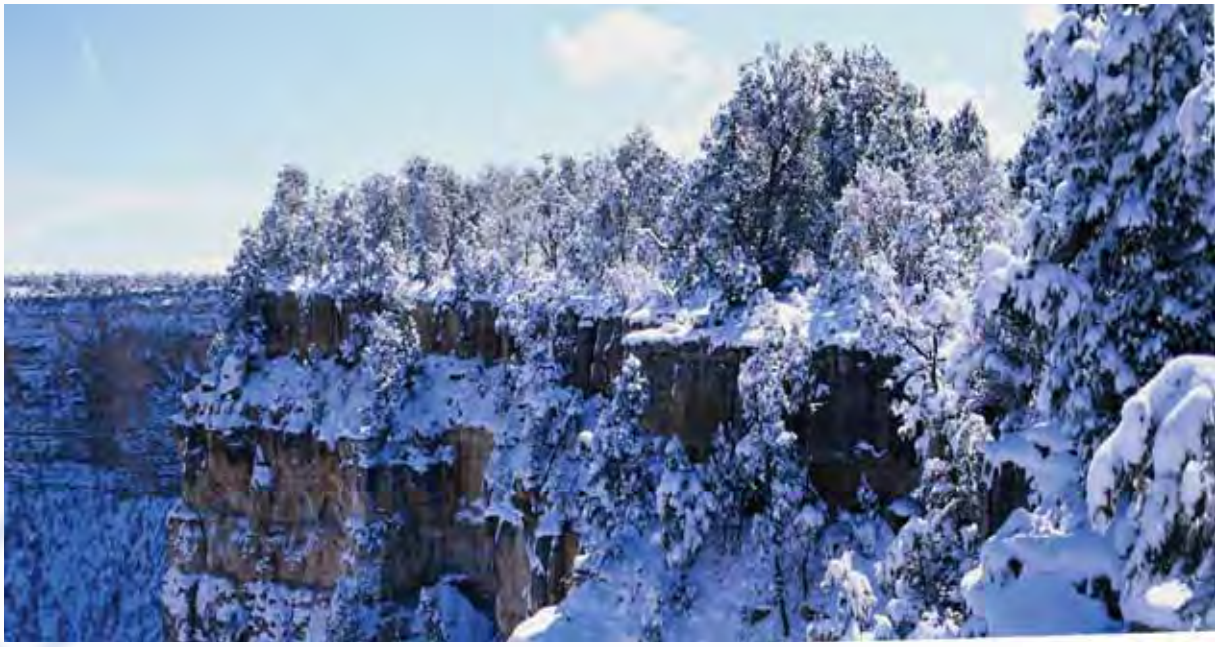
- Operational global daily snow depth analysis undertaken by the Canadian Meteorological Centre.

National snow depth products

These include:

- Historical Soviet Daily Snow Depth Version 2 (HSDSD) of observations from 1881 to 1995 at 284 WMO stations throughout Russia and the former Soviet Union (35–75°N; 20–180°E).

Winter snow cover is the most extensive element of the cryosphere and plays a fundamental role in climate



- NOAA Experimental Daily NWS/COOP Snow Depth and Snowfall Graphics and Data: Daily snow depth and snowfall graphics for the contiguous USA.
- Daily snow depth data for 1062 observing stations across the contiguous USA for 1871–1997 are available from the Carbon Dioxide Information and Analysis Center (CDIAC).
- Daily snow depth data for over 1 000 Canadian stations covering the entire record up to 1999 are available from the Meteorological Service of Canada on CD-ROM.

National SWE

SWE is observed by national, state, provincial and private networks in many countries on a 10-day to monthly basis, but no central archive exists and many national and other databases are not readily accessible. No standard global SWE product exists.

NSIDC has developed a Northern Hemisphere mean monthly product for 1978–2000, based on SMMR and SSM/I passive microwave data. The Former Soviet Union Hydrological Snow Surveys are based on observations at 1 345 sites between 1966 and 1990, and at 91 of those sites between 1991 and 1996. Observations include snow depths at WMO stations and snow depth and SWE measured over a nearby snow course transect. The station snow depth measurements are a 10-day average of individual snow depth measurements. The transect snow depth data are the spatial average of 100 to 200 individual measuring points. The transect SWE is the spatial average of twenty individual measuring points (http://nsidc.org/data/g01170.html).

ISSUES AND PRIORITIES

Many problems arise because (1) snow cover data are collected by numerous agencies with differing goals; (2) funding support for snow research is fragmentary and not well coordinated; and (3) the cost of maintaining surface networks is leading to their contraction or to a switch to automated measurement using different instrumentation. Various methodologies and standards have been developed and implemented by international and national networks for snow depth and SWE; however, there is still a lack of harmonization at a global level. Development of optimal procedures to blend surface observations with visible and microwave satellite data and airborne gamma radiation measurements of SWE is only just beginning to receive attention.

RELATED LINKS:

NSIDC: http://nsidc.org | **Snow data sets:** http://nsidc.org/data/swe | **WMO-GTS Synoptic Reports:** ftp://ftp.ncdc.noaa.gov/pub/data/globalsod
NOAA Snow: www.ssd.noaa.gov/PS/SNOW | **Global daily snow depth:** http://weatheroffice.ec.gc.ca/analysis/index_e.html
IMS: http://orbit-net.nesdis.noaa.gov/crad/sat/surf/snow/HTML/snow.htm | **Snow cover standards:** www.fao.org/gtos/ECV-T05.html
UNEP Global outlook for Snow and Ice: www.unep.org/geo/geo%5Fice/PDF/full_report_LowRes.pdf