

MULTI-DECADAL SNOW COVER EXTENT/SNOW WATER EQUIVALENT/SNOW DEPTH DATASET FROM BLENDED IN-SITU AND SATELLITE OBSERVATIONS

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ABSTRACT

Long-term estimates of daily snowpack properties - Snow Cover Area, Snow Depth and Snow Water Equivalent - over seasonal snow covered land are needed for a wide range of applications including climate model evaluation, verification of seasonal forecasts, annual updates to climate assessments and determination of freshwater availability.

Here we present a new multidecadal (1987-2022) dataset of global daily maps of snow cover properties derived through consistent reprocessing of historical satellite and in situ observations. Daily time series of snow extent at 4 km resolution is produced from multi-sensor passive microwave and visible/infrared sensor satellite data. Next, a regression based technique is used to retrieve snow depth from Special Sensor Microwave Imager (SSM/I) passive microwave data. The satellite-snow depth is used as a first guess and updated in a second step, by applying an optimal interpolation technique to in-situ snow depth observations, the latter obtained from NOAA's Global Historical Climatology Network (GHCN-Daily).

And finally, a Snow Depth to Snow Water Equivalent (SWE) conversion algorithm is used to estimate SWE from the retrieved snow depth and ancillary information. Evaluation of long term trends indicates very small changes in snow mass over the time period considered, both in Eurasia and North America, but relatively large interannual variations. Similar small changes, below 0.8 %/decade, since 1988 have been seen in the continental-scale annual snow cover extent.

Keywords: Snow Cover Area, Snow Depth, Snow Water Equivalent, Satellite observations, Climatology.