High Mountain Asia MODIS/Terra L3 Daily 500m SIN Grid Spatially and Temporally Complete (STC) Snow Cover and Snow Surface Properties, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Rittger, K., S. J. P. Lenard, R. T. Palomaki, M. J. Brodzik, E. H. Bair, & T. H. Painter. 2025. *High Mountain Asia MODIS/Terra L3 Daily 500m SIN Grid Spatially and Temporally Complete (STC) Snow Cover and Snow Surface Properties, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/9FYZPP9AIV7G. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/HMA2_MODSTC

National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 Summary

This data set contains spatially and temporally complete (STC) raster images of snow cover and snow surface properties from 24 February 2000 through 30 June 2022 for the High Mountain Asia region. The data are derived from the MODSCAG[1] and MODDRFS[2] data sets (see MODSCGDRF_NRT, Version 1), using historical surface reflectances from MODIS/Terra as input.

Variables include snow fraction (viewable and canopy-corrected); optical grain size; snow albedo (with and without light-absorbing particles); and energy flux to the snowpack from light-absorbing particles.

1.2 Parameters

Snow fraction
Snow grain size
Snow albedo
Energy flux

1.3 File Information

1.3.1 Format

NetCDF-4

1.3.2 File Contents

Data files contain the variables described in the following table:

[1] MODIS Snow Covered Area and Grain-size
[2] MODIS Dust Radiative Forcing in Snow

Table 1. Data File Variables and Descriptions

Variable	Description	Fill Value
albedo_clean_flat	Reflected fraction (%) of broadband[3] solar radiation, derived from optical grain size in MODSCAG. No adjustment for slope and aspect of the terrain.	255
albedo_dirty_flat	Reflected fraction (%) of broadband[3] solar radiation derived from optical grain size in MODSCAG and darkening due to light-absorbing impurities (i.e., darkening) in MODDRFS ("deltavis"). No adjustment made for slope and aspect of the terrain.	255
crs	Grid mapping variable with a complete description of the coordinate reference system	—
deltavis	Difference (%) between observed visible reflectance at 0.350 µm - 0.876 µm and MODDRFS grain size reflectance at the same wavelengths.	255
drfs_grnsz	Optical snow grain size (µm) based on MODDRFS normalized difference grain size index.	65535
grain_size	Optical snow grain size (µm) based on MODSCAG spectral mixture analysis.	65535
radiative_forcing	Additional energy (W/m^2) absorbed by the snowpack due to light-absorbing impurities, assuming a clear sky.	65535
snow_fraction	Viewable snow fraction (%) adjusted for canopy obstruction, based on forest height and vegetation fraction.	255
time	Days since 2000-01-01 00:00:00	—
viewable_snow_fraction	Snow fraction using surface reflectance visible from satellite	255
x	Projected x coordinate (m)	—
y	Projected y coordinate (m)	—

[3] 0.28 µm – 4.00 µm

1.3.3 Naming Convention

Convention

HMA2_MODSTC_h[HH]v[VV]_[YYYYMMDD]_v01.0.nc

Example

HMA2_MODSTC_h24v06_20220101_v01.0.nc

The following table describes the variables in file naming convention:

Table 2. File Name Variables and Descriptions

Variable	Description
HMA2_MODSTC	“High Mountain Asia MODIS/Terra L3 Daily 500m SIN Grid Spatially and Temporally Complete (STC) Snow Cover and Snow Surface Properties” data set
h[HH]v[VV]	Tile location in the MODIS sinusoidal grid, specified as two-digit horizontal (h) and vertical (v) indices. E.g., h24v06 refers to the tile located at column 24, row 6 (see Figure 1).
YYYYMMDD	Year (YYYY), month (MM), and day (DD)
v01.0	Major and minor version number. V01.0 = Version 1.0
.nc	NetCDF file extension

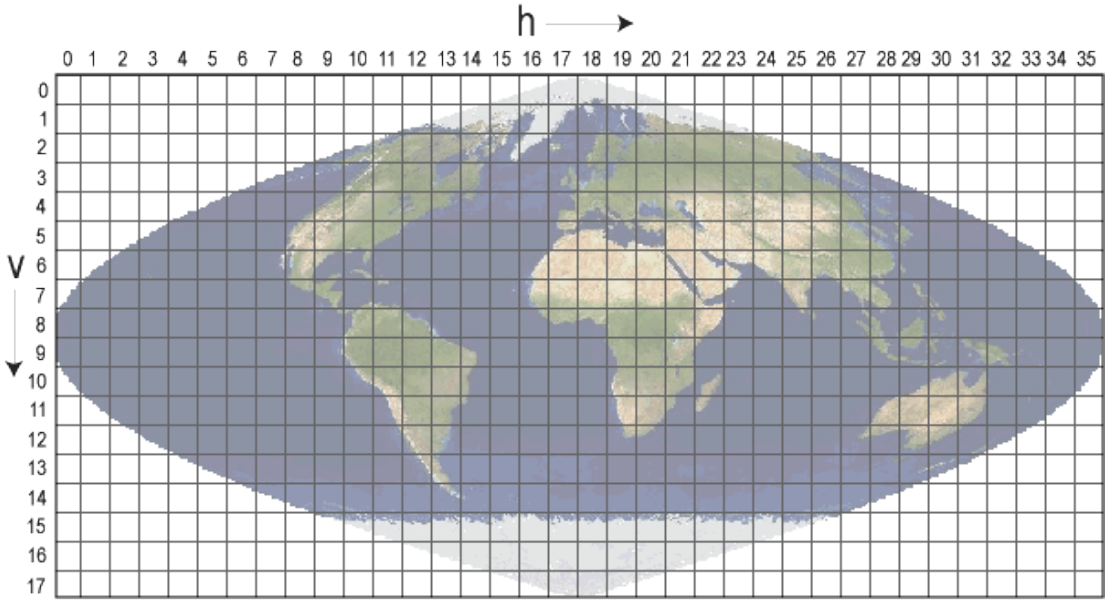

Figure 1. MODIS Sinusoidal Tile Grid (from "MODIS Land | MODIS Grids")

1.4 Spatial Information

1.4.1 Coverage

N: 50° N

S: 20° N

E: 117.4975° E

W: 46.1880° E

1.4.2 Resolution

500 m (nominal resolution)[4]

1.4.3 Geolocation

Data are provided in the Modis Sinusoidal Grid. A complete description of the projection and grid is stored in the “crs” grid mapping variable.

[4] The MODIS Sinusoidal Tile Grid is produced at a nominal resolution of 500 m. The true resolution is 463.3 m.

1.5 Temporal Information

1.5.1 Coverage

24 February 2000 - 30 June 2022

1.5.2 Resolution

Daily

2 DATA ACQUISITION AND PROCESSING

2.1 Acquisition

Inputs to the STC algorithm were derived from surface reflectance data in the following versions of the MODIS/Terra Surface Reflectance Daily L2G Global 1km and 500m SIN Grid (MOD09GA) data set:

- MOD09GA, V6 (prior to 28 December 2021)
- MOD09GA, V61 (29 December 2021 onwards)

2.2 Processing

This data set represents a High Mountain Asia-specific version of the “Historical MODIS/Terra L3 Global Daily 500m SIN Grid Snow Cover, Snow Albedo, and Snow Physical Properties, Version 1” data set, for 24 February 2000 through 30 June 2022. Data for a given file are derived from the MODIS Terra am (i.e., morning) overpass on the date specified in the file name.[5]

The STC algorithm comprises a suite of processes designed to improve the accuracy of MODSCAG/MODDRFS and add additional information, notably snow albedo with and without darkening by light absorbing particles. It accounts for off-nadir MODIS viewing geometry by using the satellite view angle to weight observations, and better identifies clouds compared with MODSCAG and MODDRFS by leveraging time series as opposed to spectral tests, which often include errors of omission and commission.

The algorithm leverages cotemporaneous MODSCAG forest height and associated fractional vegetation to create an on-the-ground viewable snow cover fraction, which is used to remove bias from the other

[5] Multiple overpasses may be used if more than one exists for the given date.

variables. Then, after identifying incorrect/clouded/inaccurate locations, the resulting data are spatially and temporally interpolated to produce a near-complete data set.

For additional details about the STC algorithm, see “Section 6 | References.”

3 VERSION HISTORY

Version 1 (initial release)

4 RELATED DATA SETS

- Near Real-Time MODIS/Terra L3 Global Daily 500m SIN Grid Snow Cover, Grain Size, and Dust Radiative Forcing, Version 1
- Historical MODIS/Terra L3 Global Daily 500m SIN Grid Snow Cover, Snow Albedo, and Snow Physical Properties, Version 1
- MODIS/Terra Surface Reflectance Daily L2G Global 1km and 500m SIN Grid, V006
- MODIS/Terra Surface Reflectance Daily L2G Global 1km and 500m SIN Grid, V061

5 ACKNOWLEDGMENTS

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6 REFERENCES

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7 DOCUMENT INFORMATION

7.1 Publication Date

November 2025

7.2 Date Last Updated

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