TRMM PR SIR-Enhanced EASE-Grid 2.0 Surface Radar Backscatter, Version 1

USER GUIDE

How to Cite These Data

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

Long, D.G. and J.Z. Miller. 2026. *TRMM PR SIR-Enhanced EASE-Grid 2.0 Surface Radar Backscatter, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/WK4DZ1LG4L6O. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NSIDC-0807

National Snow and Ice Data Center

T2.0

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1 DATA DESCRIPTION

1.1 Summary

The TRMM PR product (NSIDC-0807), derived from the Tropical Rainfall Measuring Mission (TRMM) Precipitation Radar (PR) instrument, includes Level-3 gridded radar backscatter data collected at 13.88 GHz with vertical transmit–vertical receive (VV) polarization. Data are gridded to the *EASE-Grid 2.0* cylindrical projections (Brodzik et al., 2012; Brodzik et al., 2014) at two griddings.

Input data for the NSIDC-0807 product are the TRMM PR 2A21 Version-7 files obtained from the NASA EOS-DIS system. The data coverage is global for the period beginning in January 1998 through October 2014—the full mission lifetime. No calibration corrections have been applied to the data.

1.2 Parameters

The geophysical parameter of this data set is normalized radar cross section (σ^o; Sigma0), a unitless measure of surface radar backscatter calculated in decibel (dB) space as $10 \cdot \log_{10}(\sigma^o)$. The range of values depends on the surface type and conditions.

Radar backscatter is provided at a frequency of 13.88 GHz and is available only in vertical transmit–vertical receive (VV) polarization. In addition to σ^o, the data set includes the linear slope in σ^o with respect to incidence angle, expressed in dB per degree, which characterizes the angular dependence. Radar backscatter values are provided on a gridding of 25 km for the GRD files and 3.125 km for the AVE files. A full list of parameters can be found in Table 1.

Table 1. Parameters

Parameter	Description	Units
crs	Coordinate reference system; *EASE-Grid 2.0*	For details, see the Geolocation (Section 1.4.3) section of this document
Incidence_angle	Average incidence angle of the measurements used to derive Sigma0	degrees (°)
Sigma0	Normalized radar cross section (σ^o)	dB
Sigma0_num_samples	Number of measurements contributing to each grid cell	count
Sigma0_slope	Slope of normalized radar cross section (σ^o) with respect to incidence angle	dB/deg

Parameter	Description	Units
Sigma0_std_dev	Standard deviation of normalized radar cross section (σ⁰) within each grid cell	dB
Sigma0_time	Mean observation time of the contributing Sigma0 measurements	Minutes since 2009-05-07 00:00:00
time	ANSI date	Days since 1972-01-01 00:00:00
x	projection_x_coordinate	meters
y	projection_y_coordinate	meters

1.3 File Information

1.3.1 Format

Data are provided in NetCDF (.nc) format using Climate and Forecast 1.6 and Attribute Conventions for Dataset Discovery 1.3 metadata conventions.

1.3.2 File Contents

Each NetCDF file contains gridded radar backscatter variables, coordinate variables, and metadata. The primary data variable is normalized radar cross section (σ⁰), provided in decibel (dB) space.

All files include:
- Spatial coordinate variables (x, y) defining the *EASE-Grid 2.0* projection
- A time coordinate representing the image formation period
- A grid mapping variable defining the map projection
- Global metadata describing the product version, processing details, temporal coverage, and citation information
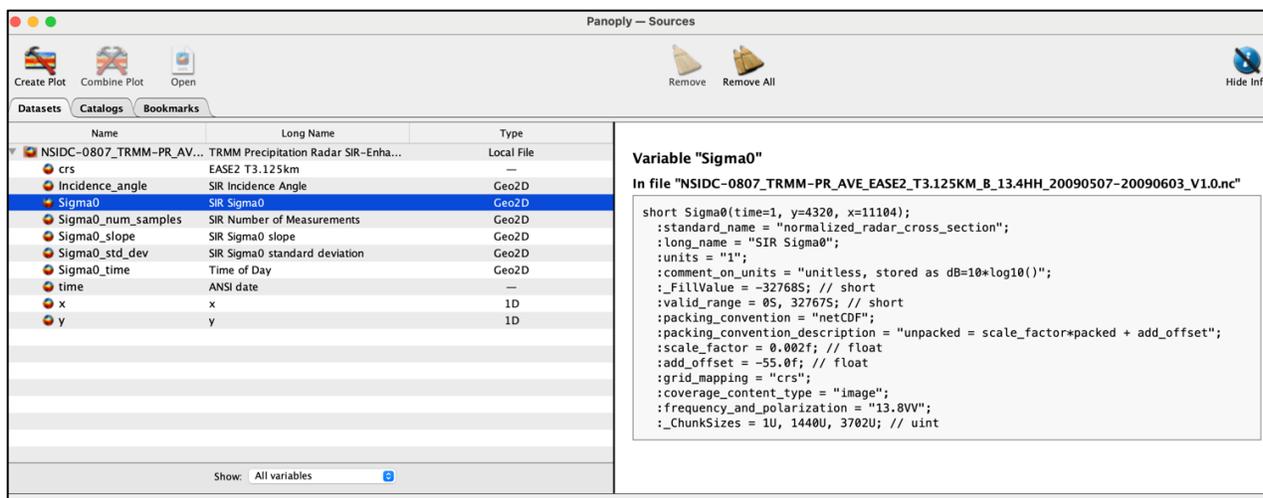
Figure 1. Sample of NetCDF file as seen in Panoply. On the left are listed the parameters, explained above in the Parameters Section (1.2). On the right, detailed metadata for each parameter.

1.3.3   Naming Convention

Date files are named according to the following convention and as described in Table 2.

Generic file name: NSIDC-XXXX_<platform-sensor>_<algorithm>_<grid-name>_<pass>_<channel_id>_<YYYYMMDD-YYYYMMDD>_V1.0.nc

Example file name: NSIDC-0807_TRMM-PR_AVE_EASE2_T3.125KM_B_13.8VV_20090507-20090603_V1.0.nc

Table 2. File Naming Convention

Variable	Description
NSIDC-XXXX	NSIDC unique data set identifier (ex: NSIDC-0807)
platform-sensor	TRMM-PR indicates data comes from that sensor
algorithm	Specifies the algorithm used: GRD or AVE
grid-name	Name of the grid (EASE2), grid type (T=Temperate/Tropical), and grid resolution (3.125KM or 25KM), ex: EASE2_T [3.125 or 25] KM
pass	The direction of the satellite pass: B = Both ascending and descending
channel_id	Channel (frequency + polarization, ex: 13.8VV): VV = vertical-vertical
YYYYMMDD-YYYYMMDD	28-day date range covered by file: 4-digit year, 2-digit month, 2-digit day (ex: 20120105)
version	Data set version number: vX.X for major/minor versions (e.g. V1.0)
.nc	NetCDF data formatting suffix

1.4 Spatial Information

1.4.1   Coverage

The TRMM PR *EASE-Grid 2.0* radar backscatter product provides spatial coverage between approximately 67°S and 67°N latitude, corresponding to the latitudinal limits of the TRMM PR Radar observations. Coverage includes land surfaces and selected cryospheric regions within this latitude range. Polar regions are not included because the TRMM PR instrument did not acquire observations at higher latitudes. Longitudinal coverage is global, extending from 180°W to 180°E.

1.4.2   Resolution

Data are provided at two griddings, depending on the algorithm, where GRD files are provided on a 25 km grid, while AVE files are provided on a 3.125 km grid. The effective resolution varies for each algorithm and is dependent on the density and orientation of satellite passes covering each grid point. For the AVE variant, the effective resolution is limited primarily by the TRMM PR sensor footprint, which is nominally ~5–6 km, and is modestly improved (~10–15%) through reconstruction, resulting in a typical effective resolution of approximately 4–5 km. The GRD variant represents spatially averaged backscatter on a 25 km grid, resulting in a coarser effective resolution. It is important to note that when using any product, the effective resolution is the real metric for spatial analysis, while the grid spacing is a convenience for data fusion and geolocation. For more information on the grid reconstruction methods, please refer to the ATBD.

1.4.3   Geolocation

Table 3 provides geolocation information for this data set.

Table 3. Geolocation Details

Projected coordinate system	*EASE-Grid 2.0* Global (Temperate and Tropical)
Longitude of true origin	0
Latitude of true origin	30
Scale factor at longitude of true origin	N/A
Datum	WGS 1984
Ellipsoid/spheroid	WGS 1984
Units	Meter
False easting	0
False northing	0

EPSG Projected CRS code	6933
PROJ4 string	+proj=cea +lon_0=0 +lat_ts=30 +x_0=0 +y_0=0 +ellps=WGS84 +towgs84=0,0,0,0,0,0,0 +units=m +no_defs
Reference	http://epsg.io/6933

1.5 Temporal Information

1.5.1   Coverage

Data coverage begins on 01 January 1998 and ends on 07 October 2014.

1.5.2   Resolution

Data are generated using a rolling 28-day composite imaging period where the number of images included in each composite is dependent on data availability over that period. Users can find the precise start and end dates of the files used to derive each composite in the file level metadata. New images are initiated every 14 days, resulting in overlapping composites. The last files in the time series (both GRD and AVE) cover an abbreviated period (24 September 2014 – 07 October 2014) due to the input data mission ending.

2   DATA ACQUISITION AND PROCESSING

2.1 Background

The instrument used to acquire this data set is the TRMM PR, flown on the joint NASA–JAXA TRMM satellite platform. TRMM PR is a Ku-band (13.88 GHz) radar that measures the σ^0 of the Earth's surface. Although the instrument was designed primarily to observe precipitation, it's measured surface backscatter is sensitive to surface roughness, dielectric properties, snow and ice structure, moisture content, and vegetation, making it a valuable source of information for land surface and cryospheric studies as well. More detailed information on the acquisition, processing, and quality can be found in the product's ATBD.

2.2 Acquisition

These TRMM PR gridded radar backscatter products are generated from Level 2 TRMM PR 2A21 Version 7 surface backscatter measurements acquired during routine satellite overpasses between January 1998 and September 2014. Individual measurements collected across the radar swath are

combined over multi-day imaging periods and processed to produce the GRD and AVE radar backscatter products on the *EASE-Grid 2.0* projection.

2.3 Processing

TRMM PR valid observations are screened and gridded to the *EASE-Grid 2.0* equal-area grid. Two product types are produced: GRD, generated using a drop-in-the-bucket averaging method; and AVE, produced using the first iteration of the Scatterometer Image Reconstruction (SIR) algorithm. Measurements from multiple satellite overpasses are composited over 28-day imaging periods, with new products initiated every 14 days.

2.4 Quality, Errors, and Limitations

Data quality is influenced by the narrow swath and orbital sampling of the TRMM PR, which can result in limited sampling in some regions and time periods. Enhanced-resolution products improve apparent spatial detail but may contain artifacts in areas with sparse observations. Surface backscatter measurements are sensitive to surface conditions and may vary seasonally. Data coverage is limited to approximately 67°S to 67°N latitude, and users are encouraged to consult ancillary variables when interpreting the data.

3   VERSION HISTORY

The following table outlines version history.

Version	Date Implemented	Impacted Temporal Coverage	Description of Changes
1.0	26 February 2026	01 January 1998 to 07 October 2014	Initial Release

4   RELATED DATA SETS

Calibrated Enhanced-Resolution Passive Microwave Daily EASE-Grid 2.0 Brightness Temperature ESDR, Version 2

SMAP Radiometer Twice-Daily rSIR-Enhanced EASE-Grid 2.0 Brightness Temperatures, Version 3

ERS SIR-Enhanced EASE-Grid 2.0 Radar Backscatter, Version 1

NSCAT Twice-Daily SIR-Enhanced EASE-Grid 2.0 Radar Backscatter, Version 1

SASS Twice-Daily SIR-Enhanced EASE-Grid 2.0 Radar Backscatter, Version 1

SMAP Radar Twice-Daily SAR and SIR-Enhanced Scatterometer EASE-Grid 2.0 Radar Backscatter, Version 1

5 ACKNOWLEDGMENTS

6 REFERENCES

Brodzik, M. J., Billingsley, B., Haran, T., Raup, B., & Savoie, M. H. (2012). EASE-Grid 2.0: Incremental but significant improvements for Earth-gridded data sets. ISPRS International Journal of Geo-Information, 1, 32–45. https://doi.org/10.3390/ijgi1010032

Brodzik, M. J., Billingsley, B., Haran, T., Raup, B., & Savoie, M. H. (2014). Correction to: EASE-Grid 2.0: Incremental but significant improvements for Earth-gridded data sets. ISPRS International Journal of Geo-Information, 3, 1154–1156. https://doi.org/10.3390/ijgi3031154

Long, D. G., & Miller, J. Z. (2024). TRMM Precipitation Radar SIR-Enhanced EASE-Grid 2.0 Surface Radar Backscatter. Zenodo. https://doi.org/10.5281/zenodo.14582576

Tropical Rainfall Measuring Mission (TRMM) (2011), TRMM Precipitation Radar Surface Cross-Section L2 1.5 hours V7, Greenbelt, MD, Goddard Earth Sciences Data and Information Services Center (GES DISC), https://disc.gsfc.nasa.gov/datacollection/TRMM_2A21_7.html

7 DOCUMENT INFORMATION

7.1 Publication Date

February 2026

7.2 Date Last Updated

February 2026