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

USER GUIDE

How to Cite These Data

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

Brodzik, M. J., D. G. Long, and M. A. Hardman. 2025. *SMAP Radiometer Twice-Daily rSIR-Enhanced EASE-Grid 2.0 Brightness Temperatures, Version 3*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/8OULQIU7ZPSX [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NSIDC-0738

National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 Summary

The SMAP Radiometer Twice-Daily rSIR-Enhanced EASE-Grid 2.0 Brightness Temperatures (NSIDC-0738), Version 3 data set contains twice-daily, enhanced-resolution brightness temperature data produced by image reconstruction of the standard SMAP product, SMAP L1B Radiometer Half-Orbit Time-Ordered Brightness Temperatures (SPL1BTB). Data are available in the Northern Hemisphere, Southern Hemisphere, Temperate and Tropical, and Mid-Latitude (subset of Global) EASE-Grid 2.0 projections and on the 3 km, 3.125 km, 9 km, 25 km, and 36 km resolution grids.

NSIDC-0738 is a companion product for the Calibrated Enhanced-Resolution Passive Microwave Daily EASE-Grid 2.0 Brightness Temperature ESDR (NSIDC-0630) data set. NSIDC-0738 utilizes the same rSIR technique to derive brightness temperatures from SMAP as is used with the SMMR, SSM/I-SSMIS, AMSR-E, and AMSR2 sensors in NSIDC-0630.

NOTE: Current data coverage is for 01 January 2023 to present. Over time, data will be backfilled to 2015. As more data becomes available, this box will be updated.

1.2 Parameters

The main parameter for this data set is Brightness Temperature (Tb), measured in kelvins (K).

The range of values for channel F, the 4th Stokes parameter, is -50 to 50 K. The range for Tb for channels H and V is 50 to 350 K

Data files are produced for all dates within the date range. If no input data are available for a given data, data variables are stored as empty arrays.

Table 1 provides details regarding the parameters.

Table 1. Parameters

Parameter	Description	Units
crs	Coordinate reference system; EASE-Grid 2.0	For details, see Geolocation section of this document
Incidence_angle	Average incidence angle of the measurements used to derive T_b (all values are fill values as incidence angle is constant for SMAP)	degrees (°) measured clockwise from local North

Parameter	Description	Units
TB	Brightness Temperature (T_b). See File Naming Conventions table for details.	kelvin (K)
TB_num_samples	Number of measurements used to derive T_b	count
TB_std_dev	Standard deviation of the measurements used to derive T_b	kelvin (K)
TB_time	Average time of the measurements used to derive T_b	Minutes since 00:00:00 on the day of measurement
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.

Extensible Markup Language (.xml) files with associated metadata are also provided.

1.3.2 File Contents

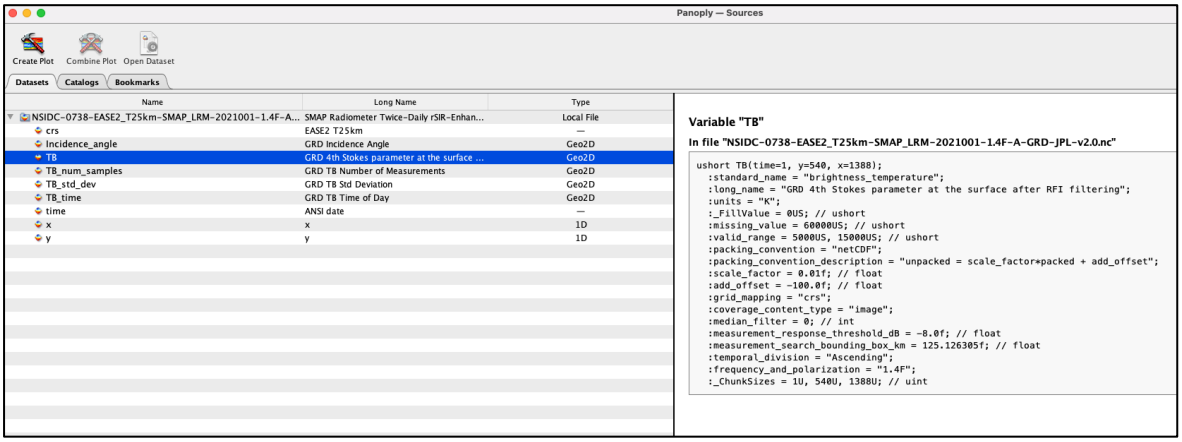

Figure 1. Sample of NetCDF file as seen in Panoply. On the left are listed the parameters, explained above in section 1.2. On the right, detailed metadata for each parameter.

1.3.3 Naming Convention

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

Sample File Name:

NSIDC0738_SIR_EASE2_N3.125km_SMAP_LRM_E_1.4H_20241231_2501071309_v3.0.nc

File Name Components

NSIDC0738_[algorithm]_EASE2_[GXXXXkm]_SMAP_LRM_[pass]_[channel]_
[date]_[processing_date]_[version].nc

Table 2. File Naming Convention

Variable	Description
NSIDC0738	NSIDC unique data set identifier
Algorithm	Specifies the algorithm used for the image reconstruction: GRD = drop-in-the-bucket SIR = radiometer version of Scatterometer Image Reconstruction
EASE2	EASE2-Grid 2.0 projection
GXXXXkm	Grid and resolution of data in the file: Grid = Northern (N), Southern (S), Temperate/Tropical (T), or Mid-Latitude (M) Resolution (in km) = ranges from 3 to 36 km
SMAP_LRM	Indicates the data are derived from the SMAP L-band radiometer
Pass	The direction or LTOD of the satellite passes used: The direction or local-time-of-day of the satellite pass: A = Ascending (T or M grids only) D = Descending (T or M grids only) M = Morning (N or S grids only) E = Evening (N or S grids only)
1.4channel	Channel (frequency + polarization), possible polarizations include: V = vertical H = horizontal F = 4th Stoke's parameter
Date	Reference date: 4-digit year, 2-digit month, 2-digit day [e.g. YYYYmmdd]
Processing date	Processing date and time: 2-digit year, 2-digit month, 2-digit day, 2-digit hour, 2-digit second (e.g., YYmmddhhss)
Version	Data set version number: vX.X for major/minor versions (e.g. v2.0)
.nc	NetCDF data formatting suffix

1.4 Spatial Information

1.4.1 Coverage

The spatial coverage for the entire data set is global. However, spatial coverage varies between data files. Data are available on the Northern Hemisphere, Southern Hemisphere, Mid-Latitude, and Temperate & Tropical EASE-Grid 2.0 projections.

1.4.2 Resolution

The spatial resolution of the data is 36 km. Temperate & Tropical data are available on 3.125 km. and 25 km grids. Mid-Latitude data are available on 3 km, 9 km, and 36 km grids. Northern and Southern Hemisphere data are available on all grids. See the Algorithm Theoretical Basis Document (Brodzik et al., 2024a) for details.

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 & Tropical and Mid-latitude)	EASE-Grid 2.0 Northern Hemisphere	EASE-Grid 2.0 Southern Hemisphere
Longitude of true origin	0	0	0
Latitude of true origin	30	90	-90
Scale factor at longitude of true origin	N/A	N/A	N/A
Datum	WGS 1984	WGS 1984	WGS 1984
Ellipsoid/spheroid	WGS 1984	WGS 1984	WGS 1984
Units	Meter	Meter	Meter
False easting	0	0	0
False northing	0	0	0
EPSG Projected CRS code	6933	6931	6932
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	+proj=laea +lat_0=90 +lon_0=0 +x_0=0 +y_0=0 +ellps=WGS84 +towgs84=0,0,0,0,0,0,0 +units=m +no_defs	+proj=laea +lat_0=-90 +lon_0=0 +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	http://epsg.io/6931	http://epsg.io/6932

1.5 Temporal Information

1.5.1 Coverage

31 March 2015 to the most recent processing. The full time series is being published in temporal batches. See the blue box in the “Summary” section for more details.

While these dates suggest a continuous sequence of data, users should note that some empty data files exist where input data were not available. For files with no available inputs, file level metadata will show a zero for "number_of_input_files”. For a comprehensive list of missing or bad data, please see the SMAP Master List of Bad and Missing Data.

1.5.2 Resolution

Temporal resolution is twice daily.

2 DATA ACQUISITION AND PROCESSING

2.1 Background

This data set applies the radiometer version of the Scatterometer Image Reconstruction (rSIR) technique to the passive microwave sensor, the NASA SMAP radiometer. This technique was originally developed and applied to the SMMR, AMSR-E, and SSM/I-SSMIS sensors; it has now been used to produce enhanced-resolution images from the SMAP radiometer. This data set is provided in the same format, with all the same high-quality metadata, as the Calibrated Enhanced-Resolution Passive Microwave Daily EASE-Grid 2.0 Brightness Temperature ESDR (NSIDC-0630) data set.

2.2 Acquisition

The input for this data set is the SMAP L1B Radiometer Half-Orbit Time-Ordered Brightness Temperatures, Version 6 (SPL1BTB) data set. Using the quality flag on the input data set, only the highest quality SPL1BTB measurements are used for image reconstruction.

2.3 Instrumentation

For a detailed description of the SMAP instrument, visit the SMAP Instrument page at the Jet Propulsion Laboratory (JPL) SMAP website.

2.4 Processing

This data set follows the same processing steps as the Calibrated Enhanced-Resolution Passive Microwave Daily EASE-Grid 2.0 Brightness Temperature ESDR (NSIDC-0630) data set. For details, see Long et al. (2019), the Algorithm Theoretical Basis Document for this data set (Brodzik et al., 2024a), the NSIDC-0630 ATBD (Brodzik et al, 2024b), and the NSIDC-0630 User Guide.

2.5 Quality, Errors, and Limitations

For a more detailed description of this data set, including estimates of resolution enhancement using numerical simulation, see Long et al., (2019). The effective resolution enhancement will change within a selected image as a function of orbital overlap, channel and polarization. An additional study that uses actual SMAP images to quantify resolution enhancement has found that the effective resolution enhancement of SMAP rSIR images at high latitude locations is 30-60% finer than conventionally processed gridded data (Long et al., 2021).

Due to differences in the input data sets, users should not mix data between NSIDC-0738 Versions 1, 2, and 3. Version 1 is derived from Version 4 of SPL1BTB, Version 2 uses Version 5 of SPL1BTB, and Version 3 uses Version 6 of SPL1BTB. See the SMAP Version History page (https://nsidc.org/data/smap/version-history) for more details on how the input product has changed.

3 VERSION HISTORY

The following table outlines version history.

Table 5. Version History Summary

Version	Date Implemented	Impacted Temporal Coverage	Description of Changes
3.0	October 2025	31 March 2015 to present	This version includes the following updates: • Updated all input SPL1BTB data to the latest L1 reprocessing, SPL1BTB v6. • Fixed a bug in v2 processing that was not properly excluding low-quality input swaths. • Updated filename convention to be consistent with NSIDC-0630 v2 conventions. • Replaced attribute missing_value with _FillValue to be consistent with NSIDC-0630 v2 conventions. • Updated file-level metadata to be consistent with NSIDC-0630 v2 conventions. • Processing is expected to continue in daily near real-time, rather than previous deliveries of annual data.

Version	Date Implemented	Impacted Temporal Coverage	Description of Changes
2.0	August 2021	31 March 2015 to 30 April 2021	This version includes the following updates: • Complete reprocessing with revised swath inputs • Updated all input SPL1BTB v5 data • Updated DAAC archive to 30 Apr 2021 • Commenced near real-time processing • No orbital drift, no change in ltod thresholds Fixed a bug in GRD time arrays that resulted in all time array data being set to earliest time stamp in the array
1.0	August 2019	31 March 2015 to 6 April 2019	Initial Release

4 RELATED DATA SETS

Calibrated Enhanced-Resolution Passive Microwave Daily EASE-Grid 2.0 Brightness Temperature ESDR (NSIDC-0630)

SMAP L1B Radiometer Half-Orbit Time-Ordered Brightness Temperatures, Version 6 (SPL1BTB)

SMAP Data at NSIDC | Overview

5 RELATED WEBSITES

SMAP at NASA JPL

6 REFERENCES

Brodzik, M. J., Long, D. G., & Hardman, M. A. 2024a. SMAP Twice-Daily rSIR-Enhanced EASE-Grid 2.0 Brightness Temperatures Algorithm Theoretical Basis Document, Version 3.0. https://doi.org/10.5281/zenodo.11069054

Brodzik, M. J., D. G. Long, and M. A. Hardman. 2024b. Calibrated Passive Microwave Daily EASE-Grid 2.0 Brightness Temperature ESDR (CETB) Algorithm Theoretical Basis Document, Version 2.1. https://doi.org/10.5281/zenodo.11626219

Long, D. G., M. J. Brodzik, and M. A. Hardman. 2019. Enhanced-Resolution SMAP Brightness Temperature Image Products. *IEEE Transactions on Geoscience and Remote Sensing* 57(7), 4151-4163. https://dx.doi.org/10.1109/TGRS.2018.2889427

Long, D. G., Brodzik, M. J., and M. A. Hardman. 2021. The Effective Resolution of CETB Image Products. NSIDC Special Report 21. Boulder CO, USA: National Snow and Ice Data Center. Available at: https://nsidc.org/sites/default/files/nsidc-special-report-21.pdf

7 DOCUMENT INFORMATION

7.1 Publication Date

October 2025

7.2 Date Last Updated

October 2025