MEaSUREs Calibrated Enhanced-Resolution Passive Microwave Daily EASE-Grid 2.0 Brightness Temperature ESDR, Version 1

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, M. A. Hardman, A. Paget, and R. Armstrong. 2016. *MEaSUREs Calibrated Enhanced-Resolution Passive Microwave Daily EASE-Grid 2.0 Brightness Temperature ESDR, Version 1. [*Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/MEASURES/CRYOSPHERE/NSIDC-0630.001. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NSIDC-0630

National Snow and Ice Data Center

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1 DATA DESCRIPTION

The Calibrated Enhanced Resolution Brightness Temperature (CETB) data set is a multi-sensor Level 3 Earth Science Data Record (ESDR) with improvements in cross-sensor calibration and quality checking, modern file formats, better quality control, improved projection grids, and local time-of-day (LTOD) processing (Brodzik and Long, 2018). These data are gridded to three EASE-Grid 2.0 projections (North Azimuthal, South Azimuthal, and Cylindrical) and include enhanced-resolution imagery, as well as coarse-resolution, averaged imagery. Inputs include brightness temperature data from the following instruments:

- Scanning Multichannel Microwave Radiometer (SMMR) on NIMBUS-7
- Special Sensor Microwave/Imager (SSM/I) on DMSP 5D-2/F8, F10, F11, F13, F14, DMSP 5D-3/F15
- Special Sensor Microwave Imager/Sounder (SSMIS) on DMSP 5D-3/F16, F17, F18, F19
- Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E) on AQUA

1.1 Parameters

The parameters for this data set are listed in Table 1.

Table 1. Parameters

Parameter	**Description**	**Fill Value**	**Missing Value**
TB	Brightness temperature	0.0	600.00
TB_time	Average time of the measurements used to derive TB	-32768	Not used
TB_std_dev	Standard deviation of the measurements used to derive TB	655.35	655.34
TB_num_samples	Number of measurements used to derive TB	0	Not used
Incidence_angle	Average incidence angle of the measurements used to derive TB	-0.01 (°)	Not used

1.2 File Information

1.2.1 Format

The data are in netCDF (.nc) format, using CF 1.6 (Climate and Forecast) and ACDD 1.3 (Attribute Conventions for Dataset Discovery) metadata conventions.

1.2.2 Directory Structure

For users retrieving data via direct HTTPS data access, the directories are organized by the date of the earliest data in them. The three equal-area projections are here denoted as Northern, Southern, and Temperate & Tropical. Files for the latter include data from 00:00 to 23:59.99, so all data correspond exactly to the date of file. For the Northern and Southern images, the files include data that may begin up to 6 hours earlier the day before and possibly 6 hours into the following day. These files are placed in the directory that matches the beginning of the data in the file, not the filename date.

For example, input data for a file from day X starts a couple hours prior to midnight UTC day X. This file will be in the directory for day X-1, and there will be no file in directory for day X.

Users who access the data through Earthdata Search are not affected by this organization method.

1.2.3 File Contents

Figure 1 contains example NetCDF data from 9 October 2013. All parameters listed in Table 1 are included, in addition to x (projected coordinate), y (projected coordinate), and time (days since 01 January 1972) variables.

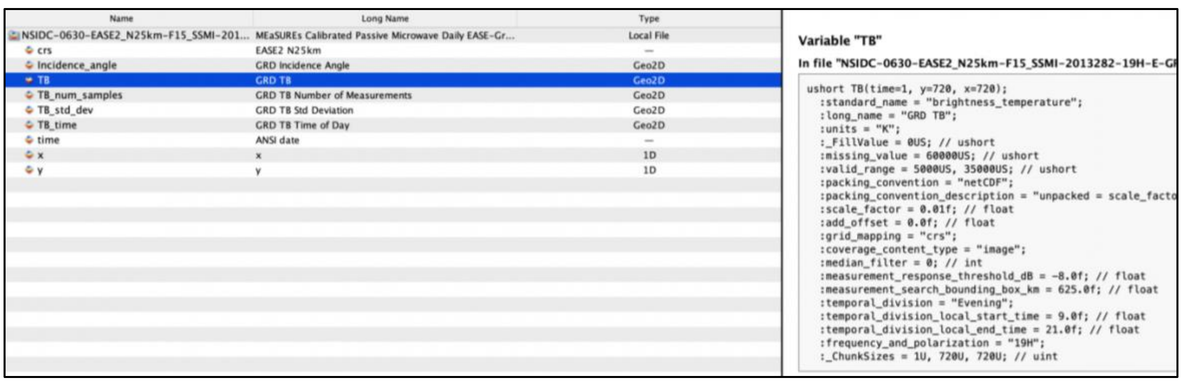

Figure 1. Sample NetCDF data from file `NSIDC-0630-EASE2_N25km-F15_SSMI-2013282-19H-E-GRD-CSU-v1.3.nc`. as displayed in the Panoply software. The data file contains the 19 GHz H-polarized measurements at the 25 km Northern Hemisphere resolution.

Figures 2-4 are examples of AMSR-E data from 27 September 2011. There is one image per projection (Southern, Temperate & Tropical, and Northern), with their spatial resolutions varying according to the frequency of the measurements.

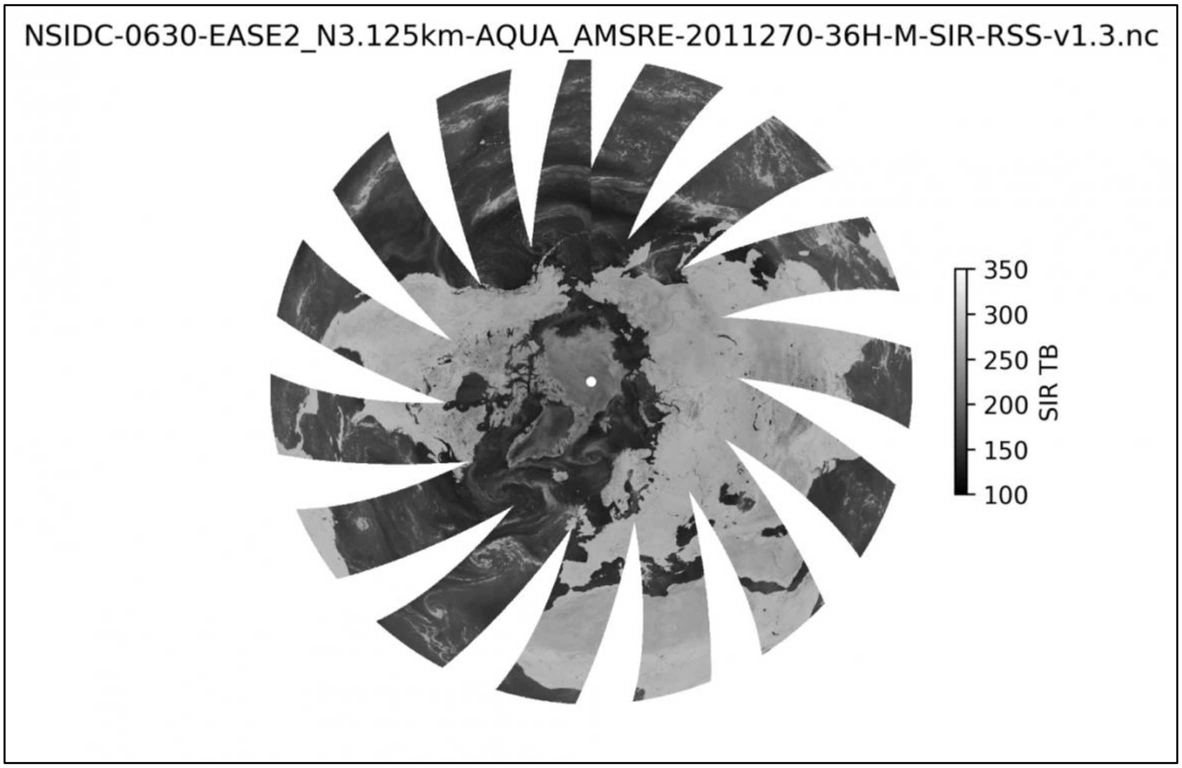

Figure 2. Northern Hemisphere sample image from file NSIDC-0630-EASE2_N3.125km-AQUA_AMSRE-2011270-36H-M-SIR-RSS-v1.3.nc. The image shows 36 GHz H-polarized TB (in Kelvin) at 3.125 km Enhanced Resolution; TB was derived using the rSIR method.

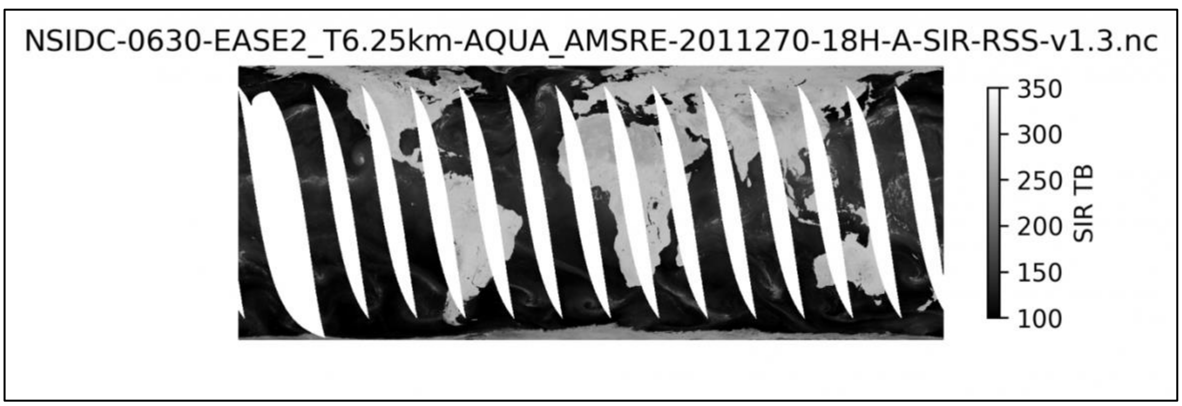

Figure 3. Temperate & Tropical sample image from file NSIDC-0630-EASE2_T6.25km-AQUA_AMSRE-2011270-18H-A-SIR-RSS-v1.3.nc. The image shows 18 GHz H-polarized TB (in Kelvin) at 6.25 km Enhanced Resolution; TB was derived using the rSIR method.

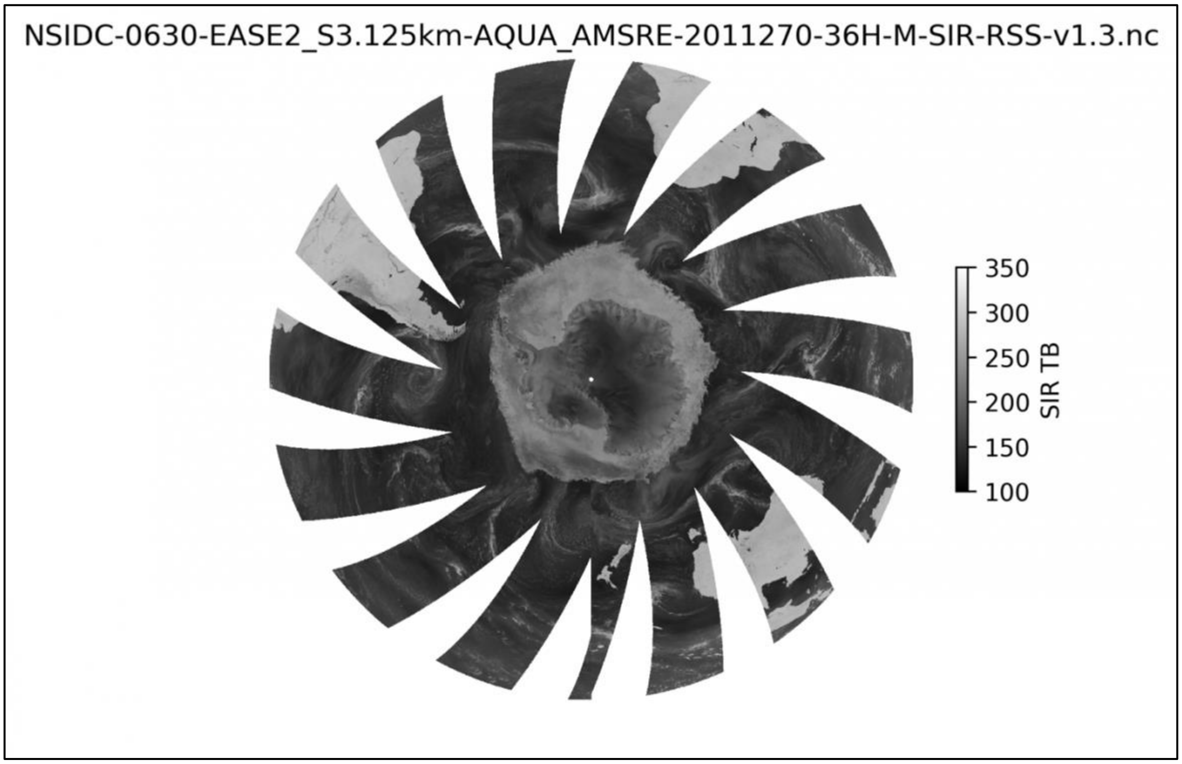

Figure 4. Southern Hemisphere sample image from file NSIDC-0630-EASE2_S3.125km-AQUA_AMSRE-2011270-36H-M-SIR-RSS-v1.3.nc. The image shows 36 GHz H-polarized TB (in Kelvin) at 3.125 km Enhanced Resolution; TB was derived using the rSIR method.

1.2.4 Naming Convention

Files are named according to the following convention and as described in Table 2:

```
NSIDC-0630-EASE2_[GXXXXkm]-[platform_sensor]-[yyyyddd]-[channel]-[pass]-
[algorithm]-[input]-[version].nc
```

Example file name:

```
NSIDC-0630-EASE2_N3.125km-F08_SSMI-1987304-37H-M-SIR-RSS-v1.3.nc
```

Table 2. File Name Variables

Variable	Description
`NSIDC-0630`	NSIDC unique data set identifier
`EASE2_`	EASE2-Grid 2.0 projection
`GXXXXkm`	Grid and resolution of data in the file: Grid = Northern (N), Southern (S), or Temperate & Tropical (T) Resolution (in km) = ranges from 3.125 to 25 km
`platform_sensor`	Satellite platform id and sensor: F08_SSMI NIMBUS7_SMMR F10_SSMI AQUA_AMSR-E F11_SSMI F16_SSMIS F13_SSMI F17_SSMIS F14_SSMI F18_SSMIS F15_SSMI F19_SSMIS
`yyyyddd`	Reference day: 4-digit year, 3-digit day of year
`channel`	Channel ID; differs by sensor: 2-digit frequency and 1-letter polarization (horizontal (H) or vertical (V)) [e.g. 37H]
`pass`	The direction or LTOD of the satellite passes used: A = Ascending (T grids only) D = Descending (T grids only) M = Morning LTOD (N or S grids only) E = Evening LTOD (N or S grids only)
`algorithm`	Specifies the algorithm used for the image reconstruction: GRD = drop-in-the-bucket (25 km grids) SIR = radiometer version of Scatterometer Image Reconstruction (enhanced-resolution grids)
`input`	Input data producer: CSU = Colorado State University Fundamental Climate Data Record (FCDR) CSU_ICDR = CSU Interim Climate Data Record RSS = Remote Sensing Systems
`version`	Data set version number: vX.X for major/minor versions (e.g. v1.3)
`.nc`	NetCDF data formatting suffix

1.3 Spatial Information

1.3.1 Coverage

Each data file contains one of three EASE-Grid 2.0 spatial coverages:

- Northern Hemisphere Lambert azimuthal equal-area
- Southern Hemisphere Lambert azimuthal equal-area
- Temperate & Tropical cylindrical equal-area projection (bounded by +/- 67° latitude).

1.3.2 Resolution

Each channel is processed at standard and enhanced resolutions. The standard grid resolution is 25 km, with enhanced-resolution grids defined in a nested fashion in powers of two: 12.5 km, 6.25 km, and 3.125 km (see Figure 5). All channels are gridded to 25 km, with higher resolutions dependent on channel frequency:

- Frequencies below 12 GHz are available at 25 km (standard) and 12.5 km (enhanced).
- Frequencies between 12 and 30 GHz are available at 25 km (standard) and 6.25 km (enhanced).
- Frequencies 30 GHz and above are available at 25 km (standard) and 3.125 km (enhanced).

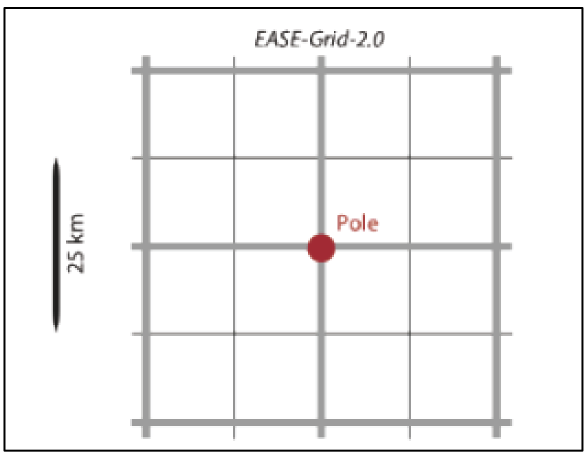

Figure 5. EASE-Grid 2.0 nesting relationship for 25 km and 12.5 km azimuthal grids at the pole. All CETB grids are nested analogously.

1.3.3 Geolocation

The following tables provide information for geolocating this data set. The data are gridded to EASE-Grid 2.0 projections, at various coverages and spatial resolutions, as defined in Table 3. For more details on EASE-Grid 2.0, please refer to the EASE Grids web pages.

Table 3. CETB EASE-Grid 2.0 Projections and Grid Dimensions

Name	Projection	Resolution (km)	Columns	Rows	Latitude Extent (degrees)
EASE2_N25km	Northern Lambert Azimuthal	25	720	720	0 – 90
EASE2_N12.5km	Northern Lambert Azimuthal	12.5	1440	1440	0 – 90
EASE2_N6.25km	Northern Lambert Azimuthal	6.25	2880	2880	0 – 90
EASE2_N3.125km	Northern Lambert Azimuthal	3.125	5760	5760	0 – 90
EASE2_S25km	Southern Lambert Azimuthal	25	720	720	-90 – 0
EASE2_S12.5km	Southern Lambert Azimuthal	12.5	1440	1440	-90 – 0
EASE2_S6.25km	Southern Lambert Azimuthal	6.25	2880	2880	-90 – 0
EASE2_S3.125km	Southern Lambert Azimuthal	3.125	5760	5760	-90 – 0
EASE2_T25km	Cylindrical Equal-Area	25.02526	1388	540	+/-67.0575406
EASE2_T12.5km	Cylindrical Equal-Area	12.51263	2776	1080	+/-67.0575406
EASE2_T6.25km	Cylindrical Equal-Area	6.256315	5552	2160	+/-67.0575406
EASE2_T3.125km	Cylindrical Equal-Area	3.128.15750	11104	4320	+/-67.0575406

1.4 Temporal Information

1.4.1 Coverage

Data are available from late October 1978 to present, though the exact temporal coverage varies by input sensor. Sensors that continue to operate are updated daily in near real-time (NRT). See Table 4 for the temporal availability by sensor.

Table 4. Temporal Coverage by Sensor

Sensor	Platform	Begin Coverage	End Coverage *
AMSR-E	AQUA	01 June 2002	04 October 2011
SSM/I	F08 F10 F11 F13 F14 F15	07 September 1987 08 December 1990 03 December 1991 03 May 1995 07 May 1997 23 February 2000	31 December 1991 14 November 1997 16 May 2000 19 November 2009 23 August 2008 09 August 2021
SSMIS	F16 F17 F18 F19	01 November 2005 01 March 2008 08 March 2010 27 November 2014	Near real-time Near real-time Near real-time 09 February 2016
SMMR	Nimbus	25 October 1978	20 August 1987
* End Coverage represents the end date for the majority of the granules.			

The three SSMIS sensors that continue to operate (F16, F17 and F18) are updated in near real-time, approximately daily within 24 hours of data acquisition. The CSU ICDR input data source is compatible with the CSU FCDR data source used for the historical processing. Users should consider the ICDR-derived data from these sensors as temporal extensions of the original FCDR-derived files (Berg et al, 2018). Time series analyses can be accomplished with the FCDR- and ICDR-derived SSM/I-SSMIS sensors.

Note: The most recent files in the NRT stream may not have used a complete set of input data. The NRT stream back-calculates 7 days from the date of processing, so the potentially incomplete files are updated on the following day.

The SMMR data are not cross-calibrated with the SSM/I-SSMIS data and should not be used for time series analysis with the other sensors. Likewise, the AMSR-E images, derived from a different input data producer using unrelated cross-calibration methods, should be analyzed separately from the remaining sensors.

1.4.2 Resolution

Data temporal resolution is twice daily. Temperate grids are separated by ascending/descending passes, while the Northern and Southern grids are separated by local time of day (LTOD).

Table 5 shows the beginning and ending times for the LTOD morning/evening split in hours after UTC midnight on the day of processing. For all platforms except AMSR-E, the LTOD split times are the same for the Northern and Southern hemispheres. All of the Northern and Southern grids in the data set were processed with these times. These values are stored as part of the metadata in the CETB files as an attribute of the TB data.

Table 5. LTOD Times

Platform	Year	Morning start time	Morning end time	Evening start time	Evening end time
F08	All years	0.0	12.0	12.0	24.0
F10	1990-1993	2.0	14.0	14.0	26.0
	1994	3.0	15.0	15.0	27.0
	1995-1997	4.0	16.0	16.0	28.0
F11	All years	0.0	12.0	12.0	24.0
F13	All years	0.0	12.0	12.0	24.0
F14	1997-2001	3.0	15.0	15.0	27.0
	2002-2004	2.0	14.0	14.0	26.0
	2005-2008	0.0	12.0	12.0	24.0
F15	2000-2005	3.0	15.0	15.0	27.0
	2006-2007	2.0	14.0	14.0	26.0
	2008-2011	0.0	12.0	12.0	24.0
	2012	-2.0	10.0	10.0	22.0
	2013-2021	-3.0	09.0	9.0	21.0
F16	2005-2007	3.0	15.0	15.0	27.0
	2008-2009	2.0	14.0	14.0	26.0
	2010-2011	1.0	13.0	13.0	25.0
	2012-2013	0.0	12.0	12.0	24.0
	2014	-1.0	11.0	11.0	23.0
	2015-2021	-2.0	10.0	10.0	22.0
F17	All years	0.0	12.0	12.0	24.0
F18	All years	0.0	12.0	12.0	24.0
F19	All years	0.0	12.0	12.0	24.0
SMMR	All years	6.0	18.0	18.0	30.0
AMSR-E	All years NH	5.0	17.0	17.0	29.0
	All years SH	8.0	20.0	20.0	32.0

2 DATA ACQUISITION AND PROCESSING

2.1 Background

The following sections describe CETB gridding algorithms. Please refer to Long and Brodzik (2016) for the theory of reconstruction techniques and complete details of the radiometer form of the Scatterometer Image Reconstruction (rSIR). The algorithm theoretical basis document (ATBD) for this data product (Brodzik and Long, 2018) also contains more details.

2.1.1 Coarse Resolution (GRD) Gridding Algorithms

The CETB standard resolution gridding procedure is a simple, “drop-in-the-bucket” average. The resulting data grids are designated GRD data arrays. For the "drop-in-the-bucket" gridding algorithm, the key information required is the location of the measurement. The center of each measurement geolocation is mapped to an output-projected grid cell. All measurements within the specified time period that fall within the bounds of a particular grid cell are averaged. This is the reported TB value for this pixel. Ancillary variables contain the number and standard deviation of included samples. The effective spatial resolution of the GRD product is defined by a combination of the pixel size and spatial extent of the 3dB antenna footprint size. Figure 6 provides a graphical representation of the standard resolution (25 km) of GRD measurements.

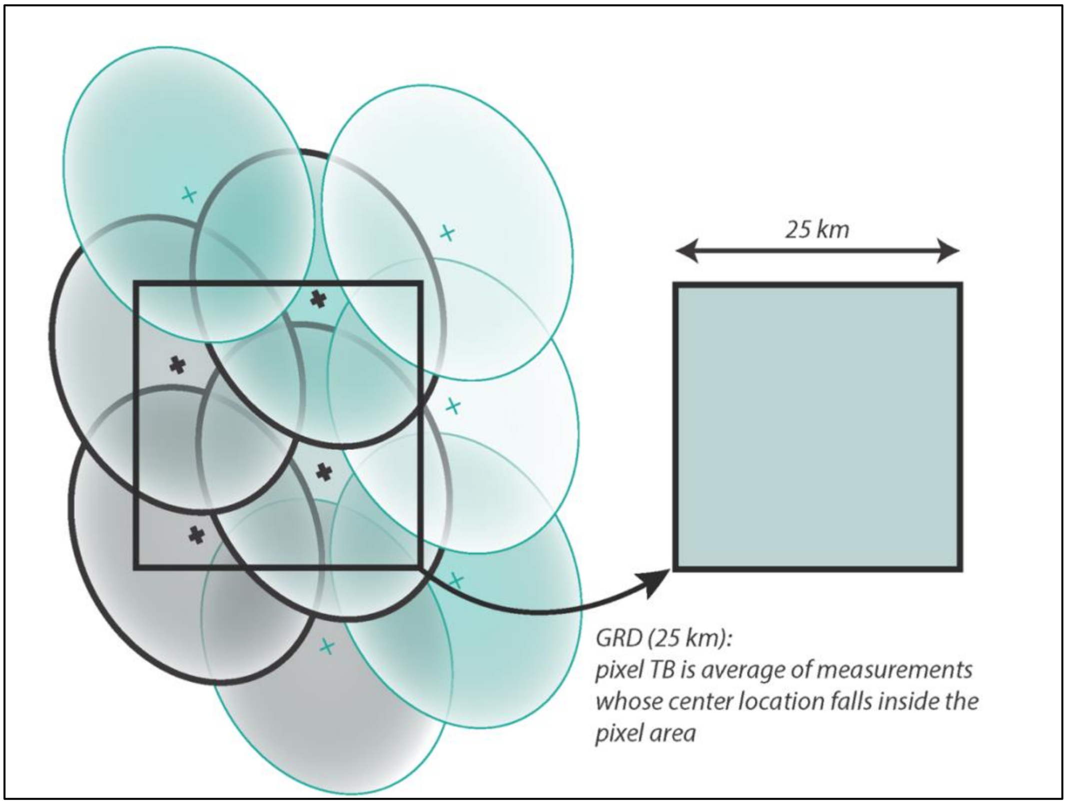

Figure 6. GRD 25 km Resolution

2.1.2 The radiometer version of the Scatterometer Image Reconstruction (rSIR) Algorithm

In addition to the standard GRD resolution (25 km), each channel is also available at one nested, enhanced resolution (12.5 km, 6.25 km, or 3.125 km); see Table 6 for more details. Enhanced resolutions are generated using the radiometer version of the Scatterometer Image Reconstruction (rSIR) algorithm. The rSIR algorithm defines a group of pixels centered at each grid point. Each pixel is then weighted based on the Measurement Response Function (MRF) to estimate the TB at the enhanced resolution location. The MRF is determined by the antenna gain pattern (which is unique for each sensor and sensor channel, and may vary with scan angle), the scan geometry (notably the antenna scan angle), and the integration period. Figure 6 provides a graphical representation of the enhanced resolution of rSIR measurements. For more details, see Long and Brodzik (2016) or Brodzik and Long (2018).

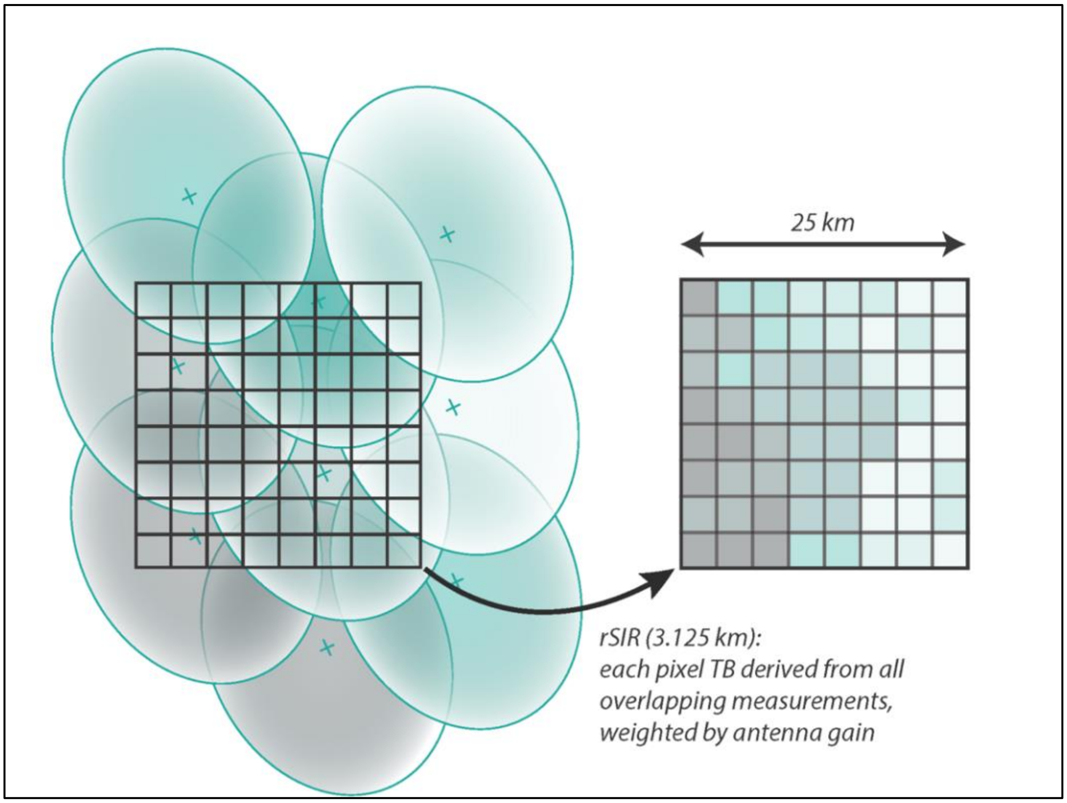

Figure 7. rSIR 3.125 km Resolution

Table 6. CETB Enhanced Resolution Grids

Sensor	Frequency (GHz)	Enhanced Resolution Grid (km)		
		12.5	6.25	3.125
SMMR	6	X		
	10	X		
	18		X	
	21		X	
	37			X
SSM/I	19		X	
	22		X	
	37			X
	85			X
SSMIS	19		X	
	22		X	
	37			X
	91			X
AMSR-E	6	X		
	10.7	X		
	18		X	
	23		X	
	36			X
	89			X

2.2 Acquisition

Table 7 lists all input data sets.

Table 7. Input Data Sources

Sensor	Temporal Coverage	Input Swath Data
SMMR	1978-1987	Nimbus-7 SMMR Pathfinder Brightness Temperatures, Version 1 (NSIDC-0036)
SSM/I-SSMIS	1987-2019	CSU FCDR (http://rain.atmos.colostate.edu/FCDR/)
	2020-present	CSU ICDR (http://rain.atmos.colostate.edu/FCDR/)
AMSR-E	2002-2011	AMSR-E/Aqua L2A Global Swath Spatially-Resampled Brightness Temperatures, Version 3 (AE_L2A)

2.3 Processing

There are two general processing steps in generating the CETB product. These include data set pre-processing for spatial and temporal selection and gridding (both standard and enhanced resolutions).

2.3.1 Data set preprocessing

The first stage of processing includes ingesting the raw swath TB and performing initial data and temporal selections. Only the highest quality TB measurements are used to ensure the most reliable data set. Swath data are mapped to output grids by measurement geolocation and LTOD.

All of the CETB passive microwave sensors fly on near-polar, sun-synchronous satellites, which maintain an orbital plane with an orientation that is (approximately) fixed with respect to the sun. Thus, the satellite crosses the equator on its ascending (northbound) path at approximately the same LTOD. The resulting coverage pattern yields passes about 12 hours apart in LTOD at the equator. Most locations near the pole are observed several times per day. Analysis shows that the data from a single sensor fall into two LTOD ranges for polar measurements. The two periods are typically less than 4 hours long and spaced 8 or 12 hours apart. Significantly, due to the orbit repeat cycle, two succeeding days at any particular location may make measurements at different LTOD, and therefore, at different times during the diurnal cycle (Gunn, 2007), introducing undesired variability into a time series analysis.

The CETB azimuthal (Northern or Southern) grids are split into two images per day based on the LTOD approach of Gunn and Long (2008). This ensures that all measurements in any one image have consistent spatial/temporal relationships. Complete analysis of the LTOD split times by sensor and time period is included in Appendix 8.4 of the ATBD (Brodzik and Long 2018). The CETB adopts the LTOD division scheme for the Northern and Southern hemispheres. For the Temperate grids the data are divided into ascending and descending passes.

Each file includes gridded arrays of the following variables: TB, number of contributing measurements, as well as the average time, standard deviation, and average incidence angle of contributing measurements used to derive the TB at each pixel. This enables investigators to explicitly account for the LTOD temporal variation of the measurements included in a particular pixel.

2.3.2 Gridding

CETB products are generated on standard resolution grids for all channels using a low-noise “drop-in-the-bucket” average (GRD algorithm), and enhanced-resolution grids using rSIR image reconstruction techniques (Long and Brodzik, 2016). For enhanced-resolution grids, the effective resolution depends on the number of measurements and the precise details of their overlap, orientation, and spatial locations; information about the antenna gain pattern, scan geometry, and integration period are required to compute the effective measurement response function (MRF). The MRF describes how much the emissions from a particular direction affect the observed TB value. For each sensor and channel, the MRF is modeled as a two-dimensional Gaussian using the 3-dB footprint size (Long and Brodzik, 2016). While Long and Brodzik (2016) use numerical simulation to analyze the theoretical resolution enhancement technique, Long et al. (2021) use actual CETB data to estimate effective resolution by sensor and channel. See Table 8 for the field-of-view values.

Table 8. Effective Field of View

Sensor	Frequency (GHz)	Semi-major (km)	Semi-minor (km)
SSM/I	19 H, V	69	43
	22 V	60	40
	37 V	37	28
	37 H	37	29
	85 H, V	15	13
SSMIS	19 H, V	72	44
	22 V	72	44
	37 H, V	44	26
	91 H, V	15	9
AMSR-E	6 H, V	75	43
	10.7 H, V	51	29
	18 H, V	27	16
	23 H, V	32	18
	36 H, V	14	8
	89 (H or V)	7	4
	89 (H or V)	6	4
SMMR	6.6 H, V	121	79
	10.7 H, V	74	49
	18 H, V	44	29
	21 H, V	38	24
	37 H, V	21	14

2.4 Quality, Errors, and Limitations

2.4.1 Empty pixels in GRD images

In cases where no swath measurement center locations were mapped to the area of a gridded pixel, GRD images will occasionally have single pixels with no data. Normally, rSIR images do not suffer from this problem, because the rSIR gain threshold is set to a value that almost always ensures at least one component measurement that can be used to derive the pixel TB. However, beginning on 04 Nov 2004, the AMSR-E 89 GHz A-horn developed a permanent problem that resulted in a loss of observations for the remaining life of AMSR-E. After this date, the rSIR 3.125 km 89 GHz data does occasionally have missing pixels (Beitsch et al., 2014).

2.4.2 Missing Dates

CETB files are produced for every day in the temporal coverage of each sensor. For dates with no data, data files exist with all variables set to "_FillValue."

2.4.3 Incomplete Image Reconstruction at Latitudinal Grid Boundaries

Not all possible input measurements were used in the image reconstruction at the high-latitude edges of the Temperate grids and at the equatorial edges of the Northern and Southern grids. Although the reconstructed TB at these locations are not erroneous, they are not as accurate as the reconstructed TB that make use of all input measurements.

The user is encouraged to exercise caution when analyzing data within approximately 20 km of these boundaries. To access the most accurate image reconstruction results, the user is advised to use the Northern or Southern grids to analyze mid- to high-latitude regions, and the Temperate grids to analyze regions near the equator. For example, when analyzing CETB 6.25 km rSIR Temperate images, switch to the Northern grid to analyze images within 3 pixels of the northern boundary. Analogously, when analyzing CETB 6.25 km rSIR Northern images, switch to the Temperate grid to analyze images within 3 pixels of the equator.

Note: the eastern and western boundaries of the Temperate grids (i.e., 180º E and 180º W) do not exhibit this problem, as all input measurements were included in the image reconstruction at these locations.

2.4.4 DMSP-F17 37V Channel

Beginning in April 2016, TB values from the DMPS-F17 37V channel may have all 0 K or NaN values. These TB could not be computed because the data were missing or flagged as too low quality in the input file.

2.4.5 GRD TB_time Array Errors

CETB GRD files through v1.4 contain erroneous values in the TB_time variable. The data are incorrectly set to the start time, instead of the actual time of measurements used to derive each pixel TB. This error has been identified and corrected with forward processing of v1.5 (from January 2020 onwards); future reprocessing will correct this error for data prior to 2020.

2.4.6 Quality

For a comparison to other passive microwave data sets, please see the Algorithm Theoretical Basis Document (Brodzik and Long 2018).

2.5 Instrumentation

For a detailed description of the instruments used to acquire the data, see the following Technical References:

- SMMR, SSM/I, and SSMIS Sensors Summary
- AMSR-E Instrument Description

Table 9 provides a list of the channels for each instrument.

Table 9. CETB Product Sensors and Channels

Sensor	Channel Frequency (GHz) and Polarization
SMMR	6H, 6V, 10H, 10V, 18H, 18V, 21H, 21V, 37H, 37V
SSM/I	19H, 19V, 22V, 37H, 37V, 85H, 85V
SSMIS	19H, 19V, 22V, 37H, 37V, 91H, 91V
AMSR-E	6H, 6V, 10.7H, 10.7V, 18H, 18V, 23H, 23V, 36H, 36V, 89H, 89V

3 SOFTWARE AND TOOLS

CETB netCDF Files contain comprehensive CF- and ACDD-compliant metadata that is understood by multiple software packages and reprojection tools. In particular, EPSG codes and proj4 strings are defined for the EASE-Grid 2.0 proejctions, and GDAL tools can be used to easily translate CETB data arrays to GeoTIFF files (Brodzik et al., 2018).

Geolocation files for this data set are in netCDF (`.nc`) format and are located here: ftp://sidads.colorado.edu/pub/tools/easegrid2/. File names indicate the grids for each file: Northern (N), Southern (S), or Temperate & Tropical (T). For example, `EASE2_N12.5km.geolocation.v0.9.nc` corresponds to the 12.5 km resolution grid in the Northern Hemisphere.

4 VERSION HISTORY

Table 10. Version History

Version	Date Published	Description of Changes
1.5	23 September 2021	• Temporal update through present, derived from CSU ICDR • Ongoing updates for F16, F17, and F18 will now be produced in daily near real-time • Corrected bug in GRD time arrays that was setting all pixels to the earliest time in the file.
1.4	26 May 2020	• Temporal update through 30 December 2019 for data derived from the SSM/I DMSP-F-15 sensor and the SSMIS DMSP-F16, -F17, and -F18 sensors. • File-level metadata updated to acknowledge new funding sources and reflect changes to the data citation.
1.3	14 June 2018	See the Appendix – Corrections made to Version 1.3 for details
1.2	26 September 2017	For the AMSR-E-derived data, changes include: • Adding missing input data for the first day of the month in the Northern Hemisphere and Southern Hemisphere projections • Changing the size of the time dimension from 1 to "unlimited" • Adding files for dates with no data For SSMI-derived data, corrected the handling of QC flags to retain more data, eliminating only the flagged data in a given channel and taking care not to eliminate data in other channels Includes data derived from the following additional sensors: • SSM/I on DMSP-F15 • SSMIS on DMSP-F16 • SSMIS on DMSP-F17 • SSMIS on DMSP-F18 • SSMIS on DMSP-F19 • SMMR on Nimbus
1.1	03 May 2017	First public release. Includes data derived from the following additional sensors: • SSM/I on DMSP-F08 • SSM/I on DMSP-F10 • SSM/I on DMSP-F11 • SSM/I on DMSP-F13 • SSM/I on DMSP-F14
1.0	December 2016	Internal release, only contained AMSR-E-derived data

5 RELATED DATA SETS

- DMSP SSM/I-SSMIS Pathfinder Daily EASE-Grid Brightness Temperatures
- Near-Real-Time DMSP SSM/I-SSMIS Pathfinder Daily EASE-Grid Brightness Temperatures
- AMSR-E/Aqua Daily EASE-Grid Brightness Temperatures

- Nimbus-7 SMMR Pathfinder Daily EASE-Grid Brightness Temperatures
- Enhanced-Resolution SSM/I and AMSR-E Daily Polar Brightness Temperatures

6 RELATED WEBSITES

NASA MEaSUREs Research Project: EASE-Grid 2.0 TB ESDR

Scatterometer Climate Record Pathfinder

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9 DOCUMENT INFORMATION

9.1 Publication Date

22 December 2016

9.2 Date Last Updated

23 September 2021

APPENDIX – CORRECTIONS MADE TO VERSION 1.3

Version 1.3 renders all previous versions of this data set obsolete; users should update their files accordingly. The Version 1.3 release included a reprocessing of all data to implement the improvements described below:

Correction #1. Some morning grids were incorrectly classified as Evening data and vice-versa. For example, Morning passes for day N were mislabeled as Evening passes for day N-1. All Morning/Evening classifications for the Northern and Southern grids are correct starting with Version 1.3.

Correction #2. Adjusted 85, 89, and 91 GHz channel gain thresholds. All the data from the affected channels were originally processed with a gain threshold of 8 dB resulting in an excess of missing pixels. The threshold was adjusted to 12 dB in Version 1.3 to minimize missing pixels.

Correction #3. Originally Temperate grid processing did not include the final orbit from the prior calendar day, which may have included data from current day at the end of the swath. At worse, this would have eliminated up to 34 minutes of data at the beginning of the day; in most cases, it was much less than that. Temperate grid processing now includes all data from the beginning of the intended calendar day.

Correction #4. All Northern and Southern grid data were correctly processed into LTOD Morning and Evening divisions using the values in Table A1, but were reported incorrectly in the metadata. The error occurred only for split times that were different from 0.0-12.0-12.0-24.0. Where the errors occur, they were for the start time in the morning grids and for the end time in the evening grids. In each case the incorrect value was set to 0.0. For example, if the LTOD split times were 0300 and 1500, then the morning start time was incorrectly reported as 0.0 and the end time was correctly reported as 15.0. Similarly, the evening start time was correctly reported as 15.0 and the evening end time was incorrectly reported as 0.0. The affected metadata fields are:

- TB: temporal_division_local_start_time for M (morning) files in the N or S projections
- TB: temporal_division_local_end_time for E (evening) files in the N or S projections

Beginning in Version 1.3, all LTOD for the Northern and Southern grid data are correctly reported in the metadata.

Table A - 1. LTOD Crossing Times

Platform	Year	Morning start time	Morning end time	Evening start time	Evening end time
F08	All years	0.0	12.0	12.0	24.0
F10	1990-1993	2.0	14.0	14.0	26.0
F10	1994	3.0	15.0	15.0	27.0
F10	1995-1997	4.0	16.0	16.0	28.0
F11	All years	0.0	12.0	12.0	24.0
F13	All years	0.0	12.0	12.0	24.0
F14	1997-2001	3.0	15.0	15.0	27.0
F14	2002-2004	2.0	14.0	14.0	26.0
F14	2005-2008	0.0	12.0	12.0	24.0
F15	2000-2005	3.0	15.0	15.0	27.0
F15	2006-2007	2.0	14.0	14.0	26.0
F15	2008-2011	0.0	12.0	12.0	24.0
F15	2012	-2.0	10.0	10.0	22.0
F15	2013-2016	-3.0	09.0	9.0	21.0
F16	2005-2007	3.0	15.0	15.0	27.0
F16	2008-2009	2.0	14.0	14.0	26.0
F16	2010-2011	1.0	13.0	13.0	25.0
F16	2012-2013	0.0	12.0	12.0	24.0
F16	2014	-1.0	11.0	11.0	23.0
F16	2015-2017	-2.0	10.0	10.0	22.0
F17	All years	0.0	12.0	12.0	24.0
F18	All years	0.0	12.0	12.0	24.0
F19	All years	0.0	12.0	12.0	24.0
SMMR	All years	6.0	18.0	18.0	30.0
AMSR-E	All years NH	-5.0	7.0	7.0	19.0
AMSR-E	All years SH	-4.0	8.0	8.0	20.0

Correction #5. At calendar year crossovers, data from the prior year (Dec 31) were not included in Jan 1 data, and data from the following year (Jan 1) were not included in Dec 31 data. Version 1.3 corrected this processing so that calendar year crossovers include data from Dec 31 and Jan 1, respectively.

Correction #6. Under rare, but not impossible conditions, occasional ascending scanlines were incorrectly classified as descending, and vice-versa. These incorrect classifications were fixed beginning with Version 1.3.

Correction #7. Prior to Version 1.3, static LTOD split times were used for the duration of the F16 record, but orbital drift required changing split times. LTOD split times became progressively more offset over the lifetime of the sensor, so that the static LTOD split times were eventually off by 5 hours, resulting in morning data being incorrectly classified as evening data and vice-versa. LTOD shifts due to orbital drift were corrected starting with Version 1.3.

Correction #8. Version 1.3 corrected the split times for the Northern grids, which were off by 2 hours. This correction only applied to AMSR-E-derived data.