AMSR-E/AMSR2 Unified L2B Half-Orbit 25 km EASE-Grid Surface Soil Moisture, Version 1

USER GUIDE

How to Cite These Data

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

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

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

National Snow and Ice Data Center

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Surface soil moisture

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1.2.1 Format

Level-2B soil moisture data consist of point data in Hierarchical Data Format - Earth Observing System5 (HDF-EOS5) format where the resulting grid is in a table format rather than a grid that image processing programs can easily visualize. Files contain core metadata, product-specific attributes, and data fields. The data fields are summarized in Tables 2 which use the data types in Table 1 in the field descriptions:

Table 1. Data Types

Notation	Description
Float64:	64-bit (8-byte) floating-point integer
Float32:	32-bit (4-byte) floating-point integer
Int32:	32-bit (4-byte) signed integer

Note: The number of records per granule depends on the number of gridded points over land.

Table 2.Data Fields

Field Name	Data Type	Description	Units	Fill Value
Time	Float64	Scan start time in International Atomic Time in seconds with 01 January 1993 00:00:00 as the zero base (TAI93).	Seconds	n/a
Latitude	Float64	Latitude of the center of a 25-km EASEv1-Grid cell (-90.0 to 90.0)	degrees	99 / 98
Longitude	Float64	Longitude of the center of a 25-km EASEv1-Grid cell (-180.0 to 180.0)	degrees	999 / 998
RowIndex	Int32	EASE-Grid row index (1-586)	n/a	-9999
ColumnIndex	Int32	EASE-Grid column index (0-1382)	n/a	-9999

Field Name	Data Type	Description	Units	Fill Value
TBH10r2*	Float32	10.7 GHz H-polarized brightness temperature (TB)	K	-9999
TBV10r2	Float32	10.7 GHz V-polarized TB	K	-9999
TBH18r2	Float32	18.7 GHz H-polarized TB	K	-9999
TBV18r2	Float32	18.7 GHz V-polarized TB	K	-9999
TBH23r2	Float32	23.8 GHz H-polarized TB	K	-9999
TBV23r2	Float32	23.8 GHz V-polarized TB	K	-9999
TBH36r2	Float32	36.5 GHz H-polarized TB	K	-9999
TBV36r2	Float32	36.5 GHz V-polarized TB	K	-9999
TBH89r2	Float32	89.0 GHz H-polarized TB	K	-9999
TBV89r2	Float32	89.0 GHz V-polarized TB	K	-9999
VegetationRoughnessNPD	Float32	Vegetation roughness	n/a	-9999
SoilMoistureNPD	Float32	Soil moisture as determined by the NPD algorithm	cm^3/cm^3	-9999
RetrievalQualityFlagNPD	Int32	Value: 0= valid retrieval, 1= invalid retrieval	n/a	-9999
SoilMoistureSCA	Float32	Soil moisture as determined by the SCA algorithm, measured in volume fraction of water/soil	cm^3/cm^3	-9999
RetrievalQualityFlagSCA	Int32	Value: 0= valid retrieval, 1= invalid retrieval	n/a	-9999
FlagCountAllSamples**	Int32	Number of TB footprints	n/a	n/a
FlagCountGoodSamples	Int32	Number of good TB footprints	n/a	n/a
FlagCountRFI	Int32	Number of RFI contaminated TB footprints	n/a	n/a
FlagCountInvalidTBRange	Int32	Number of out of range TB footprints	n/a	n/a
FlagCountWater	Int32	Number of TB footprints over water	n/a	n/a
FlagCountIce	Int32	Number of TB footprints over ice	n/a	n/a
FlagCountSnow	Int32	Number of TB footprints over snow	n/a	n/a
FlagCountFrozenGround	Int32	Number of TB footprints over frozen ground	n/a	n/a
FlagCountRain	Int32	Number of TB footprints over rain	n/a	n/a

Field Name	Data Type	Description	Units	Fill Value
FlagCountWetland	Int32	Number of TB footprints over wetland	n/a	n/a
FlagCountUrban	Int32	Number of TB footprints over an urban area	n/a	n/a
FlagCountLow2ModerateVWC	Int32	Number of TB footprints over low to moderate vegetation water content	n/a	n/a
FlagCountDenseVWC	Int32	Number of TB footprints over dense vegetation water content	n/a	n/a
FlagCountMissingSoilTexture	Int32	Numberof TB footprints over missing soil texture data	n/a	n/a
FlagCountMissingNDVI	Int32	Number of TB footprints over missing NDVI data	n/a	n/a

*All gridded Brightness Temperatures are derived from the JAXA L1R Resolution 2 (resolution of the 10 GHz channels) TB data.

**All SCA flag values are related to pixels initially identified as land. All SCA flag values are per grid cell.

1.2.2 Sample Data Record

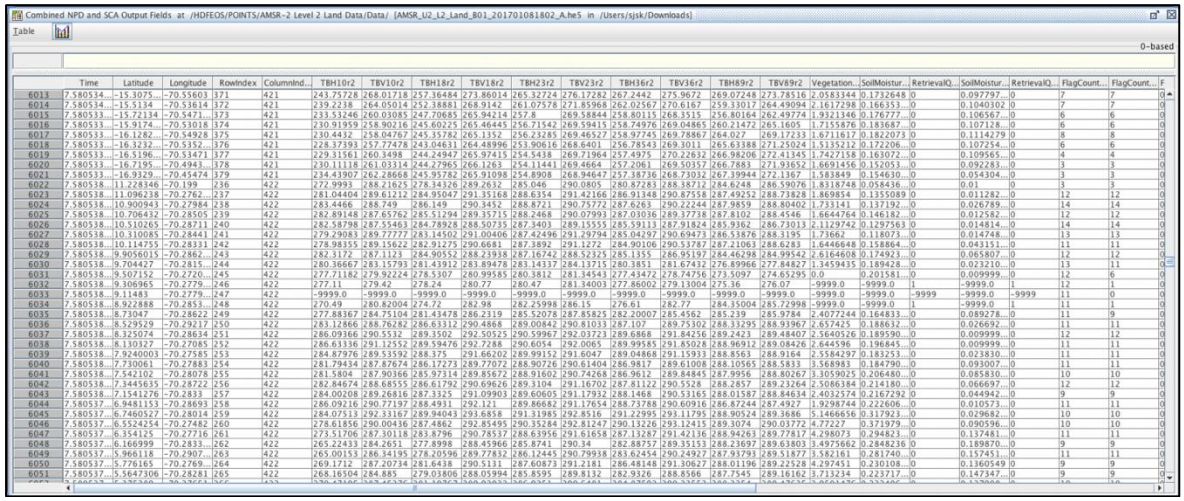

Figure 1. Sample of some data fields for Soil Moisture

1.2.3 File Contents

Each half-orbit granule is on the average 1.8 MB. The actual size depends on the number of gridded points over land. The volume of the data set is ~11.9 MB/day.

1.2.4 Naming Convention

This section explains the file naming convention used for this product with an example. The date and time correspond to the first scan of the granule.

Example file name: AMSR_U2_L2_Land_B02_201610260414_D.h5

AMSR_Ui_L2_Land_X##_yyyymmddhhmm_f.he5

Refer to Table 3 for the valid values for the file name variables listed above.

Table 3. Valid Values for the File Name Variables

Variable	Description
AMSR	Satellite sensor
Ui	Indicates the sensor used (i=2 for AMSR2)
L2	Level-2 data
X	Product Maturity Code (Refer to Table 4 for valid values.)
##	version number
yyyy	four-digit year
mm	two-digit month
dd	two-digit day
hh	hour, listed in UTC time, of first scan in the file
mm	minute, listed in UTC time, of first scan in the file
f	orbit direction flag (A = ascending, D = descending)
he5	HDF-EOS5 data format

Table 4. Valid Values for the Product Maturity Code

Product Maturity Code	Description
P	Preliminary - refers to non-standard, near-real-time data available from NSIDC. These data are only available for a limited time until the corresponding standard product is ingested at NSIDC.
B	Beta - indicates a developing algorithm with updates anticipated.
T	Transitional - period between beta and validated where the product is past the beta stage, but not quite ready for validation. This is where the algorithm matures and stabilizes.
V	Validated - products are upgraded to Validated once the algorithm is verified by the algorithm team and validated by the validation teams. Validated products have an associated validation stage. Refer to Table 5 for a description of the stages.

1.3 Spatial Information

1.3.1 Coverage

Coverage is global between 89.24° N and 89.24° S, except for snow-covered and densely-vegetated areas. See AMSR-E Pole Hole page for a description of holes that occur at the North and South Poles. The swath width is 1450 km. The flowing map shows the typical coverage of a single granule.

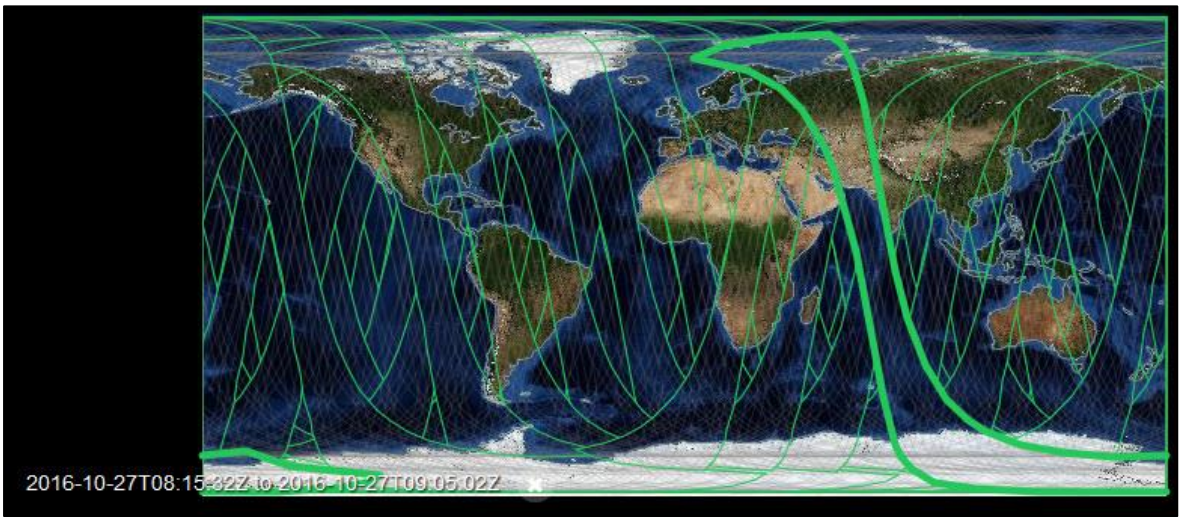

Figure 2. Spatial Coverage for Oct. 27, 2016

1.3.2 Resolution

Input brightness temperature data for all channels are resampled to a global cylindrical 25 km EASE-Grid cell spacing and have an effective spatial resolution of approximately 48 km (resolution of the 10.7 GHz channel).

1.3.3 Geolocation

The projection is EASE-Grid.

1.3.3.1 Grid Description

Level-1R brightness temperatures are resampled to a global cylindrical EASE-Grid (1383 columns by 586 rows) with a nominal grid spacing of 25 km (true at 30° S). The data consist of HDF-EOS point data where the resulting grid is in table format, rather than a grid that image processing programs can easily visualize. In the case of the Level-2R soil moisture data, each geophysical variable value has a corresponding EASE-Grid row and column index.

Please refer to EASE-Grid for more information on related products and tools.

Temporal Information

1.4.1 Coverage

Temporal coverage is July 02, 2012 to present for AMSR2 data.

1.4.2 Resolution

Each swath spans approximately 50 minutes. The data sampling interval is 2.6 msec per sample for the 6.9 GHz to 36.5 GHz channels, and 1.3 msec for the 89.0 GHz channel. A full scan takes approximately 1.5 seconds. Both AMSR-E and AMSR2 collect 243 data points per scan for the 6.9 GHz to 36.5 GHz channels, and 486 data points for the 89.0 GHz channel.

2 DATA ACQUISITION AND PROCESSING

NOTE: Backprocessing of the AMSR-E and AMSR2 data is ongoing. Forward processing continues for the AMSR2 data.

2.1 Acquisition

The AMSR-U data consists of resampled L1R brightness temperatures, geolocation information, metadata, quality assessment flags, and ancillary data from two sensors: AMSR-E and AMSR2.

2.2 Processing

Processing of the AMSR-E/AMSR2 Unified data set includes both an updated Normalized Polarization Difference (NPD) algorithm and the first standard Single Channel Algorithm (SCA). NPD and SCA codes are integrated together to create consistent AMSR-E and AMSR2 soil moisture products. Due to radio frequency interference (RFI) observed in the C-band, both algorithms use X-band observations to derive the soil moisture product. For more information regarding these two algorithms, please see AMSR2 Global Soil Moisture Retrievals Using the Normalized Polarization Difference (NPD) Algorithm and Single Channel Algorithm (SCA).

2.2.1 NPD Algorithm

The foundation of this algorithm is the use of the Microwave Polarization Difference Index (MPDI), which uses normalized polarization differences of the AMSR channel TB. Normalized polarization difference is the difference between the vertical and horizontal TB at a given frequency divided by their sum. The MPDI can be approximated in a form that is independent of surface temperature and has separable soil moisture and vegetation dependencies. See Njoku and Chan 2006 and ATBD referenced above for a more detailed explanation. Also, refer to Njoku et al. (2004) for an assessment of calibration biases over land, and methods used to correct these biases.

2.2.2 SCA Algorithm

The SCA approach uses horizontally polarized (h-pol) TB observations from the lowest frequency channel available (in this case, 10.7 GHz) due to its highest sensitivity to soil moisture observations. The SCA approach is based on the simplified radiative transfer model developed under the assumption of minimal atmospheric contribution and equal canopy and soil temperature (Jackson 1993). The SCA is applied to the individual AMSR-E footprint TB observations (L2) to produce a swath-based time-order product.

In the SCA approach, TBs are converted to emissivity using a surrogate for the effective physical temperature (T) of the emitting layer. The derived emissivity (eobs) is corrected for vegetation and surface roughness to obtain the smooth soil emissivity (esmooth). At this point, the Fresnel equation is used to determine the dielectric constant of the soil-water mixture (k). As a last step, the AMSR-E SCA uses Wang and Schmugge (1980) dielectric mixing model to estimate soil moisture (SM). For more detailed information, refer to the ATBD mentioned above.

2.2.3 Processing Steps

AMSR-U consists of the completed AMSR-E dataset and the ongoing AMSR2 dataset, processed using the JAXA L1R as input and joint algorithms (NPD and SCA) for processing. All L1R input data is ingested via internet transfer to the Science Investigator-led Processing System (SIPS) at the Global Hydrology Resource Center Distributed Active Archive Center (GHRC). A granule is defined as one-half of one orbit, the division being at the poles, so that a granule is descending (North Pole to South Pole) or ascending (South Pole to North Pole). There are approximately 29 Level 1R granules per day. The AMSR-U Level 2B land product is generated at the AMSR SIPS and includes metadata and browse imagery. These data are re-mapped to a 25 km Equal-Area Scalable Earth Grid (EASE-Grid). Each granule is stored in HDF-EOS5 format. More information is forthcoming.

2.3 Quality, Errors, and Limitations

Each HDF-EOS file contains core metadata with Quality Assessment (QA) metadata flags, RetrievalQualityFlagNPD and RetrievalQualityFlagSCA, that are set by the SIPS-GHRC prior to delivery to NSIDC. A separate metadata file (.xml file extension) is also delivered to NSIDC with the HDF-EOS file; it contains the same information as the core metadata. Three levels of QA are conducted with the AMSR-E Level 2: automatic, operational, and science QA. If a product does not fail QA, it is ready to be used for higher-level-processing, browse generation, active science QA, archive, and distribution. If a granule fails QA, SIPS does not send the granule to NSIDC until it is reprocessed (Conway 2002).

2.4 Instrumentation

2.4.1 Description

For detailed descriptions of the AMSR-E and AMSR2 instruments, refer to the AMSR-E Instrument Description and AMSR2 Channel Specification and Products respectively.

3 VERSION HISTORY

See AMSR Unified | Version History for a summary of algorithm changes since the start of mission.

4 CONTACTS AND ACKNOWLEDGMENTS

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6 DOCUMENT INFORMATION

6.1 Publication Date

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6.2 Date Last Updated

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