AMSR/ADEOS-II L2A Global Swath Spatially-Resampled Brightness Temperatures, 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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National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 File Information

1.1.1 Format

Level-2A brightness temperature files contain three swaths in HDF-EOS format:

- **Low_Res_Swath**: All channel observations, except for 89.0 GHz, at a nominal interval of 10 km; 290 observations per approximately 2000 scans.
- **High_Res_A_Swath**: 89 GHz observations from the A feedhorn AMSR scans; 580 observations per approximately 2000 scans.
- **High_Res_B_Swath**: 89 GHz observations from the B feedhorn AMSR scans; 580 observations per approximately 2000 scans.

Each file contains the following contents:

- Low Res Swath Data Fields
- High Res A Swath and High Res B Swath Data Fields
- Geolocation Fields
- Global Attributes

Level-2A files contain data elements transferred directly from Level-1A antenna temperatures, but without 1:1 mapping. Users should match the two sets of data by the corresponding time of acquisition. Missing brightness temperature data are indicated by 0. Antenna temperature coefficients, effective hot load temperatures, calibration counts, and antenna coefficients are only provided for users who want to see how brightness temperatures were calculated for this data set. They are not required to view brightness temperatures.

Antenna temperature coefficients are three-dimensional arrays (3, 12, 2001). The first component represents slope, offset, and a quadratic term. The quadratic term is zero for all channels except 6.9 GHz. Brightness Temperatures (T_b) are not calculated for the first and last scans. All other scans have two non-zero coefficients for all channels, except 6.9 GHz, which has three non-zero coefficients. The last component is the number of scans per granule; it is variable.

For data with scale and offset values, the data values can be obtained in the specified units with the following equation:

data value in units = (stored data value * scale factor) + offset

Example: T_b (kelvin) = (stored data value * 0.01) + 327.68

Scaling factors and offsets are provided with the local attributes of each HDF-EOS file. You should check each file to ensure correct values.

1.1.2 File Contents

Each half-orbit granule is approximately 68 MB using HDF compression. The daily data rate is approximately 2.5 GB. Each half-orbit granule is approximately 68 MB using HDF compression.

1.1.3 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_A_L2A_BrightnessTemperatures_V01_200302040350_A.hdf`

`AMSR_A_L2A_BrightnessTemperature_X##_yyyymmddhhmm_f.hdf`

Refer to Table 1 for the valid values for the file name variables listed above.

Table 1. Valid Values for the File Name Variables

X	Product Maturity Code (Refer to Table 2 for valid values.)
##	file version number
yyyy	four-digit year
mm	two-digit month
dd	two-digit day
hh	hour of first scan in the file
mm	minute of first scan in the file
f	orbit direction flag (A = ascending, D = descending)
hdf	HDF-EOS data format

Table 2. 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.

Product Maturity Code	Description
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 3 for a description of the stages.

Table 3. Validation Stages

Validation Stage	Description
Stage 1	Product accuracy is estimated using a small number of independent measurements obtained from selected locations, time periods, and ground-truth/field program efforts.
Stage 2	Product accuracy is assessed over a widely distributed set of locations and time periods via several ground-truth and validation efforts.
Stage 3	Product accuracy is assessed, and the uncertainties in the product are well-established via independent measurements made in a systematic and statistically robust way that represents global conditions.

1.2 Spatial Information

1.2.1 Coverage

Southernmost Latitude: -90° N

Northernmost Latitude: 90° N

Westernmost Longitude: -180° E

Easternmost Longitude: 180° E

AMSR is a conical scan sensor that sweeps the surface of the Earth at about ±90 degrees centered at the direction of the satellite flight. The swath width is about 1600 km.

1.2.2 Resolution

Spatial resolutions range from 5 km to 50 km except for the 50.3GHz and 52.8GHz data.

All channels are available at an unsampled Level-1B resolution. The higher-resolution channels are resampled to correspond to the footprint sizes of the lower-resolution channels. The Level-2A algorithm spatially averages the multiple samples of the higher-resolution data into the coarser resolution Instantaneous Field of View (IFOV) of the lower-resolution channels with the Backus-Gilbert method. The resulting brightness temperatures are called effective observations in contrast to the original or actual observations. Table 4Table 1 summarizes these relationships:

Table 4. Spatial Characteristics of Observations

Resolution	**Footprint size**	**Mean spatial resolution**	**Channels**							
			89.0 GHz	36.5 GHz	23.8 GHz	18.7 GHz	10.65 GHz	6.9 GHz	52.8 GHz	50.3 GHz
1	70 km x 40 km	50 km	•	•	•	•	•	•o		
2	27 km x 46 km	50 km	•	•	•	•	•o			
3	14 km x 25 km	25 km	•	•	•o	o				
4	8 km x 14 km	15 km	•	o						
5	6 km x 10 km	10 km							o	o
6	3 km x 6 km	5 km	o							

• Includes Level-2A (smoothed) data

o Includes Level-1B (un smoothed) data at original spatial resolution

1.3 Temporal Information

1.3.1 Coverage

Temporal coverage is from 2003-01-18 (02:34) to 2003-10-24 (20:50). Each swath spans approximately 50 minutes.

See the AMSR/ADEOS-II Overview page for a summary of temporal coverage for different AMSR products and algorithms.

1.3.2 Resolution

The scanning period is 1.5 s and the data-sampling interval is every 2.6 ms for the 6 GHz to 52 GHz channels, and 1.3 ms for the 89 GHz channel. AMSR collects 580 data points per scan for the 89 GHz channel and 290 data points per scan for all other channels.

A granule of AMSR is defined as a half orbit between the South and North Poles for its observed position on the Earth. An observed position of AMSR is not nadir but a little forward to the satellite flight direction. Therefore, a scan location shifts about 2.5 minutes earlier from the satellite nadir on the orbit, but its center is positioned to the satellite nadir. Each half-orbit granule spans 50 minutes.

2 DATA ACQUISITION AND PROCESSING

2.1 Acquisition

AMSR/ADEOS-II L1A Raw Observation Counts are used as input to calculating the Level-2A brightness temperatures.

2.2 Processing

The algorithm reads an entire file (one half orbit) of Level-1A data at a time and uses calibration coefficients to convert antenna temperatures to brightness temperatures. Coefficients embedded in the data are discarded, and new values are calculated. The algorithm applies weighting coefficients from a table of values to resample the Level-1A data using Equation 1, see 2.2.2. The weighting coefficients corresponding to each constructed observation are stored as a 29 x 29 array, which applies weights to actual observations ± 14 scans and ± 14 locations along the scan from the constructed observation. Most of the coefficients in the array are zero. In an ideal case, weighting coefficients are applied to each corresponding constructed target pattern within the scan. Level-1A data produce unsmoothed Level 1B brightness temperatures and smoothed Level-2A brightness temperatures using Equation 2; see 2.2.2 (Ashcroft and Wentz 2000).

2.2.1 Processing History

The AMSR Instrument Description document provides details on potential errors associated with radiometer calibration.

2.2.2 Derivation Techniques and Algorithms

The objective of the Level-2A algorithm is to calibrate and bring the Level-1A antenna temperatures to a set of common spatial resolutions using a set of weighted coefficients. The algorithm resamples Level-1A antenna temperatures and converts them to Level-2A brightness temperatures.

The resampled antenna temperature (T_{ac}) is defined as a weighted sum of observed antenna temperatures (T_{ai}):

$$T_{ac} = \sum_{i=1}^{N} a_i \, T_{ai}$$

Equation 1

Where:

a_i = weighting coefficients

Antenna temperature observations are corrected for cold-space spillover and cross-polarization effects to obtain brightness temperatures averaged over the normalized crossover-polarization antenna pattern. The observed brightness temperatures (T_{bi}) are expressed as:

$$T_{bi} = \int T_b(\rho) \, G_i(\rho) \, dA$$

Equation 2

Where:

$T_b(\rho)$ = brightness temperature at location ρ

$G_i(\rho)$ = antenna gain pattern corresponding to the specific observation

Antenna temperature coefficients, effective hot load temperatures, calibration counts, and antenna coefficients are only provided for users who want to see how brightness temperatures were calculated for this data set. They are not required to view brightness temperatures.

Each Level-2A (effective) observation within a single instrument scan is calculated using coefficients that describe the relative weights of the neighboring Level-1A (actual) observations. Coefficients are unique for every position along the instrument scan, yet they do not vary from scan to scan. The Backus-Gilbert method produces the weighting coefficients for Level-1A data. Antenna patterns and relative geometry are known a priori, allowing weighting coefficients to be calculated before observations are collected. Although the Backus-Gilbert method can, in principle, be used to construct effective observations corresponding to gain patterns either smaller or larger than those in the actual observations, the noise amplification from smaller gain patterns (deconvolution) is typically very high.

Calculation of weighting coefficients requires specification of the shape of the target pattern, the location of the target pattern relative to the actual measurements, the set of actual observations used, and the smoothing parameter for each constructed observation. Actual observations within an 80 km radius of the constructed pattern are considered for possible contributors to the construction. Observations that are too far from the target pattern to play a role in the construction are assigned a weight of zero by the algorithm. Weighting coefficients are computed based on a simulation of the antenna patterns for a portion of a circular orbit around a spherical earth.

The smoothing factor at each point across the scan of each Level-2A data set is chosen in the following way: The algorithm applies the same amount of smoothing at the center to observations close to the edges. This ensures that noise decreases as the spatial density of the actual observations increases toward the edges. For construction of observations at the extreme edges, sufficient smoothing is added to keep noise at the edges from exceeding the noise at the center. For a given Level-1A channel, noise decreases as the resolution of the constructed pattern becomes larger, and the number of useful actual observations increases (Ashcroft and Wentz 2000).

2.3 Instrument Calibration

AMSR had a high-temperature calibration source (about 340 K) and a small reflector to acquire the radiant temperature of deep space (at about 3 K). This external calibration scheme was first introduced by the Special Sensor Microwave/Imager (SSM/I) on the Defense Meteorological Satellites Program (DMSP) satellites. Each feed horn, from 6.9-89 GHz, sees the calibration sources once per scan period.

2.3.1 Recalibration of AMSR Hot Load and Along-Scan Adjustments

The correction of the geolocation problems required several adjustments be made to the spacecraft position and pointing geometry, as well as sensor alignment. The reported spacecraft attitude features were comparatively fast moving roll, pitch, and yaw. This complexity of motion and associated errors made correction more difficult and less accurate than the Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E) geolocation corrections. AMSR adjustments include: Sensor alignment was rolled relative to the spacecraft frame by 0.05 degrees. A dynamic yaw correction was applied (yaw corrected = yaw - 0.10*cosd(360*frcrev)). For orbits after 2900, satellite position was shifted 0.3 sec (2 km) backwards. Additionally, adjustments were made to the pointing geometry of each feedhorn. Channels 19, 23, 37, 50 and 53 GHz were found to be well aligned with each other and share the same adjustments. These geolocation corrections result in a variable incidence angle. With this roll adjustment, the true incidence angle was found to vary across the swath contrary to the assumption that it was nearly constant. This modification of the incidence angle has small but significant effects on the instrument calibration. The calibration is based on measurements of the ocean surface, and the emission from the ocean surface varies with incidence angle. Incidence angle corrections were applied before the instrument was calibrated, a hot load effective temperature table was found, and along-scan antenna temperature adjustments were made.

Earth incidence angle is computed and included in Level-2A files in data field Earth_Incidence. These variable earth incidence angle data should be used appropriately, especially for geophysical retrievals depending upon incidence angle. Using the previously assumed constant incidence angle will likely result in along scan bias. The Level-2A Brightness Temperature data set is intended to be a faithful representation of the brightness temperatures observed by the instrument. Thus, due to variable pointing geometry, incidence angle is variable along scan, and brightness temperatures are correspondingly variable along scan. This along scan variability in observed brightness temperatures is not removed and should be accounted for by using the computed Earth_Incidence.

2.3.2 Implementation of Flagging Algorithm for RFI from Geostationary TV Satellites

As part of the AMSR-E SST and wind validation activity, anomalous retrievals were found off the West Coast of Europe and in the Mediterranean Sea. Due to Radio Frequency Interference (RFI) from a European satellite TV service, AMSR instruments were receiving the broadcast from two European geostationary satellites that operate near the 10.7 GHz band. The satellite TV signal is reflecting off the ocean surface into the field of view. AMSR bandwidth at 10.7 GHz is 100 MHz, whereas the protected band is only 20 MHz. The TV signal is coming from the unprotected part of the 100-MHz band.

The TV RFI was determined to be coming from two satellites: one positioned at a longitude of 13 degrees E above the equator and the other at 19 degrees E. An algorithm was developed that computes the angle between AMSR-E look vector and the specular reflection vector for the TV RFI. This angle is called the RFI angle. Small RFI angles correspond to cases in which the TV RFI is being reflected off the ocean surface directly towards the instrument.

When the RFI angle is less than 12 degrees, in general the observation should be flagged as RFI contaminated. However, in the North Sea, the RFI is particularly strong. For this region, an RFI angle of 17 degrees is the threshold. This RFI affects descending passes only.

2.3.3 Correction for Lunar Radiation Entering the Cold Mirror

Twice each month the moon enters the Field of View (FOV) of the cold mirror. The moon’s surface temperature varies from 120 K night to 370 K day and has a relatively high emissivity. As a result, the moon acts as a source of contamination to the cold sky measurement.

A correction was applied to remove the lunar contamination. The correction depends upon the following factors:

1. The angle between the vector going from the satellite to the moon and the boresight vector of the cold mirror. This is the dominant term. When this angle becomes small, a few degrees or less, lunar contamination becomes significant. This angle is called the lunar angle.
2. The phase of the moon. A full moon is hotter than a new moon and hence has a higher brightness temperature.
3. The distance from the satellite to the moon. Radiation intensity falls off as the inverse of the square of the distance.

The lunar antenna temperature contribution to the cold sky observations is computed and then is scaled in terms of cold counts. The lunar cold counts are subtracted from the AMSR cold count observations to obtain a cold count value free of lunar contamination. For the case of 89 GHz, when the lunar angle is less than one degree, the lunar contamination is too large to perform the correction and these observations are flagged as bad and are not processed. The excluded observations are extremely rare. The accuracy of this correction is estimated to be in the order of 0.1 K.

2.3.4 Adjustment to Match the 89A and 89B Observations During Resampling

When the 89 GHz Channels are resampled to lower spatial resolutions, the observations from the A-horn and the B-horn are combined. However, the incidence angles for these two horns are different with the B-horn incidence angle being about 0.6 degrees smaller than the A-horn. To compensate for the difference in incidence angle, the following adjustments were made to the A-horn measurements before resampling.

$$T_{AV,adj} = 0.130671 + 0.993251T_{AV}$$

Equation 3

$$T_{AH,ADJ} = 0.472994 + 0.992742T_{AH}$$

Equation 4

These expressions were found from doing linear regression of actual A-horn and B-horn observations. The application of these equations normalizes the A-horn measurements to the B-horn incidence angle.

2.3.5 Implementation of Using UT1 Time to Compute the Earth Rotation Angle.

ADEOS-II position, velocity, and attitude vectors are given in terms of the J2000 inertial coordinate system. To compute Earth latitudes and particularly longitudes, it is necessary to compute the Earth rotation relative to the J2000 systems. The proper calculation requires using the UT1 time, which can be as much as one second different from UTC time. To obtain UT1, the Level-2A algorithm accesses the U.S. Naval Observatory database each day to obtain the current UT1. One advantage of this procedure is that it is independent of leap seconds; therefore, there is no discontinuity in the geolocation parameters when a leap second occurs.

2.4 Quality, Errors, and Limitations

2.4.1 Quality Assessment

Each HDF-EOS file contains core metadata with Quality Assessment (QA) metadata flags that were set by the Science Investigator-led Processing System (SIPS) at the Global Hydrology and Climate Center (GHCC) prior to delivery to NSIDC. A separate metadata file with a .xml file extension was also delivered to NSIDC with the HDF-EOS file; it contained the same information as the core metadata. Three levels of QA were conducted with the AMSR Level-2 products: automatic, operational, and science QA. If a product did 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 did not send the granule to NSIDC until it was reprocessed (Conway 2002).

2.4.2 Automatic QA

RSS generated AMSR Level-2A files from Level-1A files supplied by the Japan Aerospace Exploration Agency (JAXA). The Level-2A data files contain data flags set by JAXA for the Level-1A files and flags set by RSS. RSS quality assessment was performed when Level-2A files were generated. Resampled observations were generated wherever valid Level-1A observations existed. This occurred when the Level1A_Scan_Chan_Quality_Flag is was acceptable, and the actual observation at that location was within a plausible range. If neighboring observations were not acceptable, either because the entire neighboring scan was not acceptable, or because particular observations were implausible, the weights corresponding to the remaining acceptable observations were renormalized in order to calculate the resampled observation.

2.4.2.1 JAXA Data Quality Flags

The Data_Quality element contains the primary JAXA data quality flags. Aside from this element, JAXA provides additional quality information through reserved data values. For example, -9999 counts indicate missing data. RSS did not use the JAXA Data_Quality data element in Level-2A processing, but this element is included in the Level-2A data set for the benefit of other users.

2.4.2.2 RSS Quality Assessment

RSS adds three types of quality assessment indicators for each scan:

4-Byte Scan_Quality_Flag

- Identical flag repeated for the Low Swath, High 89A Swath, and High 89B Swath

2-Byte Channel_Quality_Flag for each channel

- 10 channels for the Low Swath
- channels for the High 89A Swath
- channels for the High 89B Swath

2-Byte Resampled_Channel_Quality_Flag for each resampled channel

- 30 channels for the Low Swath

The summary bit 0 of the Channel_Quality_Flag is automatically set whenever any of the bits in the Scan_Quality_Flag are set. Thus, the user can determine whether the data are useable by examining only the Channel_Quality_Flag without examining the Scan_Quality_Flag.

2.4.2.3 Scan_Quality_Flag

A Scan_Quality_Flag is provided for each scan. These flags pertain to all observations of a scan including all Level-1A and resampled channels.

Table 5. Summary of Scan_Quality_Flag

Bit	Meaning	Value = 0	Value = 1	Description
0	Summary Flag	All higher bits are equal to zero	Otherwise	The Scan Summary bit captures the conditions of all the other bits in the `Scan_Quality_Flag`. It is set to one if any of the bits 2 through 31 are set. The summary flag does not describe those characteristics that apply to a single channel.
1	Antenna Spin Rate	Within range	Missing or out of range	Bit 1 is set if the antenna spin rate is out of range, which is defined as 4.167 percent from nominal.
2	Navigation	Within range	Missing or out of range	Bit 2 is set if the position or velocity of the navigation data for that scan is out of bounds. The bounds are 6500-8000 km from the Earth's center to the satellite and 4-10 km/sec for spacecraft velocity. Note that these bounds are extremely large, and this flag is intended to flag bogus data rather than real anomalies in the navigation.

Bit	Meaning	Value = 0	Value = 1	Description
3	RPY Variability	Within range	Out of range	Bit 3 is set if the roll, pitch, or yaw variability from scan to scan is out of bounds. Only Midori-2 AMSR has this problem. A scan-to-scan variation in either roll, pitch, or yaw that exceeds 0.05 degrees is considered out of bounds.
4	RPY	Within range	Out of range	Bit 4 is set whenever the roll, pitch, or yaw exceeds 2.0 degrees.
5	Earth Intersection	All on earth	Some not on Earth	Bit 5 is set if any of the observation locations fail to fall on the Earth. This occurs during large orbit maneuvers.
6	Hot Load Thermistors	Within range	Missing or out of range	Bit 6 is set whenever the thermistors on the AMSR hot load are out of bounds, which is defined as their rms variance being greater than 10K or any single thermistor being outside the range 283.17K - 317.16K for AMSR and 285.17K - 316.94K for Midori-2 AMSR. When these temperature limits are converted to thermistor counts, they correspond to the minimum and maximum allowable count values.
7-31	Not Used, Always 0			

2.4.2.4 Channel_Quality_Flag

All flags in this data element are set in response to characteristics of the calibration measurements for a specific AMSR channel. In general, calibration measurements (hot and cold) are averaged over adjacent scans to compute the antenna temperatures from raw counts. The default process is to average calibration counts over a range from one scan before the scan to one scan after the scan although only a subset of these calibration measurements is used if some are unacceptable. The Calibration Quality Flags are set on the basis of the same calibration measurements over which the calibration averaging is performed.

Table 6. Summary of Channel Quality Flag

Bit	Meaning	Value = 0	Value = 1	Description
0	Summary Flag	Good	Questionable or bad	Bit 0 is a summary flag. This bit is set if any of the bits 2 through 15 are set. Note that bit 11 is set if any of the geolocation error bits in the `Scan_Quality_Flag` are set. Hence, if any errors are reported by the `Scan_Quality_Flag`, Bit 0 of all `Channel_Quality_Flags` is set to 1.

Bit	Meaning	Value = 0	Value = 1	Description
1	T_b Availability	Yes	No	Bit 1 indicates whether Level-2A brightness temperatures are computed for this channel. When there are severe problems, as indicated by any of the bits 2, 3, 4, or 12 being set, no brightness temperatures is computed and bit 1 is set to 1.
2	Scan Number	Not first or last scan	First or last scan	Bit 2 is set for the first and last scans of each Level-2A file. Because the calibration and quality checking of each scan uses both the adjacent scans, the calibration and quality checking cannot be performed on the first and last scan of the file.
3	Serious Calibration Problem	No, all is good	Yes	Bit 3 is set if one of the following occurs: 1. The automatic gain control has changed from either the preceding or succeeding scan. 2.The receiver automatic gain control is out of bounds. 3.All calibration counts for either or both the hot load and cold sky are out of bounds.
4	Hot-cold Counts Check 1	> 0	<= 0	Bit 4 is set if the cold calibration counts are the same or greater than the hot calibration counts.
5	Thermistors	Within bounds	Out of bounds	Bit 5 is set if the hot load thermistors are out of range. The acceptable range for the thermistors is described above for bit 6 of the `Scan_Quality_Flag`.
6	T_{eff} Type	Dynamic T_{eff}	Static T_{eff}	Bit 6 equals 0 denotes that the dynamic T_{eff} is used. This is the usual condition. Bit 6 equals 1 denotes that the static T_{eff} is used, which should rarely if ever occur.
7	No.of Cold Counts	>= 8	< 8	Bit 7 is set if there are fewer than 8 cold counts that are in bounds.
8	No. of Hot Counts	>= 8	< 8	Bit 8 is set if there are fewer than eight hot counts that are in bounds.
9	Hot-cold Counts Check 2	>= 100	< 100	Bit 9 is set if the difference between hot and cold counts is less than 100.
10	Hot-cold Counts Check 3	>= Channel minimum	< Channel minimum	Bit 10 is set if the difference between hot and cold counts is less than a channel-dependent threshold.

Bit	Meaning	Value = 0	Value = 1	Description
11	Geolocation	No problem exists	Problem exists	Bit 11 is set if there is a geolocation error as reported by the `Scan_Quality_Flag`.
12	T_{eff} availability	Yes	No	Bit 12 is set to 1 if T_{eff} is not available. This should rarely if ever occur.
13-15	Not Assigned, Always 0			

2.4.2.5 Resampled_Channel_Quality_Flag

A Resampled_Channel_Quality_Flag is provided with the L2A data, but it is redundant with the Channel_Quality_Flag and does not usually need to be used. For the lower frequency channels, the first two bits (0 and 1) of the Channel_Quality_Flag are copied to the first two bits of the corresponding Resampled_Channel_Quality_Flag. For the 89A Channels, the first two bits (0 and 1) of the Channel_Quality_Flag are copied to the first two bits of the corresponding Resampled_Channel_Quality_Flag. For the 89B Channels, the first two bits (0 and 1) of the Channel_Quality_Flag are copied to bits 2 and 3 of the corresponding Resampled_Channel_Quality_Flag.

Table 7. Resampled_Scan_Chan_Quality_Flag

Bit	Meaning
0-1	Equal to corresponding bits of corresponding channels
2-15	Not assigned

Before working with any channel of data, users should confirm that both the Scan_Quality_Flag and the Channel_Quality_Flag indicate that the scan is acceptable.

2.4.3 Operational QA

AMSR Level-2A data arriving at GHCC were subject to operational QA. Operational QA varies by product, but it typically checks for the following criteria in a given file (Conway 2002):

- File is correctly named and sized
- File contains all expected elements
- File is in the expected format
- Required EOS fields of time, latitude, and longitude are present and populated
- Structural metadata is correct and complete
- The file is not a duplicate
- The HDF-EOS version number is provided in the global attributes

- The correct number of input files were available and processed

2.4.4 Science QA

AMSR Level-2A data that arrived at GHCC were also subject to science QA prior to use in processing higher-level products. If less than 50 percent of a granule's data was good, the science QA flag was marked suspect when the granule was delivered to NSIDC. In the SIPS environment, the science QA included checking the maximum and minimum variable values, the percentage of missing data, and out-of-bounds data per variable value. At the Science Computing Facility (SCF) and also at GHCC, science QA involved reviewing the operational QA files, generating browse images, and performing the following additional automated QA procedures (Conway 2002):

- Historical data comparisons
- Detection of errors in geolocation
- Verification of calibration data
- Trends in calibration data
- Detection of large scatter among data points that should be consistent

Geolocation errors were corrected during Level-2A processing to prevent processing anomalies such as extended execution times and large percentages of out-of-bounds data in the products derived from Level-2A data.

The Team Lead SIPS (TLSIPS) developed tools for use at SIPS and SCF for inspecting the data granules. These tools generated a QA browse image in Portable Network Graphics (PNG) format and a QA summary report in text format for each data granule. Each browse file showed Level-2A and Level-2B data. These were forwarded from RSS to GHCC along with associated granule information where they were converted to HDF raster images prior to delivery to NSIDC.

2.4.5 Along-Scan Error

AMSR observes the Earth for 180 degrees of its rotation as it spins (±90 degrees centered at the direction of the satellite flight). This results in a 1600 km swath, considerably wider than the 1450 km swath of AMSR-E. However, it was fully anticipated that the swath edge measurements would experience contamination errors, limiting their utility for some applications. Although corrections were applied, the quality of edge observations should be considered experimental.

Along-scan errors are caused by the AMSR cold mirror or warm load entering the FOV of the feedhorns, or by the main reflector seeing part of the spacecraft. The RSS performed an analysis of the AMSR along-scan error and developed a correction.

In spite of RSS's best efforts to accomplish a robust AMSR along-scan temperature correction, users should note that some contamination remains in the edge pixels at the beginning or end of each scan line on a per channel basis. Users should determine whether to include those pixels based on their specific research application and the effects of the contamination described below.

In early 2007, researchers at NSIDC conducted an along-scan error analysis by examining brightness temperature distributions for each sample position in three different, relatively uniform climatic regions over a sufficiently long time period to eliminate effects from random, transient events. The three regions included a portion of Antarctica, an area of the Indian Ocean south of Australia, and an area of African jungle in the Salonga National Park region of the Democratic Republic of the Congo.

NSIDC concluded that even after the RSS along-scan correction, a significant cold bias remains in brightness temperature measurements in all channels over Antarctic regions from the beginning of each scan line,. There is also some evidence of a cold bias in 7 GHz channels over jungle areas. There does not appear to be a bias in any channels observing ocean areas.

2.4.6 Along-scan Error Analysis and Applied Correction Made by RSS.

To determine the magnitude of this effect at the swath edges, RSS computed the difference between the AMSR antenna temperature and the radiative transfer model. This difference was plotted versus along-scan cell positions in Figure 1, where the antenna temperature differences have been averaged over the lifetime of AMSR operations. The cell positions go from 1 to 290. The antenna temperature differences are shown for all 16 AMSR channels. Each channel is color-coded and is offset by 1 K so that the results can be easily visualized. The straight horizontal lines in Figure 1 are the zero reference lines. The spacing between the horizontal lines is 1 K.

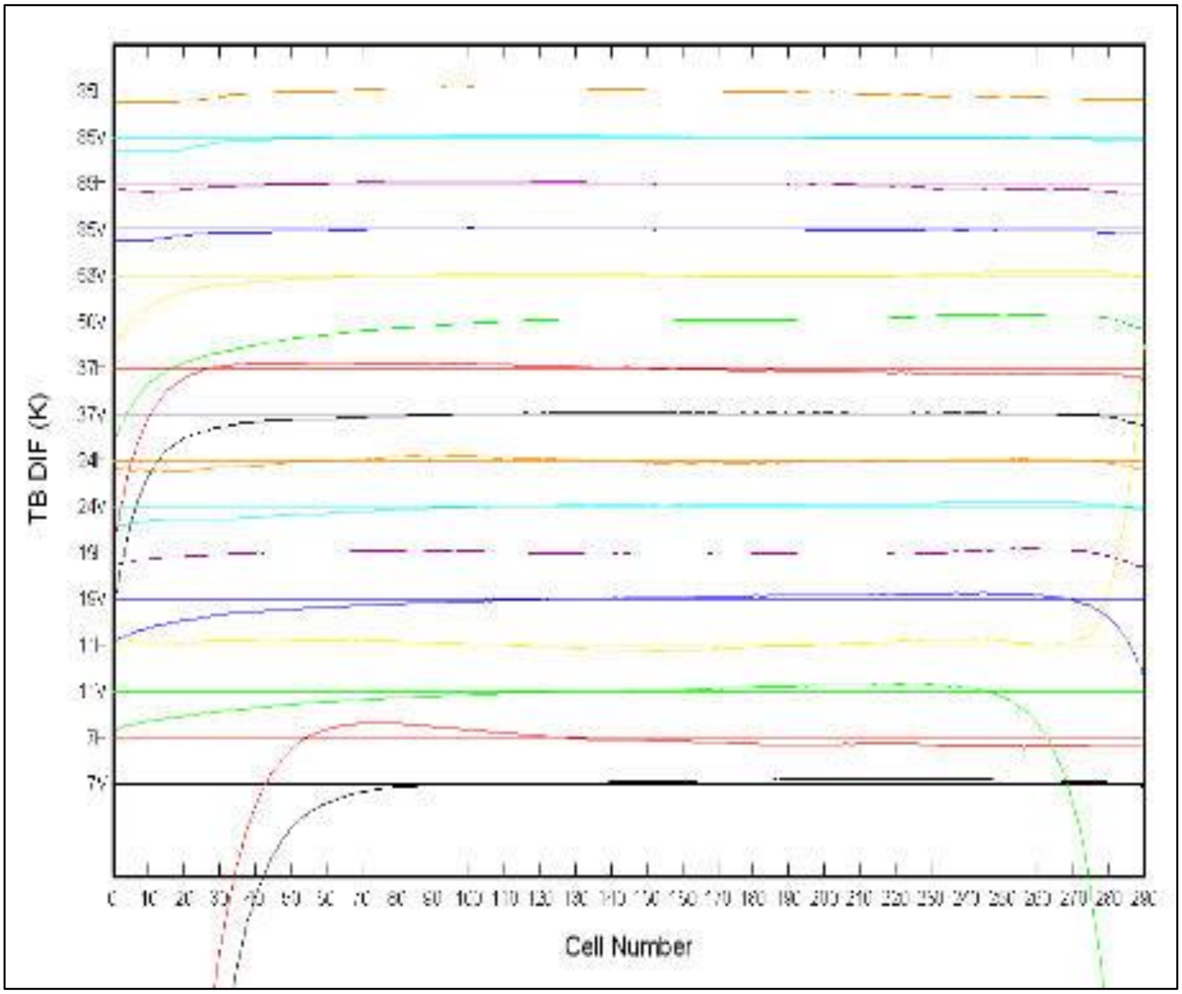

Figure 1. Along-scan Error in AMSR Observations (Pre-correction)

Many channels show cold contamination at the swath edges. At the lowest scan position, 7 GHz v-pol and 7 GHz h-pol require corrections of approximately 70 K and 50 K, respectively. At the highest scan position, 11 GHz v-pol requires correction of approximately 20 K. Interestingly, 11 GHz h-pol requires correction for a warm bias of approximately 6 K at the highest scan position.

Based on the results shown in Figure 1, a correction table was made. This table provides an antenna temperature adjustment for each AMSR channel that is a function of the along-scan cell position. This adjustment eliminates the along-scan error in the mean sense. RSS repeated this analysis and stratified the data into two half-year time periods and into two orbit segments (ascending and descending). The variation in the along-scan error for these four stratifications is about 0.5 K, thereby showing the along-scan error is a somewhat constant feature. The greatest contributers to edge contamination are probably stable features of the instument's geometric interaction with itself and the spacecraft. However, swath edge contamination does have a variable component and appears to be more significant earlier in the mission.This is likely due to greater mis-specification of pointing geometry and associated errors in geolocation, especially errors affecting Earth incidence angle.

These along-scan adjustments were implemented into the standard AMSR processing algorithm. However, caution should be exercised when using many channel and edge scan position combinations. Figure 1 illustrates the magnitude of correction applied to each channel at each scan position. The greater the correction required, the greater the likelihood of residual error, and the less confidence should be given to the resulting brightness temperatures. The utility of AMSR swath edges should be evaluated based on specific application and accuracy requirement.

2.5 Instrumentation

2.5.1 Description

See the AMSR Instrument Description document.

3 RELATED DATA SETS

- AMSR-E/Aqua Daily EASE-Grid Brightness Temperatures
- AMSR-E/Aqua Daily Global Quarter-Degree Gridded Brightness Temperatures
- DMSP SSM/I-SSMIS Daily Polar Gridded Brightness Temperatures
- DMSP SSM/I-SSMIS Pathfinder Daily EASE-Grid Brightness Temperatures
- DMSP-F8 SSM/I Pathfinder Antenna Temperatures
- Near-Real-Time DMSP SSM/I-SSMIS Daily Polar Gridded Brightness Temperatures
- NIMBUS-5 ESMR Polar Gridded Brightness Temperatures
- NIMBUS-7 SMMR Antenna Temperatures
- NIMBUS-7 SMMR Pathfinder Brightness Temperatures
- Nimbus-7 SMMR Pathfinder Daily EASE-Grid Brightness Temperatures
- Nimbus-7 SMMR Polar Gridded Radiances and Sea Ice Concentrations

4 CONTACTS AND ACKNOWLEDGMENTS

Remote Sensing Systems
Dr. Peter Ashcroft and Dr. Frank Wentz

5 REFERENCES

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For more information regarding related publications, see the AMSR/ADEOS-II Overview

6 DOCUMENT INFORMATION

6.1 Publication Date

April 2009

6.2 Date Last Updated

30 March 2021