Sentinel-6 Project

AMR Science Data Product Description Document

Revision E

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CHANGE LOG

VERSION	DATE	SECTIONS CHANGED	REASON FOR CHANGE
Preliminary	2018-02-23	ALL	Preliminary Version. Approved for public release (CL#18-0987)
Initial Release	2018-08-08	ALL	Added file naming convention, updated Global Attributes, updated rad_distance_to_land variable name. (CL#18-4251)
Revision A	2019-03-26	5	Fix typos in global and variable attributes. Add global attributes for number of open ocean measurements. (CL#19-2120)
Revision B	2019-07-19	5	Change valid_min and valid_max for rad_wet_tropo_cor. (CL#19-4332)
Revision C	2020-03-16	3.7, 4.1.2, 5	Change data type for antenna and brightness temperatures from short to int, and associated valid_max. Update data volumes. Modify description of rad_state_oper_flag. Add platform, time_coverage_start, time_coverage_end, geospatial_lat_min, geospatial_lat_max, geospatial_lon_min, and geospatial_lon_max. (URS291531, CL#20-1554)
Revision D	2020-12-15	4.1.1, 5.1.1, 5.1.4	Explicitly define default value of leap_second attribute. Modify format of dates in history and leap_second attribute. (URS297522, CL#20-6514)
Revision E	2022-04-19	2.1, 2.2, 3.4, 4.1.3, 4.1.5, 4.1.6, 4.1.7, 5.1.4.	Add HRMR antenna and main beam temperatures, HRMR flags, AMR-alone path delay, AMR and HRMR geolocation flags. (URS307716, CL#22-1932)

EPDM ELECTRONIC SIGNATURES

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Table of Contents

CHANGE LOG **2**

Table of Contents **3**

Table of Figures **4**

Table of Tables **5**

List of TBC Items **6**

List of TBD Items **6**

1 Introduction **7**
1.1 Purpose **7**
1.2 Scope **7**
1.3 Document Organization **7**
1.4 Applicable Documents **7**
1.5 Reference Documents **8**

2 General Product Description **8**
2.1 Purpose **8**
2.2 Requirements **9**
2.3 Latency **9**

3 Product Structure **10**
3.1 File Naming Convention **10**
3.2 Granule Definition **10**
3.3 File Organization **10**
3.4 Spatial Sampling and Resolution **10**
3.5 Temporal Organization **12**
3.6 Spatial Organization **12**
3.7 Volume **12**

4 Qualitative Product Description **13**
4.1 Radiometer Product File **13**
4.1.1 Time and Location 13
4.1.2 Sensor Flags 14
4.1.3 Quality Flags 14
4.1.4 Geophysical Flags 15
4.1.5 Sensor Measurements 16
4.1.6 Geophysical Information 16
4.1.7 Geophysical Estimates 17

5 Detailed Product Description **17**
5.1 Radiometer Product File **17**
5.1.1 Global Attributes 17
5.1.2 Variables 20
5.1.3 Dimensions 21
5.1.4 Detailed NetCDF Format Description 21

Appendix A. **Acronyms** **36**

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Table of Figures

FIGURE 1. AMR-C ANTENNA PATTERN CONTOURS PROJECTED ONTO THE EARTH'S SURFACE FOR EACH CHANNEL. 11
FIGURE 2. HRMR ANTENNA PATTERN CONTOURS PROJECTED ONTO THE EARTH'S SURFACE FOR EACH CHANNEL. 12

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Table of Tables

TABLE 1:APPLICABLE DOCUMENTS (ADS) 7
TABLE 2:REFERENCES DOCUMENTS (RDS)....8
TABLE 3: DESCRIPTION OF FILE COMPRISING THE AMR SCIENCE DATA PRODUCT. 10
TABLE 4: DESCRIPTION OF DATA VOLUME OF EACH FILE OF RADIOMETER PRODUCT. 13
TABLE 5. GLOBAL ATTRIBUTES OF AMR SCIENCE DATA PRODUCT 17
TABLE 6. VARIABLE DATA TYPES IN NETCDF FILE 20
TABLE 7. VARIABLE ATTRIBUTES IN NETCDF FILE....20
TABLE 8. DIMENSIONS OF VARIABLES IN NETCDF FILE....21

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List of TBC Items

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Page	Section

List of TBD Items

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Page	Section

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1 Introduction

1.1 Purpose

The purpose of this Product Description Document is to describe the radiometer science data product from the Sentinel-6 mission. The product provides antenna and brightness temperatures from the Advanced Microware Radiometer (AMR-C) and the High Resolution Microwave Radiometer (HRMR). Three versions of this product are generated depending on latency:

- Near Real Time (NRT) available at latencies of < 3 hours.
- Short Time Critical (STC) available at latencies of < 36 hours.
- Non-Time Critical (NTC) available at latencies of < 60 days.

1.2 Scope

The scope of this document is to provide:

1. A general description of the product (Section 2).
2. The structure of the product (Section 3).
3. Qualitative descriptions of the information provided in the product (Section 4).
4. Detailed identification of the individual fields within the product (Section 5).

1.3 Document Organization

Section 2 provides a general description of the product, including its purpose, the relevant requirements, and latency.

Section 3 provides the structure of the product, including granule definition, file organization, spatial resolution, temporal and spatial organization of the content, the size and data volume.

Section 4 provides qualitative descriptions of the information provided in the product.

Section 5 provides a detailed identification of the individual fields within the product, including their units, size, coordinates, etc.

Appendix A provides a listing of the acronyms used in this document.

1.4 Applicable Documents

This document is consistent with the applicable documents (ADs) listed in Table 1 below. If this document conflicts with any of these ADs, the ADs take precedence and this Product Description document will be consequently updated.

Table 1:Applicable Documents (ADs)

Identifier	Reference
AD1	Sentinel-6 System Requirements Document, Issue v3E, EUM/LEO-JASCS/SPE/12/0039, 1 October, 2018.

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1.5 Reference Documents

The list of reference documents (RDs) below are referenced for context and additional details. They provide companion and reference information. Only directly useful reference documents to this particular product are provided in Table 2 below.

Table 2:References Documents (RDs)

Identifier	Reference
RD1	Sentinel-6 Algorithm Theoretical Basis Document, AMR Level 1B Processing, JPL D-101397.
RD2	Sentinel-6 Algorithm Theoretical Basis Document, AMR Level 2 Processing, JPL D-101398.

2 General Product Description

2.1 Purpose

The primary objective of Sentinel-6 Radiometer Science Data Product is to provide radiometer measurements of the altimeter range delay correction due to the wet troposphere content, and the two-way atmospheric attenuation to the altimeter backscatter coefficient, sigma0, at the Ku- and C-band altimeter frequencies. Sentinel-6 carries a three-frequency, redundant radiometer, AMR-C. The three operating frequencies of 18.7, 23.8, and 34.0 GHz are primarily aimed towards recovery of atmospheric attenuation to sigma0, water vapor, and cloud liquid burden, respectively. The AMR-C consists of nominal and redundant sides with H and V polarizations, respectively. At any time, only one of the two sides of the AMR-C will be operating. The two sides of the radiometer operate independently from each other. For a given time span, this product consists of a single file that contains data from the operating side of the radiometer.

A High Resolution Microwave Radiometer (HRMR) is included as an experiment on the Sentinel-6 mission. The HRMR is aimed towards demonstrating the use of high frequency channels (90, 130, and 166 GHz) for extending the wet path delay measurements into coastal areas, with a performance goal of 1.0 cm accuracy within 5-50 km. Antenna and main beam brightness temperature measurements from the HRMR are provided in the AMR product.

Two wet troposphere corrections are provided in this product, *rad_wet_tropo_cor* and *amr_wet_tropo_cor*. The variable *rad_wet_tropo_corr* provides the recommended wet troposphere correction as computed from a combination of AMR-C and HRMR measurements. The variable *amr_wet_tropo_cor* provides a wet troposphere correction as computed from AMR data alone, consistent with heritage approaches used in earlier versions of this product that did not include HRMR data.

This product serves as an input to the nadir altimeter processing, since the radiometer measurements noted above are expected to be applicable for the respective over-ocean and large inland water nadir altimeter measurements. Temporally interpolated values of the radiometer measurements from this product are provided at the nadir altimeter measurement times on the

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nadir altimeter products. The nadir altimeter science algorithm software also computes atmospheric attenuation to sigma0 for cases where the radiometer measurements are not valid (e.g., when the associated quality flag is indicated as bad, typically over land, and sea ice).

A description of the algorithms used to generate the radiometer science data product are provided in the Algorithm Theoretical Basis Documents (ATBDs), in RD1 and RD2.

2.2 Requirements

The radiometer science data product is generated in response to the Sentinel-6 project requirements provided in AD1. The product consists of one file for a particular data window. The single file contains Level 1B and Level 2 measurements from the operating side of the Sentinel-6 radiometer. In particular, this product provides:

1. Level 1B measurements of radiometer antenna temperatures at the three AMR-C frequencies and three HRMR frequencies.
2. Level 1B measurements of radiometer main beam brightness temperatures at the three AMR-C frequencies and three HRMR frequencies.
3. Level 1B measurements of radiometer equalized brightness temperatures at the three AMR-C frequencies only. Along-track averaging of the HRMR main beam brightness temperatures is not performed to preserve their high spatial resolution.
4. Level 2 measurements of the wet troposphere range correction in support of sea surface height measurements performed by the nadir altimeter instruments. As mentioned earlier two values are provided: *rad_wet_tropo_cor* as computed from a combination of AMR-C and HRMR measurements, and *amr_wet_tropo_cor* as computed from AMR-C measurements alone. These measurements include those over open ocean, as well as those derived using algorithms to derive the correction in proximity of coastlines.
5. Level 2 measurements of two-way atmospheric attenuation to Sigma0 measurements at the Ku- and C-band radar altimeter frequencies.
6. Level 2 measurements of cloud liquid water, water vapor content, and wind speed.

2.3 Latency

The latency of the radiometer science data product allows for consolidation of instrument calibrations through the required auxiliary calibration data that are needed to generate this product, as well as the orbit ephemeris and spacecraft attitude needed to geolocate the radiometer measurements. The calibration coefficients that are needed to generate the definitive Non-Time Critical (NTC) radiometer science data product are available with a latency of no longer than 40 days from sensing time. The NTC radiometer science data product is generated when the calibration coefficients and Precise Orbit Ephemeris for the measurement times are available. The NTC radiometer science data product then facilitates generation of the NTC nadir altimeter product within 60 days from sensing time.

Shorter latency versions of the radiometer science data product are generated using best available calibration coefficients, typically from < 40 days earlier. In particular, shorter latency versions of the radiometer product, namely the short time critical (STC) and the near real time (NRT) versions of the product, are also generated. They are used to facilitate generation of the

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respective STC and NRT nadir altimeter products within 36 hours and 3 hours, respectively, from sensing time.

3 Product Structure

3.1 File Naming Convention

The radiometer product consists of one file at each of the three latencies, NRT, STC, and NTC. The file naming convention for these files is as follows:

*MMM*_MW_2__AMR____*XX_CCC_PPP_<start_time>_<end_time>_FFF*.nc

where:
MMM = S6A or S6B, for Sentinel-6A and Sentinel-6B, respectively.
XX = NR, ST, or NT for the NRT, STC, and NTC latencies, respectively.
CCC = Cycle number at the time of the first measurement in the file.
PPP = Pass number at the time of the first measurement in the file.
<start_time> = UTC time of the first measurement in the file, with format YYYYMMDDThhmmss.
<end_time> = UTC time of the last measurement in the file, with format YYYYMMDDThhmmss.
FFF = Processing version number of the file, starting from F00.

An example radiometer NTC product file name for Sentinel-6A is:
S6A_MW_2__AMR____NT_001_002_20200904T160101_20200904T165714_F00.nc

3.2 Granule Definition

The NTC and STC radiometer science data products are organized into pass files. A single pass is a half revolution of the Earth by the satellite from pole to pole (extreme south to north latitudes for ascending passes, and north to south latitudes for descending passes). The NRT radiometer science data product is organized by data telemetry downloads from the instrument.

3.3 File Organization

The radiometer science data product adopts the NetCDF-4 data format to store the radiometer measurements. The product consists of a single file containing sequential measurements from the operating side of the radiometer.

Table 3: Description of File Comprising the AMR Science data product.

File	Name	Description
1	AMR Science Data Product.	Provides Level 1B and 2 measurements from the AMR-C and HRMR.

3.4 Spatial Sampling and Resolution

The measurements from the operating side of the AMR-C and the HRMR are temporally organized along the satellite ground track. The reported time tags of the measurements

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correspond to the middle of the AMR-C measurement integration period. The reported latitude and longitude of the measurements correspond to the location of the AMR measurement on the surface of the Earth. The AMR measurement is approximately 0.03 degrees off nadir. The reported geophysical estimates (e.g., wet troposphere correction, two-way sigma0 atmospheric attenuation) correspond to the vertical atmospheric column directly above the reported locations. The nominal temporal resolution of the radiometer measurements is 16 Hz. The reported time tags are independent of the altimeter measurements. As such, temporal interpolation of the radiometer data is required for application to the nadir altimeter measurements.

It should be noted that while the AMR-C instrument is operating at 16 Hz, the 16 Hz measurements are composed of measurements of the antenna temperature, instrument reference load, and noise diodes. As such, and depending on the instrument configuration, only 10-12 antenna (i.e. science) measurements are available in each second and reported on this radiometer science data product. Not reported on this product are the remaining 4-6 instrument measurements in each second that are of the reference load and noise diodes. The reference load and noise diode measurements are used to generate the antenna temperature measurements themselves. As a result, the 10-12 measurements per second of the antenna temperatures, corresponding brightness temperatures, and geophysical parameters, on this product are not necessarily equally spaced within each second.

The spatial resolution of each of the individual 10-12 AMR-C main beam brightness temperature measurements per second at the 3dB antenna pattern contour is 40, 34, and 31 km at 18.7, 23.8, 34.0 GHz, respectively. The equalized brightness temperatures and corresponding geophysical measurements (e.g., path delay reported in *amr_wet_tropo_cor*, atmospheric attenuation) at each of the 16 Hz measurements then have a spatial resolution of 34 km, namely the same resolution as the 23.8 GHz main beam brightness temperatures. Figure 1 below shows the -20, -10 and -3dB beam contours for each frequency.

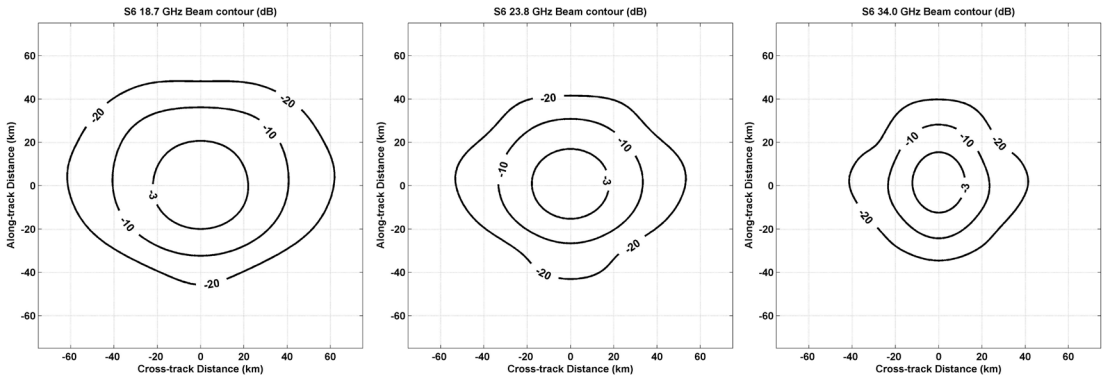

Figure 1. AMR-C antenna pattern contours projected onto the Earth's surface for each channel.

The HRMR has 4 antenna temperature measurements per second and these are not coincident in time of space with the AMR-C measurements. The spatial resolution of each of the HRMR main beam brightness temperatures at the 3dB antenna pattern contour is 6.8, 4.2, and 2.8 km at 90, 130, and 166 GHz, respectively, as shown in Figure 2. The high resolution of the HRMR measurements are used to improve the retrieval of wet path delays near coasts, as reported in *rad_wet_tropo_cor*. The HRMR measurements are approximately 3.4 degrees off-

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nadir (~80km apart of AMR). This means that when the spacecraft is flying in the forward direction the HRMR measurements at the nadir (e.g., AMR-C) position are from ~14 seconds earlier. The HRMR antenna and main beam brightness temperature measurements provided in this product are after interpolation to the AMR-C locations, and therefore provided at the same data rate as the AMR-C measurements. Spacecraft attitude information is nominally used to determine the positions of both the AMR-C and HRMR measurements.

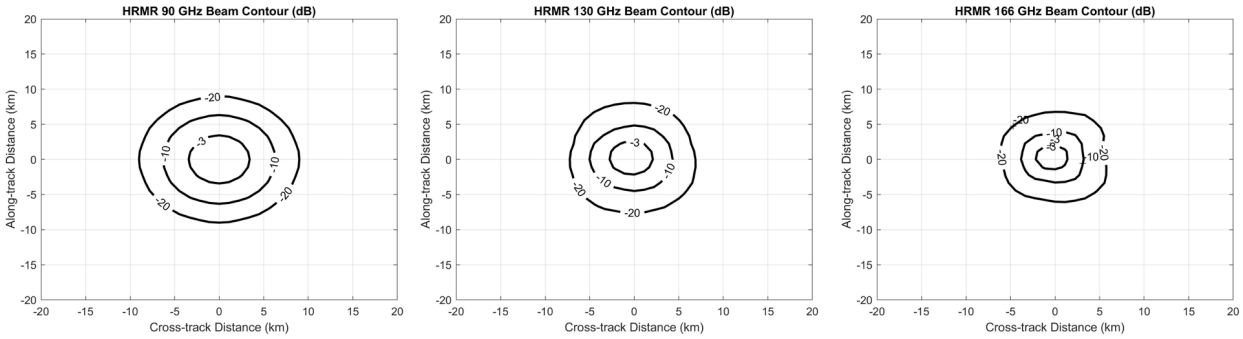

Figure 2. HRMR antenna pattern contours projected onto the Earth's surface for each channel.

3.5 Temporal Organization

A single time tag is associated with each record of the radiometer science data product. Each record is sequential in time along the satellite ground track. Each record consists of the parameters that are described below.

3.6 Spatial Organization

Each record corresponds to one 16 Hz measurement along the satellite ground track, with only 10-12 16 Hz science measurements per second (refer to section 3.3). The measurement in each record has an associated time tag, latitude, and longitude. The latitude and longitude correspond to the nadir point on the surface of the Earth at the time of the measurement.

3.7 Volume

Table 4 provides the expected volume of the individual pass files comprising the radiometer science data product. The provided data product volume is conservative as it does not account for any NetCDF internal compression. Each data record is comprised of 148 bytes. For Sentinel-6 we expect up to 12 data records per second, 3373 seconds per pass, and approximately 25 passes per day.

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Table 4: Description of Data Volume of Each File of Radiometer Product.

File	Name	Volume/Pass (GB/pass)	Volume/Day (GB/day)
1	Radiometer Measurements Pass File	0.00599	0.14976

4 Qualitative Product Description

The following descriptions apply to the Sentinel-6 radiometer science data product. The radiometer onboard Sentinel-6 provides antenna and main beam brightness temperature measurements from the AMR-C at 18.7, 23.8, and 34.0 GHz, and from the HRMR at 90, 130, and 166 GHz. The geophysical measurements of troposphere content, atmospheric attenuation, and radiometer wind speed are then derived from equalized brightness temperature measurements. Equalized brightness temperatures are derived from along-track averaging of the 18.7, 23.8, and 34.0 GHz main beam brightness temperatures to provide footprint sizes equal to the footprint size of the 23.8 GHz channel along the spacecraft track. The wet troposphere correction is provided from two separate computations, using a combination of AMR-C and HRMR main beam brightness temperatures (*rad_wet_tropo_cor*) to take advantage of the high resolution HRMR measurements especially near coasts, and from AMR-C equalized brightness temperatures (*amr_wet_tropo_cor*). All of the other geophysical variables are computed from AMR-C data alone (e.g., *rad_cloud_liquid_water*, *rad_water_vapor*, *rad_wind_speed*, *rad_atm_cor_sig0_ku* and *rad_atm_cor_sig0_c*).

4.1 Radiometer Product File

4.1.1 Time and Location

A single time tag applies to each data record within the files. The time tag corresponds to the middle of the integration period of the AMR-C measurement.

Time tags for each data record are provided in the UTC and TAI time scales:

- *time*: Time in UTC time scale (seconds since January 1, 2000 00:00:00 UTC)
- *time_tai*: Time in TAI time scale (seconds since January 1, 2000 00:00:00 TAI)

These two time tags are related by the attribute *time:tai_utc_difference*, which represents the total number of leap seconds.

time_tai = *time* + *tai_utc_difference*

If a leap second occurs within the range of times of the data set, the attribute *time:leap_second* provides the UTC date at which an additional leap second should be applied to generate *time_tai*. When no additional leap second occurs within the time span of the data in the product, then time:leap_second is set to 0000-00-00T00:00:00Z.

Example 1: January 1, 2000 00:00:00 UTC corresponds to January 1, 2000 00:00:32 TAI, with *time:tai_utc_difference* = 32 seconds, *time* = 0, *time_tai* = 32.

Example 2: January 1, 2017 12:00:00 UTC corresponds to January 1, 2017 12:00:37 TAI,

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with *time:tai_utc_difference* = 37 seconds, *time* = 536587200.0 seconds, *time_tai* = 536587237.0 seconds.

The location of the measurement is provided for each time tag, and corresponds to the position of the AMR-C measurement on the Earth's surface. The latitude and longitude are computed using the reference ellipsoid as defined in the global attributes *ellipsoid_semi_major_axis* and *ellipsoid_flattening*.

- *latitude*: Latitude (degrees)
- *longitude*: Longitude (degrees)

4.1.2 Sensor Flags

Some general information is provided to indicate the operating mode of the instrument. The following flags are provided for each time tag:

- *rad_state_oper_flag*: Operating mode flag of instrument (0 = science mode, 1 = calibration mode). A value of 0 indicates nominal science measurements being taken by the instrument.
- *hrmr_pointing_flag*: This flag indicates if the HRMR beam pointing vector is taken into account to determine the position of the measurement before combining with AMR-C measurements. A value of 0 indicates that the position of the HRMR measurement is computed using the HRMR beam pointing vector, a value of 1 indicates the position of the HRMR measurement is set to the AMR measurement position, and a value of 2 indicates that the position of the HRMR measurement is not computed because orbit information is not available. When this flag is set to 1 or 2, all geophysical parameters using HRMR measurements should be treated as not valid as they have been incorrectly assigned to the AMR position.

4.1.3 Quality Flags

Quality flags are provided for the sensor and geophysical measurements at every data record. Each of these quality flags have a value of 0 for "good" and 1 for "bad".

- *rad_coordinates_qual*: Quality flag for the latitude and longitude coordinates. A value of 0 indicates that the latitude and longitude coordinates are computed using orbit and attitude information, a value of 1 indicates they are computed without attitude information and reflect nadir coordinates, and a value of 2 indicates that they are not computed because orbit information is not available. When this flag is set to 1, the AMR-C measurements are still useful, because the AMR-C measurements are only 0.03 degrees off-nadir.
- *rad_ta_187_qual, rad_ta_238_qual, rad_ta_340_qual*: the antenna temperature measurement quality flags at the three AMR-C operating frequencies (18.7, 23.8, and 34.0 GHz).
- *rad_ta_090_qual, rad_ta_130_qual, rad_ta_166_qual*: the antenna temperature measurement quality flags at the three HRMR operating frequencies (90, 130, and 166 GHz).
- *rad_tmb_187_qual, rad_tmb_238_qual,* and *rad_tmb_340_qual*: the main beam

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brightness temperature measurement quality flags at the three AMR-C operating frequencies (18.7, 23.8, and 34.0 GHz).

- *rad_tmb_090_qual, rad_tmb_130_qual,* and *rad_tmb_166_qual*: the main beam brightness temperature measurement quality flags at the three HRMR operating frequencies (90, 130, and 166 GHz).
- *rad_tb_187_qual, rad_tb_238_qual,* and *rad_tb_340_qual*: the equalized brightness temperature measurement quality flags at the three AMR-C operating frequencies (18.7, 23.8, and 34.0 GHz). Along-track averaging of HRMR brightness temperatures is not performed to preserve their high resolution, so equalized HRMR brightness temperatures are not provided.
- *rad_water_vapor_qual, rad_cloud_liquid_water_qual, rad_wind_speed_qual, rad_wet_tropo_cor_qual, amr_wet_tropo_cor_qual, rad_atm_cor_sig0_ku_qual,* and *rad_atm_cor_sig0_c_qual*: the quality flags for the geophysical measurements of water vapor, cloud liquid water, wind speed, wet troposphere correction, and two-way Ku- and C-band atmospheric attenuations, respectively.

4.1.4 Geophysical Flags

The following geophysical flags are provided for each record. The geophysical estimates of wet troposphere correction, cloud liquid water, water vapor content, and wind speed are generally considered as invalid with any one of the following values of these flags: *rad_surface_type_flag* = 3, *rad_rain_flag* = 1, *rad_sea_ice_flag* = 1, but this is captured by the associated quality flags described in section 4.1.3.

- *rad_surface_type_flag*: Surface type (0 = open ocean, 1 = coastal ocean, 2 = coastal ocean with only AMR data, and 3 = land) applied for the generation of the wet troposphere correction (*rad_wet_tropo_cor*) from a combination of AMR-C and HRMR data as derived from a static surface type database. The surface type database accounts for the antenna patterns of the HRMR and each side of the AMR-C, and is therefore unique to each. A nominal open ocean retrieval algorithm is used to determine the wet troposphere correction when *rad_surface_type_flag* = 0, a nominal coastal ocean retrieval algorithm is used to determine the wet troposphere correction when *rad_surface_type_flag* = 1, while a coastal retrieval algorithm using only AMR data is used when *rad_surface_type_flag* = 2. Wet troposphere corrections (*rad_wet_tropo_cor*) are invalid when *rad_surface_type_flag* = 3.
- *rad_rain_flag*: Rain flag (0 = no rain, 1 = rain) based upon brightness temperature measurements from the AMR-C and HRMR.
- *rad_sea_ice_flag*: Sea ice flag (0 = no sea ice, 1 = sea ice) based upon brightness temperature measurements from the AMR-C and HRMR.
- *amr_surface_type_flag:* Surface type (0 = open ocean, 1 = coastal ocean, and 2 = land) of AMR-C measurements applied for the generation of the AMR wet troposphere correction (*amr_wet_tropo_cor*), as derived from a static surface type database. The surface type database accounts for the antenna patterns of each side of the radiometer, and is therefore unique to each side of the AMR-C. A nominal open ocean retrieval algorithm is used to determine the wet troposphere correction when *rad_surface_type_flag* = 0, while a coastal retrieval algorithm is used when *rad_surface_type_flag* = 1. AMR wet troposphere corrections (*amr_wet_tropo_cor*)

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are invalid when *amr_surface_type_flag* = 2.

- *amr_rain_flag:* Rain flag (0 = no rain, 1 = rain) based upon AMR-C brightness temperature measurements.
- *amr_sea_ice_flag:* Sea ice flag (0 = no sea ice, 1 = sea ice) based upon AMR-C brightness temperature measurements.
- *hrmr_surface_type_flag:* Surface type of HRMR measurements (0 = open ocean, 1 = coastal ocean, and 2 = land) applied for the generation of the combined AMR-C and HRMR wet troposphere correction (*rad_wet_tropo_cor*), as derived from a static surface type database. The surface type database accounts for the antenna patterns of the HRMR. A nominal open ocean retrieval algorithm is used to determine the wet troposphere correction when *hrmr_surface_type_flag* = 0, while a coastal retrieval algorithm is used when *hrmr_surface_type_flag* = 1. HRMR geophysical retrievals are invalid when *hrmr_surface_type_flag* = 2.
- *hrmr_rain_flag:* Rain flag (0 = no rain, 1 = rain) based upon HRMR brightness temperature measurements.
- *hrmr_sea_ice_flag:* Sea ice flag (0 = no sea ice, 1 = sea ice) based upon HRMR brightness temperature measurements.

4.1.5 Sensor Measurements

The following Level 1B sensor measurements are provided for each record:

- *rad_ta_187, rad_ta_238,* and *rad_ta_340*: Antenna temperature measurements at each of the three AMR-C operating frequencies (18.7, 23.8, and 34.0 GHz)
- *rad_ta_090, rad_ta_130,* and *rad_ta_166*: Antenna temperature measurements at each of the three HRMR operating frequencies (90, 130, and 166 GHz)
- *rad_tmb_187, rad_tmb_238,* and *rad_tmb_340*: Main beam brightness temperature measurements at each of the three AMR-C operating frequencies (18.7, 23.8, and 34.0 GHz)
- *rad_tmb_090, rad_tmb_130,* and *rad_tmb_166* Main beam brightness temperature measurements at each of the three HRMR operating frequencies (90, 130, and 166 GHz)
- *rad_tb_187, rad_tb_238,* and *rad_tb_340*: Equalized brightness temperature measurements at each of the three operating frequencies (18.7, 23.8, and 34.0 GHz). Equalized brightness temperatures of the HRMR are not provided to preserve their high resolution.

4.1.6 Geophysical Information

The following geophysical information is provided for each record:

- *rad_distance_to_land*: Radiometer radial distance to land.
- *rad_land_frac_187, rad_land_frac_238,* and *rad_land_frac_340*: Radiometer land fraction: this parameter indicates the fraction of the AMR-C 18.7, 23.8, and 34.0 GHz footprints that contain land. Values range from 0 for no land within footprint, and 1 for entire footprint covered by land.
- *rad_land_frac_090, rad_land_frac_130,* and *rad_land_frac_166*: Radiometer land

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fraction: this parameter indicates the fraction of the HRMR 90, 130, and 166 GHz footprints that contain land. Values range from 0 for no land within footprint, and 1 for entire footprint covered by land.

4.1.7 Geophysical Estimates

The following Level 2 geophysical estimates are provided for each record. Only *rad_wet_tropo_cor* is computed from a combination of AMR-C and HRMR measurements, while the remaining parameters are computed from AMR-C measurements alone.

- *rad_cloud_liquid_water*: Cloud liquid water content.
- *rad_water_vapor*: Water vapor content.
- *rad_wet_tropo_cor*: Wet troposphere correction (negative value to be added to the nadir altimeter range measurements) as computed from a combination of HRMR and AMR-C measurements.
- *amr_wet_tropo_cor*: Wet troposphere correction (negative value to be added to the nadir altimeter range measurements) as computed from AMR-C measurements alone.
- *rad_wind_speed*: Wind speed.
- *rad_atm_cor_sig0_ku* and *rad_atm_cor_sig0_c*: Two-way atmospheric attenuation to backscatter coefficients (Sigma0) at Ku- and C-band frequencies. Should be added to respective backscatter coefficient measurements from altimeter.

5 Detailed Product Description

5.1 Radiometer Product File

The AMR Science Data Product adopts a NetCDF-4 file format and conventions. This is a self-documenting format that contains metadata as global attributes, dimensions, variables, and attributes for variables. Global attributes apply to all of the data within the file, while variable attributes only apply to the associated variable. The NetCDF command "ncdump –h product.nc" can be used to view the header of the product, which describes the content of the product.

5.1.1 Global Attributes

Global attributes of the AMR Science Data Product are provided in Table 5 below.

Table 5. Global Attributes of AMR Science Data Product

Global Attribute Name	Format	Description
Conventions	string	NetCDF-4 conventions adopted in this product. This attribute should be set to "CF-1.7" to indicate that the file is compliant with the Climate and Forecast NetCDF conventions.
title	string	A descriptive title for the data product, built as follows: **"Radiometer L2 " + XXX**

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		Where XXX = "**Near Real Time**", "**Short Time Critical**", or "**Non Time Critical**".
institution	string	Name of producing agency. (e.g., "EUMETSAT")
source	string	The method of production of the original data. If it was model-generated, source should name the model and its version, as specifically as could be useful. If it is observational, source should characterize it (e.g., "radiometer").
history	string	UTC time when file generated. Format is: "YYYY-MM-DDThh:mm:ssZ : Creation"
platform	string	"Sentinel-6A" or "Sentinel-6B"
mission_name	string	"Sentinel-6A" or "Sentinel-6B"
radiometer_sensor_name	string	"AMR-C H Polarization (APID=1408)" or "AMR-C V Polarization (APID=1402)" corresponding to active AMR side for first measurement.
references	string	Published or web-based references that describe the data or methods used to produce it. Provides version number of software generating product.
reference_document	string	Name of Product Description Document to use as reference for product.
contact	string	Contact information for producer of product. (e.g., "ops@eumetsat.int")
time_coverage_start	string	UTC time of first radiometer measurement in product. Format is: "YYYY-MM-DDThh:mm:ss.ssssssZ"
time_coverage_end	string	UTC time of last radiometer measurement in product. Format is: "YYYY-MM-DDThh:mm:ss.ssssssZ"
geospatial_lon_min	double	Westernmost longitude of the bounding box of the product dataset (degrees)(1)
geospatial_lon_max	double	Easternmost longitude of the bounding box of the product dataset (degrees)(1)
geospatial_lat_min	double	Southernmost latitude of the bounding box of the product dataset (degrees)
geospatial_lat_max	double	Northernmost longitude of the bounding box of the product dataset (degrees)
first_measurement_time	string	UTC time of first radiometer measurement in product. Format is: "YYYY-MM-DDThh:mm:ss.ssssssZ"
last_measurement_time	string	UTC time of last radiometer measurement in product. Format is: "YYYY-MM-DDThh:mm:ss.ssssssZ"

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first_measurement_longitude	double	Longitude of first radiometer measurement in product (degrees)
first_measurement_latitude	double	Latitude of first radiometer measurement in product (degrees)
last_measurement_longitude	double	Longitude of last radiometer measurement in product (degrees)
last_measurement_latitude	double	Latitude of last radiometer measurement in product (degrees)
cycle_number	int	Cycle number of first radiometer measurement in product.
pass_number	int	Pass number of first radiometer measurement in product.
equator_time	string	UTC time of the first equator crossing in product. Format is: "YYYY-MM-DDThh:mm:ss.ssssssZ"
equator_longitude	double	Longitude of the first equator crossing in product (degrees)
number_open_ocean_measurements	int	Number of open ocean measurements.
percent_valid_open_ocean_measurements	double	Percent of open ocean measurements with wet troposphere correction quality flag set to good.
xref_dynamic_radiometer_coefficient_file	string	Name of dynamic radiometer coefficient file used to generate data in product.
xref_static_radiometer_coefficient_file	string	Name of static radiometer coefficient file used to generate data in product.
xref_static_radiometer_map_file	string	Name of static radiometer surface type map used to generate data in product.
xref_radiometer_level0_files	string	List of Level 0 radiometer files used to generate data spanning time_coverage_start and time_coverage_end.
xref_orbit_ephemeris_files	string	List of orbit ephemeris files used to generate data spanning time_coverage_start and time_coverage_end.
xref_navatt_files	string	List of attitude files used to generate data spanning time_coverage_start and time_coverage_end.
ellipsoid_semi_major_axis	double	Semi-major axis of the reference ellipsoid in meters.
ellipsoid_flattening	double	Flattening of reference ellipsoid

(1)Note, where geospatial_lon_min is greater than geospatial_lon_max, the bounding box of the dataset extends from geospatial_lon_min through the Prime Meridian (0 degrees longitude) to geospatial_lon_max; for example, geospatial_lon_min = 350 degrees and geospatial_lon_max = 10 degrees incorporates 20 degrees of longitude (ranges 350 to 360, and 0 to 10).

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5.1.2 Variables

Variables are used to store the various measurements. Each variable is assigned a name and a particular data type. Variables can be scalar values (i.e. 0 dimension), or can have one or more of the dimensions described in section 5.1.3. Each variable then has attributes that provide additional information about the variable. Table 6 below identifies the data types used in the AMR science data product, and Table 7 identifies the attributes that may be assigned to each variable.

Table 6. Variable Data Types in NetCDF File

Data Type	Description
char	Characters
byte	8-bit integer
short	16-bit integer
int	32-bit integer
float	IEEE single precision floating point (32 bits)
double	IEEE double precision floating point (64 bits)

Table 7. Variable Attributes in NetCDF File

Attribute	Description
_FillValue	The value used to represent missing or undefined data. (Before applying add_offset and scale_factor).
add_offset	If present this value should be added to each data element after it is read. If both scale_factor and add_offset attributes are present, the data are first scaled before the offset is added.
calendar	Reference time calendar
comment	Miscellaneous information about the data or the methods to generate it.
coordinates	Coordinate variables associated with the variable
flag_meanings	Used in conjunction with flag_values. Describes the meanings of each of the elements of flag_values.
flag_values	Used in conjunction with flag_meanings. Posssible values of the flag variable.
Institution	Institution which generates the source data for the variable, if applicable.
leap_second	UTC date at which a leap second occurs within the time span of data within the file.
long_name	A descriptive variable name that indicates its content.
quality_flag	Names of variable quality flag(s) that are associated with this variable to indicate its quality.
scale_factor	If present, the data are to be multiplied by the value after they are read. If both scale_factor and add_offset attributes are present, the data are first scaled before the offset is added.
source	Data source (model, author, or instrument)
standard_name	A standard variable name that indicates its content.
tai_utc_difference	Difference between TAI and UTC reference time.
units	Unit of data after applying offset (add_offset) and scale_factor.

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valid_max	Maximum theoretical value of variable before applying scale_factor and add_offset (not necessarily the same as maximum value of actual data)
valid_min	Minimum theoretical value of variable before applying scale_factor and add_offset (not necessarily the same as minimum value of actual data)

5.1.3 Dimensions

The NetCDF product file uses the dimensions attributes to identify the physical dimensions of variables within the file. The AMR science data product uses the one dimension shown in Table 8 below.

Table 8. Dimensions of Variables in NetCDF File

Dimension Name	Value
time	Number of measurement records in file.

5.1.4 Detailed NetCDF Format Description

This section provides a detailed listing of each of the variables in the AMR Science Data Product and their associated variable attributes.

// TIME AND LOCATION	
double time(time);	
	_FillValue = 9.9692099683868687e+36 ;
	time:long_name = “time in UTC”;
	time:standard_name = “time”;
	time:calendar = “gregorian”;
	time:tai_utc_difference = [Value of TAI-UTC at time of first record];
	time:leap_second = “YYYY-MM-DDThh:mm:ssZ”;
	time: units = “seconds since 2000-01-01 00:00:00.0”;
	time: comment = ”Time of measurement in seconds in the UTC time scale since 1 Jan 2000 00:00:00 UTC. [tai_utc_difference] is the difference between TAI and UTC reference time (seconds) for the first measurement of the data set. If a leap second occurs within the data set, the attribute leap_second is set to the UTC time at which the leap second occurs.”;
double time_tai(time);	
	_FillValue = 9.9692099683868687e+36
	time_tai:long_name = “time in TAI”;
	time_tai:standard_name = “time”;
	time_tai:calendar = “gregorian”;
	time_tai: units = “seconds since 2000-01-01 00:00:00.0”;
	time_tai: comment = ”Time of measurement in seconds in the TAI time scale since 1 Jan 2000 00:00:00 TAI. This time scale contains no leap seconds. The difference (in seconds) with time in UTC is given by the attribute [time:tai_utc_difference].”;
int latitude(time);	
	latitude:_FillValue = 2147483647;
	latitude:long_name = “latitude (positive N, negative S)”;
	latitude:standard_name=”latitude”;
	latitude:units = “degrees_north”;

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	latitude:scale_factor = 1.0e-6;
	latitude:quality_flag = “rad_coordinates_qual”
	latitude:valid_min = -80000000;
	latitude:valid_max = 80000000;
	latitude:comment = “Latitude of measurement [-90, +90]. Positive latitude is North latitude, negative latitude is South latitude.”;
int longitude(time):	
	longitude:_FillValue = 2147483647;
	longitude:long_name = “longitude (degrees East)”;
	longitude:standard_name=”longitude”;
	longitude:units = “degrees_east”;
	longitude:scale_factor = 1.0e-6;
	longitude:quality_flag = “rad_coordinates_qual”
	longitude:valid_min = 0;
	longitude:valid_max = 359999999;
	longitude:comment = “Longitude of measurement [0, 360]. East longitude relative to Greenwich meridian.”
// SENSOR FLAGS	
byte rad_state_oper_flag(time) ;	
	rad_state_oper_flag:_FillValue = 127b;
	rad_state_oper_flag:long_name = "operating mode of the radiometer";
	rad_state_oper_flag:standard_name = "status_flag";
	rad_state_oper_flag:flag_meanings = "operational calibration";
	rad_state_oper_flag:flag_values = 0b, 1b;
	rad_state_oper_flag:valid_min = 0b;
	rad_state_oper_flag:valid_max = 1b;
	rad_state_oper_flag:comment = "Flag indicating operating state of radiometer. A value of 0 indicates nominal science measurements from the instrument.";
byte hrmr_pointing_flag(time) ;	
	hrmr_pointing_flag:_FillValue = 127b;
	hrmr_pointing _flag:long_name = "hrmr pointing flag";
	hrmr_pointing _flag:standard_name = "status_flag";
	hrmr_pointing _flag:flag_meanings = "good amr_position bad";
	hrmr_pointing _flag:flag_values = 0b, 1b, 2b;
	hrmr_pointing _flag:valid_min = 0b;
	hrmr_pointing _flag:valid_max = 2b;
	hrmr_pointing _flag:comment = "Flag indicating if the HRMR beam pointing vector is taken into account to determine the position of the measurement before combining with AMR-C measurements. A value of 0 indicates that the position of the HRMR measurement is computed using the HRMR beam pointing vector, a value of 1 indicates the position of the HRMR measurement is set to the AMR measurement position, and a value of 2 indicates that the position of the HRMR measurement is not computed because orbit information is not available.";
// QUALITY FLAGS	
byte rad_coordinates_qual(time);	
	rad_coordinates_qual:_FillValue = 127b;
	rad_coordinates_qual:long_name = "quality flag for latitude and longitude coordinates";
	rad_coordinates_qual:standard_name = "status_flag";
	rad_state_oper_flag:flag_meanings = "good no_attitude bad";
	rad_coordinates_qual:flag_values = 0b, 1b, 2b;
	rad_coordinates_qual:valid_min = 0b;
	rad_coordinates_qual:valid_max = 2b;
	rad_coordinates_qual:comment = "Quality flag for the latitude and longitude coordinates. A value of 0 indicates that the latitude and longitude coordinates are computed using orbit and attitude information, a value of 1 indicates they

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	are computed without attitude information and reflect nadir coordinates, and a value of 2 indicates that they are not computed because orbit information is not available.”;
byte rad_ta_187_qual(time);	
	rad_ta_187_qual:_FillValue = 127b;
	rad_ta_187_qual:long_name = "quality flag for 18.7 GHz antenna temperature";
	rad_ta_187_qual:standard_name = "status_flag";
	rad_ta_187_qual:flag_meanings = "good bad";
	rad_ta_187_qual:flag_values = 0b, 1b;
	rad_ta_187_qual:valid_min = 0b ;
	rad_ta_187_qual:valid_max = 1b;
	rad_ta_187_qual:comment = "Quality flag for 18.7 GHz antenna temperature.”;
byte rad_ta_238_qual(time);	
	rad_ta_238_qual:_FillValue = 127b;
	rad_ta_238_qual:long_name = "quality flag for 23.8 GHz antenna temperature";
	rad_ta_238_qual:standard_name = "status_flag";
	rad_ta_238_qual:flag_meanings = "good bad";
	rad_ta_238_qual:flag_values = 0b, 1b;
	rad_ta_238_qual:valid_min = 0b;
	rad_ta_238_qual:valid_max = 1b;
	rad_ta_238_qual:comment = "Quality flag for 23.8 GHz antenna temperature.”;
byte rad_ta_340_qual(time);	
	rad_ta_340_qual:_FillValue = 127b;
	rad_ta_340_qual:long_name = "quality flag for 34.0 GHz antenna temperature";
	rad_ta_340_qual:standard_name = "status_flag";
	rad_ta_340_qual:flag_meanings = "good bad";
	rad_ta_340_qual:flag_values = 0b, 1b;
	rad_ta_340_qual:valid_min = 0b;
	rad_ta_340_qual:valid_max = 1b;
	rad_ta_340_qual:comment = "Quality flag for 34.0 GHz antenna temperature.”;
byte rad_ta_090_qual(time);	
	rad_ta_090_qual:_FillValue = 127b;
	rad_ta_090_qual:long_name = "quality flag for 90 GHz antenna temperature";
	rad_ta_090_qual:standard_name = "status_flag";
	rad_ta_090_qual:flag_meanings = "good bad";
	rad_ta_090_qual:flag_values = 0b, 1b;
	rad_ta_090_qual:valid_min = 0b ;
	rad_ta_090_qual:valid_max = 1b;
	rad_ta_090_qual:comment = "Quality flag for 90 GHz antenna temperature.”;
byte rad_ta_130_qual(time);	
	rad_ta_130_qual:_FillValue = 127b;
	rad_ta_130_qual:long_name = "quality flag for 130 GHz antenna temperature";
	rad_ta_130_qual:standard_name = "status_flag";
	rad_ta_130_qual:flag_meanings = "good bad";
	rad_ta_130_qual:flag_values = 0b, 1b;
	rad_ta_130_qual:valid_min = 0b ;
	rad_ta_130_qual:valid_max = 1b;
	rad_ta_130_qual:comment = "Quality flag for 130 GHz antenna temperature.”;
byte rad_ta_166_qual(time);	
	rad_ta_166_qual:_FillValue = 127b;
	rad_ta_166_qual:long_name = "quality flag for 166 GHz antenna temperature";
	rad_ta_166_qual:standard_name = "status_flag";
	rad_ta_166_qual:flag_meanings = "good bad";
	rad_ta_166_qual:flag_values = 0b, 1b;
	rad_ta_166_qual:valid_min = 0b ;

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	rad_ta_166_qual:valid_max = 1b;
	rad_ta_166_qual:comment = "Quality flag for 166 GHz antenna temperature.";
byte rad_tmb_187_qual(time);	
	rad_tmb_187_qual:_FillValue = 127b;
	rad_tmb_187_qual:long_name = "quality flag for 18.7 GHz main beam brightness temperature";
	rad_tmb_187_qual:standard_name = "status_flag";
	rad_tmb_187_qual:flag_meanings = "good bad";
	rad_tmb_187_qual:flag_values = 0b, 1b;
	rad_tmb_187_qual:valid_min = 0b;
	rad_tmb_187_qual:valid_max = 1b;
	rad_tmb_187_qual:comment = "Quality flag for 18.7 GHz main beam brightness temperature.";
byte rad_tmb_238_qual(time);	
	rad_tmb_238_qual:_FillValue = 127b;
	rad_tmb_238_qual:long_name = "quality flag for 23.8 GHz main beam brightness temperature";
	rad_tmb_238_qual:standard_name = "status_flag";
	rad_tmb_238_qual:flag_meanings = "good bad";
	rad_tmb_238_qual:flag_values = 0b, 1b;
	rad_tmb_238_qual:valid_min = 0b;
	rad_tmb_238_qual:valid_max = 1b;
	rad_tmb_238_qual:comment = "Quality flag for 23.8 GHz main beam brightness temperature.";
byte rad_tmb_340_qual(time);	
	rad_tmb_340_qual:_FillValue = 127b;
	rad_tmb_340_qual:long_name = "quality flag for 34.0 GHz main beam brightness temperature";
	rad_tmb_340_qual:standard_name = "status_flag";
	rad_tmb_340_qual:flag_meanings = "good bad";
	rad_tmb_340_qual:flag_values = 0b, 1b;
	rad_tmb_340_qual:valid_min = 0b;
	rad_tmb_340_qual:valid_max = 1b;
	rad_tmb_340_qual:comment = "Quality flag for 34.0 GHz main beam brightness temperature.";
byte rad_tmb_090_qual(time);	
	rad_tmb_090_qual:_FillValue = 127b;
	rad_tmb_090_qual:long_name = "quality flag for 90 GHz main beam brightness temperature";
	rad_tmb_090_qual:standard_name = "status_flag";
	rad_tmb_090_qual:flag_meanings = "good bad";
	rad_tmb_090_qual:flag_values = 0b, 1b;
	rad_tmb_090_qual:valid_min = 0b;
	rad_tmb_090_qual:valid_max = 1b;
	rad_tmb_090_qual:comment = "Quality flag for 90 GHz main beam brightness temperature.";
byte rad_tmb_130_qual(time);	
	rad_tmb_130_qual:_FillValue = 127b;
	rad_tmb_130_qual:long_name = "quality flag for 130 GHz main beam brightness temperature";
	rad_tmb_130_qual:standard_name = "status_flag";
	rad_tmb_130_qual:flag_meanings = "good bad";
	rad_tmb_130_qual:flag_values = 0b, 1b;
	rad_tmb_130_qual:valid_min = 0b;
	rad_tmb_130_qual:valid_max = 1b;
	rad_tmb_130_qual:comment = "Quality flag for 130 GHz main beam brightness temperature.";
byte rad_tmb_166_qual(time);	
	rad_tmb_166_qual:_FillValue = 127b;
	rad_tmb_166_qual:long_name = "quality flag for 166 GHz main beam brightness temperature";
	rad_tmb_166_qual:standard_name = "status_flag";
	rad_tmb_166_qual:flag_meanings = "good bad";
	rad_tmb_166_qual:flag_values = 0b, 1b;
	rad_tmb_166_qual:valid_min = 0b;

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	rad_tmb_166_qual:valid_max = 1b;
	rad_tmb_166_qual:comment = "Quality flag for 166 GHz main beam brightness temperature.";
byte rad_tb_187_qual(time);	
	rad_tb_187_qual:_FillValue = 127b;
	rad_tb_187_qual:long_name = "quality flag for 18.7 GHz equalized brightness temperature";
	rad_tb_187_qual:standard_name = "status_flag";
	rad_tb_187_qual:flag_meanings = "good bad";
	rad_tb_187_qual:flag_values = 0b, 1b;
	rad_tb_187_qual:valid_min = 0b;
	rad_tb_187_qual:valid_max = 1b;
	rad_tb_187_qual:comment = "Quality flag for 18.7 GHz equalized brightness temperature.";
byte rad_tb_238_qual(time);	
	rad_tb_238_qual:_FillValue = 127b;
	rad_tb_238_qual:long_name = "quality flag for 23.8 GHz equalized brightness temperature";
	rad_tb_238_qual:standard_name = "status_flag";
	rad_tb_238_qual:flag_meanings = "good bad";
	rad_tb_238_qual:flag_values = 0b, 1b;
	rad_tb_238_qual:valid_min = 0b;
	rad_tb_238_qual:valid_max = 1b;
	rad_tb_238_qual:comment = "Quality flag for 23.8 GHz equalized brightness temperature.";
byte rad_tb_340_qual(time);	
	rad_tb_340_qual:_FillValue = 127b;
	rad_tb_340_qual:long_name = "quality flag for 34.0 GHz equalized brightness temperature";
	rad_tb_340_qual:standard_name = "status_flag";
	rad_tb_340_qual:flag_meanings = "good bad";
	rad_tb_340_qual:flag_values = 0b, 1b;
	rad_tb_340_qual:valid_min = 0b;
	rad_tb_340_qual:valid_max = 1b;
	rad_tb_340_qual:comment = "Quality flag for 34.0 GHz equalized brightness temperature.";
byte rad_cloud_liquid_water_qual(time);	
	rad_cloud_liquid_water_qual:_FillValue = 127b;
	rad_cloud_liquid_water_qual:long_name = "quality flag for radiometer cloud liquid water content";
	rad_cloud_liquid_water_qual:standard_name = "status_flag";
	rad_cloud_liquid_water_qual:flag_meanings = "good bad";
	rad_cloud_liquid_water_qual:flag_values = 0b, 1b;
	rad_cloud_liquid_water_qual:valid_min = 0b;
	rad_cloud_liquid_water_qual:valid_max = 1b;
	rad_cloud_liquid_water_qual:comment = "Quality flag for radiometer cloud liquid water content.";
byte rad_wind_speed_qual(time);	
	rad_wind_speed_qual:_FillValue = 127b;
	rad_wind_speed_qual:long_name = "quality flag for radiometer wind speed";
	rad_wind_speed_qual:standard_name = "status_flag";
	rad_wind_speed_qual:flag_meanings = "good bad";
	rad_wind_speed_qual:flag_values = 0b, 1b;
	rad_wind_speed_qual:valid_min = 0b ;
	rad_wind_speed_qual:valid_max = 1b;
	rad_wind_speed_qual:comment = "Quality flag for radiometer wind speed.";
byte rad_water_vapor_qual(time);	
	rad_water_vapor_qual:_FillValue = 127b;
	rad_water_vapor_qual:long_name = "quality flag for radiometer water vapor content";
	rad_water_vapor_qual:standard_name = "status_flag";
	rad_water_vapor_qual:flag_meanings = "good bad";
	rad_water_vapor_qual:flag_values = 0b, 1b;
	rad_water_vapor_qual:valid_min = 0b;

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	rad_water_vapor_qual:valid_max = 1b;
	rad_water_vapor_qual:comment = "Quality flag for radiometer water vapor content.";
byte rad_wet_tropo_cor_qual(time);	
	rad_wet_tropo_cor_qual:_FillValue = 127b;
	rad_wet_tropo_cor_qual:long_name = "quality flag for radiometer wet troposphere correction";
	rad_wet_tropo_cor_qual:standard_name = "status_flag";
	rad_wet_tropo_cor_qual:flag_meanings = "good bad";
	rad_wet_tropo_cor_qual:flag_values = 0b, 1b;
	rad_wet_tropo_cor_qual:valid_min = 0b;
	rad_wet_tropo_cor_qual:valid_max = 1b;
	rad_wet_tropo_cor_qual:comment = "Quality flag for radiometer wet troposphere correction computed from AMR and HRMR measurements.";
byte amr_wet_tropo_cor_qual(time);	
	amr_wet_tropo_cor_qual:_FillValue = 127b;
	amr_wet_tropo_cor_qual:long_name = "quality flag for AMR radiometer wet troposphere correction";
	amr_wet_tropo_cor_qual:standard_name = "status_flag";
	amr_wet_tropo_cor_qual:flag_meanings = "good bad";
	amr_wet_tropo_cor_qual:flag_values = 0b, 1b;
	amr_wet_tropo_cor_qual:valid_min = 0b;
	amr_wet_tropo_cor_qual:valid_max = 1b;
	amr_wet_tropo_cor_qual:comment = "Quality flag for radiometer wet troposphere correction computed from AMR data alone.";
byte rad_atm_cor_sig0_ku_qual(time);	
	rad_atm_cor_sig0_ku_qual:_FillValue = 127b;
	rad_atm_cor_sig0_ku_qual:long_name = "quality flag for radiometer two-way atmospheric correction to Ku band backscatter coefficient";
	rad_atm_cor_sig0_ku:standard_name = "status_flag";
	rad_atm_cor_sig0_ku_qual:flag_meanings = "good bad";
	rad_atm_cor_sig0_ku_qual:flag_values = 0b, 1b;
	rad_atm_cor_sig0_ku_qual:valid_min = 0b ;
	rad_atm_cor_sig0_ku_qual:valid_max = 1b;
	rad_atm_cor_sig0_ku_qual:comment = "Quality flag for radiometer two-way atmospheric correction to Ku band backscatter coefficient.";
byte rad_atm_cor_sig0_c_qual(time);	
	rad_atm_cor_sig0_c_qual:_FillValue = 127b;
	rad_atm_cor_sig0_c_qual:long_name = "quality flag for radiometer two-way atmospheric correction to C band backscatter coefficient";
	rad_atm_cor_sig0_c_qual:standard_name = "status_flag";
	rad_atm_cor_sig0_c_qual:flag_meanings = "good bad";
	rad_atm_cor_sig0_c_qual:flag_values = 0b, 1b;
	rad_atm_cor_sig0_c_qual:valid_min = 0b;
	rad_atm_cor_sig0_c_qual:valid_max = 1b;
	rad_atm_cor_sig0_c_qual:comment = "Quality flag for radiometer two-way atmospheric correction to C band backscatter coefficient.";
// GEOPHYSICAL FLAGS	
byte rad_surface_type_flag(time);	
	rad_surface_type_flag:_FillValue = 127b;
	rad_surface_type_flag:long_name = “radiometer surface type”;
	rad_surface_type_flag:standard_name = “status_flag”;
	rad_surface_type_flag:flag_meanings = "open_ocean coastal_ocean coastal_ocean_amr land";
	rad_surface_type_flag:flag_values = 0b, 1b, 2b, 3b;
	rad_surface_type_flag:valid_min = 0b;
	rad_surface_type_flag:valid_max = 3b;
	rad_surface_type_flag:comment = " Flag indicating the validity and type of processing applied to generate the wet

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	troposphere correction (rad_wet_tropo_cor) from a combination of AMR and HRMR data. A value of 0 indicates open ocean processing, a value of 1 indicates nominal coastal processing, a value of 2 indicates coastal processing with only AMR data, and a value of 3 indicates that rad_wet_trop_cor is invalid due to land contamination.”;
byte rad_rain_flag(time);	
	rad_rain_flag:_FillValue = 127b;
	rad_rain_flag:long_name = “radiometer rain flag”;
	rad_rain_flag:standard_name = “status_flag”;
	rad_rain_flag:flag_meanings = "no_rain rain";
	rad_rain_flag:flag_values = 0b, 1b;
	rad_rain_flag:valid_min = 0b;
	rad_rain_flag:valid_max = 1b;
	rad_rain_flag:comment = " Flag indicating if radiometer measurements from combination of AMR and HRMR data are invalid due to rain contamination.";
byte rad_sea_ice_flag(time);	
	rad_sea_ice_flag:_FillValue = 127b;
	rad_sea_ice_flag:long_name = “radiometer sea ice flag”;
	rad_sea_ice_flag:standard_name = “status_flag”;
	rad_sea_ice_flag:flag_meanings = "no_sea_ice sea_ice";
	rad_sea_ice_flag:flag_values = 0b, 1b;
	rad_sea_ice_flag:valid_min = 0b;
	rad_sea_ice_flag:valid_max = 1b;
	rad_sea_ice_flag:comment = " Flag indicating if radiometer measurements from combination of AMR and HRMR data are invalid due to sea ice contamination.";
byte amr_surface_type_flag(time);	
	amr_surface_type_flag:_FillValue = 127b;
	amr_surface_type_flag:long_name = “AMR surface type”;
	amr_surface_type_flag:standard_name = “status_flag”;
	amr_surface_type_flag:flag_meanings = "open_ocean coastal_ocean land";
	amr_surface_type_flag:flag_values = 0b, 1b, 2b;
	amr_surface_type_flag:valid_min = 0b;
	amr_surface_type_flag:valid_max = 2b;
	amr_surface_type_flag:comment = " Flag indicating the validity and type of processing applied to generate the AMR wet troposphere correction (amr_wet_tropo_cor). A value of 0 indicates that open ocean processing is used, a value of 1 indicates coastal processing is used, and a value of 2 indicates that amr_wet_trop_cor is invalid due to land contamination.”;
byte amr_rain_flag(time);	
	amr_rain_flag:_FillValue = 127b;
	amr_rain_flag:long_name = “AMR rain flag”;
	amr_rain_flag:standard_name = “status_flag”;
	amr_rain_flag:flag_meanings = "no_rain rain";
	amr_rain_flag:flag_values = 0b, 1b;
	amr_rain_flag:valid_min = 0b;
	amr_rain_flag:valid_max = 1b;
	amr_rain_flag:comment = " Flag indicating if AMR measurement is impacted by rain contamination.";
byte amr_sea_ice_flag(time);	
	amr_sea_ice_flag:_FillValue = 127b;
	amr_sea_ice_flag:long_name = “AMR sea ice flag”;
	amr_sea_ice_flag:standard_name = “status_flag”;
	amr_sea_ice_flag:flag_meanings = "no_sea_ice sea_ice";
	amr_sea_ice_flag:flag_values = 0b, 1b;
	amr_sea_ice_flag:valid_min = 0b;
	amr_sea_ice_flag:valid_max = 1b;
	amr_sea_ice_flag:comment = " Flag indicating if AMR measurement is impacted by sea ice contamination.";
byte hrmr_surface_type_flag(time);	

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	hrmr_surface_type_flag:_FillValue = 127b;
	hrmr_surface_type_flag:long_name = “HRMR surface type”;
	hrmr_surface_type_flag:standard_name = “status_flag”;
	hrmr_surface_type_flag:flag_meanings = "open_ocean coastal_ocean land";
	hrmr_surface_type_flag:flag_values = 0b, 1b, 2b;
	hrmr_surface_type_flag:valid_min = 0b;
	hrmr_surface_type_flag:valid_max = 2b;
	hrmr_surface_type_flag:comment = " Flag indicating the validity and type of processing applied to generate the HRMR contribution to the wet troposphere correction (rad_wet_tropo_cor). A value of 0 indicates that open ocean processing is used, a value of 1 indicates coastal processing is used, and a value of 2 indicates that HRMR geophysical retrievals are invalid due to land contamination.”;
byte hrmr_rain_flag(time);	
	hrmr_rain_flag:_FillValue = 127b;
	hrmr_rain_flag:long_name = “HRMR rain flag”;
	hrmr_rain_flag:standard_name = “status_flag”;
	hrmr_rain_flag:flag_meanings = "no_rain rain";
	hrmr_rain_flag:flag_values = 0b, 1b;
	hrmr_rain_flag:valid_min = 0b;
	hrmr_rain_flag:valid_max = 1b;
	hrmr_rain_flag:comment = " Flag indicating if HRMR measurement is impacted by rain contamination.";
byte hrmr_sea_ice_flag(time);	
	hrmr_sea_ice_flag:_FillValue = 127b;
	hrmr_sea_ice_flag:long_name = “HRMR sea ice flag”;
	hrmr_sea_ice_flag:standard_name = “status_flag”;
	hrmr_sea_ice_flag:flag_meanings = "no_sea_ice sea_ice";
	hrmr_sea_ice_flag:flag_values = 0b, 1b;
	hrmr_sea_ice_flag:valid_min = 0b;
	hrmr_sea_ice_flag:valid_max = 1b;
	hrmr_sea_ice_flag:comment = " Flag indicating if HRMR measurement is impacted by sea ice contamination.";
// Sensor Measurements	
int rad_ta_187(time);	
	rad_ta_187:_FillValue = 2147483647;
	rad_ta_187:long_name = "radiometer antenna temperature at 18.7 GHz";
	rad_ta_187:units = "K";
	rad_ta_187:scale_factor = 1.0e-2;
	rad_ta_187:coordinates = “longitude latitude”;
	rad_ta_187:quality_flag = “rad_ta_187_qual”;
	rad_ta_187:valid_min = 0s;
	rad_ta_187:valid_max = 36000;
	rad_ta_187:comment = “Antenna temperature measurement at 18.7 GHz.”;
int rad_ta_238(time);	
	rad_ta_238:_FillValue = 2147483647;
	rad_ta_238:long_name = "radiometer antenna temperature at 23.8 GHz";
	rad_ta_238:units = "K";
	rad_ta_238:scale_factor = 1.0e-2;
	rad_ta_238:coordinates = “longitude latitude”;
	rad_ta_238:quality_flag = “rad_ta_238_qual”;
	rad_ta_238:valid_min = 0s;
	rad_ta_238:valid_max = 36000;
	rad_ta_238:comment = “Antenna temperature measurement at 23.8 GHz.”;

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int rad_ta_340(time);	
	rad_ta_340:_FillValue = 2147483647;
	rad_ta_340:long_name = "radiometer antenna temperature at 34.0 GHz";
	rad_ta_340:units = "K";
	rad_ta_340:scale_factor = 1.0e-2;
	rad_ta_340:coordinates = “longitude latitude”;
	rad_ta_340:quality_flag = “rad_ta_340_qual”;
	rad_ta_340:valid_min = 0s;
	rad_ta_340:valid_max = 36000;
	rad_ta_340:comment = “Antenna temperature measurement at 34.0 GHz.”;
int rad_ta_090(time);	
	rad_ta_090:_FillValue = 2147483647;
	rad_ta_090:long_name = "radiometer antenna temperature at 90 GHz";
	rad_ta_090:units = "K";
	rad_ta_090:scale_factor = 1.0e-2;
	rad_ta_090:coordinates = “longitude latitude”;
	rad_ta_090:quality_flag = “rad_ta_090_qual”;
	rad_ta_090:valid_min = 0s;
	rad_ta_090:valid_max = 36000;
	rad_ta_090:comment = “Antenna temperature measurement at 90 GHz.”;
int rad_ta_130(time);	
	rad_ta_130:_FillValue = 2147483647;
	rad_ta_130:long_name = "radiometer antenna temperature at 130 GHz";
	rad_ta_130:units = "K";
	rad_ta_130:scale_factor = 1.0e-2;
	rad_ta_130:coordinates = “longitude latitude”;
	rad_ta_130:quality_flag = “rad_ta_130_qual”;
	rad_ta_130:valid_min = 0s;
	rad_ta_130:valid_max = 36000;
	rad_ta_130:comment = “Antenna temperature measurement at 130 GHz.”;
int rad_ta_166(time);	
	rad_ta_166:_FillValue = 2147483647;
	rad_ta_166:long_name = "radiometer antenna temperature at 166 GHz";
	rad_ta_166:units = "K";
	rad_ta_166:scale_factor = 1.0e-2;
	rad_ta_166:coordinates = “longitude latitude”;
	rad_ta_166:quality_flag = “rad_ta_166_qual”;
	rad_ta_166:valid_min = 0s;
	rad_ta_166:valid_max = 36000;
	rad_ta_166:comment = “Antenna temperature measurement at 166 GHz.”;
int rad_tmb_187(time);	
	rad_tmb_187:_FillValue = 2147483647;
	rad_tmb_187:long_name = "radiometer main beam brightness temperature at 18.7 GHz";
	rad_tmb_187:standard_name = "toa_brightness_temperature";
	rad_tmb_187:units = "K";
	rad_tmb_187:scale_factor = 1.0e-2;

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	rad_tmb_187:coordinates = “longitude latitude”;
	rad_tmb_187:quality_flag = “rad_tmb_187_qual”;
	rad_tmb_187:valid_min = 0s;
	rad_tmb_187:valid_max = 36000;
	rad_tmb_187:comment = “Main beam brightness temperature measurement at 18.7 GHz. Value is unsmoothed (along-track averaging has not been performed).”;
int rad_tmb_238(time);	
	rad_tmb_238:_FillValue = 2147483647;
	rad_tmb_238:long_name = "radiometer main beam brightness temperature at 23.8 GHz";
	rad_tmb_238:standard_name = "toa_brightness_temperature";
	rad_tmb_238:units = "K";
	rad_tmb_238:scale_factor = 1.0e-2;
	rad_tmb_238:coordinates = “longitude latitude”;
	rad_tmb_238:quality_flag = “rad_tmb_238_qual”;
	rad_tmb_238:valid_min = 0s;
	rad_tmb_238:valid_max = 36000;
	rad_tmb_238:comment = “Main beam brightness temperature measurement at 23.8 GHz. Value is unsmoothed (along-track averaging has not been performed).”;
int rad_tmb_340(time);	
	rad_tmb_340:_FillValue = 2147483647;
	rad_tmb_340:long_name = "radiometer main beam brightness temperature at 34.0 GHz";
	rad_tmb_340:standard_name = "toa_brightness_temperature";
	rad_tmb_340:units = "K";
	rad_tmb_340:scale_factor = 1.0e-2;
	rad_tmb_340:coordinates = “longitude latitude”;
	rad_tmb_340:quality_flag = “rad_tmb_340_qual”;
	rad_tmb_340:valid_min = 0s;
	rad_tmb_340:valid_max = 36000;
	rad_tmb_340:comment = “Main beam brightness temperature measurement at 34.0 GHz. Value is unsmoothed (along-track averaging has not been performed).”;
int rad_tmb_090(time);	
	rad_tmb_090:_FillValue = 2147483647;
	rad_tmb_090:long_name = "radiometer main beam brightness temperature at 90 GHz";
	rad_tmb_090:standard_name = "toa_brightness_temperature";
	rad_tmb_090:units = "K";
	rad_tmb_090:scale_factor = 1.0e-2;
	rad_tmb_090:coordinates = “longitude latitude”;
	rad_tmb_090:quality_flag = “rad_tmb_090_qual”;
	rad_tmb_090:valid_min = 0s;
	rad_tmb_090:valid_max = 36000;
	rad_tmb_090:comment = “Main beam brightness temperature measurement at 90 GHz. Value is unsmoothed (along-track averaging has not been performed).”;
int rad_tmb_130(time);	
	rad_tmb_130:_FillValue = 2147483647;
	rad_tmb_130:long_name = "radiometer main beam brightness temperature at 130 GHz";
	rad_tmb_130:standard_name = "toa_brightness_temperature";
	rad_tmb_130:units = "K";

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	rad_tmb_130:scale_factor = 1.0e-2;
	rad_tmb_130:coordinates = “longitude latitude”;
	rad_tmb_130:quality_flag = “rad_tmb_130_qual”;
	rad_tmb_130:valid_min = 0s;
	rad_tmb_130:valid_max = 36000;
	rad_tmb_130:comment = “Main beam brightness temperature measurement at 130 GHz. Value is unsmoothed (along-track averaging has not been performed).”;
int rad_tmb_166(time);	
	rad_tmb_166:_FillValue = 2147483647;
	rad_tmb_166:long_name = "radiometer main beam brightness temperature at 166 GHz";
	rad_tmb_166:standard_name = "toa_brightness_temperature";
	rad_tmb_166:units = "K";
	rad_tmb_166:scale_factor = 1.0e-2;
	rad_tmb_166:coordinates = “longitude latitude”;
	rad_tmb_166:quality_flag = “rad_tmb_166_qual”;
	rad_tmb_166:valid_min = 0s;
	rad_tmb_166:valid_max = 36000;
	rad_tmb_166:comment = “Main beam brightness temperature measurement at 166 GHz. Value is unsmoothed (along-track averaging has not been performed).”;
int rad_tb_187(time);	
	rad_tb_187:_FillValue = 2147483647;
	rad_tb_187:long_name = "radiometer equalized brightness temperature at 18.7 GHz";
	rad_tb_187:standard_name = "toa_brightness_temperature";
	rad_tb_187:units = "K";
	rad_tb_187:scale_factor = 1.0e-2;
	rad_tb_187:coordinates = “longitude latitude”;
	rad_tb_187:quality_flag = “rad_tb_187_qual”;
	rad_tb_187:valid_min = 0s;
	rad_tb_187:valid_max = 36000;
	rad_tb_187:comment = “Equalized brightness temperature measurement at 18.7 GHz. Value is smoothed (along-track averaging has been performed).”;
int rad_tb_238(time);	
	rad_tb_238:_FillValue = 2147483647;
	rad_tb_238:long_name = "radiometer equalized brightness temperature at 23.8 GHz";
	rad_tb_238:standard_name = "toa_brightness_temperature";
	rad_tb_238:units = "K";
	rad_tb_238:scale_factor = 1.0e-2;
	rad_tb_238:coordinates = “longitude latitude”;
	rad_tb_238:quality_flag = “rad_tb_238_qual”;
	rad_tb_238:valid_min = 0s;
	rad_tb_238:valid_max = 36000;
	rad_tb_238:comment = “Equalized brightness temperature measurement at 23.8 GHz. Value is smoothed (along-track averaging has been performed).”;
int rad_tb_340(time);	
	rad_tb_340:_FillValue = 2147483647;
	rad_tb_340:long_name = "radiometer equalized brightness temperature at 34.0 GHz";
	rad_tb_340:standard_name = "toa_brightness_temperature";

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	rad_tb_340:units = "K";
	rad_tb_340:scale_factor = 1.0e-2;
	rad_tb_340:coordinates = “longitude latitude”;
	rad_tb_340:quality_flag = “rad_tb_340_qual”;
	rad_tb_340:valid_min = 0s;
	rad_tb_340:valid_max = 36000;
	rad_tb_340:comment = “Equalized brightness temperature measurement at 34.0 GHz. Value is smoothed (along-track averaging has been performed).”;
// Geophysical Information	
int rad_distance_to_land(time);	
	rad_distance_to_land:_FillValue = 2147483647;
	rad_distance_to_land:long_name = "radiometer main beam radial distance to land";
	rad_distance_to_land:units = "m";
	rad_distance_to_land:scale_factor = 1.0e2;
	rad_distance_to_land:coordinates = “longitude latitude”;
	rad_distance_to_land:valid_min = 0;
	rad_distance_to_land:valid_max = 2147483646;
	rad_distance_to_land:comment = “Shortest distance between main beam measurement and land.”;
short rad_land_frac_187(time);	
	rad_land_frac_187:_FillValue = 32767s;
	rad_land_frac_187:long_name = "land fraction within main beam of 18.7 GHz channel";
	rad_land_frac_187:units = "1";
	rad_land_frac_187:scale_factor = 1.0e-4;
	rad_land_frac_187:coordinates = “longitude latitude”;
	rad_land_frac_187:valid_min = 0s;
	rad_land_frac_187:valid_max = 10000s;
	rad_land_frac_187:comment = “Fraction of land within the 18.7 GHz main beam. Value is from 0 to 1.”;
short rad_land_frac_238(time);	
	rad_land_frac_238:_FillValue = 32767s;
	rad_land_frac_238:long_name = "land fraction within main beam of 23.8 GHz channel";
	rad_land_frac_238:units = "1";
	rad_land_frac_238:scale_factor = 1.0e-4;
	rad_land_frac_238:coordinates = “longitude latitude”;
	rad_land_frac_238:valid_min = 0s;
	rad_land_frac_238:valid_max = 10000s;
	rad_land_frac_238:comment = “Fraction of land within the 23.8 GHz main beam. Value is from 0 to 1.”;
short rad_land_frac_340(time);	
	rad_land_frac_340:_FillValue = 32767s;
	rad_land_frac_340:long_name = "land fraction within main beam of 34.0 GHz channel";
	rad_land_frac_340:units = "1";
	rad_land_frac_340:scale_factor = 1.0e-4;
	rad_land_frac_340:coordinates = “longitude latitude”;
	rad_land_frac_340:valid_min = 0s;
	rad_land_frac_340:valid_max = 10000s;
	rad_land_frac_340:comment = “Fraction of land within the 34.0 GHz main beam. Value is from 0 to 1.”;
short rad_land_frac_090(time);	
	rad_land_frac_090:_FillValue = 32767s;
	rad_land_frac_090:long_name = "land fraction within main beam of 90 GHz channel";
	rad_land_frac_090:units = "1";
	rad_land_frac_090:scale_factor = 1.0e-4;
	rad_land_frac_090:coordinates = “longitude latitude”;
	rad_land_frac_090:valid_min = 0s;

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	rad_land_frac_090:valid_max = 10000s;
	rad_land_frac_090:comment = “Fraction of land within the 90 GHz main beam. Value is from 0 to 1.”;
short rad_land_frac_130(time);	
	rad_land_frac_130:_FillValue = 32767s;
	rad_land_frac_130:long_name = "land fraction within main beam of 130 GHz channel";
	rad_land_frac_130:units = "1";
	rad_land_frac_130:scale_factor = 1.0e-4;
	rad_land_frac_130:coordinates = “longitude latitude”;
	rad_land_frac_130:valid_min = 0s;
	rad_land_frac_130:valid_max = 10000s;
	rad_land_frac_130:comment = “Fraction of land within the 130 GHz main beam. Value is from 0 to 1.”;
short rad_land_frac_166(time);	
	rad_land_frac_166:_FillValue = 32767s;
	rad_land_frac_166:long_name = "land fraction within main beam of 166 GHz channel";
	rad_land_frac_166:units = "1";
	rad_land_frac_166:scale_factor = 1.0e-4;
	rad_land_frac_166:coordinates = “longitude latitude”;
	rad_land_frac_166:valid_min = 0s;
	rad_land_frac_166:valid_max = 10000s;
	rad_land_frac_166:comment = “Fraction of land within the 166 GHz main beam. Value is from 0 to 1.”;
// Geophysical Estimates	
short rad_cloud_liquid_water(time);	
	rad_cloud_liquid_water:_FillValue = 32767s;
	rad_cloud_liquid_water:long_name = "radiometer cloud liquid water content";
	rad_cloud_liquid_water:standard_name = "atmosphere_cloud_liquid_water_content";
	rad_cloud_liquid_water:units = "kg/m^2";
	rad_cloud_liquid_water:scale_factor = 1.0e-2;
	rad_cloud_liquid_water:coordinates = “longitude latitude”;
	rad_cloud_liquid_water:quality_flag = “rad_cloud_liquid_water_qual”;
	rad_cloud_liquid_water:valid_min = 0s;
	rad_cloud_liquid_water:valid_max = 32766s;
	rad_cloud_liquid_water:comment = “Integrated cloud liquid water content.”;
short rad_wind_speed(time);	
	rad_wind_speed:_FillValue = 32767s;
	rad_wind_speed:long_name = "radiometer wind speed";
	rad_wind_speed:standard_name = "wind_speed";
	rad_wind_speed:units = "m/s";
	rad_wind_speed:scale_factor = 1.0e-2;
	rad_wind_speed:coordinates = “longitude latitude”;
	rad_wind_speed:quality_flag = “rad_wind_speed_qual”;
	rad_wind_speed:valid_min = 0s;
	rad_wind_speed:valid_max = 32766s;
	rad_wind_speed:comment = “Sea surface wind speed.”;
short rad_water_vapor(time);	
	rad_water_vapor:_FillValue = 32767s;
	rad_water_vapor:long_name = "radiometer water vapor content";
	rad_water_vapor:standard_name = "atmosphere_water_vapor_content";
	rad_water_vapor:units = "kg/m^2";
	rad_water_vapor:scale_factor = 1.0e-1;

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	rad_water_vapor:coordinates = “longitude latitude”;
	rad_water_vapor:quality_flag = “rad_water_vapor_qual”;
	rad_water_vapor:valid_min = 0s;
	rad_water_vapor:valid_max = 32766s;
	rad_water_vapor:comment = “Integrated water vapor content.”;
short rad_wet_tropo_cor(time);	
	rad_wet_tropo_cor:_FillValue = 32767s;
	rad_wet_tropo_cor:long_name = "radiometer wet troposphere correction";
	rad_wet_tropo_cor:standard_name = "altimeter_range_correction_due_to_wet_troposphere";
	rad_wet_tropo_cor:units = "m";
	rad_wet_tropo_cor:scale_factor = 1.0e-4;
	rad_wet_tropo_cor:coordinates = “longitude latitude”;
	rad_wet_tropo_cor:quality_flag = “rad_wet_tropo_cor_qual”
	rad_wet_tropo_cor:valid_min = -10000s;
	rad_wet_tropo_cor:valid_max = 0s;
	rad_wet_tropo_cor:comment = “Value must be added to altimeter range to correct for delay due to the wet troposphere. Computed from combination of AMR and HRMR measurements.”;
short amr_wet_tropo_cor(time);	
	amr_wet_tropo_cor:_FillValue = 32767s;
	amr_wet_tropo_cor:long_name = "AMR radiometer wet troposphere correction";
	amr_wet_tropo_cor:standard_name = "altimeter_range_correction_due_to_wet_troposphere";
	amr_wet_tropo_cor:units = "m";
	amr_wet_tropo_cor:scale_factor = 1.0e-4;
	amr_wet_tropo_cor:coordinates = “longitude latitude”;
	amr_wet_tropo_cor:quality_flag = “amr_wet_tropo_cor_qual”
	amr_wet_tropo_cor:valid_min = -10000s;
	amr_wet_tropo_cor:valid_max = 0s;
	amr_wet_tropo_cor:comment = “Value must be added to altimeter range to correct for delay due to the wet troposphere. Computed from AMR measurements alone.”;
short rad_atm_cor_sig0_ku(time);	
	rad_atm_cor_sig0_ku:_FillValue = 32767s;
	rad_atm_cor_sig0_ku:long_name = "two-way atmospheric attenuation on Ku band altimeter backscatter coefficient";
	rad_atm_cor_sig0_ku:units = "dB";
	rad_atm_cor_sig0_ku:scale_factor = 1.0e-3;
	rad_atm_cor_sig0_ku:coordinates = “longitude latitude”;
	rad_atm_cor_sig0_ku:quality_flag = “rad_atm_cor_sig0_ku_qual”;
	rad_atm_cor_sig0_ku:valid_min = 0s;
	rad_atm_cor_sig0_ku:valid_max = 32766s;
	rad_atm_cor_sig0_ku:comment = “Value must be added to altimeter backscatter coefficient to correct for atmospheric attenuation.”;
short rad_atm_cor_sig0_c(time);	
	rad_atm_cor_sig0_c:_FillValue = 32767s;
	rad_atm_cor_sig0_c:long_name = "two-way atmospheric attenuation on C band altimeter backscatter coefficient";
	rad_atm_cor_sig0_c:units = "dB";
	rad_atm_cor_sig0_c:scale_factor = 1.0e-3;
	rad_atm_cor_sig0_c:coordinates = “longitude latitude”;
	rad_atm_cor_sig0_c:quality_flag = “rad_atm_cor_sig0_c_qual”;
	rad_atm_cor_sig0_c:valid_min = 0s;
	rad_atm_cor_sig0_c:valid_max = 32766s;

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	rad_atm_cor_sig0_c:comment = “Value must be added to altimeter backscatter coefficient to correct for atmospheric attenuation.”;

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Appendix A. **Acronyms**

AD	Applicable Document
API	Application Interface
AMR	Advanced Microwave Radiometer
ATBD	Algorithm Theoretical Basis Document
HRMR	High Resolution Microwave Radiometer
JPL	Jet Propulsion Laboratory
NASA	National Aeronautics and Space Administration
NRT	Near Real Time
NTC	Non-Time Critical
PGE	Product Generation Executable
RD	Reference Document
SDS	Science Data System
STC	Short Time Critical
TBC	To Be Confirmed
TBD	To Be Determined

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