TROPICAL RAINFALL MEASURING MISSION SCIENCE DATA AND INFORMATION SYSTEM

Interface Control Specification Between the Tropical Rainfall Measuring Mission Science Data and Information System (TSDIS) and the TSDIS Science User (TSU)

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This is the sixth volume of the Tropical Rainfall Measuring Mission (TRMM) Science Data and Information System (TSDIS) - TSDIS Science Users (TSU) Interface Control Specification Metadata for TSDIS Products.   Section 1 defines the Earth Observing System Data and Information System Core System (ECS) metadata elements for TSDIS products. Section 2 defines the Product Specific (PS) metadata elements for TSDIS products. Level 1 products are described in Volume 3. Level 2 and 3 products are described in Volume 4. Browse specifications are described in Volume 5.

1. ECS CORE METADATA ELEMENTS

ECS Core Metadata Format (Attribute, maximum 10,000-byte character): ECS Core Metadata are those metadata defined by ECS as Core metadata. A description of each ECS Core metadata element is shown in Table 1-1. The size column refers to the size of the name plus value. The actual element would take up an additional 100 bytes due to metadata implementation overhead. In other words, the true size is the listed size plus 100 bytes. Note that "All" or "L1" in the "Products Using Element" column includes Level 1B and Level 1C, but not Level 1A.

Table 1-1
ECS Core Metadata

ECS Metadata Element	Estimated Size (bytes)	Description	Products Using Element
ID of ECS Data Object (collection)	100	The unique identifier of an ECS collection to which this granule belongs. (i.e., "Total Power, Noise")	All
Size MB ECS Data Object	50	The size attribute will indicate the volume of data contained in the granule.	All
Spatial Coverage Type	50	This attribute denotes whether the locality/coverage requires horizontal, vertical or both spatial domain and coordinate system definitions.	All
Ellipsoid Name	50	Name of the ellipsoid.	L1 and L2 Satellite
Equatorial Radius	50	Equatorial radius of the earth ellipsoid (meters).	L1 and L2 Satellite
Denominator of Flattening Ratio	50	The reciprical of the flattening ratio, f, where $f = 1 - b / a$, a = Equatorial radius of the earth ellipsoid and b = Polar radius of the earth ellipsoid	L1 and L2 Satellite
Orbit Model Name	100	The reference name to the orbital model to be used to calculate the geolocation of this data to determine global spatial extent.	L1 and L2 Satellite
Orbit Number	50	The orbit number to be used in calculating the spatial extent of this data.	L1 and L2 Satellite
Semi Major Axis	50	Half of the long axis of the orbit ellipse (meters).	L1 and L2 Satellite
Mean Anomaly	50	Angle around the orbit at the Epoch Time about the Ellipse center from the ascending node (radians).	L1 and L2 Satellite
Right Ascension of Ascending Node	50	Right Ascension in Geocentric Inertial Coordinates of the north bound equator crossing (radians).	L1 and L2 Satellite
Argument of Perigee	50	Angle from the ascending node to perigee (radians).	L1 and L2 Satellite
Eccentricity	50	Eccentricity of ellipse (unitless).	L1 and L2 Satellite
Inclination	50	Angle between Orbit plane and Earth Equatorial plane (radians).	L1 and L2 Satellite
Epoch date	50	Reference date for orbital elements	L1 and L2 Satellite

ECS Metadata Element	Estimated Size (bytes)	Description	Products Using Element
Epoch time	50	Reference time for orbital elements	L1 and L2 Satellite
Epoch milliseconds	50	Reference milliseconds for orbital elements	L1 and L2 Satellite
West Bounding Coordinate	50	The degree value for the west longitude of boundary.	All
East Bounding Coordinate	50	The degree value for the east longitude of boundary.	All
North Bounding Coordinate	50	The degree value for the north latitude of boundary.	All
South Bounding Coordinate	50	The degree value for the south latitude of boundary.	All
Center Point Latitude	50	Latitude of center point of product.	L1 GV
Center Point Longitude	50	Longitude of center point of product.	L1 GV
Radius	50	Distance in km from Point	None
Latitude Resolution	50	The minimum difference between two adjacent latitude values expressed in Geographic Coordinate units of measure	L3 Satellite and L2-3 GV
Longitude Resolution	50	The minimum difference between two adjacent longitude values expressed in Geographic Coordinate units of measure.	L3 Satellite and L2-3 GV
Geographic Coord Units	50	Units of measure used for the latitude and longitude resolution values.	L3 Satellite and L2-3 GV
Temporal Range Type	50	This tells the system how temporal coverage is specified for the granule.	All
Beginning Date	50	The date when the granule coverage began. Granule coverage is defined as the orbit for Level-1 and Level-2 satellite data, as the hour of the granule for Level-1 and Level-2 ground validation data, as the day of the granule for rain gauge and disdrometer data, and as the pentad or month of the granule for Level-3 data.	All
Beginning Time	50	The time when the granule coverage began. See beginning date.	All
Ending Date	50	The date when the granule coverage ended. See beginning date.	All
Ending Time	50	The time when the granule coverage ended. See beginning date.	All
QA Parameter Name	50	"ScienceQualityFlag"	All
QA Parameter Value	100	A post processing indication of quality by the algorithm developer. The Quality Indicator takes the form of 4 possible ASCII strings: "NOT BEING INVESTIGATED", "BEING INVESTIGATED", "FAILED", or "PASSED".	All
Reprocessing Status	50	This attribute identifies the intent of the product author to reprocess the data (i.e., data gaps, geolocation accuracy, scientist review quality flags).	All
Browse Package Reference	100	This attribute will contain a system-resolvable reference to an HDF package containing a collection of browse granules.	All
Contact Name	100	The name of the algorithm developer related to this granule. The contact name supplied here must exist in the ECS contact database.	All

2. PRODUCT SPECIFIC METADATA ELEMENTS

Product Specific Metadata (Attribute, maximum 10,000-byte character): PS Metadata are metadata defined by TSDIS. The size column refers to the size of the name plus value. The actual element would take up an additional 100 bytes due to metadata implementation overhead. In other words, the true size is the listed size plus 100 bytes. Note that "All" or "L1" in the "Products Using Element" column includes Level 1B and Level 1C, but not Level 1A. A description of each PS metadata element is shown in Table 2-1.

Table 2-1
PS Metadata

PS Metadata Element	Estimated Size (bytes)	Description	Products Using Element
Granule ID	100	TSDIS granule ID	All
Algorithm ID	50	Name of the algorithm (i.e., 1B21)	All
Algorithm Version	50	The version of the science algorithm is written as "M.m", where M is an integer corresponding to major revisions of the code. Major revisions are changes in the science algorithm which do affect the science, are delivered to TSDIS in an official delivery package, and require reprocessing. "m" is an integer corresponding to minor revisions or corrections. Minor revisions or corrections are made so the science algorithm will function properly in TSDIS, do not affect the science, are not delivered to TSDIS in an official delivery package, and do not require reprocessing. "M" is written without leading zeroes, with a range from 1 to 99. "m" is written with leading zeroes, with a range from 00 to 99. At launch, the version of all science algorithms is "1.00".	All
Product Version Number	50	A single integer indicating the version of the product. The first Product Version Number is 1. The Product Version Number is incremented every time the product is reprocessed due to the fact that the algorithm creating it changes or the algorithms creating the input to the algorithm change.	All
Toolkit Version	50	Version of Toolkit used to create thisgranule	All
Calibration Coefficient Version	50	Version of the calibration coefficients. (i.e., 1, 2, 3, etc.)	All PR

Anomaly Flag	100	This flag indicates if and why a granule is empty. The possible values are:
		    "EMPTY: GENERATED AFTER SOFTWARE ERROR" *
		    "EMPTY: NO DATA DUE TO NO RAIN"
		    "EMPTY: NO DATA RECORDED"
		    "EMPTY: DATA RECORDED BUT STILL MISSING"
		    "EMPTY: REASON UNKNOWN" *
		    "NOT EMPTY: POSSIBLE PROBLEM"
		    "NOT EMPTY" *
		It is expected that satellite data would use only the three values followed by an asterisk. GV data is expected to use all seven values.
			All

PS Metadata Element	Estimated Size (bytes)	Description	Products Using Element
Missing Data	50	Number of missing scans in the orbit (satellite data), missing rays (ground radar data), or missing observations (rain gauge or disdrometer data) expressed in percent.	L1 and L2 data
Percentage of bad or missing pixels	100	List by channel of the percentage of bad or missing pixels in the orbit (satellite data) or granule (GV data).	L1 satellite and L2 data
Number of Data Gaps	50	The number of data gaps in the data in the orbit (satellite data) or granule (GV data).	L1 satellite and L2 data
Data Gaps Duration	50	The sum of the durations of the data gaps in seconds in the orbit (satellite data) or granule (GV data).	L1 satellite and L2 data
Data Accuracy	50	List by channel of the accuracies of the data.	L1 satellite data
Maximum valid value of channel	100	List by channel of the maximum valid value (value specified by the instrument scientist).	L1 satellite L1, L2 GV
Minimum valid value of channel	100	List by channel of the minimum valid value (value specified by the instrument scientist).	L1 satellite L1, L2 GV
Min Max Units	50	Units of the Minimum and Maximum valid values.	L1 satellite L1, L2 GV
Input Ids	300	List of input granule IDs.	L1 and L2
Date of Generation of input files	100	List of the generation dates of the input files. For ingested files, this is the date TSDIS received the file.	L1 and L2
Data center source of input files	100	List of the data centers generating the input files, e.g., TSDIS, NMC	L1 and L2
Generation date	50	Date the dataset was generated	All
Day/Night	50	Percentage scans during the orbit in daytime mode	1B-01
Solar Channel Gains	50	Channel 1 Mirror Side A, Channel 1 Mirror Side B Channel 2 Mirror Side A, Channel 2 Mirror Side B	1B-01
TMIrolloverCoef	300	List of 18 coefficients to correct 1B11 brightness temperatures in each channel for a warm bias in the lower temperatures. The correction is based on observations made during a TRMM Rollover maneuver. The equation to correct Tb0 to Tb is: $Tb = A0+A1*Tb0$ The order of the coefficients is: A0 channels 1 - 9, then A1 channels 1 - 9.	1B-11, 2A-12 and 3A-11
Longitude of Maximum Latitude	50	Longitude of the northernmost extent of the satellite orbit. Decimal degrees with 6 figures precision after the decimal point. Positive east, negative west. A point on the 180th meridian is assigned to the western hemisphere.	L1 and L2 Satellite
Mean Motion	50	Number of orbits per day, including fractions of orbits.	L1 and L2 Satellite
Orbit Adjust Flag	50	Orbit Adjust Flag. Values are as follows: 0 = no orbit adjust activity during this orbit. 1 = orbit adjustment control modes occurred during this orbit.	L1 and L2 Satellite
Attitude Mode Flag	50	Attitude Mode Flag. Values are as follows: 0 = forward mode (+X forward) throughout this orbit 1 = backward mode (-X forward) throughout this orbit 2 = yaw maneuver during this orbit	L1 and L2 Satellite

PS Metadata Element	Estimated Size (bytes)	Description	Products Using Element
Solar beta angle at beginning of granule	50	Elevation of sun in the orbit plane at the orbit start (degrees).	L1 and L2 Satellite
Solar beta angle at end of the granule	50	Elevation of sun in the orbit plane at the orbit end (degrees).	L1 and L2 Satellite
Sensor Alignment	100	Euler Sequence (3 integers) and Euler angles for rotation from spacecraft coordinates to sensor coordinates in degrees. (These are to be provided by the science team)	L1 and L2 Satellite
Sensor Alignment Channel Offsets	50 x number of channels	Euler Sequence (3 integers) and Euler angles for rotation from sensor coordinates to Channel coordinates with angles separately for each channel in degrees. (These are to be provided by the science team if needed, but they are not nominally used in TSDIS processing since geolocation is not done per channel)	L1 and L2 Satellite
Scan Path Model	100	Parameters describing the scan path as used for pixel geolocation. For a (nominal) conical scan model the following parameters are used: Axis of Scan (+/- 1,2,or 3). Reference Axis for zero rotation angle (+/- 1,2,or 3), and Scan cone angular radius in degrees. Starting rotation angle relative to the scan axis in degrees, Total rotation angle spanned in degrees, Active scan duration time in seconds (between first and last pixel), and Time Offset between spacecraft time of the sensor data packet and the first pixel time, in seconds.	L1 and L2 Satellite
Scan Path Parameters Per Channel	50	Parameters describing the scan path separately for each channel in degrees. (These are to be provided by the science team if needed, but they are not nominally used in TSDIS processing since geolocation is not done per channel)	L1 and L2 Satellite
Ephemeris File Descriptor	50	TSDIS granule ID for the ephemeris file. The format is EPHEM.YYMMDD.nn, where YY is year, MM is month, DD is day of the month, and nn is the version number.	L1 and L2 Satellite
Orbit Size	50	Number of scans in Orbit. If the granule is empty, Orbit Size = 0.	L1 and L2 Satellite
Orbit First Scan UTC Date	50	Orbit First Scan UTC Date in the format described in Section 3. If the granule is empty, the value is '9999/99/99'.	L1 and L2 Satellite
Orbit First Scan UTC Time	50	Orbit First Scan UTC Time in the format described in Section 3. If the granule is empty, the value is '99:99:99'.	L1 and L2 Satellite
Orbit First Scan UTC Milliseconds	50	Orbit First Scan UTC Milliseconds in the format described in Section 3	L1 and L2 Satellite
Orbit First scan time - Spacecraft clock - seconds	50	The seconds field of the spacecraft clock time of the first scan in the orbit	L1 and L2 Satellite
Orbit First scan time - Spacecraft clock - subseconds	50	The subseconds field of the spacecraft clock time of the first scan in the orbit	L1 and L2 Satellite
Orbit Last Scan UTC Date	50	Orbit Last Scan UTC Date in the format described in Section 3. If the granule is empty, the value is '9999/99/99'.	L1 and L2 Satellite
Orbit Last Scan UTC Time	50	Orbit Last Scan UTC Time in the format described in Section 3. If the granule is empty, the value is '99:99:99'.	L1 and L2 Satellite
Orbit Last Scan UTC Milliseconds	50	Orbit Last Scan UTC Milliseconds in the format described in section 3	L1 and L2 Satellite
Orbit Last scan time - Spacecraft clock - seconds	50	The seconds field of the spacecraft clock time of the last scan in the orbit	L1 and L2 Satellite

PS Metadata Element	Estimated Size (bytes)	Description	Products Using Element
Orbit Last scan time - Spacecraft clock - subseconds	50	The subseconds field of the spacecraft clock time of the last scan in the orbit	L1 and L2 Satellite
UTCF seconds	50	The seconds field of the UTCF for the granule.	L1 and L2 Satellite
UTCF subseconds	50	The subseconds field of the UTCF for the granule.	L1 and L2 Satellite
UTCF flag	50	Flag that indicates the origin of the UTCF. 0 = UTCF was derived from the first ACS packet in the orbit. 1 = a corrected UTCF was used.	L1 and L2 Satellite
Leap second flag	50	Flag that indicates if a leap second or UTCF update occurred within the granule. 0 = none; 1 = leap second; 2 = UTCF change; 3 = both leap second and UTCF change	All
Radar wavelength	50	Wavelength of the radar (meters).	L1 PR and GV
Minimum Reflectivity Threshold	50	The threshold (dBz) below which ground based radar reflectivity data is set to the missing value.	L1 and L2 GV
Software Version	50	Version of the software	All PR
Data base Version	50	Version of PR Database in the PR L1 software	All PR
Total Quality Code	50	Total quality of the PR L1 product. Range is 'G', 'F', or 'P'	All PR
Longitude on the Equator	50	Longitude on the equator from the ascending node. Range is -180.000 to 179.999	L1 PR and L2 PR
UTC Date on the Equator	50	UTC date on the equator.	L1 PR and L2 PR
UTC Time on the Equator	50	UTC time on the equator.	L1 PR and L2 PR
UTC Milliseconds on the Equator	50	UTC Milliseconds on the Equator.	L1 PR and L2 PR
Orbit Center Scan UTC Date	50	UTC date at orbit center scan.	L1 PR and L2 PR
Orbit Center Scan UTC Time	50	UTC time at orbit center scan.	L1 PR and L2 PR
Orbit Center Scan UTC Milliseconds	50	UTC milliseconds at orbit center scan.	L1 PR and L2 PR
Orbit First Scan Latitude	50	Latitude of orbit first scan. Range is -40.000 to 40.000	L1 PR and L2 PR
Orbit First Scan Longitude	50	Longitude of orbit first scan. Range is -180.000 to 179.999	L1 PR and L2 PR
Orbit Last Scan Latitude	50	Latitude of orbit last scan. Range is -40.000 to 40.000	L1 PR and L2 PR
Orbit Last Scan Longitude	50	Longitude of orbit last scan. Range is -180.000 to 179.999	L1 PR and L2 PR
Number of Rain Scans	50	The number of rain scans.	L1 PR and L2 PR
Radar site name	50	Name of the GV radar or radar site, whichever is applicable	GV, gauge and disdrometer
Radar city	100	Nearest city to the radar site.	GV, gauge and disdrometer

PS Metadata Element	Estimated Size (bytes)	Description	Products Using Element
Radar state	50	State or province containing the radar site, if applicable.	GV, gauge and disdrometer
Radar country	50	Country containing the radar site.	GV, gauge and disdrometer
Number of VOS	50	The number of volume scans in this granule. If the granule is empty, Number of VOS = 0.	GV L1 and L2
Radar Grid Origin Latitude	50	Latitude (degrees) of the origin.	GV L2 and L3
Radar Grid Origin Longitude	50	Longitude (degrees) of the origin.	GV L2 and L3
Radar Grid Origin Altitude	50	Altitude (km) of the origin.	GV L2 and L3
Radar Grid Spacing x	50	The zonal interval (km) between grid points.	GV L2 and L3
Radar Grid Spacing y	50	The meridional interval (km) between grid points.	GV L2 and L3
Radar Grid Spacing z	50	The vertical interval (km) between grid points.	GV L2 and L3
Radar Grid Size x	50	The number of grid points in the zonal grid direction.	GV L2 and L3
Radar Grid Size y	50	The number of grid points in the meridional grid direction.	GV L2 and L3
Radar Grid Size z	50	The number of grid points in the vertical grid direction.	GV L2 and L3
DZCal	50	Radar calibration offset (dBZ)	1B-51, 1C-51
GVL1C_Scale	50	Scaling factor for 1C-51 mask (unitless)	1B-51, 1C-51
Alpha	50	Correction for gaseous two-way attenuation (dB/Km)	1B-51, 1C-51
Runtime options	1000	Runtime options for algorithm including QC parameters used	All GV