CloudSat Project

A NASA Earth System Science Pathfinder Mission

2B-GEOPROF Interface Control Document

Algorithm Version: 5.3 (18 September 2007)
2B-GEOPROF Product Version: 011 (18 September 2007)

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1. I/O Lists

1.1 Algorithm Inputs

	Source	Field
(1)	1B-CPR 008	Seconds since the start of the granule.
(2)	1B-CPR 008	Range to the CPR boresight intercept with the geoid
(3)	1B-CPR 008	Digital Elevation Map
(4)	1B-CPR 008	Spacecraft Latitude
(5)	1B-CPR 008	Spacecraft Longitude
(6)	1B-CPR 008	Ray (frame) header Metadata wavelength
(7)	1B-CPR 008	Ray status range bin size
(8)	1B-CPR 008	Surface Bin Number
(9)	1B-CPR 008	Range to First Bin
(10)	1B-CPR 008	Nominal satellite pitch angle offset from nadir
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(15)	MODIS-AUX 007	Geodetic latitude of MODIS pixels
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(17)	MODIS-AUX 007	MODIS Cloud Mask Subset
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(35)	MODIS-AUX 007	MODIS Earth View 1KM Reflective Solar Bands Scaling Factor
(36)	MODIS-AUX 007	MODIS Earth View 250M Aggregated 1km Reflective Solar Bands Scaled Integers Subset
(37)	MODIS-AUX 007	Radiance scales for EV_250_RefSB

	Source	Field
(38)	MODIS-AUX 007	Radiance offsets for EV_250_RefSB
(39)	MODIS-AUX 007	Reflectance scales for EV_250_RefSB
(40)	MODIS-AUX 007	Reflectance offsets for EV_250_RefSB
(41)	MODIS-AUX 007	MODIS Earth View 250M Aggregated 1KM Reflective Solar Bands Uncertainty Indexes Subset
(42)	MODIS-AUX 007	MODIS Earth View 250M Aggregated 1KM Reflective Solar Bands Specified Uncertainty
(43)	MODIS-AUX 007	MODIS Earth View 250M Aggregated 1KM Reflective Solar Bands Scaling Factor
(44)	1B-CPR 008	Sigma-Zero
(45)	1B-CPR 008	
(46)	1B-CPR 008	
(47)	1B-CPR 008	
(48)	1B-CPR 008	Land Sea Flag

1.2 Products

1.2.1 2B-GEOPROF 011 Fields

	Source	Field
(1)	1B-CPR 008	Seconds since the start of the granule.
(2)	1B-CPR 008	UTC seconds since 00:00 Z of the first profile
(3)	1B-CPR 008	TAI time for the first profile.
(4)	1B-CPR 008	Spacecraft Latitude
(5)	1B-CPR 008	Spacecraft Longitude
(6)	2B-GEOPROF 011	Height of range bin in Reflectivity/Cloud Mask above reference surface (~ mean sea level).
(7)	1B-CPR 008	Range to the CPR boresight intercept with the geoid
(8)	1B-CPR 008	Digital Elevation Map
(9)	2B-GEOPROF 011	
(10)	1B-CPR 008	Nominal satellite pitch angle offset from nadir
(11)	1B-CPR 008	Nominal satellite roll angle offset from nadir
(12)	1B-CPR 008	Data Quality
(13)	1B-CPR 008	Data status flags
(14)	1B-CPR 008	CPR bus orientation (target ID)
(15)	2B-GEOPROF 011	Location of Surface Bin as determined by 1B CPR algorithm. The value here is shifted (as Height).
(16)	2B-GEOPROF 011	SurfaceHeightBin_fraction
(17)	2B-GEOPROF 011	CPR Cloud Mask
(18)	2B-GEOPROF 011	Gaseous_Attenuation
(19)	2B-GEOPROF 011	Radar Reflectivity Factor
(20)	1B-CPR 008	Sigma-Zero
(21)	2B-GEOPROF 011	MOD35_bit_2and3_cloud_flag
(22)	2B-GEOPROF 011	MODIS 250m Cloud Fraction

	Source	Field
(23)	2B-GEOPROF 011	MODIS scene characterizations
(24)	2B-GEOPROF 011	MODIS scene variability
(25)	2B-GEOPROF 011	CPR Echo Top Characterizations
(26)	2B-GEOPROF 011	Noise Floor calculated in Cloud_Masking Routine
(27)	2B-GEOPROF 011	Noise Variance in measured return (i.e. Echo) power
(28)	2B-GEOPROF 011	Noise Floor and Noise Variance estimate based on window of a fixed size centered at this range bin.
(29)	1B-CPR 008	Land Sea Flag
(30)	2B-GEOPROF 011	Clutter_reduction_flag

2. Input Field Specifications

(1) Seconds since the start of the granule.

Name in file: Profile_time
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nray
Units: seconds
Range: 0 to 6000
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0.139

Seconds since the start of the granule for each profile. The first profile is 0.

(2) Range to the CPR boresight intercept with the geoid

Name in file: Range_to_intercept
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nray
Units: km
Range: 600 to 800
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0.139

Range from the spacecraft to the CPR boresight intercept with the geoid.

(3) Digital Elevation Map

Name in file: DEM_elevation
Source: 1B-CPR 008
Field type (in file): INT(2)
Field type (in algorithm): INT(2)
Dimensions: nray
Units: meters
Range: -9999 to 8850
Missing value: 9999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.069

Elevation in meters above Mean Sea Level. A value of -9999 indicates ocean. A value of 9999 indicates

an error in calculation of the elevation.

(4) Spacecraft Latitude

Name in file: Latitude
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nray
Units: degrees
Range: -90 to 90
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0.139

Spacecraft Geodetic Latitude.

(5) Spacecraft Longitude

Name in file: Longitude
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nray
Units: degrees
Range: -180 to 180
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0.139

Spacecraft geodetic longitude

(6) Ray (frame) header Metadata wavelength

Name in file: RayHeader_lambda
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: <scalar>
Units: meters
Range: 0.0031879 to 0.0031879
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0

Ray (frame) header Metadata Header information about each ray, its contents are defined in Table 1. Wavelength.

(7) Ray status range bin size

Name in file: RayHeader_RangeBinSize
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: <scalar>
Units: meters
Range: 239.8 to 239.8
Missing value: -9999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0

spacing between samples in range in meters

(8) Surface Bin Number

Name in file: SurfaceBinNumber
Source: 1B-CPR 008
Field type (in file): UINT(1)
Field type (in algorithm): INT(2)
Dimensions: nray
Units: --
Range: 90 to 125
Missing value: 255
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.035

The range bin number of the peak surface echo. Surface bin number is –99 when surface return is missing.

(9) Range to First Bin

Name in file: Range_to_first_bin
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nray
Units: meters
Range: 650000 to 740000
Missing value: -9999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.139

Range to first bin is the distance between the satellite and the starting bin number of the ray in meters.

(10) Nominal satellite pitch angle offset from nadir

Name in file: Pitch_offset
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: <scalar>
Units: degrees
Range: -90 to 90
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0

The pitch angle offset from nadir during normal operations. Pitch up is positive (radar points along the flight track in the direction of motion), down is negative (radar points along the flight track opposite the direction of motion).

(11) Nominal satellite roll angle offset from nadir

Name in file: Roll_offset
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: <scalar>
Units: degrees
Range: -90 to 90
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0

The roll angle offset from nadir during normal operations. Positive roll results in the radar pointing to the right of the flight track. Negative roll to the left.

(12) Average transmit power

Name in file: TransmitPower_Avg
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: <scalar>
Units: W
Range: 1500 to 2000
Missing value: -9999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0

The granule-average transmit power.

(13) Received Echo Powers

Name in file: ReceivedEchoPowers
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nbin,nray
Units: W
Range: 1e-015 to 1e-006
Missing value: -9999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 17.349

Echo Power is the calibrated range gate power in watts, made in-flight and averaged.

(14) CPR Calibration coefficients

Name in file: RadarCoefficient
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nray
Units: m^(-3)
Range: 0.01 to 0.1
Missing value: -9999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.139

The Radar calibration constant

(15) Geodetic latitude of MODIS pixels

Name in file: MODIS_latitude
Source: MODIS-AUX 007
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: mod_1km,nray
Units: degrees
Range: -90 to 90
Missing value: -999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 2.082

This array contains the vector of latitudes for the closest 15 pixels to the CloudSat CPR footprint in a 3x5 (across track x along track) grid.

(16) Geodetic longitude of MODIS pixels

Name in file: MODIS_longitude
Range: -180 to 180

Source: MODIS-AUX 007
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: mod_1km,nray
Units: degrees
Missing value: -999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 2.082

This array contains the vector of longitudes for the closest 15 pixels to the CloudSat CPR footprint in a 3x5 (across track x along track) grid.

(17) MODIS Cloud Mask Subset

Name in file: Cloud_Mask
Source: MODIS-AUX 007
Field type (in file): INT(1)
Field type (in algorithm): INT(1)
Dimensions: mod_1km,nray,Byte_Segment
Units: --
Range: 0 to 1
Missing value: 0
Missing value operator: ==
Factor: 1
Offset: 0
MB: 3.123

The MODIS cloud mask is a bit field that contains information about clouds observed in each pixel including type and height. A full description of the cloud mask can be found at the MODIS web site from the AN-MODIS document or the MODIS website: http://modis-atmos.gsfc.nasa.gov/MOD35_L2/index.html. The full MODIS data has been subset to the closest 15 pixels around the CloudSat CPR footprint.

(18) Atmospheric pressure

Name in file: Pressure
Source: ECMWF-AUX 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nbin,nray
Units: Pa
Range: to
Missing value: -999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 17.349

(19) Temperature

Name in file: Temperature
Source: ECMWF-AUX 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nbin,nray
Units: K
Range: to
Missing value: -999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 17.349

(20) Specific humidity

Name in file: Specific_humidity
Source: ECMWF-AUX 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nbin,nray
Units: kg/kg
Range: to
Missing value: -999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 17.349

(21) MODIS granule index of each pixel.

Name in file: MODIS_granule_index
Source: MODIS-AUX 007
Field type (in file): INT(1)
Field type (in algorithm): INT(2)
Dimensions: mod_1km,nray
Units: --
Range: 1 to 25
Missing value: -99
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.52

Key to the granule index dimension in data fields associating each field with a MODIS granule and corresponding scales and offsets.

(22) MODIS Earth View 1KM Reflective Solar Bands Scaled Integers Subset

Name in file: EV_1KM_RefSB
Source: MODIS-AUX 007
Field type (in file): UINT(2)
Field type (in algorithm): UINT(2)
Dimensions: mod_1km,nray,Band_1KM_RefSB
Units: W/(m2 str um)
Range: 0 to 32767
Missing value: 32768
Missing value operator: >=
Factor: 1
Offset: 0
MB: 4.164

This data array contains radiances for MODIS band numbers 17-19 and 26. The full MODIS data has been subset to the closest 15 pixels around the CloudSat CPR footprint. More information can be obtained from the AN-MODIS ICD or from the MODIS web site at http://mcstweb.gsfc.nasa.gov/product.html.

(23) Radiance scales for EV_1KM_RefSB

Name in file: EV_1KM_RefSB_rad_scales
Source: MODIS-AUX 007
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: mod_granules,Band_1KM_RefSB
Units: --
Range: to
Missing value: -999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0

Radiance scales needed to convert unscaled radiance data to scientific values.

(24) Radiance offsets for EV_1KM_RefSB

Name in file: EV_1KM_RefSB_rad_offsets
Source: MODIS-AUX 007
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: mod_granules,Band_1KM_RefSB
Units: --
Range: to
Missing value: -999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0

Radiance offsets needed to convert unscaled radiance data to scientific values.

(25) Reflectance scales for EV_1KM_RefSB

Name in file: EV_1KM_RefSB_ref_scales
Source: MODIS-AUX 007
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: mod_granules,Band_1KM_RefSB
Units: --
Range: to
Missing value: -999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0

Reflectivity scales needed to convert unscaled radiance data to scientific values.

(26) Reflectance offsets for EV_1KM_RefSB

Name in file: EV_1KM_RefSB_ref_offsets
Source: MODIS-AUX 007
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: mod_granules,Band_1KM_RefSB
Units: --
Range: to
Missing value: -999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0

Reflectivity offsets needed to convert unscaled radiance data to scientific values.

(27) MODIS Earth View 1KM Reflective Solar Bands Uncertainty Indexes Subset

Name in file: EV_1KM_RefSB_Uncert_Indexes
Source: MODIS-AUX 007
Field type (in file): UINT(1)
Field type (in algorithm): UINT(1)
Dimensions: mod_1km,nray,Band_1KM_RefSB
Units: --
Range: 0 to 15
Missing value: 255
Missing value operator: ==
Factor: 1
Offset: 0
MB: 2.082

Uncertainty indexes corresponding to the EV_1KM_RefSB radiances. The radiance uncertainty is calculated with:

uncertainty(%) = specified_uncertainty*exp(uncertainty_index/scaling_factor)

(28) MODIS Earth View 1KM Reflective Solar Bands Specified Uncertainty

Name in file: EV_1KM_RefSB_spec_uncert
Source: MODIS-AUX 007
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: mod_granules,Band_1KM_RefSB
Units: --
Range: to
Missing value: -999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0

The specified uncertainty is used along with the uncertainty indexes and scale factors to calculate the radiance uncertainty in % (see uncertainty indexes description).

(29) MODIS Earth View 1KM Reflective Solar Bands Uncertainty Scaling Factor

Name in file: EV_1KM_RefSB_scaling_factor
Source: MODIS-AUX 007
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: mod_granules,Band_1KM_RefSB
Units: --
Range: to
Missing value: -999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0

The scaling factor is used along with the uncertainty indexes and specified uncertainty to calculate the radiance uncertainty in % (see uncertainty indexes description).

(30) MODIS Earth View 1KM Emissive Bands Scaled Integers Subset

Name in file: EV_1KM_Emissive
Source: MODIS-AUX 007
Field type (in file): UINT(2)
Field type (in algorithm): UINT(2)
Dimensions: mod_1km,nray,Band_1KM_Emissive
Units: W/(m2 str um)
Range: 0 to 32767
Missing value: 32768
Missing value operator: >=
Factor: 1
Offset: 0
MB: 11.45

This data array contains radiances for MODIS band numbers 20 and 27-36. The full MODIS data has been subset to the closest 15 pixels around the CloudSat CPR footprint. More information can be obtained from the AN-MODIS ICD or from the MODIS web site at http://mcstweb.gsfc.nasa.gov/product.html.

(31) Radiance scales for EV_1KM_Emissive

Name in file: EV_1KM_Emissive_rad_scales
Source: MODIS-AUX 007
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: mod_granules,Band_1KM_Emissive
Range: to
Missing value: -999
Missing value operator: ==
Factor: 1
Offset: 0

Units: --
MB: 0.001

Radiance scales needed to convert unscaled radiance data to scientific values.

(32) Radiance offsets for EV_1KM_Emissive

Name in file: EV_1KM_Emissive_rad_offsets
Range: to
Source: MODIS-AUX 007
Missing value: -999
Field type (in file): REAL(4)
Missing value operator: ==
Field type (in algorithm): REAL(4)
Factor: 1
Dimensions: mod_granules,Band_1KM_Emissive
Offset: 0
Units: --
MB: 0.001

Radiance offsets needed to convert unscaled radiance data to scientific values.

(33) MODIS Earth View 1KM Emissive Bands Uncertainty Indexes Subset

Name in file: EV_1KM_Emissive_Uncert_Indexes
Range: 0 to 15
Source: MODIS-AUX 007
Missing value: 255
Field type (in file): UINT(1)
Missing value operator: ==
Field type (in algorithm): UINT(1)
Factor: 1
Dimensions: mod_1km,nray,Band_1KM_Emissive
Offset: 0
Units: --
MB: 5.725

Uncertainty indexes corresponding to the EV_1KM_Emissive radiances. The radiance uncertainty is calculated with:

uncertainty(%) = specified_uncertainty*exp(uncertainty_index/scaling_factor)

(34) MODIS Earth View 1KM Emissive Bands Specified Uncertainty

Name in file: EV_1KM_Emissive_spec_uncert
Range: to
Source: MODIS-AUX 007
Missing value: -999
Field type (in file): REAL(4)
Missing value operator: ==
Field type (in algorithm): REAL(4)
Factor: 1
Dimensions: mod_granules,Band_1KM_Emissive
Offset: 0
Units: --
MB: 0.001

The specified uncertainty is used along with the uncertainty indexes and scale factors to calculate the radiance uncertainty in % (see uncertainty indexes description).

(35) MODIS Earth View 1KM Reflective Solar Bands Scaling Factor

Name in file: EV_1KM_Emissive_scaling_factor
Range: to
Source: MODIS-AUX 007
Missing value: -999

Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: mod_granules,Band_1KM_Emissive
Units: --
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.001

The scaling factor is used along with the uncertainty indexes and specified uncertainty to calculate the radiance uncertainty in % (see uncertainty indexes description).

(36) MODIS Earth View 250M Aggregated 1km Reflective Solar Bands Scaled Integers Subset

Name in file: EV_250_RefSB
Source: MODIS-AUX 007
Field type (in file): UINT(2)
Field type (in algorithm): UINT(2)
Dimensions: mod_1km,nray,Band_250M
Units: W/(m2 str um)
Range: 0 to 32767
Missing value: 32768
Missing value operator: >=
Factor: 1
Offset: 0
MB: 2.082

This data array contains radiances for MODIS band numbers 1 and 2 aggregated to 1 km. The full MODIS data has been subset to the closest 15 pixels around the CloudSat CPR footprint. More information can be obtained from the AN-MODIS ICD or from the MODIS web site at http://mcstweb.gsfc.nasa.gov/product.

(37) Radiance scales for EV_250_RefSB

Name in file: EV_250_RefSB_rad_scales
Source: MODIS-AUX 007
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: mod_granules,Band_250M
Units: --
Range: to
Missing value: -999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0

Radiance scales needed to convert unscaled radiance data to scientific values.

(38) Radiance offsets for EV_250_RefSB

Name in file: EV_250_RefSB_rad_offsets
Source: MODIS-AUX 007
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: mod_granules,Band_250M
Units: --
Range: to
Missing value: -999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0

Radiance offsets needed to convert unscaled radiance data to scientific values.

(39) Reflectance scales for EV_250_RefSB

Name in file: EV_250_RefSB_ref_scales **Range:** to
Source: MODIS-AUX 007 **Missing value:** -999
Field type (in file): REAL(4) **Missing value operator:** ==
Field type (in algorithm): REAL(4) **Factor:** 1
Dimensions: mod_granules,Band_250M **Offset:** 0
Units: -- **MB:** 0

Reflectivity scales needed to convert unscaled radiance data to scientific values.

(40) Reflectance offsets for EV_250_RefSB

Name in file: EV_250_RefSB_ref_offsets **Range:** to
Source: MODIS-AUX 007 **Missing value:** -999
Field type (in file): REAL(4) **Missing value operator:** ==
Field type (in algorithm): REAL(4) **Factor:** 1
Dimensions: mod_granules,Band_250M **Offset:** 0
Units: -- **MB:** 0

Reflectivity offsets needed to convert unscaled radiance data to scientific values.

(41) MODIS Earth View 250M Aggregated 1KM Reflective Solar Bands Uncertainty Indexes Subset

Name in file: EV_250_RefSB_Uncert_Indexes **Range:** 0 to 15
Source: MODIS-AUX 007 **Missing value:** 255
Field type (in file): UINT(1) **Missing value operator:** ==
Field type (in algorithm): UINT(1) **Factor:** 1
Dimensions: mod_1km,nray,Band_250M **Offset:** 0
Units: -- **MB:** 1.041

Uncertainty indexes corresponding to the EV_250_Aggr1km_RefSB radiances. The radiance uncertainty is calculated with:

uncertainty(%) = specified_uncertainty*exp(uncertainty_index/scaling_factor)

(42) MODIS Earth View 250M Aggregated 1KM Reflective Solar Bands Specified Uncertainty

Name in file: EV_250_RefSB_spec_uncert **Range:** to
Source: MODIS-AUX 007 **Missing value:** -999
Field type (in file): REAL(4) **Missing value operator:** ==
Field type (in algorithm): REAL(4) **Factor:** 1
Dimensions: mod_granules,Band_250M **Offset:** 0
Units: -- **MB:** 0

The specified uncertainty is used along with the uncertainty indexes and scale factors to calculate the radiance uncertainty in % (see uncertainty indexes description).

(43) MODIS Earth View 250M Aggregated 1KM Reflective Solar Bands Scaling Factor

Name in file: EV_250_RefSB_scaling_factor
Source: MODIS-AUX 007
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: mod_granules,Band_250M
Units: --
Range: to
Missing value: -999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0

The scaling factor is used along with the uncertainty indexes and specified uncertainty to calculate the radiance uncertainty in % (see uncertainty indexes description).

(44) Sigma-Zero

Name in file: Sigma-Zero
Source: 1B-CPR 008
Field type (in file): INT(2)
Field type (in algorithm): INT(2)
Dimensions: nray
Units: dB*100
Range: -1000 to 4000
Missing value: -9999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.069

The Sigma-Zero is the normalized surface cross section (not corrected for attenuation). It's multiplied by 100 and stored as 2-byte integers

(45)

Name in file: FlatSurfaceClutter
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nscbin,nray
Units: W
Range: to
Missing value: 1e-030
Missing value operator: ==
Factor: 1
Offset: 0
MB: 1.943

Estimated profile of surface clutter.

(46)

Name in file: SurfaceClutter_Index
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nray
Units:
Range: to
Missing value: 99
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.139

An mse over the used bins, if positive ==> 5 bins were used for good match, if negative ==> 3 bins were used (and the sign of the MSE was changed). Anything less than 0.1 in modulus is good.

(47)

Name in file: SurfaceBinNumber_Fraction
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nray
Units:
Range: to
Missing value: -99
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.139

The fraction of bin # that the surface is off w/r to the corrected isurf. The preliminary assessment is that this is good to better than 1/100th of range bin (over good matches).

(48) Land Sea Flag

Name in file: Navigation_land_sea_flag
Source: 1B-CPR 008
Field type (in file): UINT(1)
Field type (in algorithm): INT(1)
Dimensions: nray
Units: --
Range: 1 to 3
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0.035

Flag indicating whether spacecraft is over land or sea:

1 = land
2 = ocean
3 = coast

3. Product Field Specifications

3.1 2B-GEOPROF 011 Fields

(1) Seconds since the start of the granule.

Name in file: Profile_time
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nray
Units: seconds
Range: 0 to 6000
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0.139

Seconds since the start of the granule for each profile. The first profile is 0.

(2) UTC seconds since 00:00 Z of the first profile

Name in file: UTC_start
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: <scalar>
Units: seconds
Range: 0 to 86400
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0

The UTC seconds since 00:00 Z of the first profile in the data file.

(3) TAI time for the first profile.

Name in file: TAI_start
Source: 1B-CPR 008
Field type (in file): REAL(8)
Field type (in algorithm): REAL(8)
Dimensions: <scalar>
Units: seconds
Range: 0 to 6e+008
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0

The TAI timestamp for the first profile in the data file. TAI is International Atomic Time: seconds since 00:00:00 Jan 1 1993.

(4) Spacecraft Latitude

Name in file: Latitude
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nray
Units: degrees
Range: -90 to 90
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0.139

Spacecraft Geodetic Latitude.

(5) Spacecraft Longitude

Name in file: Longitude
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nray
Units: degrees
Range: -180 to 180
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0.139

Spacecraft geodetic longitude

(6) Height of range bin in Reflectivity/Cloud Mask above reference surface (~ mean sea level).

Name in file: Height
Source: 2B-GEOPROF 011
Field type (in file): INT(2)
Field type (in algorithm): INT(2)
Dimensions: nbin,nray
Units: m
Range: -5000 to 30000
Missing value: -9999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 8.674

Height of the radar range bins in meters above mean sea level.

(7) Range to the CPR boresight intercept with the geoid

Name in file: Range_to_intercept
Source: 1B-CPR 008
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nray
Units: km
Range: 600 to 800
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0.139

Range from the spacecraft to the CPR boresight intercept with the geoid.

(8) Digital Elevation Map

Name in file: DEM_elevation
Source: 1B-CPR 008
Field type (in file): INT(2)
Field type (in algorithm): INT(2)
Dimensions: nray
Units: meters
Range: -9999 to 8850
Missing value: 9999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.069

Elevation in meters above Mean Sea Level. A value of -9999 indicates ocean. A value of 9999 indicates an error in calculation of the elevation.

(9)

Name in file: Vertical_binsize
Source: 2B-GEOPROF 011
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: <scalar>
Units: m
Range: to
Missing value: -9999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0

effective vertical height of the radar range bin.

(10) Nominal satellite pitch angle offset from nadir

Name in file: Pitch_offset
Source: 1B-CPR 008
Range: -90 to 90
Missing value:

Field type (in file): REAL(4) **Missing value operator:**
Field type (in algorithm): REAL(4) **Factor:** 1
Dimensions: <scalar> **Offset:** 0
Units: degrees **MB:** 0

The pitch angle offset from nadir during normal operations. Pitch up is positive (radar points along the flight track in the direction of motion), down is negative (radar points along the flight track opposite the direction of motion).

(11) Nominal satellite roll angle offset from nadir

Name in file: Roll_offset **Range:** -90 to 90
Source: 1B-CPR 008 **Missing value:**
Field type (in file): REAL(4) **Missing value operator:**
Field type (in algorithm): REAL(4) **Factor:** 1
Dimensions: <scalar> **Offset:** 0
Units: degrees **MB:** 0

The roll angle offset from nadir during normal operations. Positive roll results in the radar pointing to the right of the flight track. Negative roll to the left.

(12) Data Quality

Name in file: Data_quality **Range:** 0 to 127
Source: 1B-CPR 008 **Missing value:**
Field type (in file): UINT(1) **Missing value operator:**
Field type (in algorithm): INT(2) **Factor:** 1
Dimensions: nray **Offset:** 0
Units: -- **MB:** 0.035

Flags indicating data quality. If 0, then data is of good quality. Otherwise, treat as a bit field with 8 flags:

0: RayStatus_validity not normal.
1: GPS data not valid.
2: Temperatures not valid.
3: Radar telemetry data quality is not normal.
4: Peak power is not normal.
5: CPR calibration maneuver.
6: Missing frame.
7: Not used.

(13) Data status flags

Name in file: Data_status **Range:** 0 to 127
Source: 1B-CPR 008 **Missing value:**
Field type (in file): UINT(1) **Missing value operator:**
Field type (in algorithm): UINT(1) **Factor:** 1
Dimensions: nray **Offset:** 0

Units: -- **MB:** 0.035

This is a bit field that contains data status flags:

Bit 0: missing frame (0=false, 1=true)
Bit 1: SOH missing (0=false, 1=true)
Bit 2: GPS data valid (0=false, 1=true)
Bit 3: 1 PPS lost (0=false, 1=true)
Bit 4: Star tracker 1 (0=off, 1=on)
Bit 5: Star tracker 2 (0=off, 1=on)
Bit 6: Coast (0=false, 1=true)
Bit 7: NISC (0=false, 1=true)

(14) CPR bus orientation (target ID)

Name in file: Data_targetID **Range:** 0 to 81
Source: 1B-CPR 008 **Missing value:**
Field type (in file): UINT(1) **Missing value operator:**
Field type (in algorithm): INT(1) **Factor:** 1
Dimensions: nray **Offset:** 0
Units: -- **MB:** 0.035

The target id indicates the orientation of the spacecraft bus. For normal operations the target ID is 0. The complete ID table is listed below:

Control Frame 0
0: CPR to point in 300 seconds - Nominal science mode
1 - 15: Target ID for testing - not planned for operational use

Control Frame 0, CPR Calibration
16: CPR to point in 160 seconds
17: CPR 15º to the right
18: CPR 15º to the left
19: CPR 10º to the right -- default rotation
20: CPR 10º to the left -- default rotation
21: CPR 5º to the right
22: CPR 5º to the left
23 - 29: Target ID for testing - not planned for operational use
30 - 36: CPR rotation - not planned for operational use
37 - 39: Not planned for operational use

Control Frame 1, Four thruster closed-loop
40: Rotation into the OR orientation
41: Rotation into the x-track along the anti-ang momentum
42: Rotation into the x-track along ang momentum
43: Rotation into the orbit lower orientation
44: Rotation into alt. OR w/ CPR away from Sun
45 - 49: Not planned for operational use

Control Frame 2, One thruster open-loop
50: Rotation into the OR orientation
51: Rotation into the x-track along the anti-ang momentum
52: Rotation into the x-track along ang momentum
53: Rotation into the orbit lower orientation
54: Rotation into alt. OR w/ CPR away from Sun
55 - 59: Not planned for operational use

Control Frame 3, Two thruster open-loop
60: Rotation into the OR orientation
61: Rotation into the x-track along the anti-ang momentum
62: Rotation into the x-track along ang momentum
63: Rotation into the orbit lower orientation
64: Rotation into alt. OR w/ CPR away from Sun
65 - 69: Not planned for operational use

Control Frame 4, Four thruster open-loop
70: Rotation into the OR orientation
71: Rotation into the x-track along the anti-ang momentum
72: Rotation into the x-track along ang momentum
73: Rotation into the orbit lower orientation
74: Rotation into alt. OR w/ CPR away from Sun
75 - 80: Not planned for operational use

Control Frame 5
81: Body into the x-track along the anti-ang momentum
82 - 1023: Not planned for operational use

(15) Location of Surface Bin as determined by 1B CPR algorithm. The value here is shifted (as Height).

Name in file: SurfaceHeightBin
Source: 2B-GEOPROF 011
Field type (in file): INT(1)
Field type (in algorithm): INT(1)
Dimensions: nray
Units:
Range: 1 to 125
Missing value: -1
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.035

Location of Surface Bin as determined by 1B CPR algorithm. The value here is shifted (as is the Height matrix) so bins in neighboring rays are about the same height.

(16) SurfaceHeightBin_fraction

Name in file: SurfaceHeightBin_fraction
Source: 2B-GEOPROF 011
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nray
Units: none
Range: to
Missing value: 0
Missing value operator:
Factor: 1
Offset: 0
MB: 0.139

Estimated fraction of a bin to location of surface within "SurfaceHeightBin". Estimated Surface Height = SurfaceHeighBin + SurfaceHeightBin_fraction. This value is determined from the bin_fraction in the clutter estimation algorithm run in 1B-CPR. the "faction" may have values larger than +/- 1 when clutter estimation does not put the surface bin in the same place as estimated in the 2B GeoProf - which has selected the DEM elevation rather than the radar esitmated surface location.

(17) CPR Cloud Mask

Name in file: CPR_Cloud_mask
Source: 2B-GEOPROF 011
Field type (in file): INT(1)
Field type (in algorithm): INT(1)
Dimensions: nbin,nray
Units:
Range: 0 to 40
Missing value: -9
Missing value operator: ==
Factor: 1
Offset: 0
MB: 4.337

Each CPR resolution volume is assigned 1 bit mask value:

0 = No cloud detected
1 = likely bad data
5 = likely ground clutter
5-10 = week detection found using along track integration.
20 to 40 = Cloud detected .. increasing values represents clouds with lower chance of a being a false detection.

(18) Gaseous_Attenuation

Name in file: Gaseous_Attenuation
Source: 2B-GEOPROF 011
Field type (in file): INT(2)
Field type (in algorithm): REAL(4)
Dimensions: nbin,nray
Units: dBZe
Range: 0 to 10
Missing value: -99.99
Missing value operator: ==
Factor: 0.01
Offset: 0
MB: 8.674

Gaseous attenuation

(19) Radar Reflectivity Factor

Name in file: Radar_Reflectivity
Source: 2B-GEOPROF 011
Field type (in file): INT(2)
Field type (in algorithm): REAL(4)
Dimensions: nbin,nray
Units: dBZe
Range: -40 to 50
Missing value: -88.88
Missing value operator: ==
Factor: 0.01
Offset: 0
MB: 8.674

Radar reflectivity factor Ze is calculated with the echo power and other input data as described in Li and Durden (2001)

(20) Sigma-Zero

Name in file: Sigma-Zero
Source: 1B-CPR 008
Field type (in file): INT(2)
Field type (in algorithm): INT(2)
Dimensions: nray
Units: dB*100
Range: -1000 to 4000
Missing value: -9999
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.069

The Sigma-Zero is the normalized surface cross section (not corrected for attenuation). It's multiplied by 100 and stored as 2-byte integers.

(21) MOD35_bit_2and3_cloud_flag

Name in file: MODIS_cloud_flag
Source: 2B-GEOPROF 011
Field type (in file): INT(1)
Field type (in algorithm): INT(1)
Dimensions: nray
Units: None
Range: 0 to 3
Missing value: 99
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.035

Value from MOD35 under radar track, bits 2 and 3. --- cloud flag w/confidence

(22) MODIS 250m Cloud Fraction

Name in file: MODIS_Cloud_Fraction
Source: 2B-GEOPROF 011
Field type (in file): INT(1)
Field type (in algorithm): INT(1)
Dimensions: nray
Units:
Range: 0 to 100
Missing value: -99
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.035

MODIS 250m cloud fraction included cloud fraction calculated with MODIS 250m pixels.

(23) MODIS scene characterizations

Name in file: MODIS_scene_char
Source: 2B-GEOPROF 011
Field type (in file): INT(1)
Field type (in algorithm): INT(1)
Dimensions: nray
Units:
Range: 0 to 9
Missing value: -9
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.035

This data includes MODIS pixel cloudiness characterization using cloudmask bit tests. See Table 3 for a detailed specification.

(24) MODIS scene variability

Name in file: MODIS_scene_var
Source: 2B-GEOPROF 011
Field type (in file): INT(1)
Field type (in algorithm): INT(1)
Dimensions: nray
Units:
Range: 0 to 5
Missing value: -9
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.035

MODIS scence variability -variability of classification assigned to the 1 km MODIS pixels that compose the CloudSat footprint and immediately adjacent region. See Table 5 for a detail specification.

(25) CPR Echo Top Characterizations

Name in file: CPR_Echo_Top
Source: 2B-GEOPROF 011
Field type (in file): INT(1)
Field type (in algorithm): INT(1)
Dimensions: nray
Units:
Range: 0 to 5
Missing value: -9
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.035

See Table 4 for the detail specification

(26) Noise Floor calculated in Cloud_Masking Routine

Name in file: sem_NoiseFloor
Source: 2B-GEOPROF 011
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nray
Units:
Range: to
Missing value: 0
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.139

Noise Floor calculated in Cloud_Masking Routine

(27) Noise Variance in measured return (i.e. Echo) power

Name in file: sem_NoiseFloorVar
Source: 2B-GEOPROF 011
Field type (in file): REAL(4)
Field type (in algorithm): REAL(4)
Dimensions: nray
Units:
Range: to
Missing value: 0
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.139

Noise Variance in measured return (i.e. Echo) power

(28) Noise Floor and Noise Variance estimate based on window of a fixed size centered at this range bin.

Name in file: sem_NoiseGate
Source: 2B-GEOPROF 011
Field type (in file): INT(1)
Field type (in algorithm): INT(1)
Dimensions: nray
Units:
Range: to
Missing value: 0
Missing value operator: ==
Factor: 1
Offset: 0
MB: 0.035

Noise Floor and Noise Variance estimate based on window of a fixed size centered at this range bin.

(29) Land Sea Flag

Name in file: Navigation_land_sea_flag
Source: 1B-CPR 008
Field type (in file): UINT(1)
Field type (in algorithm): INT(1)
Dimensions: nray
Units: --
Range: 1 to 3
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0.035

Flag indicating whether spacecraft is over land or sea:

1 = land
2 = ocean
3 = coast

(30) Clutter_reduction_flag

Name in file: Clutter_reduction_flag
Source: 2B-GEOPROF 011
Field type (in file): INT(1)
Field type (in algorithm): INT(1)
Dimensions: nray
Units:
Range: to
Missing value:
Missing value operator:
Factor: 1
Offset: 0
MB: 0.035

A value of 1 indicates that an estimate of surface clutter has been subtracted from the observed return power in bins 2 through 5 above the surface. A value of 0 indicate that NO clutter reduction has been applied.

4. Changes Since the Last Product Version

4.1 2B-GEOPROF 011

General product changes
None.

Field changes

Profile_time (source: 1B-CPR 008):
None.
UTC_start (source: 1B-CPR 008):
None.
TAI_start (source: 1B-CPR 008):
None.
Latitude (source: 1B-CPR 008):
None.
Longitude (source: 1B-CPR 008):
None.
Height:
None.
Range_to_intercept (source: 1B-CPR 008):
None.
DEM_elevation (source: 1B-CPR 008):
None.
Vertical_binsize:
None.
Pitch_offset (source: 1B-CPR 008):
None.
Roll_offset (source: 1B-CPR 008):
None.
Data_quality (source: 1B-CPR 008):
None.
Data_status (source: 1B-CPR 008):
None.
Data_targetID (source: 1B-CPR 008):
None.
SurfaceHeightBin:
07/23/2007 16:24:30 - The missing value is -1, not 255 as previously specified. (Phil Partain)
SurfaceHeightBin_fraction:
05/18/2007 10:22:12 - Added field (Roger Marchand)
05/18/2007 10:53:35 - Mis-spelled name when first entered (Roger Marchand)
CPR_Cloud_mask:
None.
Gaseous_Attenuation:
None.
Radar_Reflectivity:
None.
Sigma-Zero (source: 1B-CPR 008):
None.
MODIS_cloud_flag:
05/18/2007 12:29:10 - Added field (Roger Marchand)
05/18/2007 12:37:48 - Change long name and description. (Roger Marchand)
MODIS_Cloud_Fraction:
None.
MODIS_scene_char:
None.
MODIS_scene_var:
None.
CPR_Echo_Top:

None.

sem_NoiseFloor:

None.

sem_NoiseFloorVar:

None.

sem_NoiseGate:

None.

Navigation_land_sea_flag (source: 1B-CPR 008):

05/18/2007 13:46:33 - Added flag values to the field description. (Phil Partain)

Clutter_reduction_flag:

06/08/2007 09:47:08 - Added field (Roger Marchand)

06/08/2007 09:49:00 - Changed variable name (Roger Marchand)