

CALIPSO IIR Level 1 Calibration Correction Data Description Document

Version 3.00

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Introduction

The Infrared Imaging Radiometer (IIR) Level 1 Calibration Correction data product complements the IIR Level 1 Calibration data product. This product contains the semi-empirical corrections of the initial gains used to compute the calibrated radiances reported in the IIR Level 1B science product. These corrections were defined for each of the three channels at 8.65, 10.6, and 12.05 μm to reduce a “Tartan” striping effect and biases with respect to MODIS/Aqua observations.

The maximum number of IIR sequences processed in one full orbit is 730, which equates to 1 sequence every 8.184 seconds. Each sequence includes one Earth view image in each IIR channel. These images are composed of 64 rows x 64 columns, where the rows are perpendicular to the satellite track and the columns are parallel. The semi-empirical corrections are based on a table for each IIR channel where the correction coefficients vary with the sequence number of the Earth view image and are of different amplitude in the 64 rows. For a given sequence number, the corrections are identical for all the 64 columns of a given row.

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Additional Documentation

Project Documentation

- CALIPSO Data Management Team: CALIPSO Data Products Catalog, PC-SCI-503, Release 5.00.
- IIR Level 1 Processing Requirements, CNES, Ed. 4, 12 March, 2014.

Peer-Reviewed Algorithm Papers

- Garnier, A., T. Trémas, J. Pelon, K.-P. Lee, D. Nobileau, L. Gross-Colzy, N. Pascal, P. Ferrage and N. A. Scott, 2018: CALIPSO IIR Version 2 Level 1b calibrated radiances: analysis and reduction of residual biases in the Northern Hemisphere, *Atmos. Meas. Tech.*, 11, 2485–2500, <https://doi.org/10.5194/amt-11-2485-2018>.
- Garnier, A., N. A. Scott, J. Pelon, R. Armante, L. Crépeau, B. Six and N. Pascal, 2017: Long term assessment of the CALIPSO Imaging Infrared Radiometer (IIR) calibration and stability through comparisons with MODIS/Aqua and SEVIRI/Meteosat, *Atmos. Meas. Tech.*, 10, 1403–1424, <https://doi.org/10.5194/amt-10-1403-2017>.

Data Product Descriptions

Orbit_Start_Time

Units: s

Format: Float_64

Valid Range: 4.203E8, 9.623E8

Fill Value: -9999.0

Description: Orbit start time reported in International Atomic Time (TAI) in elapsed seconds from January 1, 1993.

Row_Number

Units: NoUnits

Format: Int_8

Valid Range: 0, 63

Description: Row number of each of the 64 x 64 pixels of an image.

Column_Number

Units: NoUnits

Format: Int_8

Valid Range: 0, 63

Description: Column number of each of the 64 x 64 pixels of an image.

Initial_Correction_Table_Sequence_Number_Night

Units: NoUnits

Format: Int_16

Valid Range: 0, 729

Fill Value: -9999

Description: Sequence number in the correction table of the first nighttime image.

Initial_Correction_Table_Sequence_Number_Day

Units: NoUnits

Format: Int_16

Valid Range: 0, 729

Fill Value: -9999

Description: Sequence number in the correction table of the first daytime image.

Initial_Image_Sequence_Number_Night

Units: NoUnits

Format: Int_16

Valid Range: 0, 20479

Fill Value: -9999

Description: Sequence number of the first nighttime image.

Initial_Image_Sequence_Number_Day

Units: NoUnits

Format: Int_16

Valid Range: 0, 20479

Fill Value: -9999

Description: Sequence number of the first daytime image.

Image_Sequence_Number_8.65**Image_Sequence_Number_12.05****Image_Sequence_Number_10.6**

Units: NoUnits

Format: Int_16

Valid Range: 0, 20479

Fill Value: -9999

Description: Image sequence number for channels 8.65, 12.05, and 10.6.

Correction_Table_Sequence_Number_8.65**Correction_Table_Sequence_Number_12.05****Correction_Table_Sequence_Number_10.6**

Units: NoUnits

Format: Int_16

Valid Range: 0, 729

Fill Value: -9999

Description: Sequence number of the image in the correction table for channels 8.65, 12.05, and 10.6.

Row_Equalization_Tartan_Radiance_Correction_8.65**Row_Equalization_Tartan_Radiance_Correction_12.05****Row_Equalization_Tartan_Radiance_Correction_10.6**

Units: NoUnits

Format: Float_32

Valid Range: 0.9, 1.1

Fill Value: -9999.0

Description: Calibration equalization correction factor to correct for the "Tartan" effect for channels 8.65, 12.05, and 10.6. There is one correction factor per row, and all the columns of a given row have the same correction factor. The gains reported in the IIR level 1 Calibration product are corrected by dividing by this factor.

Row_Bias_Radiance_Correction_8.65

Row_Bias_Radiance_Correction_12.05

Row_Bias_Radiance_Correction_10.6

Units: NoUnits

Format: Float_32

Valid Range: 0.9, 1.1

Fill Value: -9999.0

Description: Calibration correction factor to correct for a systematic bias with respect to MODIS/Aqua for channels 8.65, 12.05, and 10.6. There is one correction factor per row, and all the columns of a given row have the same correction factor. The gains reported in the IIR level 1 Calibration product are corrected by dividing by this factor.

Row_Total_Radiance_Correction_8.65

Row_Total_Radiance_Correction_12.05

Row_Total_Radiance_Correction_10.6

Units: NoUnits

Format: Float_32

Valid Range: 0.9, 1.1

Fill Value: -9999.0

Description: Overall calibration correction factor to correct for both the "Tartan" effect and a systematic bias with respect to MODIS/Aqua for channels 8.65, 12.05, and 10.6. There is one correction factor per row, and all the columns of a given row have the same correction factor. The gains reported in the IIR level 1 Calibration product are corrected by dividing by this factor.

Metadata Parameter Descriptions

Product_ID

An 80-byte character string containing the product name. For the IIR Level 1 calibration correction product, the value of this string is "CORIIR_L1".

Date_Time_at_Granule_Start

A 27-byte character string that specifies the granule start date and time. The format is yyyy-mm-ddThh:nn:ss.ffffffZ, where yyyy is the year, mm is the month, dd is the day, hh is the hour, nn is the minute, ss is the second, and fffffff is the fractional second. Date and time are separated by the character 'T'. The 'Z' indicates that time is given in UTC.

Date_Time_at_Granule_End

A 27-byte character string that specifies the granule end date and time. The format is yyyy-mm-ddThh:nn:ss.ffffffZ, where yyyy is the year, mm is the month, dd is the day, hh is the hour, nn is the minute, ss is the second, and fffffff is the fractional second. Date and time are separated by the character 'T'. The 'Z' indicates that time is given in UTC.

Date_Time_of_Production

A 27-byte character string that specifies the date and time at granule production. The format is yyyy-mm-ddThh:nn:ss.ffffffZ, where yyyy is the year, mm is the month, dd is the day, hh is the hour, nn is the minute, ss is

the second, and ffffff is the fractional second. Date and time are separated by the character 'T'. The 'Z' indicates that time is given in UTC.

Initial_Subsatellite_Latitude

This field reports the first subsatellite latitude of the granule.

Initial_Subsatellite_Longitude

This field reports the first subsatellite longitude of the granule.

Final_Subsatellite_Latitude

This field reports the last subsatellite latitude of the granule.

Final_Subsatellite_Longitude

This field reports the last subsatellite longitude of the granule.

Orbit_Number_at_Granule_Start

Orbit_Number_at_Granule_Stop

Orbit_Number_Change_Time

Orbit Number consists of three fields that define the number of revolutions by the CALIPSO spacecraft around the Earth. This number is incremented each time the spacecraft passes the equator on the ascending node. To maintain consistency between the CALIPSO and CloudSat orbit parameters, the Orbit Number is keyed to the CloudSat orbit 2121 at 23:00:47 on 2006/09/20. Because the CALIPSO data granules are organized according to the day and night conditions, based on fixed Sun-Earth-Satellite angles, day/night boundaries do not coincide with transition points for defining orbit number. As such, three parameters are needed to describe the orbit number for each granule as:

- **Orbit Number at Granule Start:** orbit number at the granule start time.
- **Orbit Number at Granule End:** orbit number at the granule stop time.
- **Orbit Number Change Time:** time at which the orbit number changes in the granule.

Path_Number_at_Granule_Start

Path_Number_at_Granule_Stop

Path_Number_Change_Time

Path Number consists of three fields that define an index ranging from 1-233 that references orbits to the Worldwide Reference System (WRS). This global grid system was developed to support scene identification for Landsat imagery. Since the A-Train is maintained to the WRS grid within +/- 10 km, the Path Number provides a convenient index to support data searches, instead of having to define complex latitude and longitude regions along the orbit track. The Path Number is incremented after the maximum latitude in the orbit is attained and changes by a value of 16 between successive orbits. Because the CALIPSO data granules are organized according to the day and night conditions, based on fixed Sun-Earth-Satellite angles, day/night boundaries do not coincide with transition points for defining path number. As such, three parameters are needed to describe the path number for each granule as:

- **Path Number at Granule Start:** path number at the granule start time.
- **Path Number at Granule End:** path number at the granule stop time.
- **Path Number Change Time:** time at which the path number changes in the granule.

While CALIPSO was formation flying in the A-Train all path numbers in the metadata are exact. Beginning in September 2018, when CALIPSO lowered its orbit into the C-Train, path numbers are no longer exact, but they instead indicate the closest WRS reference orbit.

Data Release Information

Table 1: Date, version, and production strategy for this first public release of the CALIPSO IIR level 1 Calibration Correction data product

IIR Level 1 Calibration Correction: Full Orbit			
Release Date	Version	Data Date Range	Production Strategy
September 2025	3.00	June 13, 2006 to June 30, 2023	Standard