

JPL D-92238, Revision B

Earth Observing System



Data Products Specifications for the MISR Cloud Fraction by Altitude Product

-Incorporating the Science Data Processing Interface Control Document

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Multi-angle Imaging SpectroRadiometer (MISR)

Data Products Specifications

-Incorporating the Science Data Processing Interface Control Document

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To determine the latest released version of this document, consult the MISR web site
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Document Change Log

Revision	Date	Affected Portions and Description
Release A	04 September 2014	All, original release
Release B	24 July 2019	Updated to include useage of resolution-corrected RCCM cloud fractions

Which Product Versions Does this Document Cover?

Product Filename Prefix	Version Number in Filename	Brief Description
MISR_AM1_CFbA	F02_0004	L3 Cloud Fraction by Altitude Product



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Acronym List

AGP	Ancillary Geographic Product
ASCM	Angular Signature Cloud Mask
DAAC	Distributed Active Archive Center
ECS	EOSDIS Core System (Data Production System at DAAC)
EOS	Earth Observing System
EOSDIS	Earth Observing System Data and Information System
ESDT.....	Earth Science Datatype
HDF	Hierarchical Data Format
JPL	Jet Propulsion Laboratory
LaRC.....	NASA Langley Research Center
MISR.....	Multi-angle Imaging SpectroRadiometer
NASA.....	National Aeronautics and Space Administration
RCCM.....	Radiometric Camera-by-camera Cloud Mask
SCF	Science Computing Facility
SDCM	Stereoscopically Derived Cloud Mask
SDP	Science Data Processing
SOM.....	Space-Oblique Mercator
WGS84.....	World Geodetic System 1984

1 MISR DATA PRODUCT SPECIFICATION DOCUMENT

1.1 MISR LEVEL3 CLOUD FRACTION BY ALTITUDE PRODUCT

The Cloud Fraction by Altitude (CFbA) product contains the frequency of cloud occurrence partitioned into different cloud top height bins at a global and monthly scale with a spatial resolution of $0.5^\circ \times 0.5^\circ$ latitude/longitude and vertical resolution of 500 m. For each height bin, the frequency of cloud occurrence of a region over a time period is represented by the temporal mean of the spatial coverage of cloud tops. Clouds are assigned to height bins based on their top height as retrieved by the MISR stereoscopic technique [7]

The purpose of this document is to describe the format of the MISR CFbA product. Other MISR standard products, as well as the ancillary datasets used in their generation, are fully detailed in their respective MISR Data Product Specification Documents (DPS). The prior version of the CFbA (F01_0001) product is detailed in the MISR DPS, Revision S.

1.2 MISR DATA PRODUCTS

The MISR project is a component of the Earth Observing System (EOS) Terra Mission and the EOS Data and Information System (EOSDIS), which are components of the National Aeronautics and Space Administration's (NASA) Earth Science Enterprise. An integral part of the MISR project is the Science Data Processing (SDP) of the observations coming from the MISR instrument on-board the EOS Terra satellite.

MISR SDP exists to produce science and supporting data products from MISR instrument data. All functions of the MISR SDP system are directed toward this goal. MISR SDP does not operate as an independent entity, but rather is linked to the functionality of the EOSDIS at the Langley Research Center (LaRC) Distributed Active Archive Center (DAAC). The EOSDIS Core System (ECS) ingest subsystem at the LaRC DAAC is the agent for receiving and organizing all of the input data needed by MISR SDP. These data are then made available to MISR SDP through the data server and staging facilities provided by ECS at the LaRC DAAC. After MISR standard data processing is complete, the standard output products are archived through the EOSDIS data server and made available to users through ECS client services.

The MISR Science Computing Facility (SCF) at the Jet Propulsion Laboratory (JPL) supports the development of MISR science algorithms and software, instrument calibration and performance assessment, as well as providing quality assessment and data validation services with respect to MISR SDP. The MISR SCF is used to produce software, supporting data, and coefficients that are required to operate MISR SDP software at the LaRC DAAC.

MISR SDP depends upon the availability of MISR instrument data, internal data sets produced at the MISR SCF, and external data sets that are products of other EOS data processing systems.

1.3 CONTROLLING DOCUMENTS

- 1) MISR Data System Science Requirements, JPL D-11398, September 1996 (or latest version).
- 2) MISR Level 1 Radiance Scaling and Conditioning Algorithm Theoretical Basis, JPL D-11507, Revision D, January 1999 (or latest version).
- 3) MISR Level 1 Georectification and Registration Algorithm Theoretical Basis, JPL D-11532, Revision B, August 1996 (or latest version).
- 4) MISR Level 1 Cloud Detection Algorithm Theoretical Basis, JPL D-13397, Revision A, November 1997 (or latest version).
- 5) MISR Level 1 In-flight Radiometric Calibration and Characterization Algorithm Theoretical Basis, JPL D-13398, June 1996 (or latest version).
- 6) MISR Level 1 Ancillary Geographic Product Algorithm Theoretical Basis, JPL D-13400, Revision B, March 1999 (or latest version).
- 7) MISR Level 2 Cloud Algorithm Theoretical Basis, JPL D-73327, April 2012 (or latest version).
- 8) MISR Level 3 Cloud Fraction by Altitude Algorithm Theoretical Basis, JPL D-62358, August 2010 (or latest version).
- 9) MISR Science Data Product Guide, JPL D-73355, April 2012 (or latest version).

APPLICABLE DOCUMENTS

- 10) SDP Toolkit Users Guide for the ECS Project, HAIS 194-809-SD4-001 (or latest version)

2 MISR LEVEL 3 CLOUD FRACTION BY ALTITUDE DATA PRODUCT SPECIFICATION

The MISR Cloud Fraction by Altitude product contains the fraction of cloud in a given height range, where the cloud altitude is determined as either (a) the median stereoscopically derived cloud-top height in a given 17.6 km region, or (b) the same heights this time with missing data filled in by a nearest-neighbour interpolation algorithm.

2.1 MISR LEVEL 3 CLOUD FRACTION BY ALTITUDE PRODUCT GRANULE NAMES

The CFbA is reported at four different time scales: daily, monthly, seasonally and annually. All these files have an identical file format. The corresponding granule names are listed below in respective order.

2.1.1 File Metadata Description

Table 1 - MISR Cloud Fraction by Altitude Data Products

MISR LEVEL 3 FILE GRANULE NAME ¹	ESDT Name	File Type	Applicable Product Version
MISR_AM1_CFbA_mmm_dd_yyyy_Fff_vvvv.hdf	MIL3DCFA	HDF-EOS latitude-longitude grid	F02_0004
MISR_AM1_CFbA_mmm_yyyy_Fff_vvvv.hdf	MIL3MCFA	HDF-EOS latitude-longitude grid	F02_0004
MISR_AM1_CFbA_sss_yyyy_Fff_vvvv.hdf	MIL3QCFA	HDF-EOS latitude-longitude grid	F02_0004
MISR_AM1_CFbA_yyyy_Fff_vvvv.hdf	MIL3YCFA	HDF-EOS latitude-longitude grid	F02_0004

¹ “mmm” is the three character month (one of “JAN”, “FEB”, “MAR”, “APR”, “MAY”, “JUN”, “JUL”, “AUG”, “SEP”, “OCT”, “NOV”, “DEC”), “sss” is the season (one of “WIN”, “SPR”, “SUM”, “FALL”), “dd” is the two digit day (e.g., “03”), “yyyy” is the four digit year (e.g., “2002”), “ff” is the format version number (e.g. “01”), and “vvvv” is the data version number (e.g., “0002”).

2.2 MISR LEVEL 3 MIL3DFCA, MIL3MCFA, MIL3QCFA, MIL3YCFA CLOUD FRACTION BY ALTITUDE PRODUCT

2.2.1 File Metadata Description

Table 2 - CFbA File Metadata

Vdata Name	Vdata Field Name	Definition	Data Type	Units	Valid Range
Source File	Orbit Number	List of orbits that are summarized in this Level 3 file	INT32	N/A	1-999999
	Path Number	List of paths that are summarized in this Level 3 file	INT32	N/A	1-233
	Local Granule Id	List of local granule IDs summarized in this Level 3 file.	CHAR8 x 128	N/A	N/A
	Local Version Id	List of local version IDs summarized in this Level 3 file.	CHAR8 x 128	N/A	N/A
	Included in Summary	List of true/false values to indicate if an orbit was included (1) or was screened out due to poor registration (0).	UINT8	N/A	0-1
<Dimension name> Enumeration ²	Value	Meaning of each value in the dimension. For example, Latitude has 360 entries: “[90.0,89.5)”, “[89.5, 89.0)”, “[89.0, 88.5)”, and so on.	CHAR8 x 128	N/A	N/A

2.2.2 File Dimensions

Table 3 - CFbA Field Dimension Descriptions

Dimension	Description	Number of values	Values
HeightBin	Height bin	45	0 = (-infinity,-500m) 1 = [-500m, 0m) 2 = [0m, 500m) 3 = [500m, 1000m) 4 = [1000m, 1500m) 5 = [1500m, 2000m) 6 = [2000m, 2500m) 7 = [2500m, 3000m) 8 = [3000m, 3500m) 9 = [3500m, 4000m) 10 = [4000m, 4500m) 11 = [4500m, 5000m) 12 = [5000m, 5500m)

² <Dimension name> is a place holder for each dimension in file. For example, there is one Vdata named “CloudType Enumeration”, and another named “HeightBin Enumeration”. See Table 10-20 for list of Dimensions.

			13 = [5500m, 6000m) 14 = [6000m, 6500m) 15 = [6500m, 7000m) 16 = [7000m, 7500m) 17 = [7500m, 8000m) 18 = [8000m, 8500m) 19 = [8500m, 9000m) 20 = [9000m, 9500m) 21 = [9500m, 10000m) 22 = [10000m, 10500m) 23 = [10500m, 11000m) 24 = [11000m, 11500m) 25 = [11500m, 12000m) 26 = [12000m, 12500m) 27 = [12500m, 13000m) 28 = [13000m, 13500m) 29 = [13500m, 14000m) 30 = [14000m, 14500m) 31 = [14500m, 15000m) 32 = [15000m, 15500m) 33 = [15500m, 16000m) 34 = [16000m, 16500m) 35 = [16500m, 17000m) 36 = [17000m, 17500m) 37 = [17500m, 18000m) 38 = [18000m, 18500m) 39 = [18500m, 19000m) 40 = [19000m, 19500m) 41 = [19500m, 20000m) 42 = [20000m, infinity) 43 = (-infinity, infinity) 44 = No Height Retrieval
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2.2.3 Grid Dataset Description

Table 4 - CFbA Product Grid Dataset Description

Field Name Parameter Description	Dimensions List	Number Type	Units	Flag Values
CFbA (0.5 degree x 0.5 degree, XDim = 720, YDim = 360) XDim and YDim are the longitude and latitude dimensions respectively. For row-based reads, the upper-left corner of the grid (element [0, 0]) is centered at (89.75 N, 179.75 W), and the lower-right corner of the grid (element [359, 719]) is centered at (89.75 S, 179.75 E). This assumes zero-based arrays. For column-major languages, the array dimensions will be reversed so the data will appear to have the dimensions [720, 360].				
RawCloudTopHeightFraction_Avg Percent cloud fraction at a particular height. Calculated using BestEstimateCloudFraction data from the TC_CLASSIFIER product	YDim, XDim, HeightBin	FLOAT32	percent	-9999 = fill Range: 0.0-1.0
RawCloudTopHeightFraction_Num³	YDim, XDim,	UINT32	N/A	0 = fill

³ In the daily file, this number represents the number of 17.6 km cloud fractions sampled at a particular height. In the monthly file, this number represents the number of days that were combined to create the average. In seasonal

Number of values that were averaged together to generate CloudTopHeightFraction_Avg. Calculated using BestEstimateCloudFraction data from the TC_CLASSIFIER product	HeightBin			
RawCloudTopHeightFraction_Std Standard deviation of cloud fraction. Calculated using BestEstimateCloudFraction data from the TC_CLASSIFIER product	YDim, XDim, HeightBin	FLOAT32	N/A	-9999 = fill
RawCloudTopHeightFraction_NN_Avg Percent cloud fraction at a particular height, uses nearest neighbor heights up to 200km. Calculated using BestEstimateCloudFraction data from the TC_CLASSIFIER product	YDim, XDim, HeightBin	FLOAT32	percent	-9999 = fill Range: 0.0-1.0
RawCloudTopHeightFraction_NN_Num³ Number of values that were averaged together to generate CloudTopHeightFraction_NN_Avg. Calculated using BestEstimateCloudFraction data from the TC_CLASSIFIER product	YDim, XDim, HeightBin	UINT32	N/A	0 = fill
RawCloudTopHeightFraction_NN_Std Standard deviation of cloud fraction generated using nearest neighbor height. Calculated using BestEstimateCloudFraction data from the TC_CLASSIFIER product	YDim, XDim, HeightBin	FLOAT32	N/A	-9999 = fill
CorrCloudTopHeightFraction_Avg Corrected percent cloud fraction at a particular height using resolution-corrected RCCM fractions from TC_CLASSIFIERS product	YDim, XDim, HeightBin	FLOAT32	percent	-9999 = fill Range: 0.0-1.0
CorrCloudTopHeightFraction_Num³ Corrected number of values that were averaged together to generate CloudTopHeightFraction_Avg. using the resolution-corrected RCCM	YDim, XDim, HeightBin	UINT32	N/A	0 = fill
CorrCloudTopHeightFraction_Std Corrected standard deviation of cloud fraction using the resolution-corrected RCCM fractions	YDim, XDim, HeightBin	FLOAT32	N/A	-9999 = fill
CorrCloudTopHeightFraction_NN_Avg Corrected percent cloud fraction at a particular height, uses nearest neighbor heights up to 200km. Calculated using the resolution-corrected RCCM fractions	YDim, XDim, HeightBin	FLOAT32	percent	-9999 = fill Range: 0.0-1.0
CorrCloudTopHeightFraction_NN_Num³ Corrected number of values that were averaged together to generate CloudTopHeightFraction_NN_Avg using the resolution-corrected RCCM	YDim, XDim, HeightBin	UINT32	N/A	0 = fill
CorrCloudTopHeightFraction_NN_Std Corrected standard deviation of cloud fraction generated using nearest neighbor height using the resolution-corrected RCCM	YDim, XDim, HeightBin	FLOAT32	N/A	-9999 = fill

annual files, this number represents the number of months that were combined.