

JPL D-74995

Earth Observing System



Data Product Specification for the MISR Cloud Motion Vector Product

-Incorporating the Science Data Processing Interface Control Document

Kevin Mueller

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Jet Propulsion Laboratory
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September 2, 2014



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Multi-angle Imaging SpectroRadiometer (MISR)

Data Product Specification for the MISR Cloud Motion Vector Product

-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
(<http://misr.jpl.nasa.gov>).

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Document Change Log

Revision	Date	Affected Portions and Description
	16 September 2012	All, original release
	2 September 2014	The original document described only the Level 3 CMV product. Descriptions of the Level 2 NRT CMV product have been added, including information comparing/contrasting the two product variations.

Which Product Versions Does this Document Cover?

Product Filename Prefix	ESDT (short names)	Version Number	Brief Description
MISR_AM1_CMV	MI2CMVPR MI2CMVBR	F01_0001	Level 2 Cloud Motion Vectors
	MI3MCMVN MI3QCMVN MI3YCMVN	F02_0002	Level 3 Cloud Motion Vectors

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1 INTRODUCTION

1.1 MISR CLOUD MOTION VECTOR PRODUCT

The Multi-angle Imaging SpectroRadiometer (MISR) Cloud Motion Vector (CMV) product provides retrievals of the height-resolved cloud motion determined from two multi-angle image triplets, each spanning a 3.5 minute window. The CMV product offers both Level 2 datasets available in near real time (NRT) for rapid response applications such as numerical weather prediction (NWP) and Level 3 datasets aggregating observations over longer time scales to facilitate climate studies. Level 2 NRT CMV datasets are distributed within three hours of satellite overflight as HDF or BUFR format files comprising data collected over a 10 to 50 minute observational session. Level 3 CMV product datasets are distributed as NetCDF format files comprising data collected over the course of a month, season, or year.

The MISR CMV product is closely related to the MISR Level 2 Cloud product. Level 3 MISR CMV product datasets consist of high quality subsets of CMVs reported in the Level 2 Cloud product. The Level 2 Cloud ATBD [7] documents the CMV retrieval algorithm whereas the Level 3 CMV ATBD [8] documents the additional quality control procedures applied to produce the CMV product. Level 2 NRT CMV product datasets are generated by a separate implementation of these same algorithms that yields nearly equivalent results. Differences are due to the nature of NRT processing and fall within the expected uncertainty of the retrieval.

The purpose of this document is to describe the various formats of the MISR CMV product. The details of other MISR products can be found in their respective MISR Data Product Specifications Documents. Information concerning the MISR georegistration is contained in the MISR Science Data Product Guide.

This document is organized as follows. Section 1 introduces the CMV product and MISR product documentation. Section 2 describes the format of monthly, seasonal, and annual CMV product files in NetCDF format. Section 3 describes the format of session-based CMV product files in HDFEOS format. Section 4 describes the format of session-based CMV product files in BUFR format.

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 Cloud Motion Vector Product Algorithm Theoretical Basis, JPL D-64973, September 2012 (or latest version)
- 9) MISR Level 2 Ancillary Products and Datasets Algorithm Theoretical Basis, JPL D-13402, Revision A, December 1998 (or latest version).
- 10) 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 2 NRT CMV DATA PRODUCT SPECIFICATION

2.1 MISR LEVEL 2 NRT CMV PRODUCT GRANULE NAMES

MISR Level 2 NRT CMV datasets are distributed in 10 to 50 minute sessions within three hours of satellite overflight as HDF and BUFR format files. The session start time encoded in the file name is unique to each CMV dataset.

One HDF file and one BUFR file will usually be generated for each session. However, there are circumstances for which an HDF file will be generated for a session, but no associated BUFR file will be produced. In particular, if no valid retrievals were retrieved during a session (for example, due to poor georegistration), then an HDF file will be produced that contains only fill values for retrieval parameters. In this case, no BUFR file will be produced.

Table 1 – MISR Level 2 NRT CMV Product Granule Names

MISR Level 2 CMV Product Granule Name ¹	ESDT Name
MISR_AM1_CMV_Tdddddddttttt_Pppp_Ooooooo_Fff_vvvv.hdf	MI2CMVPR
MISR_AM1_CMV_BUFR_Tdddddddttttt_Pppp_Ooooooo_Fff_vvvv.bufr	MI2CMVBR

2.2 MISR LEVEL 2 NRT CMV HDF GRANULE OVERVIEW

MISR Level 2 NRT CMV files offered in HDF format use the HDF-EOS Grid “stacked-block” format to define a 17.6 km spatial resolution grid of SOM projected coordinates of retrieval. The grid structure for retrieval parameters is three dimensional, organized into sequential adjacent SOM projected blocks, and x and y SOM grid dimensions within the block. Because HDF-EOS conventions are employed, HDF compliant software is sufficient to read the files, but HDF-EOS software is recommended.

HDF format files provide a number of data structures with relevant information. Parameters defined for each field are grouped in the "Motion_17.6_km" grid described in sections 0. Parameters defined on a per-block basis are described in section 2.3.3. Parameters defined for each session file are described in section 2.3.1.

¹ MISR DPS update for CMV product data has been defined (in UTC). The date consists of a four-digit year (e.g., “2014”), two-digit month (e.g., “02” for February), and two digit day of month. The time consists of a two-digit hour (e.g., “23”), two-digit minute (e.g., “59”), and two digit second (e.g., “59”). "oooooo" and "ppp" are the six-digit orbit number and corresponding three-digit SOM path projection (e.g., “037435” and “094,” respectively). “ff” is the format version number (e.g., “01”), and “vvvv” is the data version number (e.g., “0001”).

2.3 MISR LEVEL 2 NRT CMV HDF GRANULE COMPONENTS

2.3.1 File Metadata Description

Table 2 - File Metadata

File Metadata Field Name	Definition	Data Type	Units	Valid Range
Path_number	Orbit path number	INT32	N/A	1-233
AGP_version_id	Version identifier for AGP	INT32	N/A	2
DID_version_id	Version Identifier for DID (<u>D</u> TED [<u>D</u> igital <u>T</u> errain <u>E</u> levation <u>D</u> ataset] <u>I</u> ntermediate <u>D</u> ataset)	INT32	N/A	4
Number_blocks	Total number of blocks	INT32	N/A	1-180
Ocean_blocks_size	Dimension of ocean_blocks parameter	INT32	N/A	1-180
Ocean_blocks.count	Total number of blocks containing entirely ocean data	INT32	N/A	1-180
Ocean_blocks.numbers	List of block numbers containing entirely ocean data	180 x INT32	N/A	1-180
SOM_parameters.som_ellipsoid.a	Semimajor axis of Earth ellipsoid	FLOAT64	meters	WGS84 ellipsoid (6.3781370E+ 06)
SOM_parameters.som_ellipsoid.e2	Eccentricity of Earth ellipsoid squared	FLOAT64	N/A	WGS84 ellipsoid (6.6943480E-03)
SOM_parameters.som_orbit.aprime	Semimajor axis of Terra satellite orbit	FLOAT64	meters	1.0
SOM_parameters.som_orbit.eprime	Eccentricity of Terra satellite orbit	FLOAT64	N/A	1.0
SOM_parameters.som_orbit.gama	Longitude of Terra satellite perigee	FLOAT64	radians	1.0
SOM_parameters.som_orbit.nrev	Number of revolutions per ground track repeat cycle	INT32	N/A	233
SOM_parameters.som_orbit.ro	Radius of circular Terra satellite orbit	FLOAT64	meters	7.0780408E+06
SOM_parameters.som_orbit.i	Inclination of Terra satellite orbit	FLOAT64	radians	1.7157253
SOM_parameters.som_orbit.P2P1	Ratio of time of revolution over length of Earth rotation/orbit	FLOAT64	N/A	6.8666667E-02
SOM_parameters.som_orbit.lambda0	Geodetic longitude of ascending node	FLOAT64	radians	-2 π : 2 π
Origin_block.ulc.x	SOM X coordinate of the upper left corner of the first block	FLOAT64	meters	
Origin_block.ulc.y	SOM Y coordinate of the upper left corner of the first block	FLOAT64	meters	
Origin_block.lrc.x	SOM X coordinate of the lower right corner of the first block	FLOAT64	meters	
Origin_block.lrc.y	SOM Y coordinate of the lower right corner of	FLOAT64	meters	

	the first block			
Start_block	The block number in the AGP which corresponds to the first block in this file containing valid data	INT32	N/A	1 - 180 Start_block < End_block
End_block	The block number in the AGP which corresponds to the last block in this file containing valid data	INT32	N/A	1 - 180 End_block > Start_block
Cam_mode	Indicates whether the data in this grid file was obtained in MISR global observing mode or local observing mode	INT32	N/A	0-1 1 = global 0 = local
Num_local_modes	The number of MISR local mode acquisitions contained in this file	INT32	N/A	0-6 0 if data is global mode
Local_mode_site_name	The geographical name of the first local mode site contained in this file	CHAR8	N/A	String up to 12 characters in length, excluding null
Orbit_QA	Indication of the overall quality of the session data based on analysis of quality flags in the spacecraft attitude and ephemeris data. A value of -1.0 suggests that the orbit is poorly registered, in which case no valid wind retrievals will be reported.	FLOAT32	N/A	-9999.0 = NoRetrieval -1.0 = Poor 0.0 = Nominal
Orbit_qa_winds	Indication of the overall quality of the orbit data based on the wind retrievals retrieved prior to quality control. A value of -1.0 indicates that the session is likely poorly registered, while a value of -2.0 indicates that an insufficient quantity of retrievals was available to assess the session. In either of these cases, no valid wind retrievals will be reported.	FLOAT32	None	-9999.0 = NoRetrieval -1.0 = Poor 0.0 = Nominal

2.3.2 Per-grid Metadata Description

Table 3 - Per-grid Metadata for Cloud Product

Common Grid Metadata	Definition	Data Type	Valid Values
Block_size.resolution_x	Resolution of block x dimension in meters	INT32	17600
Block_size.resolution_y	Resolution of block y dimension in meters	INT32	17600
Block_size.size_x	Block x dimension	INT32	128
Block_size.size_y	Block y dimension	INT32	512
MISRReferenceCamera	Name of reference camera used in production of data contained in grid	CHAR8*2	An
MISRCameras	Names of all cameras used in production of data contained in this grid	CHAR8*18	DfBfAnBaDa

2.3.3 Per-block Metadata Description

Table 4 - Per-block Metadata for Cloud Product

PerBlockMetadataCommon	Definition	Data Type	Valid Values
Block_number	Current block number	INT32	1-180
Ocean_flag	Flag signaling whether the block contains entirely ocean data	INT8	0 = block has no ocean or is a mix of ocean and land 1 = block is entirely ocean
Block_coor_ulc_som_meter.x	Upper left corner SOM block x coordinate in meters	FLOAT64	
Block_coor_ulc_som_meter.y	Upper left corner SOM block y coordinate in meters	FLOAT64	
Block_coor_lrc_som_meter.x	Lower right corner SOM block x coordinate in meters	FLOAT64	
Block_coor_lrc_som_meter.y	Lower right corner SOM block y coordinate in meters	FLOAT64	
Data_flag	Flag signaling whether the block contains entirely fill data	INT8	0 = block contains entirely fill data 1 = block contains valid data

Common Per Block Metadata	Definition	Data Type	Valid Values
Geometric DQI	Geometric Data Quality Indicator for the An camera copied from the L1B2 Ellipsoid parameter file	FLOAT64	-1 to 1

PerBlockMetadataTime	Definition	Data Type	Valid Values
BlockCenterTime	TAI time of the lower right pixel of the center four pixels in the current block, converted to UTC time, and displayed in CCSDS ASCII time code A format. The time displayed is that of the nadir (An) camera. The times for the other cameras will differ by up to ±3.5 minutes.	CHAR8*28	Null string = No Data

2.3.4 Grid Structure and Parameter Descriptions

Table 5 - HDFEOS Field Dimension Descriptions

Dimension	Description	Dimension Size
SOMBlockDim	<i>SOMBlockDim</i> is the number of SOM blocks in the file. The slowest-varying dimension is implicitly the SOM block dimension. It is not shown in the dimension list column below.	180
XDim	Number of lines in a block. The x dimension direction is identical to the standard SOM x dimension.	8
YDim	Number of samples in a block. The y dimension direction is identical to the standard SOM y dimension.	32

Table 6 - HDFEOS Format Grid Structure Description

Field Name Parameter Description	Dimension List	Number Type	Units	Flag Values
Motion_17.6_km (Spatial Resolution: 17.6 km x 17.6 km, XDim = 8, YDim = 32, SOMBlockDim = 180)				
CloudTopHeightOfMotion Height above the WGS84 ellipsoid of the retrieved cloud motion vector	XDim, YDim,	FLOAT32	m	No data=-9999.0
CloudMotionNorthward Northward component of cloud motion vector	XDim, YDim,	FLOAT32	m/s	No data=-9999.0
CloudMotionEastward Eastward component of cloud motion vector	XDim, YDim,	FLOAT32	m/s	No data=-9999.0
InstrumentHeading Eastward component of cloud motion vector	XDim, YDim	FLOAT32	degrees east of north	No data=-9999.0
MotionDerivedCloudMask Indicator, with low or high confidence, of whether motion vector is associated with cloud or terrain	XDim, YDim,	INT8	None	0 = No Data, 1 = High Confidence Cloud, 2 = Low Confidence Cloud, 3 = Low Confidence Terrain, 4 = High Confidence Terrain
MotionQualityIndicator Quality flag corresponding to the cloud motion vector	XDim, YDim,	INT8	None	Range from 0 = Worst Quality 100=Best Quality No data=-128 (Note that QI values less than 50 are not reported by the product.)

2.4 MISR LEVEL 2 NRT CMV BUFR GRANULE OVERVIEW

MISR Level 2 NRT CMV files offered in BUFR format provide a list of retrievals for which a consistent set of parameters is defined. The parameters defined conform to version 14 of the WMO BUFR table specifications. Each file contains up to 180 BUFR messages, consisting of up to 256 subsets.

MISR BUFR format files have been verified to be compatible with the ECMWF BUFRDC 000400 library and the NCEP BUFRLIB v10-2-3 library.

Section 2.5.1 describe the header information, while Section 2.5.2 describes the data fields defined by MISR BUFR files.

2.5 MISR LEVEL 2 NRT CMV BUFR GRANULE COMPONENTS

2.5.1 MISR BUFR Header Definitions (Sections 0,1,2,3)

Table 7 provides the values MISR has assigned to header parameters defined in Sections 0, 1, 2, and 3 of BUFR format files.

Table 7 – CMV BUFR Header Values

Header Definition	Value
Code center	<i>NASA (173)</i>
Code subcenter	<i>LaRC (8)</i>
Observation type	<i>single level upper air (5)</i>
Observation sub-type	<i>wind (0)</i>
Table master version	<i>14</i>
Compression flag	<i>Compressed (64)</i>

2.5.2 MISR BUFR Table A Definitions

Table 8 lists the fields defined by MISR BUFR files, including units, bits, and the value of the retrieval, if constant. For reference, fields that are present in the MISR BUFR files, but not included in the commonly used Geostationary Wind BUFR template (Code 310014) have been highlighted in green. Table 9 also lists fields included in that template that are not included in the MISR BUFR products.

Table 8 – CMV BUFR Table A Definitions

Mnemonic: label	Code	Units	Bits	Value / Data Notes
SAID: Satellite Identifier:	001007	-	10	<i>Terra (783)</i>
GCLONG: Originating Center	001031	-	16	<i>NASA (173)</i>
SIDP: Satellite Instrument	002152	-	31	<i>MISR (385)</i>
SCLF: Classification	002020	-	9	<i>EOS (10)</i>
SWCM: Wind Computation Method	002023	-	4	<i>Visible Channel Cloud Motion (2)</i>
SSNX: X Resolution	002028	m	18	<i>17600</i>
SSNY: Y Resolution	002029	m	18	<i>17600</i>
SCCF: Satellite Channel Frequency	002153	Hz	26	<i>4.4e14 (i.e., Red)</i>
SCBW: Satellite Channel Width	002154	Hz	26	<i>136e14</i>
TSIG: Time Significance	008021	-	5	<i>2</i>
TPHR: Time Period of Displacement	004024	hours	12	<i>0</i>
TPMI: Time Period of Displacement	004025	minutes	12	<i>7</i>
YEAR: Year	004001	year	12	
MNTH: Month	004002	month	4	
DAYS: Day	004003	day	6	
HOUR: Hour	004004	hour	5	
MINU: Minute	004005	minute	6	
SECO: Second	004006	second	6	
CLATH: Latitude	005001	degrees North	25	
CLONH: Longitude	006001	degrees East	26	
HOCT: Height of Cloud Top	020014	m	11	Height is relative to WGS84 Ellipsoid
WDIR: Wind Direction	011001	degrees True	9	
WSPD: Wind Speed	011002	ms ⁻¹	12	
LSQL: Land / Sea Qualifier	008012	-	2	0=Land 1=Sea 2=Coast 3=Missing
PCCF: Per Cent Confidence	033007	-	7	PCCF is equivalent to Quality Indicator, and ranges from 50 (worst) to 100 (best).
DOMO: Direction of Moving Observer	001012	degrees True	9	Orientation of the Terra ground track
ORBN: Orbit Number	005040	-	24	Terra orbit number
SWID: Software ID	025060	-	14	Unique identifier associated with date that dataset was initially generated

Table 9 – Geostationary wind mnemonics not present in MISR BUFR files

Mnemonic: label	Code
PRLC: Pressure	007004
CCST: Coldest Cluster Temperature	012071
HAMD: Height Assignment Method	002163
TCMD: Tracer Correlation Method	002164
SAZA: Satellite Zenith Angle	007024
OFGI: Origin of first guess	002057
TMDBST: Dry bulb temperature	012001
GNAP: Generating Application	001032
MAQC: Manual/Automatic QC	033035
NCTH: Confidence Threshold	033036

3 MISR LEVEL 3 CMV DATA PRODUCT SPECIFICATION

3.1 MISR LEVEL 3 CMV PRODUCT GRANULE NAMES

MISR Level 3 CMV Products are reported in NetCDF format files with monthly, seasonal, and yearly granularity.

Table 10 – Level 3 CMV Product Granule Names

MISR Level 3 CMV Product Granule Name ²	ESDT Name
MISR_AM1_CMV_mmm_yyyy_Fff_vvvv.nc	MI3MCMVN
MISR_AM1_CMV_sss_yyyy_Fff_vvvv.nc	MI3QCMVN
MISR_AM1_CMV_yyyy_Fff_vvvv.nc	MI3YCMVN

3.2 MISR LEVEL 3 CMV NETCDF GRANULE OVERVIEW

Each MISR CMV product granule consists of a Network Common Data Form (NetCDF) formatted file providing a list of CMV retrievals and a list of orbits during which those CMVs have been retrieved. The granule compiles these lists from a subset of Level 2 Cloud gridded data captured during the granule’s defined time period. Parameters associated with each list are

²“mmm” is the three-character month (one of “DEC”, “JAN”, “FEB”, “MAR”, “APR”, “MAY”, “JUN”, “JUL”, “AUG”, “SEP”, “OCT”, “NOV”), “sss” is the season (one of “WIN”, “SPR”, “SUM”, “FALL”, corresponding to groups of three months starting with December), “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., “0001”). Note that the labeled year of WIN files corresponds to the central month (i.e., the WIN_2013 file includes data from December 2012).

specified following point observation conventions defined by NetCDF Climate and Forecast (CF) Metadata Conventions, V1.0 (<http://www.cgd.ucar.edu/cms/eaton/cf-metadata/CF-1.0.html>).

The determination of which retrievals correspond to the granule defined time period is undertaken with fine granularity. In particular, even if a pair of CMV are retrieved during the same orbit, they will appear in different CMV product granules if one is within the defined time range and the other is not. However, note that a yearly CMV product granule contains exactly the same information as do the four associated seasonal granules or twelve associated monthly granules.

Retrieval parameters are specified with respect to the NetCDF *time* dimension. They include not only the cloud height and motion, but also the time, location, and quality assessment of each retrieval. Per orbit parameters are specified with respect to the NetCDF *orbits* dimension. They include orbit quality assessments and block ranges for which retrievals were attempted during that orbit.

3.3 MISR LEVEL 3 CMV NETCDF GRANULE COMPONENTS

3.3.1 File Metadata Description

Table 11 - File Metadata for Cloud Product

Attribute Name	Attribute Value or <Description>
Conventions	CF-1.4
CF:featureType	point
title	MISR Level 3 Cloud Motion Vector <monthly, seasonal, annual> Product for <period>; Version Fff_vvvv
history	<production date and time>, produced by MISR Level 3 Cloud Motion Vector <monthly, seasonal, annual> Product from TC_STEREO
institution	NASA Langley Atmospheric Sciences Data Center (ASDC)
source	Multi-angle Imaging SpectroRadiometer (MISR) on Terra, NASA's first Earth Observing System (EOS) spacecraft
references	MISR Data Sets: http://eosweb.larc.nasa.gov/PRODOCS/misr/table_misr.html MISR Data Products Specifications: http://eosweb.larc.nasa.gov/PRODOCS/misr/DPS/MISR Algorithm Theoretical Basis Documents (ATB): http://eosps.gsfc.nasa.gov/eos_homepage/for_scientists/atbd/viewInstrument.php?instrument=9 For MISR Level 2 Cloud Detection and Classification ATB references: http://eosps.gsfc.nasa.gov/eos_homepage/for_scientists/atbd/docs/MISR/atbd-misr-07.pdf
comment	The MISR Level 3 Cloud Motion Vector <monthly, seasonal, annual> Product contains a list of best quality cloud motion retrievals collected from the MISR Level 2 Cloud Detection and Classification product.
L2CloudVersion	0001

ProductionHost	Computer on which product was produced
ProductionDateTime	Date and time which product was produced
LocalGranuleID	See Table 10 – Level 3 CMV Product Granule Names
PGEVersion	1.3.1
RangeEndingDate	<yyyy-mm-dd>
RangeEndingTime	<hh:mm:ss.ssssss>
RangeBeginningDate	<yyyy-mm-dd>
RangeBeginningTime	<hh:mm:ss.ssssss>

3.3.2 Parameter Descriptions

Table 12 – Cloud Motion Vector Point Observation Sets

Field Name Parameter Description	Dimensions	Units	Type	Data Notes
Parameters ordered by time dimension				
Time³ Time at which retrieved cloud feature was observed by An camera	time	seconds since 1970-01-01 00:00:00	float64	standard calendar
Latitude Latitude of center of 17.6 km SOM grid cell	time	degrees north	float32	least significant recorded digit is 0.01
Longitude Longitude of center of 17.6 km SOM grid cell	time	degrees east	float32	least significant recorded digit is 0.01
CloudTopHeight Height above the WGS84 ellipsoid of the retrieved cloud motion vector	time	m	float32	least significant recorded digit is 1
CloudMotionNorthward Northward component of cloud motion vector	time	m/s	float32	least significant recorded digit is 0.1
CloudMotionEastward Eastward component of cloud motion vector	time	m/s	float32	least significant recorded digit is 0.1
QualityIndicator Integer between 0 and 100 estimating retrieval quality	time	-	int16	ranges from 0 to 100 increasing in quality
InstrumentHeading Earth-relative heading of Terra satellite at retrieval time, which influences retrieval error characteristics	time	-	float32	least significant recorded digit is 0.1
Year³ Year (redundant with Time variable)	time	year	int16	
DayOfYear³	time	days	int16	

³ Fields relating to time are based on the UTC time zone.

Julian day (redundant with Time variable)				
HourOfDay ³ Fractional hour of Julian day (redundant with Time variable)	time	hours	float32	least significant recorded digit is 0.01
Orbit Orbit during which retrieval was observed	time	-	int32	
Block SOM grid block number of retrieval	time	-	int16	Valid range: 1-180
DomainIndex SOM grid index within block of retrieval (significance of index dimensions is ordered SOM-x, then SOM-y)	time	-	int16	Valid range: 0-255
Parameters ordered by <i>orbits</i> dimension				
OrbitNumber Orbit from which Level 2 Cloud CMV information has been compiled	orbits	-	int32	
OrbitStartBlock Start block of orbit	orbits	-	int16	No Data = 255
OrbitEndBlock End block of orbit	orbits	-	int16	No Data = 255
OrbitQA Indication of the overall quality of the orbit data based on analysis of quality flags in the spacecraft attitude and ephemeris data.	orbits	-	int8	Poor Quality = -1 Nominal Quality = 0 No Data = -128
OrbitQAWind Indication of the overall quality of the orbit data based on analysis of cloud motion vector forward and aft camera consistency.	orbits	-	int8	Poor Quality = -1 Nominal Quality = 0 No Data = -128

4 Appendix

4.1 Acronym List

AGP	Ancillary Geographic Product
CMV	Cloud Motion Vector
CTH.....	Cloud Top Height
DAAC	Distributed Active Archive Center
DID	DTED Intermediate Dataset
DTED	Digital Terrain Elevation Dataset
ECMWF	European Center for Medium-range Weather Forecasting
ECS	EOSDIS Core System (Data Production System at DAAC)
EOS.....	Earth Observing System
EOSDIS	Earth Observing System Data and Information System
ESDT.....	Earth Science Data Type
HDF	Hierarchical Data Format
HDF-EOS	Hierarchical Data Format for EOS
JPL	Jet Propulsion Laboratory
LaRC DAAC.....	NASA Langley Research Center DAAC
MISR.....	Multi-angle Imaging SpectroRadiometer
NASA.....	National Aeronautics and Space Administration
NCEP	National Center for Environmental Prediction
SCF	Science Computing Facility
SDP	Science Data Processing
SDS	Scientific Data Set
SOM.....	Space-Oblique Mercator
TAI	Temps Atomique International (International Atomic Time)
TC	Top-Of-Atmosphere and Cloud
TOA	Top-Of-Atmosphere
UTC	Coordinated Universal Time
WGS84.....	World Geodetic System 1984



