

JPL D-74995

Earth Observing System



# Data Product Specification for the MISR Cloud Motion Vector Product

-Incorporating the Science Data Processing Interface Control Document

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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

## Which Product Versions Does this Document Cover?

Product Filename Prefix	Version Number in Filename	Brief Description
MISR_AM1_CMV	F02_0002	L2 Cloud Heights and Motion



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# 1 INTRODUCTION

## 1.1 MISR CLOUD MOTION VECTOR PRODUCT

The Multi-angle Imaging SpectroRadiometer (MISR) Cloud Motion Vector (CMV) product contains retrievals of cloud motion determined by geometrically triangulating the position and motion of cloud features observed by MISR from multiple perspectives and times during the ~7 minute overpass of the Terra platform over each cloud scene. Estimates of cloud motion, here labeled cloud motion vectors (CMVs), are a valuable proxy observation of the horizontal atmospheric wind field at the retrieved altitude of the cloud. MISR CMVs have been and continue to be operationally produced as part of the publicly available Level 2 Cloud product, whose record dates from February 2000 to the present. The CMV product provides users a complete global list of the highest quality CMVs extracted from the standard Level 2 Cloud product, distributed as monthly, seasonal, and annual NetCDF files that are neither gridded nor averaged. The annual files, the largest of these, are a manageable 400 MB, facilitating scientific applications requiring CMV information spanning multiple months or years. The parameters encoded within each MISR CMV and recorded by the CMVp are summarized in Table 1. Distributed NetCDF files follow Climate and Forecast (CF) conventions established by the Program for Climate Model Diagnosis and Intercomparison (PCMDI).

The purpose of this document is to describe the format of the MISR CMV product. The full details of the other MISR standard products, as well as the ancillary datasets used in their generation, can be found in their respective MISR Data Product Specifications Documents (and for earlier versions of the products in the MISR Data Products Specifications Document, Rev S). Information concerning the MISR georegistration is contained in the MISR Science Data Product Guide.

## 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 2 Ancillary Products and Datasets Algorithm Theoretical Basis, JPL D-13402, Revision A, December 1998 (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 CLOUD MOTION VECTOR DATA PRODUCT SPECIFICATION

### 2.1 MISR CMV PRODUCT GRANULE NAMES

MISR CMV Products granules are reported at three time scales: monthly, seasonal, and yearly.

Table 1 – CMV Product Granule Names

MISR CMV Product Granule Name <sup>1</sup>	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

### 2.2 MISR CMV PRODUCT GRANULE BRIEF DESCRIPTIONS

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 CMV 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 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. A yearly CMV product granule contains no more or less information than the four associated seasonal granules or twelve associated monthly granules.

### 2.3 MISR CMV PRODUCT GRANULE COMPONENTS

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. Orbit parameters are specified with respect to the netCDF *orbits* dimension. They include orbit quality assessments and block range defining the span of attempted CMV retrieval.

<sup>1</sup> “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 “vvv” 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 included data from December of 2012.



Table 2 - CMV Product Point Observation Dimensions

ESDT (Shortname)	Local Granule Name <sup>1</sup>	Point Observation Dimension
MI3MCMVN	MISR_AM1_CMV_mmm_yyyy_Fff_vvvv.nc	time
MI3QCMVN	MISR_AM1_CMV_sss_yyyy_Fff_vvvv.nc	orbits
MI3YCMVN	MISR_AM1_CMV_yyyy_Fff_vvvv.nc	

## 2.4 MISR CMV PRODUCT

### 2.4.1 Global File Metadata Description

Table 3 - 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: <a href="http://eosweb.larc.nasa.gov/PRODOCS/misr/table_misr.html">http://eosweb.larc.nasa.gov/PRODOCS/misr/table_misr.html</a> MISR Data Products Specifications: <a href="http://eosweb.larc.nasa.gov/PRODOCS/misr/DPS/MISR Algorithm Theoretical Basis Documents (ATB):">http://eosweb.larc.nasa.gov/PRODOCS/misr/DPS/MISR Algorithm Theoretical Basis Documents (ATB):</a> <a href="http://eospsa.gsfc.nasa.gov/eos_homepage/for_scientists/atbd/viewInstrument.php?instrument=9">http://eospsa.gsfc.nasa.gov/eos_homepage/for_scientists/atbd/viewInstrument.php?instrument=9</a> For MISR Level 2 Cloud Detection and Classification ATB references: <a href="http://eospsa.gsfc.nasa.gov/eos_homepage/for_scientists/atbd/docs/MISR/atbd-misr-07.pdf">http://eospsa.gsfc.nasa.gov/eos_homepage/for_scientists/atbd/docs/MISR/atbd-misr-07.pdf</a>
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 1 – 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>

## 2.4.2 Point Observation Descriptions

Table 4 – Cloud Motion Vector Point Observation Sets

Field Name Parameter Description	Dimensions	Units	Type	Data Notes
<b>Parameters ordered by <i>time</i> dimension</b>				
<b>Time<sup>2</sup></b> Time at which retrieved cloud feature was observed by An camera	time	seconds since 1970-01-01 00:00:00	float64	standard calendar
<b>Latitude</b> Latitude of center of 17.6 km SOM grid cell	time	degrees north	float32	least significant recorded digit is 0.01
<b>Longitude</b> Longitude of center of 17.6 km SOM grid cell	time	degrees east	float32	least significant recorded digit is 0.01
<b>CloudTopHeight</b> Height above the WGS84 ellipsoid of the retrieved cloud motion vector	time	m	float32	least significant recorded digit is 1
<b>CloudMotionNorthward</b> Northward component of cloud motion vector	time	m/s	float32	least significant recorded digit is 0.1
<b>CloudMotionEastward</b> Eastward component of cloud motion vector	time	m/s	float32	least significant recorded digit is 0.1
<b>QualityIndicator</b> Integer between 0 and 100 estimating retrieval quality	time	-	int16	ranges from 0 to 100 increasing in quality
<b>InstrumentHeading</b> Earth-relative heading of Terra satellite at retrieval time, which influences retrieval error characteristics	time	-	float32	least significant recorded digit is 0.1
<b>Year<sup>2</sup></b> Year (redundant with Time variable)	time	year	int16	
<b>DayOfYear<sup>2</sup></b> Julian day (redundant with Time variable)	time	days	int16	

<sup>2</sup> Fields relating to time are based on the UTC time zone.

<b>HourOfDay<sup>2</sup></b> Fractional hour of julian day (redundant with Time variable)	time	hours	float32	least significant recorded digit is 0.01
<b>Orbit</b> Orbit number of Terra Instrument	time	-	int32	
<b>Block</b> SOM grid block number of retrieval	time	-	int16	Valid range: 1-180
<b>DomainIndex</b> SOM grid index within block of retrieval (significance of index dimensions is ordered SOM-x, then SOM-y)	time	-	int16	Valid range: 0-255
<b>Parameters ordered by <i>orbits</i> dimension</b>				
<b>OrbitNumber</b> Orbit from which Level 2 Cloud CMV information has been compiled	orbits	-	int32	
<b>OrbitStartBlock</b> Start block of orbit	orbits	-	int16	No Data = 255
<b>OrbitEndBlock</b> End block of orbit	orbits	-	int16	No Data = 255
<b>OrbitQA</b> 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
<b>OrbitQAWind</b> 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

## 3 Appendix

### 3.1 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
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-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
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