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Earth Observing System

Data Products Specifications for the MISR Level 2 Classifiers 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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Document Change Log

Revision	Date	Affected Portions and Description
Release A	25 June 2014	All, original release

Which Product Versions Does this Document Cover?

Product Filename Prefix	Version Number in Filename	Brief Description
MISR_AM1_TC_CLASSIFIERS	F07_0012	L2 Cloud Classifiers

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Acronym List

AGP	Ancillary Geographic Product
ASCM	Angular Signature Cloud Mask
BRF	Bidirectional Reflectance Factor
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 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
RCCT	Radiometric Camera-by-camera Cloud mask Thresholds
SCF	Science Computing Facility
SDP	Science Data Processing
SOM	Space-Oblique Mercator
SVM	Support Vector Machine
TOA	Top-Of-Atmosphere
TASC	Terrestrial Atmosphere and Surface Climatology

WGS84 World Geodetic System 1984

1 MISR DATA PRODUCT SPECIFICATION DOCUMENT

1.1 MISR LEVEL 2 CLOUD CLASSIFIERS PRODUCT

The Multi-angle Imaging SpectroRadiometer (MISR) Level 2 Cloud Classifiers Product (TC_CLASSIFERS) contains geophysical retrievals of clouds and cloud-related properties, including a unique AngularSignatureCloudMask at 1.1 km resolution as well as multiple measurements of cloud fraction at 17.6 km resolution (including a newly added version that has been corrected for pixel resolution). Additional fields include a scene classification performed by a support-vector machine algorithm, and a regridded snow-ice field (both at 1.1 km resolution). Retrievals are recorded across the 380 km MISR swath and distributed as a single HDF-EOS file for each orbit.

The purpose of this document is to describe the format of the MISR TC_CLASSIFIERS product. Other MISR standard products, as well as the ancillary datasets used in their generation, are fully detailed in their respective MISR Data Product Specifications Documents. Prior versions (before version 12) of TC_CLASSIFIERS are detailed 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 LEVEL 2 CLOUD CLASSIFIERS DATA PRODUCT SPECIFICATION

2.1 MISR LEVEL 2 CLOUD CLASSIFICATION PRODUCT GRANULE BRIEF DESCRIPTION

The MISR Cloud Classification product contains the AngularSignatureCloudMask, a reprojected version of the RadiometricCamerabyCameraCloudMask, multiple cloud fractions (including one which has been corrected for the affects of pixel resolution), a pixel-level scene classifier and snow-ice information. All these parameters are recorded across the 380 km MISR swath and distributed in a single HDF-EOS file per orbit.

The file contains nine grids in all, each corresponding to one of the following categories of data: Angular Signature Cloud Mask (ASCM); reprojected RCCM; snow-ice mask; support-vector machine scene classifier; various cloud fractions of the three MISR cloud masks, a resolution-corrected cloud fraction, consensus cloud classifiers that identify the scene as clear, partially cloudy, or overcast at both 2.2 km and 35. 2 km resolution; and a cirrus mask.

The end result of MISR Cloud Classifier processing at the LaRC DAAC are the MISR project standard science data products listed in Table [2-5] below. This document describes the product versions indicated in the final column.

Table 1 - MISR Cloud Classifier Data Products

Product	ESDTs	File Description	File Type	Applicable Product Version
Level 2 Cloud Classifiers Product	MIL2TCCL	L2TC Cloud Classifiers	HDF-EOS Stacked-Block Grid	F07_0012

2.1 MISR LEVEL 2 CLOUD CLASSIFIERS PRODUCT GRANULE COMPONENTS

Each granule of the MISR Cloud Classifiers Product corresponds to one full orbit of data, consisting of observations made on the sunlit side of the Earth. The product is associated with one Earth Science Data Type (ESDT) that has a short name of MIL2TCCL. Each file uses the HDF-EOS Grid "stacked-block" format and contains HDF-EOS Grid structures, corresponding to parameters at 1.1 km, 2.2 km, 17.6 km, and 35.2 km spatial resolution. The grid structures have x and y spatial dimensions, as well as a third dimension corresponding to the SOM block number. The x and y dimensions correspond to the number of 1.1 km by 1.1 km, 2.2 km by 2.2 km, 17.6 km by 17.6 km, or 35.2 km by 35.2 km regions in the along-track (x) and cross-track (y) directions. For each Level 2 Cloud Classifiers Product granule, the number of blocks in the grid structure corresponds exactly to the number and location of blocks in the Level 1B2 and the other Level 2 Product files for the same orbit. Also, the blocks that make up the Cloud Classifers Product files are a subset of the blocks that make up the Ancillary Geographic Product (AGP).

2.2 MISR LEVEL 2 TOA/CLOUD PRODUCT GRANULE NAMES

MISR Level 2 Cloud Classifier Products are composed of the granules listed below.

Table 7-1: MISR Level 2 TOA/CLOUD File Granule Names

MISR LEVEL 2 TOA/CLOUD FILE GRANULE NAME	ESDT Name	Section
MISR_AM1_TC_CLASSIFIERS_Pmmm_Onnnnnn_Fff_vvvv.hdf	MIL2TCCL	4.1
MISR_AM1_TC_CLASSIFIERS_FIRSTLOOK_Pmmm_Onnnnnn_Fff_vvvv.hdf	MIL2TCCF	

2.3 DIFFERENCES BETWEEN FIRSTLOOK AND FINAL PROCESSING

The MISR processing stream has now been split into two parts, "FIRSTLOOK" and "FINAL", to adjust for the new time dependence of the Terrestrial Atmosphere and Surface Climatology (TASC) and Radiometric Camera-by-camera Cloud mask Thresholds (RCCT) ancillary datasets. Both the TASC and RCCT datasets now contain data that are unique to the time period for which the datasets are constructed. The TASC dataset contains snow-ice and ocean surface wind speed values that are updated on a monthly basis, and the RCCTs are derived from the observations for a given 3-month period. Therefore, these datasets cannot be generated until the end of the month or season. Rather than delaying all MISR Level 2 and Level 3 processing until the datasets that need to be updated monthly or seasonally become available, the Level 2 and Level 3 data are now produced twice. These two different runs are given the names "FIRSTLOOK" and "FINAL". The FIRSTLOOK processing uses the TASC from the same month in the previous year, and the RCCTs are taken from the same season in the previous year. When the updated datasets become available, FINAL processing which uses the updated RCCT and TASC data is run. The FIRSTLOOK products are distinguished by the presence of the "FIRSTLOOK" in the filenames, the FINAL products use the standard filenames without additional designation.

Table 7-2: Level 2 TOA/CLOUD Product Files and Grid Datasets

ESDT Shortname	Local Granule ID[1]	Grid Dataset Name
MIL2TCCL MIL2TCCF	MISR_AM1_TC_CLASSIFIERS_Pmmm_Onnnnnn_Fff_vvvv .hdf MISR_AM1_TC_CLASSIFIERS_FIRSTLOOK_Pmmm_Onnnnn_Fff_vvvv .hdf	ASCMParams_1.1_km
		FeatureReferencedRccm_1.1_km
		SnowIce_1.1_km
		SupportVectorSceneClassifier_1.1km
		CloudClassifiers_2.2_km
		CloudFractions_17.6_km
		ResolutionCorrectedCloud Fractions_17.6_km
		SupportVectorCirrusFraction_17.6_km
		CloudClassifiers_35.2_km

2.4 MISR LEVEL 2 MIL2TCCL CLOUD CLASSIFIER PRODUCT

2.4.1 File Metadata Description

Table 7-9: File Metadata for Cloud Classifier Product Files

File Metadata Field Name	Definition	Data Type	Units	Valid Range
Path_number	Orbit path number	INT32	N/A	1-233

1 Where Pmmm corresponds to the orbit path number, Onnnnnn is the absolute orbit number, ff is the file format version and vvvv is the version number (relating to the reprocessing of a dataset with different software and/or ancillary inputs).

AGP_version_id	Version identifier for AGP	INT32	N/A	2
DID_version_id	Version Identifier for DID (DTED Digital Terrain Elevation Dataset] Intermediate Dataset)	INT32	N/A	4
Number_blocks	Total number of blocks	INT32	N/A	1-180
Ocean_blocks_size	Ocean_blocks.number dimension	INT32	N/A	1-180
Ocean_blocks.count	Total number of blocks containing entirely ocean radiances	INT32	N/A	1-180
Ocean_blocks.numbers	List of block numbers containing entirely ocean radiances	180 x INT32	N/A	1-180
SOM_parameters.som_ellipsoid.a	Semimajor axis of ellipsoid	FLOAT64	meters	WGS84 ellipsoid (6.3781370E+ 06)
SOM_parameters.som_ellipsoid.e2	Eccentricity of ellipsoid squared	FLOAT64	N/A	WGS84 ellipsoid (6.6943480E-03)
SOM_parameters.som_orbit.aprime	Semimajor axis of orbit	FLOAT64	meters	1.0
SOM_parameters.som_orbit.eprime	Eccentricity of orbit	FLOAT64	N/A	1.0
SOM_parameters.som_orbit.gama	Longitude of 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 orbit	FLOAT64	meters	7.0780408E+06
SOM_parameters.som_orbit.i	Inclination of orbit (degrees)	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 at time 0 (degrees)	FLOAT64	radians	$-2\pi : 2\pi$
Origin_block.ulc.x	SOM X coordinate (in meters) of the upper left corner of the first block	FLOAT64	meters	

Origin_block.ulc.y	SOM Y coordinate (in meters) of the upper left corner of the first block	FLOAT64	meters	
Origin_block.lrc.x	SOM X coordinate (in meters) of the lower right corner of the first block	FLOAT64	meters	
Origin_block.lrc.y	SOM Y coordinate (in meters) of the lower right corner of the first block	FLOAT64	meters	
Start_block	The block number in the AGP which corresponds to the first block in this file containing 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 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 mode or local 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, including null
Orbit_QA	Indication of the overall quality of the orbit data based on analysis of quality flags in the spacecraft attitude and ephemeris data. Geolocation accuracy may be impaired for orbits with poor quality orbit data.	FLOAT32	N/A	-9999.0 = NoRetrieval, -1.0 = Poor, 0.0 = Nominal

2.4.2 Per-grid Metadata Description

Table 7-10: Per-grid Metadata for Cloud Classifier Product Files

Common Grid Metadata	Definition	Data Type	Valid Values
Block_size.resolution_x	Resolution of block x dimension in meters	INT32	1100, 17600
Block_size.resolution_y	Resolution of block y dimension in meters	INT32	1100, 17600
Block_size.size_x	Block x dimension	INT32	128, 8
Block_size.size_y	Block y dimension	INT32	512, 32

2.4.3 Per-block Metadata Description

Table 7-11: Per-block Metadata for Cloud Classifier Product Files

PerBlockMetadataCommon	Definition	Data Type	Valid Values
Block_number	Current block number	INT32	1-180
Ocean_flag	Flag signalling whether the block contains entirely ocean radiances	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 signalling 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 Terrain projected parameter file.	INT32	-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. Note: BlockCenterTime may be incorrect or missing for the first and last blocks processed in a swath.	CHAR8*28	

2.4.4 Per-line Metadata Description

None.

2.4.5 Per-pixel Metadata Description

None.

2.4.6 Grid Data Set Descriptions

To facilitate the interpretation of scientific data, floating point values are not scaled. Floating point values, and some integer values, may take on a flag value indicating invalid data. Currently, there is only a single flag value of -9999.0, representing missing floating point data. Missing integer data may be represented either by a value of 0 (for flag data) or -9999 (for measured data) or -99 (for measured byte integer data). Note that flag values may be added later to distinguish the reason that the data are missing (e.g., never computed, arithmetic error, overflow, etc.).

Table 7-12: Cloud Classifier Product Field Dimension Descriptions

Dimension	Description	Valid Values
SOMBlockDim	*SOMBlockDim* 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 tables below.	This number can vary from orbit to orbit, with the nominal value being 143 or 144
XDim	*XDim* is the number of lines in a block. The x dimension direction is identical to the standard SOM x dimension.	128 for 1.1 km parameters 64 for 2.2 km parameters 8 for 17.6 km parameters 4 for 35.2 km parameters
YDim	*YDim* is the number of samples in a block. The y dimension direction is identical to the standard SOM y dimension.	512 for 1.1 km parameters 256 for 2.2 km parameters 32 for 17.6 km parameters 16 for 35.2 km parameters
NCamDim	NCamDim distinguishes the individual nine cameras	1-9. DF=1, CF=2, BF=3, AF=4, AN=5, AA=6, BA=7,CA=8, DA=9
NAltitudeDim	NAltitudeDim is the number of altitude bins in the Regional Scene Classifiers	0-4. NoRetrieval=0, Surface=1, LowAltitude=2 (,ht < 2 km) MiddleAltitude=3, (2 km < ht < 6 km) HighAltitude=4. (ht > 6 km) where ht stands for the CloudTop Height.

Table 7-13: Cloud Classifier Product Grid Dataset Description

Field Name Parameter Description	Dimension List	Number Type	Units	Transformation	Flag Values
ASCMParams_1.1_km (Spatial Resolution: 1.1 km x 1.1 km, XDim = 128, YDim = 512)					
AngularSignatureCloudMask Final Angular Signature Cloud Mask that is the feature-referenced version of the TerrainRefASCM field described below. (*see Appendix A for an explanation of the differences between ellipsoid, terrain and feature-referenced data)*	XDim,YDim	UINT8	None	None	NoRetrieval=0, CloudHC=1, CloudLC=2, ClearLC=3, ClearHC=4
ASCMObservable The observable that is compared against the threshold to calculate the cloud-mask (Feature-referenced)	XDim,YDim	FLOAT32	None	None	No data = -9999.0
ASCMRefCamScatteringAngle The scattering angle (in degrees) of the reference camera (Feature-referenced)	XDim,YDim	FLOAT32	None	None	No data = -9999.0
ASCMReferenceCamera ASCM Reference Camera (one of Df, Da, Cf or Ca) (Feature-referenced)	XDim,YDim	UINT8	None	None	NoRetrieval=0, Df=1, Cf=2, Ca=8, Da=9
ASCMComparisonCamera ASCM Comparison Camera (one of Cf, Ca, Bf or Ba) (Feature-referenced)	XDim,YDim	UINT8	None	None	NoRetrieval=0, Cf=2, Bf=3, Ba=7, Ca=8
TerrainRefASCM “Preliminary” terrain-referenced ASCM as formed from a combination of forward and aft camera data	XDim,YDim	UINT8	None	None	NoRetrieval=0, CloudHC=1, CloudLC=2, ClearLC=3, ClearHC=4

FwdCamTerrainRefASCM "Preliminary" terrain-referenced ASCM as calculated using the forward cameras	XDim,YDim	UINT8	None	None	NoRetrieval=0, CloudHC=1, CloudLC=2, ClearLC=3, ClearHC=4
AftCamTerrainRefASCM "Preliminary" terrain-referenced ASCM as calculated using the aft cameras	XDim,YDim	UINT8	None	None	NoRetrieval=0, CloudHC=1, CloudLC=2, ClearLC=3, ClearHC=4
FeatureReferencedRccm_1.1_km (Spatial Resolution: 1.1km x 1.1km, XDim=128, YDim=512)					
FRRCCM_AnCamera_BestWind An Camera RCCM as projected to the wind-corrected CloudTop Heights	XDim,YDim	UINT8	None	None	NoRetrieval=0, CloudHC=1, CloudLC=2, ClearLC=3, ClearHC=4
FRRCCM_AnCamera_WithoutWind An Camera RCCM as projected to the uncorrected CloudTop Heights	XDim,YDim	UINT8	None	None	NoRetrieval=0, CloudHC=1, CloudLC=2, ClearLC=3, ClearHC=4
SnowIce_1.1_km (Spatial Resolution: 1.1km x 1.1km, XDim=128, YDim=512)					
TRSnowIceMask Mask indicating the presence or absence of snow or ice (terrain-referenced)	XDim,YDim	UINT8	None	None	Snow/Ice Not Present = 0, Snow or Ice Present = 1
TRSnowIceType Type of snow or ice present (terrain-referenced)	XDim,YDim	UINT8	None	None	Snow/Ice Not Present = 0, Fresh Snow = 1, Sea Ice = 2, Permanent Snow = 3
SupportVectorSceneClassifier (Spatial Resolution: 1.1km x 1.1km, XDim=128, YDim=512)					

SVMSceneClassifier Pixel classification from Support Vector Machine learning algorithm	XDim,YDim	UINT8	None	None	0 = NoRetrieval, 1 = Aerosol, 2 = Cloud, 3 = Water, 4 = Land, 5 = Snow_Ice
SVMAerosolConfidenceLevel Probability that this pixel is really aerosol	XDim,YDim	UINT8	None	None	0 = NoRetrieval, 1 = Highly Likely, 2 = Likely, 3 = Unlikely, 4 = Highly Unlikely
SVMCloudConfidenceLevel Probability that this pixel is really cloud	XDim,YDim	UINT8	None	None	0 = NoRetrieval, 1 = Highly Likely, 2 = Likely, 3 = Unlikely, 4 = Highly Unlikely
SVMWaterConfidenceLevel Probability that this pixel is really water	XDim,YDim	UINT8	None	None	0 = NoRetrieval, 1 = Highly Likely, 2 = Likely, 3 = Unlikely, 4 = Highly Unlikely
SVMLandConfidenceLevel Probability that this pixel is really land	XDim,YDim	UINT8	None	None	0 = NoRetrieval, 1 = Highly Likely, 2 = Likely, 3 = Unlikely, 4 = Highly Unlikely
SVMIceSnowConfidenceLevel Probability that this pixel is really ice-snow	XDim,YDim	UINT8	None	None	0 = NoRetrieval, 1 = Highly Likely, 2 = Likely, 3 = Unlikely, 4 = Highly Unlikely

SVMDustConfidenceLevel Probability that the detected aerosol is composed of dust – disregard if classification is not "Aerosol"	XDim,YDim	UINT8	None	None	0 = NoRetrieval, 1 = Highly Likely, 2 = Likely, 3 = Unlikely, 4 = Highly Unlikely
SVMSmokeConfidenceLevel Probabiliy that the detected aerosol is composed of smoke – disregard if classification is not "Aerosol"	XDim,YDim	UINT8	None	None	0 = NoRetrieval, 1 = Highly Likely, 2 = Likely, 3 = Unlikely, 4 = Highly Unlikely
CloudClassifiers_2.2km *(*Spatial Resolution: 2.2km x 2.2km, XDim=64, YDim=256*)*					
ConsensusCloudMask FineResolution ConsensusCloudClassifier calculated from SDCM, RCCM, and ASCM	XDim,YDim	UINT8	None	None	NoRetrieval = 0, Overcast = 1, KnownCloud = 2, KnownClear = 3
ConsensusOvercastMask FineResolution_BestWind OverCast Mask calculated using ASCM, BestWinds versions of SDCM, and feature-referenced RCCM	XDim,YDim	UINT8	None	None	NotOvercast = 0, Overcast = 1
ConsensusOvercastMask FineResolution_WithoutWind OverCast Mask calculated using ASCM, WithoutWinds versions of SDCM and feature-referenced RCCM	XDim,YDim	UINT8	None	None	NotOvercast = 0, Overcast = 1
MaxRegionalHeightFine Resolution_BestWind Maximum BestWinds CloudTop Height in this 2.2km pixel – only calculated when corresponding OverCast mask is true	XDim,YDim	INT16	None	None	No data = -9999

MaxRegionalHeightFine Resolution_BestWind Maximum BestWinds CloudTop Height in this 2.2km pixel – only calculated when corresponding OverCast mask is true	XDim,YDim	INT16	None	None	No data = -9999
CloudFractions_17.6_km (Spatial Resolution: 17.6 km x 17.6 km, XDim = 8, YDim = 32)					
CombinedFractionCloudBestEstimate Best Estimate of the fractional area classified as containing any type of cloud	XDim,YDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
CombinedFractionCloudHC Fractional area classified as containing any type of cloud with high confidence	XDim,YDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
NumberPixelsCloudHC_BestEst Number of 1.1km subregions that were counted in the CombinedFractionCloud BestEstimate and CloudHC fields	XDim,YDim	FLOAT32	None	None	No data = -9999, Valid data = 0 - 256
FractionNoRetrievalStereoHeight Fractional area that had a NoRetrieval for the BestWind CloudTop height	XDim,YDim	FLOAT32	None	None	No data = -9999, Valid data = 0.0 – 1.0
FractionNoRetrievalASCM Fractional area that had a NoRetrieval for the feature-referenced Angular Signature Cloud Mask	XDim,YDim	FLOAT32	None	None	No data = -9999, Valid data = 0.0 – 1.0
FractionNoRetrievalFR_RCCM Fractional area that had a NoRetrieval for the feature-referenced Radiometric Camera-by-camera Cloud Mask	XDim,YDim	FLOAT32	None	None	No data = -9999, Valid data = 0.0 – 1.0
FractionLandPixels Fraction of 1.1 km subregions classified as land	XDim,YDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
AverageCloudHeight Average Wind-corrected CloudTop Height for this region	XDim,YDim	INT16	Meters	None	No data = -9999

MedianCloudHeight Median Wind-corrected CloudTop Height for this region	XDim,YDim	INT16	Meters	None	No data = -9999
AverageCloudHeightAboveSurface Average value of Wind-corrected CloudTop Height – surface height for this region	XDim,YDim	INT16	Meters	None	No data = -9999
MedianCloudHeightAboveSurface Median value of Wind-corrected CloudTop Height– surface height for this region	XDim,YDim	INT16	Meters	None	No data = -9999
NumberPixelsAvgMdianHeights Number of 1.1km CloudTop Heights that went into the calculations of average and median cloud heights	XDim,YDim	INT16	None	None	No data = -9999
FractionRCCMCloudHC Fraction of terrain-referenced RCCM pixels that are CloudHC – derived directly from the contents of the GRP_RCCM product, not the feature-referenced RCCM that is contained in this product	XDim,YDim, NCamDim	FLOAT32	None	None	No data=-9999.0 Valid data = 0.0 - 1.0
FractionRCCMCloudLC Fraction of terrain-referenced RCCM pixels that are CloudLC	XDim,YDim, NCamDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
FractionRCCMNoRetrieval Fraction of terrain-referenced RCCM pixels that do not have a retrieval	XDim,YDim, NCamDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
SDCMCloudHCByHeight Fraction of 1.1km wind-corrected SDCM pixels that are CloudHC	XDim,YDim, NAltitudeDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
SDCMCloudLCByHeight Fraction of 1.1km wind-corrected SDCM pixels that are CloudLC	XDim,YDim, NAltitudeDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0

SDCMClearLCByHeight Fraction of 1.1km wind-corrected SDCM pixels that are ClearLC (NearSurface)	XDim,YDim, NAltitudeDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
SDCMClearHCByHeight Fraction of 1.1km wind-corrected SDCM pixels that are ClearHC	XDim,YDim, NAltitudeDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
ASCMCloudHCByHeight Fraction of 1.1km feature-referenced ASCM pixels that are CloudHC	XDim,YDim, NAltitudeDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
ASCMCloudLCByHeight Fraction of 1.1km feature-referenced ASCM pixels that are CloudLC	XDim,YDim, NAltitudeDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
ASCMClearLCByHeight Fraction of 1.1km feature-referenced ASCM pixels that are ClearLC	XDim,YDim, NAltitudeDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
ASCMClearHCByHeight Fraction of 1.1km feature-referenced ASCM pixels that are ClearHC	XDim,YDim, NAltitudeDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
RCCM_FrCloudHCByHeight Fraction of 1.1km feature-referenced RCCM_An pixels that are CloudHC – derived from the (BestWinds) re-referenced RCCM found in this product	XDim,YDim, NAltitudeDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
RCCM_FrCloudLCByHeight Fraction of 1.1km feature-referenced RCCM_An pixels that are CloudLC	XDim,YDim, NAltitudeDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
RCCM_FrClearLCByHeight Fraction of 1.1km feature-referenced RCCM_An pixels that are ClearLC	XDim,YDim, NAltitudeDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
RCCM_FrClearHCByHeight Fraction of 1.1km feature-referenced RCCM_An pixels that are ClearHC	XDim,YDim, NAltitudeDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
ResolutionCorrectedCloudFractions_17.6_km (Spatial Resolution: 17.6km x 17.6km, XDim=8, YDim=32)					

PatternRecognitionCorrectedCloud Fraction Terrain-referenced RCCM cloud fraction (*StandardEstimateCloudFraction)* corrected by matching to best fit vector of the 7 elements listed below - derived directly from the contents of the GRP_RCCM product, not the feature-referenced RCCM that is contained in this product	XDim,YDim, NCamDim	FLOAT32	None	Nolne	No data=-9999.0, Valid data = 0.0 - 1.0
A17CorrectedCloudFraction *StandardEstimateCloudFraction* corrected by assuming a cloud scale resolution of 15 m	XDim,YDim, NCamDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
StandardEstimateCloudFraction Fraction of non-NoRetrieval terrain-referenced RCCM pixels that contain cloud	XDim,YDim, NCamDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
CloudEdgeFraction Fraction of terrain-referenced RCCM pixels that are both cloudy and border a clear pixel on at least one of their 8 sides/vertices	XDim,YDim, NCamDim	FLOAT32	None	None	No data=-9999.0, Valid data = 0.0 - 1.0
GlcmMean Mean value of gray-level co-occurence matrix	XDim,YDim, NCamDim	FLOAT32	None	None	No data=-9999.0
GlcmVariance Variance of gray-level co-occurence matrix	XDim,YDim, NCamDim	FLOAT32	None	None	No data=-9999.0
GlcmEntropy Entropy of gray-level co-occurence matrix	XDim,YDim, NCamDim	FLOAT32	None	None	No data=-9999.0
HuFirstMoment First moment invariant	XDim,YDim, NCamDim	FLOAT32	None	None	No data=-9999.0
SupportVectorCirrusFraction_17.6_km (Spatial Resolution: 17.6km x 17.6km, XDim=8, YDim=32)					

SVMCirrusFraction Percentage of this pixel that contains cirrus clouds according to the SVM cirrus classifier	XDim,YDim	UINT8	None	None	0 = NoCirrus, 100 = Entirely Cirrus, Valid data = 0 - 100
CloudClassifiers_35.2km *(*Spatial Resolution: 35.2km x 35.2km, XDim=4, YDim=16*)*					
ConsensusCloudMaskCoarseResolution ConsensusCloudClassifier calculated from the SDCM, RCCM, and ASCM	XDim,YDim	UINT8	None	None	NoRetrieval = 0, Overcast = 1, KnownCloud = 2, KnownClear = 3,
ConsensusOvercastMask CoarseResolution_BestWind OverCast Mask calculated using wind-corrected versions of SDCM and feature-referenced RCCM and ASCM	XDim,YDim	UINT8	None	None	NotOvercast = 0, Overcast = 1
ConsensusOvercastMaskCoarse Resolution_WithoutWind OverCast Mask calculated using uncorrected versions of SDCM and feature-referenced RCCM and ASCM	XDim,YDim	UINT8	None	None	NotOvercast = 0, Overcast = 1
MaxRegionalHeightCoarseResolution_ BestWind Maximum wind-corrected CloudTop Height in this 35.2km pixel – only calculated when corresponding OverCast mask is true	XDim,YDim	INT16	None	None	No data = -9999
MaxRegionalHeightCoarseResolution_ ZeroWind Maximum uncorrected CloudTop Height in this 35.2km pixel – only calculated when corresponding OverCast mask is true	XDim,YDim	INT16	None	None	No data = -9999

APPENDIX A: Cloud Mask Registration Locations

This document refers to "terrain-referenced" and "feature-referenced" versions of cloud masks. The "rereferencing" process involves shifting the pixel locations to which a given cloud mask retrieval is assigned. This process is necessary because the ASCM and RCCM are originally calculated from the terrain-referenced BRFs (GRP_TERRAIN product), and the SDCM is calculated from the ellipsoid-referenced BRFs (GRP_ELLIPSOID). In order to compare all three cloud masks on a head-to-head basis for a given pixel, all of them need to have the same frame of reference. This *feature-referenced* frame of reference as the figure below shows, is the location directly below the feature (nominally a cloud, although for a clear-sky case the feature-referenced and terrain-referenced locations are the same) in question,. In this product, the feature-referenced ASCM is calculated using the wind-corrected CloudTop Heights, and the feature-referenced RCCM is calculated using both the wind-corrected and uncorrected heights.

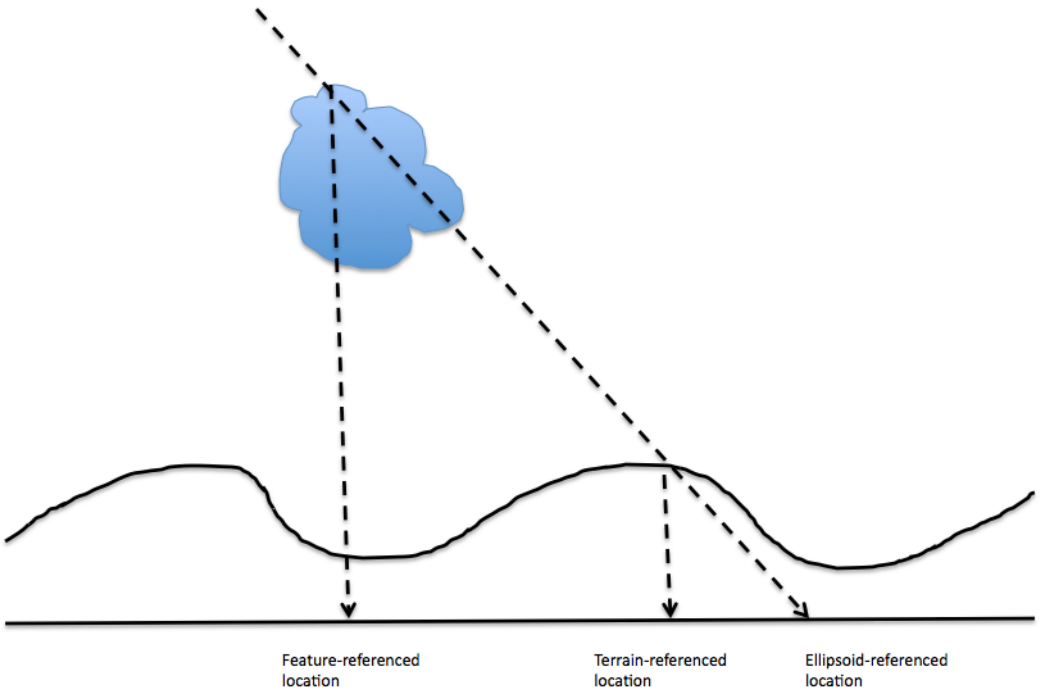

Figure 1 - Reference locations for cloud masks.