MISR Level 3 Component Products Quality Statement December 1, 2005

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Quality Designator:

- **Stage 3 Validated:** Component Global Georectified Radiance Product
- **Stage 2 & 3 Validated:**
  - Component Global Aerosol Product
  - Component Global Cloud Product
  - Component Global Land Surface Product
- **Stage 1 Validated:** Component Global Albedo Product

Note that the MISR Level 3 CFbA and CMV products have independent quality summaries. (CFbA) | CMV)

MISR maturity level definitions

This statement applies to the MISR Level 3 Georectified Radiance product, MISR Level 3 Aerosol product, the MISR Level 3 Land Surface product, the MISR Level 3 Albedo product, and the MISR Level 3 Cloud product with a production date of December 1, 2005, or later until such a time as further improvements to MISR software or ancillary inputs are made. See the Versioning Page for an in-depth explanation of the differences between various MISR product versions. Quality statements covering earlier time periods may be accessed through links at the bottom of this page.

An extensive review of product quality has not yet been performed. Please read the summary words of caution if you have not done so already.

Although there are warnings relating to Beta and Provisional quality parameters, the MISR Level 3 software which generated this product is believed to be functioning quite well except where noted below. This statement highlights major known problems with the products, as well as functionalities which are currently not implemented.

Georectified | Aerosol | Land Surface| Albedo | Cloud

Component Global Georectified Radiance Product (a.k.a. CGGRP, MIL3DRD, MIL3MRD, MIL3QRD, MIL3YRD) (from MISR PGE 12a)
Quality Designator: Stage 3 Validated

PRODUCT MATURITY

All component global georectified radiance parameters now have a "Stage 3 Validated" status.

LEVEL 1 PROBLEMS

The Level 3 Georectified Radiance product is a summary of the L1B2 Terrain and L1B2 Ellipsoid Radiance products and therefore, all of the Level 1 quality statements apply.

Component Global Aerosol Product (a.k.a. CGAS, MIL3DAE, MIL3MAE, MIL3QAE, MIL3YAE) (from MISR PGE 12c)
Quality Designator: Stage 2 & 3 Validated

PRODUCT MATURITY

All component global aerosol parameters now have a "Stage 2 Validated" status with the exception of the Aerosol optical depths which are now at Stage 3.

LEVEL 2 AEROSOL PROBLEMS

The Level 3 Aerosol product is a summary of the Level 2 Aerosol product, therefore all of the Level 2 aerosol quality statements apply.

Notes on using MISR Level 3 Aerosol Data:

1. Be sure to take into account the Quality Statement for the MISR AOT products. In particular, it takes about a year to reprocess the entire MISR data set with the current version of the algorithm, so the currently available Level 3 products may include a mix of validated and un-validated versions. Regional and global studies using the Level 3 product should include only the available validated versions of the AOT products.
2. Note in particular from the Level 2 Quality Statements, that **optical depth blunders** in the Level 2 product can frequently occur **over snow/ice fields** due to low spatial contrast and also as a consequence of inadequate cloud screening. Many such blunders have been observed over Greenland and Antarctica. Therefore, these two geographic areas are **currently being excluded** in the Level 3 Global Aerosol Product but with the expectation that they will be included at a later date.
3. MISR **sampling** must be taken into account when using the Level 3 Aerosol products, as they are aggregates of numerous observations. The number of counts in a space-time bin is included in the Level 3 data files. Note also that MISR and MODIS sampling are quite different, and over water, they are rarely coincident, since MODIS is in sun-glint over the narrower MISR swath much of the time, whereas MISR can use the off-nadir cameras for aerosol retrievals where the nadir view is glint-contaminated. Conversely, MISR observes the entire Earth about once per week, whereas MODIS sees it about once in two days; cloud contamination eliminates many of the observations, preferentially in cloud-prone regions. On a global, monthly or seasonal basis, short-lived, severe aerosol events, such as dust storms and wildfires, often dominate the signal. So a careful analysis must take account of the number of observations available in each space-time sampling bin, and the study also needs to account for the sampling of severe aerosol events.
4. Published MISR-AERONET Level 2 aerosol validation studies use coincident events for which both satellite and surface instruments report cloud-free, good quality results. **BOTH cloud masks** must say it is cloud-free for a case to be included is such studies. The MISR data set overall of course uses only the satellite cloud-screening algorithm; these are known to have some problems, and are as yet being refined and validated as of the current Version (0021) of the MISR Level 3 Aerosol product.

Key issues currently being addressed by the MISR team and associates that bear upon the use of the Level 3 aerosol products for regional and global scale studies:

1. The **absolute calibration scales** for MISR and MODIS differ by 3% over much of the brightness range. This has been traced to the difference between the on-board calibrator used to set the MODIS absolute radiometric scale, and the vicarious calibration experiments (Bruegge et al., TGARS 2004; Thome et al., SPIE 2004; Abdou et al., TGARS 2002) used for the MISR absolute scale. The scale difference is in the sense that MISR is higher than MODIS, so any convergence would reduce current differences between the MISR and MODIS AOT products over water.

   A paper looking deeply into a possible resolution of this calibration difference is in preparation:

   Lyapustin, A., Y. Wang, R. Kahn, R. Wolfe, J. Xiong, K. Thome, A. Smirnov, C. Bruegge, A. Ignatov, O. Dubovik, 2006. Analysis of MODIS-MISR Calibration Difference: Implications for Data Fusion, Remt. Sens. Environ., in preparation. Note that the absolute calibration stability, as well as the band-to-band and camera-to-camera relative calibration for MISR itself, are within a few percent or better.

2. **Cloud masking** is under study by the MISR team, as well as several other groups. For aerosol retrievals, the MISR cloud mask has eight separate tests to draw upon, and the logic that defines their use is being optimized with the help of numerous cloud validation cases, distributed globally. Some work has already appeared regarding MISR cloud detection (e.g., DiGirolamo and Wilson, TGARS 2003; Zhao and DiGirolamo, JAM 2004), but current tasks need to be completed before that aspect of the product will be validated.

3. The MISR Level 2 aerosol microphysical property values are currently being validated. Level 3 aggregates will be released once these quantities are at least Provisionally Validated. Improvements in the Aerosol Retrieval Algorithm based on the validation studies may also result in incremental improvements in the optical depth values for the more challenging cases.

Component Global Land Surface Product (a.k.a. CGLS, MIL3DLS, MIL3MLS, MIL3QLS, MIL3YLS) (from MISR PGE 12c)
Quality Designator: Stage 2 & 3 Validated

PRODUCT MATURITY

All component global land surface parameters now have a "Stage 2" status with the exception of the albedos and BRFs which are now at Stage 3.

LEVEL 2 LAND SURFACE PROBLEMS

The Level 3 Land Surface product is a summary of the Level 2 Land Surface product, and therefore all of the Level 2 land surface quality statements apply. In particular, it is noted that optical depth blunders in the Level 2 product can frequently occur over snow/ice fields due to low spatial contrast and also as a consequence of inadequate cloud screening. Many such blunders have been observed over Greenland and Antarctica. Therefore, these two geographic areas are currently being excluded in the Level 3 Global Land Product but with the expectation that they will be included at a later date.

Component Global Albedo Product (a.k.a. CGAL, MIL3DAL, MIL3MAL, MIL3QAL, MIL3YAL) (from MISR PGE 12b)
Quality Designator: Stage 1 Validated

PRODUCT MATURITY

All component global albedo parameters now have a "Stage 1" status.

LEVEL 2 ALBEDO PROBLEMS

The Level 3 Albedo product is a summary of the Level 2 Albedo product, and therefore all of the Level 2 albedo quality statements apply. Note in particular that at high latitudes, notably poleward of 60 degrees, the angular models used in the Albedo retrievals currently fail due to extreme anistropy. Albedos in these regions are frequently over-estimated.

Component Global Cloud Product (a.k.a. CGAL, MIL3DCLD, MIL3MCLD, MIL3QCLD, MIL3YCLD) (from MISR PGE 12b)
Quality Designator: Stage 2 & Stage 3 Validated

PRODUCT MATURITY

The cloud parameter Height Histograms are at "Stage 3 Validated" and the Wind Vectors have a "Stage 2" status.

LEVEL 2 CLOUD PROBLEMS

The Level 3 Cloud product is a summary of the Level 2 Cloud product, and therefore all of the Level 2 cloud quality statements apply.

Note in particular the following properties of the retrieved heights:

The pattern-matchers used in the stereo height retrievals identify the location of greatest contrast, which is not necessarily the highest point in the cloud. MISR, along with many other instruments, has difficulty in retrieving the height of optically thin clouds. The optical depth threshold at which the algorithm identifies the thin cloud rather than the underlying object depends on the contrast of the underlying feature. The reader should take this inherent limitation of the retrievals into account when comparing MISR heights to other instruments or to model results.

For the extreme case of very dark features (such as open water) near bright features such as snow, clouds with optical depth of at least 2 and perhaps as much as 5 can be missed. When boundary layer clouds such as stratocumulus or trade cumulus are present, cirrus clouds with optical depths of 2 to 5 are sometimes not retrieved. However, for cases without lower clouds or underlying bright surfaces, thin cirrus clouds with optical depths near 0.5 (over heterogeneous land) and perhaps even smaller (over dark water) are usually detected.

Also see the

- Statement dated May 13, 2005 for MISR Level 3 Products from May 13, 2005 to December 1, 2005.
- Statement dated March 10, 2004 for MISR Level 3 Products from March 10, 2004 to May 13, 2005.
- Statement dated March 24, 2003 for MISR Level 3 Products from March 24, 2003 to March 9, 2004.
- Statement dated July 31, 2002 for MISR Level 3 Products from July 31, 2002 to March 23, 2003.