

## AirMISR Radiometric Data Quality

The science flights made by AirMISR over the Smithsonian Environmental Research Center, Maryland, target on August 20, 2003 were successful. The camera successfully slewed to all nine angle positions for one run. The radiometric accuracy and signal-to-noise during this mission was as good as the Science Team has reported in the literature. Individual product files contain metadata identifying dropped/corrupt lines, saturated pixels and related image quality parameters.

The radiometric calibration of AirMISR was done using the same procedures as used to calibrate the MISR cameras; the reported radiometric calibration uncertainties are therefore the same as reported for MISR. (The exception is the camera-to-camera uncertainty, which is believed to be smaller for AirMISR, as the aircraft instrument consists of one gimbaled camera). Thus, it is believed that the radiometric uncertainties are small, and the camera signal-to-noise is high.

The values quoted for the systematic component of the radiometric uncertainty, based on vicarious calibration of the instrument, in fractional units, are:

abs\_sys\_error 0.030  
cam\_sys\_error 0.000  
band\_sys\_error 0.010  
pixel\_sys\_error 0.005

That is, the systematic component of the absolute, camera-to-camera, band-to-band, and pixel-to-pixel uncertainties are given above. The pixel-to-pixel uncertainty is large enough to cause some visible striping in the imagery where the scene contrast is low and the image display is stretched to highlight small radiometric differences. These systematic components are combined with signal-to-noise (SNR) to determine the total error uncertainties. As SNR is signal dependent, the uncertainties are likewise signal dependent. SNR, at two radiance input levels, are as follows:

SNR(equivalent-reflectance=1.0) ~ 1000  
SNR(equivalent-reflectance=0.05) ~ 200

Using these, the total radiometric uncertainties can be determined:

abs\_total\_error= $\sqrt{\text{abs\_sys\_error}^2+(1/\text{SNR})^2}$   
cam\_total\_error= $\sqrt{2}/\text{SNR}$   
band\_total\_error= $\sqrt{2}*\sqrt{\text{band\_sys\_error}^2+(1/\text{SNR})^2}$   
pixel\_total\_error= $\sqrt{2}*\sqrt{\text{pixel\_sys\_error}^2+(1/\text{SNR})^2}$

## AirMISR Georectified Radiance Data Quality

Geometric calibration is performed prior to orthorectification to the UTM map projection grid. The orthorectified Landsat TM scenes (path 011 row 029) obtained through ESE Scientific Data Purchase are used to collect a set of ground control points in order to remove static errors in the camera pointing and airplane position and assure absolute geolocation accuracy in particular for nadir images from both runs. An automated tie points identification and bundle adjustment is used to improve coregistration accuracy between off-nadir and nadir imagery. Using calibration results, geolocation and coregistration errors of about 1000 meters for the nadir view to up to 6000 meters for the most oblique views are reduced down to an average of about 60 meters for both absolute geolocation and coregistration out of nine view angles. Errors associated with the D camera view angles are somewhat larger, about 150 meters on average, due to the inability to identify a sufficient number of reliable ground control points in the imagery acquired at those oblique angles.

## References

References on the radiometric calibration of AirMISR and MISR include the following. Additional references are available from the [MISR web site](#).

1. Bruegge, Carol J., Wedad A. Abdou, Nadine L. Chrien, Barbara J. Gaitley (1998). AirMISR spectral and radiometric performance studies. In Earth Observing System III, Proc. SPIE 3439, San Diego, CA, 19-21 July.
2. Bruegge, C. J., N. L. Chrien, R. A. Kahn, J. V. Martonchik, David Diner (1998). MISR radiometric uncertainty analyses and their utilization within geophysical retrievals. Conference issue: New Developments and Applications in Optical Radiometry (NEWRAD '97), Metrologia., 35, 571-579.
3. Bruegge, C. J., V. G. Duval, N. L. Chrien, R. P. Korechoff, B. J. Gaitley, and E. B. Hochberg (1998). MISR prelaunch instrument

calibration and characterization results. IEEE Trans. Geosci. Rem. Sens., Vol. 36, pp. 1186-1198.

4. Chrien, Nadine L., Carol J. Bruegge, Barbara J. Gaitley (2000). AirMISR laboratory calibration and in-flight performance results. Submitted to Remote Sens. Environment, December 1998.
5. Diner, David J., et al. (1998). The Airborne Multi-Angle Imaging SpectroRadiometer (AirMISR): Instrument Description and First Results. IEEE Trans. Geosci. Rem. Sens., Vol. 36, No. 4.

## **Feedback:**

For questions or comments on the AirMISR products, contact the NASA Langley Atmospheric Science Data Center [User Services Office](#).

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