# Using AirMISR Data

1. Read software written in Exelis Visual Information Solutions Interactive Data Language (IDL) is available from the ASDC as an example of how to extract the various data components from an AirMISR Level 1B2 Georectified Radiance Product data file. The program as written does apply scaling factors when reading the radiance values, but no other processing is applied to the data. Obtain read software.

2. Section 2 in the publication Aerosol properties derived from aircraft multiangle imaging over Monterey Bay (PDF) gives detailed information about the processing steps applied to calculate spectral equivalent reflectance from the radiance data. Equation 2a in that section defines the spectral equivalent reflectance calculation, and information is given about the location in the AirMISR L1B2 georectified radiance product of the various data used in the equation. Information is also provided for calculating the out-of-band radiation correction (Eq. 3) and ozone correction (Eq. 4).

3. AirMISR L1B2 data are georectified, resampled to a 27.5 m/pixel grid, and projected to the Universal Transverse Mercator (UTM) map projection. The radiance values are scaled and stored as integers. In order to convert the scaled radiance data for a particular wavelength to the actual radiance values, they must be multiplied by the scale factor for that wavelength. The scale factors are stored in the data file as HDF-EOS grid attributes associated with the file's AirMISR grid structure. The AirMISR read software discussed in item 1) above provides an example of how to read and apply the scale factors.

   Geolocation information for the UTM projected data is specified in terms of the upper left and lower right corners of a bounding box large enough to surround the image area from any of the nine camera angles [see Figure 1, p. 3-2 in the Rev A version of the AirMISR Data Products Specification (PDF)]. This box is oriented with North to the top.

   The images below show an actual AirMISR image along with a general illustration of the relationship of the bounding box to the image area and AirMISR flight line. Note that this illustration is not specific to the actual image shown. In general, the flight line may be in any direction. The resulting L1B2 image area, resampled to UTM coordinates, is a uniform data set with edges parallel to and normal to the direction of flight. The flight line is centered over the image area rectangle.
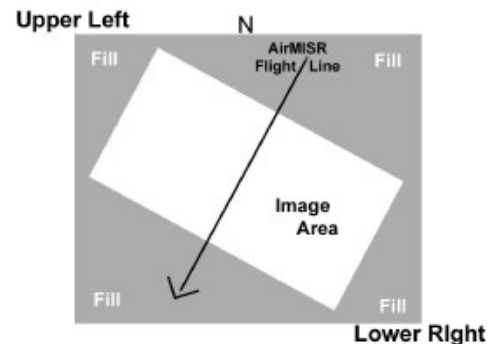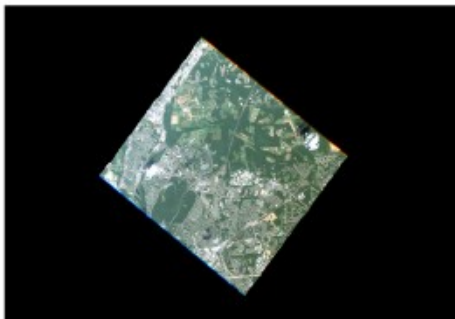
   The same UTM rectangular box is used to project data from all nine camera angles for a single flight run. Since there is only one camera with a single focal length, the size of the ground footprint varies depending on the camera angle. As the camera pivots to steeper angles, the pixel footprint grows in the along-track direction.

   Corner coordinates for the UTM projection are specified in meters, and these are the values stored in each file's structural metadata which is written to the file as an HDF file or global attribute. The corner information is also stored in the file as latitude/longitude values in the HDF-EOS grid structure attributes "UL Corner" and "LR Corner."

4. AirMISR Level 2Aerosol/Surface (L2AS) data files have the same pixel size (resolution), 27.5 m, and pixel locations as the L1B2 data files. The data area in L2AS is the intersection of footprints of the seven corresponding L1B2 camera files (CF, BF, AF, AN, AA, BA, CA). The D cameras (DF, DA) are not used in creating the L2AS product.

5. The L2AS camera mask parameters (one for each wavelength) indicate which cameras are used for each pixel. The camera mask values are unsigned 16 bit integers. The low order two bits are not used. The next 7 higher order bits represent the seven cameras. From left to right, the bits correspond to the CF, BF, AF, AN, AA, BA, and CA cameras. The highest order 7 bits are unused. So the 16 bit mask values are interpreted as

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        0  0  0  0    0  0  0  CF    BF  AF  AN  AA    BA  CA  0  0
   When all seven cameras are used, the mask value is 0000 0001 1111 1100 binary,
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or 1FC in hexadecimal, which is the decimal value 508.

6. Geometric parameters that may be useful in working with the Level 2 AS data can be obtained from the corresponding Level 1B2 camera files. The available parameters include Sun Azimuth, Sun Zenith, View Azimuth, and View Zenith, as well as Elevation and Elevation uncertainty.

7. To import AirMISR L1B2 (GP) or Level2 (AS) data into ENVI geolocate the data, follow these steps:

   a. In the ENVI menu bar go to File -> Open External File -> Generic Formats -> HDF and select the AirMISR data file to work with.

   b. In the HDF Data Selection window, choose the HDF Datasets you want to work with and click OK.

   c. In the ENVI menu bar go to Basic Tools -> Preprocessing -> Data-Specific Utilities -> View HDF Global Attributes and choose the file just opened. Leave that window up and

   d. In the Available Bands List, right-click on the file name above one of the bands and choose Edit Header.

   e. In the Header Info window that appears, choose Edit Attributes and then Map Info.

   f. In the Edit Map Information window that appears, first click on Change Projection.

   g. In the Projection Selection window that appears, click on UTM and fill in the Zone box with the ZoneCode value from the Global Attributes window. Click OK.

   h. Back in the Edit Map Information window, put a 1 in both the X and Y image coordinate boxes (to indicate the top left corner), and put 27.5 in the Pixel Size X and Y boxes, since the AirMISR pixel size is 27.5 m. From the Global Attributes window, use the UpperLeftPointMtrs values to fill in the E and N boxes in the Edit Map Information window. E is the first number in the listed pair of values and N is the second number. This step maps the location information of the AirMISR data box surrounding the image in terms of the UTM projection coordinates, using the upper left corner as the reference point. Click OK. Then click OK in the Header Info window. You can close the Global Attributes window at this point too.

   Now if, for example, in the Available Bands window you select and load one of the bands to create a greyscale image, in the image window menu choose Tools -> Cursor Location/Value. This will bring up a Cursor Location/Value window to display the coordinates and data value for the current cursor location. As you move your cursor over the AirMISR image the latitude and longitude coordinates of the pixel and the data value at that point will be displayed.

8. An additional source of information for the AirMISR campaigns is the MISR Validation Activities and Results web site.