

MODIS Reprojection Tool Swath (MRTSwath) Release Notes
Version 2.2
November 2010

Land Processes DAAC
USGS Earth Resources Observation and Science (EROS) Center

Capabilities

1. MODIS Data Products

The MODIS Reprojection Tool Swath (MRTSwath) allows the user to reproject swath (DAAC and direct broadcast Level-1 and Level-2) MODIS data products.

Support for gridded land products has been implemented in the MODIS Reprojection Tool (MRT).

2. Map Projections

The MODIS Reprojection Tool Swath allows the user to reproject to the following map projections:

- * Albers Equal Area
- * Equirectangular
- * Geographic
- * Hammer
- * Integerized Sinusoidal
- * Interrupted Goode Homolosine
- * Lambert Azimuthal
- * Lambert Conformal Conic
- * Mercator
- * Mollweide
- * Polar Stereographic
- * Sinusoidal
- * Transverse Mercator
- * Universal Transverse Mercator

3. ISIN-Enhanced GCTP

As part of this software, the Generalized Cartographic Transformation Package (GCTP) has been modified to incorporate the new Integerized Sinusoidal Projection.

4. Spectral Subsetting

Any subset of the input HDF-EOS Scientific Data Sets (SDSs) may be selected

for reprojection. The default is to reproject all input SDSs. NOTE: The MRTSwath will only process SDSs of the nominal MODIS scan size. If other SDSs are specified, the MRTSwath will output an error message for that SDS,

but will continue on to process any other specified SDSs.

5. Spatial Subsetting

Two corners (upper left and lower right) of a rectangle in input/output space may be specified. These corners may be given as coordinates in input latitude and longitude, input line/sample pairs, or output projection coordinates. If specifying line/sample pairs specify using a zero-based coordinate system where the upper left corner is (0, 0). When specifying input lat/long or input line/sample, the other two rectangle corners (upper right and lower left) are computed automatically in input space. Then all four corners are reprojected into output space, using the specified map projection. Finally, a minimum-bounding rectangle is computed that contains the four reprojected points, in output space. All points inside this rectangle in output space are mapped back into input space for reprojection. The default is to reproject the entire input image, using the bounding rectangular coordinates from the global attributes metadata.

When specifying output projection coordinates, these coordinates must be specified in the same units as is used for the projection (degrees for geographic and meters for all other projections). The upper right and lower left corners are computed from the specified upper left and lower right corners to create a rectangle in output space. Using these coordinates in output space, the corners are mapped back into input space to determine the spatial subset corners in input space. The output image corner coordinates should match the user-specified output spatial subset corners. If not already, the lower right corner may need to be adjusted slightly so that it is an integral number of lines and samples, based on the output pixel size.

6. Resampling

Resampling may be nearest neighbor, bilinear, or cubic convolution.

7. Datum Conversions

Datum conversions are not supported in the MRTSwath application.

8. Output Pixel Size

An output pixel size may be specified, one for each SDS. If only one pixel size is specified, then it will be used for all SDSs. The default is to use the same input and output pixel sizes for corresponding input and output SDSs. For output to the Geographic projections, the pixel size must be specified in decimal degrees. For output to all other projections, the pixel size must be specified in meters.

9. Data Types

The MRTSwath supports character data and 8-bit and 16-bit integer data (both signed and unsigned). If not specified, the default output data type is the same as the input data type for each corresponding SDS.

10. File Formats

MODIS swath HDF-EOS files are supported on input. HDF-EOS, GeoTIFF, and raw binary files are supported on output.

12. Platforms

The MODIS Reprojection Tool Swath is highly portable software. It currently runs on four different platforms:

- * Windows
- * Linux-32
- * Linux-64
- * Macintosh

13. Interfaces

The MODIS Reprojection Tool Swath may be invoked from a powerful command-line interface. A GUI version of MRTSwath is being developed and will be available at a later date. The scriptable command-line interface, with its variety of command-line options, is likely to be the method of choice for reprojecting large numbers of files.

History

Version 2.2 (November 2010)

1. Windows version was compiled with Visual Studio Express 2008. It no longer depends on Cygwin.
2. Due to conflicts with the MRTDATADIR environment variable with MRT and the HEG tool, MRTSwath now uses MRTSWATH_DATA_DIR as the default. It will use MRTDATADIR if MRTSWATH_DATA_DIR is not defined, however.
3. MRTSwath can now be installed into and work with input and output data contained in directories with spaces.
4. There is a slight variation when rounding pixel values when writing integer

output images in that negative values are now rounded to the next higher negative value, i.e. -1.5 is rounded to -2.

5. Higher precision variables are now used in calculations to fix an issue using nearest neighbor sampling which was setting some output pixels to the default fill value.

6. Added INT32 and UINT32 output file types.

7. A miscalculation during nearest neighbor resampling, which affected categorical value output, was resolved so that no non-source values are written to MRTSwath output.

Version 2.1 (January 2006)

1. Modified the software to ignore '/'s in output SDS names when creating the output GeoTiff and RawBinary names. The output GeoTiff and Raw Binary filenames are created by appending the SDSname to the base output filename.

The '/' in the SDS name makes the software think there is a directory in the filename that doesn't exist. For example, given a base filename of

"MOD03out" and an SDS name of "Land/SeaMask", the output GeoTiff filename

would be "MOD03out_Land/SeaMask". The fix will ignore the '/' and the new output filename would be "MOD03out_LandSeaMask".

2. Fixed a bug in the software that prevented more than 32 SDSs from being processed in a file. The software would often core dump on files with more than 32 SDSs (i.e. MOD03 files contain 39 SDSs).

3. Modified the software to read the `_FillValue` for the SDS and use that fill value in the output product. If no `_FillValue` is specified then 0.0

will be used for the default fill value. NOTE: In some cases, the fill value is 65535 instead of 0 or a negative number. In these cases, the non-image data resulting from the projection (in addition to the fill values in the image) will be very bright instead of the dark pixels that most users are expecting.

4. Modified the resampling process so that if 50% or more of the pixels in the kernel are background fill, then the resulting output pixel will also be background fill. The background fill value used is the `_FillValue`

tag associated with the SDSs. If no `_FillValue` is specified then 0.0 will be used for the default fill value.

5. Modified the routine which reads the bounding coordinates so that the bounding coordinates will be read even if they are not in the standard Struct, Core, and/or Archive metadata groups. The direct broadcast data commonly does not provide the full-blown metadata (i.e. Struct, Core, and Archive) groups that are available in the MODIS HDF products from the DAAC.

6. The previous release specified that the Geotiff files would have the UL corner refer to the center of the UL corner pixel. An incorrect Geotiff tag was used in this modification. `RasterPixelIsArea` actually refers to the UL corner of the pixel instead of the center of the pixel. This has been changed and we are now using `RasterPixelIsPoint` so that the center of the pixel is specified appropriately.

7. Modified the NN resampling kernel processing to use a post-processing pass to fill any holes left in the output image. Previous versions of the software would produce NN output products with holes (single pixels with values of background fill) down the center of the image.

Version 2.0 (July 2004)

1. Added a Graphical User Interface in addition to the command-line `MRTSwath` executable.
2. Modified the parameter file parser to handle the Windows `^M` characters at the end of a line. Version 1.0 could not handle any `^M` characters in the parameter file, which caused problems for users creating parameter files on the Windows platform.
3. Modified `swath2grid` executable to output all information and error messages to `mrtswath.log` in the local directory.
4. Modified `swath2grid` executable to no longer tag the WGS84 datum to all GeoTiff and Raw Binary output products. Since the user is providing an ellipsoid and/or semi-major and semi-minor axes, it technically is incorrect to say that data set has a particular datum. Datums have their own

- ellipsoid axes, which may be different from what the user specified.
If the user specifies WGS84 as the ellipsoid, then the WGS84 datum will be tagged since it has the same axes values as the WGS84 ellipsoid.
5. During testing of the GUI, a bug was found in the conversion of the UL and LR corners when using the LINE_SAMPLE option. This problem has been fixed.
 6. Modified the install script to not create .tcshrc, .cshrc, .bashrc, .login, or .bash_profile scripts if they don't already exist on the local system.
If they do exist, then they are updated for the MRTSwath environment variables and to add the MRTSwath 'bin' directory to the PATH.
 7. Fixed a bug that caused the software to core dump when projecting to the ISIN projection. The MRTSwath software used a value of 99 to represent the ISIN projection, however the GCTP software was expecting a value of 31. The issue was fixed by modifying MRTSwath to use a value of 31 to represent the ISIN projection.
 8. Added output for CHAR8 data types.
 9. Fixed a bug that caused incorrect background fill values to be output when converting from one data type to another.
 10. Added a shortcut icon for the MRTSwath and instructions for installation and setup in the User's Guide.
 11. Added the MODIS sphere, radius of 6371007.181, to the list of spheres for output data. It will have a sphere code of 20.
 12. If the user specifies a file extension of .hdf, .HDF, .tif, .TIF, .hdr, or .HDR for the output filename, that extension is now ignored. The output file format determines the extension of the output filename. Previous versions of MRTSwath would leave in the original extension and then add an additional extension, based on the output file format.
 13. Previous versions of the MRTSwath output the GeoTiff UL corner point as the outer extent of the UL corner. This has been modified to represent the center of the pixel of the UL corner. In addition, the GTRasterTypeGeoKey GeoTiff tag has been modified to RasterPixelisArea to correctly represent that the corner point is the center of the pixel.

The corner point representations for HDF-EOS and raw binary will remain the outer extent of the pixels.

Version 1.0

1. First public release.
2. Installation scripts provided.

Caveats

1. MODIS gridded data (Level-2G, Level-3, and Level-4) is not supported. Only Level-1 and Level-2 swath HDF-EOS products are supported.
2. The output GeoTiff products follow the GeoTiff standard that has been in use at the USGS EROS. ENVI supports the output GeoTiff products from the MRTSwath, but we have been informed that other software does not always support ingesting our GeoTiff products.

Installation

To obtain the MRTSwath software, download the appropriate installation files for your specific platform from the USGS EROS LP DAAC MODIS Reprojection Tool web site (<https://lpdaac.usgs.gov/lpdaac/tools>). The download package needs to be unzipped to extract a zip archive containing the MRTSwath software with an installation script. In the Windows package, an executable file named unzip is also included. For UNIX systems, unzip and zip are freeware packages available from GNU. For more information, or to obtain the zip/unzip software, see the GNU Web site at <http://www.gnu.org/software/software.html>. If using the automatic installation for Windows, only the download.zip should be unzipped. The installation script will handle the inflation of the MRTSwath_<platform>.zip.

Once the MRTSwath software has been downloaded, it needs to be installed on the user's host system. This can be done with either an automatic or manual installation process. The automatic installation process is recommended for most

users. Both methods require some pre-install checks. First, be advised that entry of full pathnames during installation is highly recommended for all directories. Second, in order to run the MRTSwath GUI, a current version of Java must be installed on the system (at least the Java 2 Runtime Environment version 1.5 or the Java 2 SDK version 1.5 or later). Third, the path to the Java directory is needed during the installation process, so have this information available during installation.

Instructions for automatic and manual installation to UNIX-based (Linux-32, Linux-64, and Mactel) and Windows-based systems are detailed in the MRTSwath User Manual available from the LP DAAC Tools download site.