The MODIS Conversion Toolkit (MCTK) User's Guide

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MCTK Releases on GitHub: https://github.com/dawhite/MCTK/releases

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I. Introduction

The MODIS Conversion Toolkit (MCTK) is an HDF file conversion and projection utility for all known MODIS data products. The plugin works on all operating systems that can run IDL and ENVI. A complete list of supported products can be found in Section VI. MCTK allows you to take a cafeteria-style approach to working with MODIS data. Through an intuitive user interface, you can extract and project only the data you need. Full programmatic access to MCTK is also available (see Section V for details).

II. Installation

To install MCTK, place the "mctk.sav" and "modis_products.scsv" files in your ENVI save_add and/or extensions folder. The location of this folder will vary by operating system and ENVI version.

ENVI 5.0+ Standard:	Windows: c:\program files\exelis\enviXX\extensions UNIX\Linux: /usr/local/exelis/enviXX/extensions Mac: /applications/exelis/enviXX/extensions
ENVI 5.0+ Classic:	Windows: c:\program files\exelis\enviXX\classic\save_add UNIX\Linux: /usr/local/exelis/enviXX /classic/save_add Mac: /applications/exelis/enviXX /classic /save_add

NOTE: To use the batch interface for MCTK in ENVI 5.0+, you must perform the Classic mode installation. It is also a good idea to increase the Image Tile Size in the ENVI Classic Preferences from 1.0MB to at least 10.0MB.

If the plugin is installed correctly for ENVI 5.0+ Classic, there should be a MODIS Conversion Toolkit button in the ENVI menu system under File→Open External File→EOS the next time ENVI is started. If the plugin is installed correctly for ENVI 5.0+ Standard, there should be an MCTK option in the extensions folder the next time ENVI is started. See Figure 1 for examples.

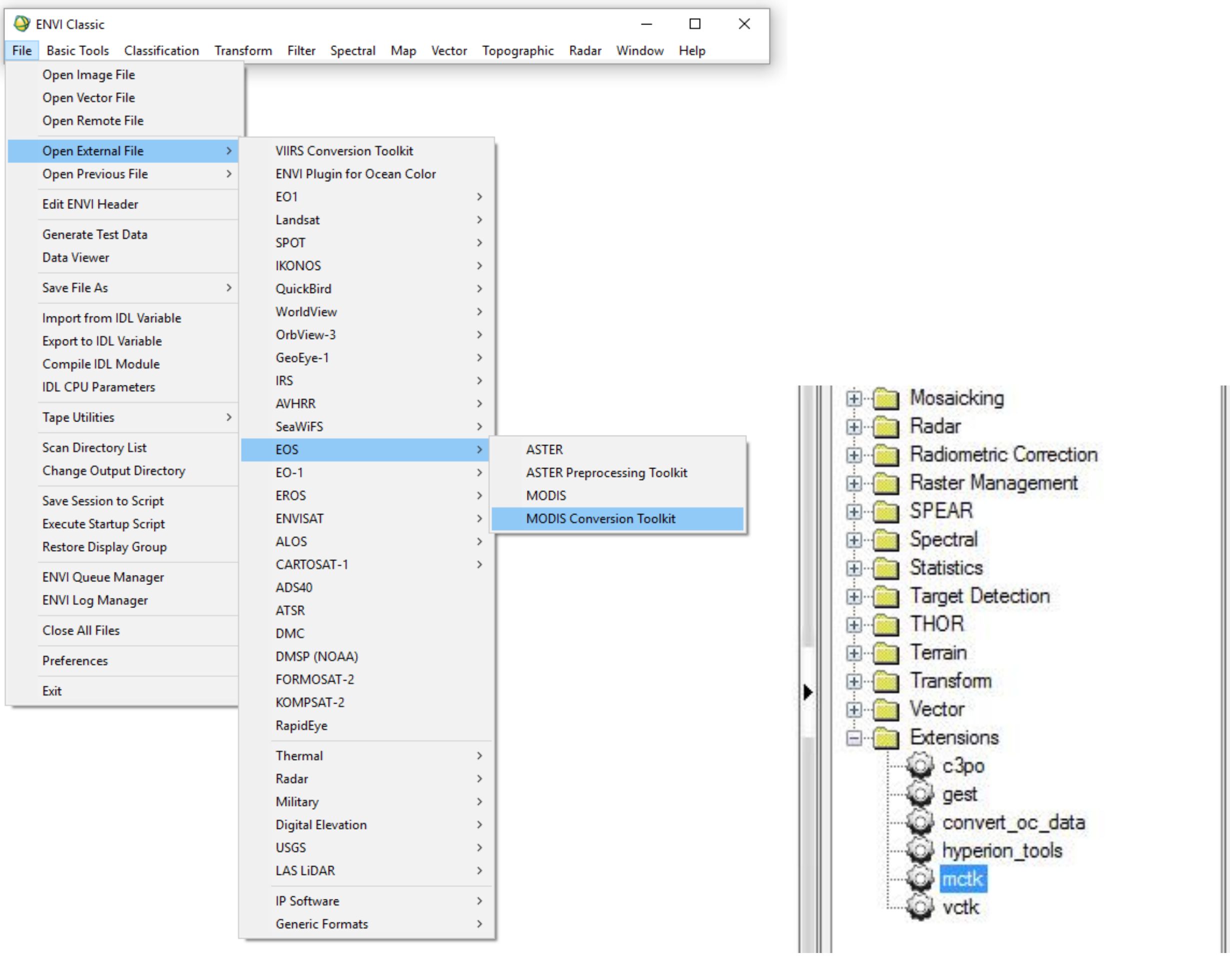


Figure 1. The plugin creates a button in the EOS group in ENVI Classic (left) and the Extensions folder in ENVI 5.0+ (right), allowing for easy access to data sets.

Beginning with version 2.0.0, MCTK leverages exactly the same multithreaded, rigorous swath projection engine as EPOC and VCTK, which performs bowtie correction automatically and supports all three standard interpolation methods. This is a significant improvement over previous versions of MCTK, which used triangulation for regular projection and only supported linear resampling during bowtie correction. If you use EPOC and/or VCTK in addition to MCTK, please ensure that you always have the latest version of each one installed. The GitHub release sites for the plugins are as follows:

- MCTK: https://github.com/dawhite/MCTK/releases
- EPOC: https://github.com/dawhite/EPOC/releases
- VCTK: https://github.com/dawhite/VCTK/releases

MCTK also now uses a rigorous reprojection method for grids, which is much more accurate than the previous triangulation-based method.

III. A note on Projected and Reprojected MCTK output compared to MRT and MRTSwath

Projected swath and reprojected grid MCTK output has been extensively compared to that of the MODIS Reprojection Tool (MRT) and the MODIS Reprojection Tool Swath (MRTSwath).

Apart from small spatial differences that stem from how each application implements specific interpolation algorithms, the output is consistent with (and in some ways superior to) MRT and MRTSwath. In addition to output being in scientifically meaningful units and collected into as few files as possible, bilinear and cubic interpolated results are sharper, there are no artifacts along the edges of NoData regions and along the outside edges of swaths and grid tiles, and there are no gaps present after virtual or physical mosaicking for both swath and grid products. The only way to avoid gaps during mosaicking for grid products processed using MRT is to create a physical mosaic from the very beginning, which is not necessarily feasible for extremely large areas (e.g., continental or global coverage).

IV. Converting MODIS data interactively in ENVI using MCTK

To bring a MODIS file into MCTK, launch the tool from the Open External File menu and in the resulting window, click on Input HDF, and select the file you wish to input. By design, a file filter is preset so that only files that begin with "M" and have an ".hdf" suffix will be displayed in the file selection dialog. Only one file can be selected at a time for conversion. It is crucial that the name of your input file follows standard MODIS naming convention. The tool uses the first part of the file name (e.g., MOD02HKM) to determine the product type and appropriate processing options. The best way to ensure compliance with the naming convention is to retain the filenames assigned by your data provider. When a valid MODIS product is supplied to the tool, the various fields in the window will update (Figure 2). Directly below the Input HDF button is a field that will display metadata related to the inputted file. Georeferencing options for converted data will appear directly below the metadata viewer, when appropriate. The Processing Options area on the right side will provide you with an interactive list of what can be done with the inputted data. This list is different for every product. If georeferencing options are available for the inputted product, and one of them is chosen, the window will expand to include a section that gives you control over several parameters including projection type, resampling method, density, and pixel size (when appropriate).

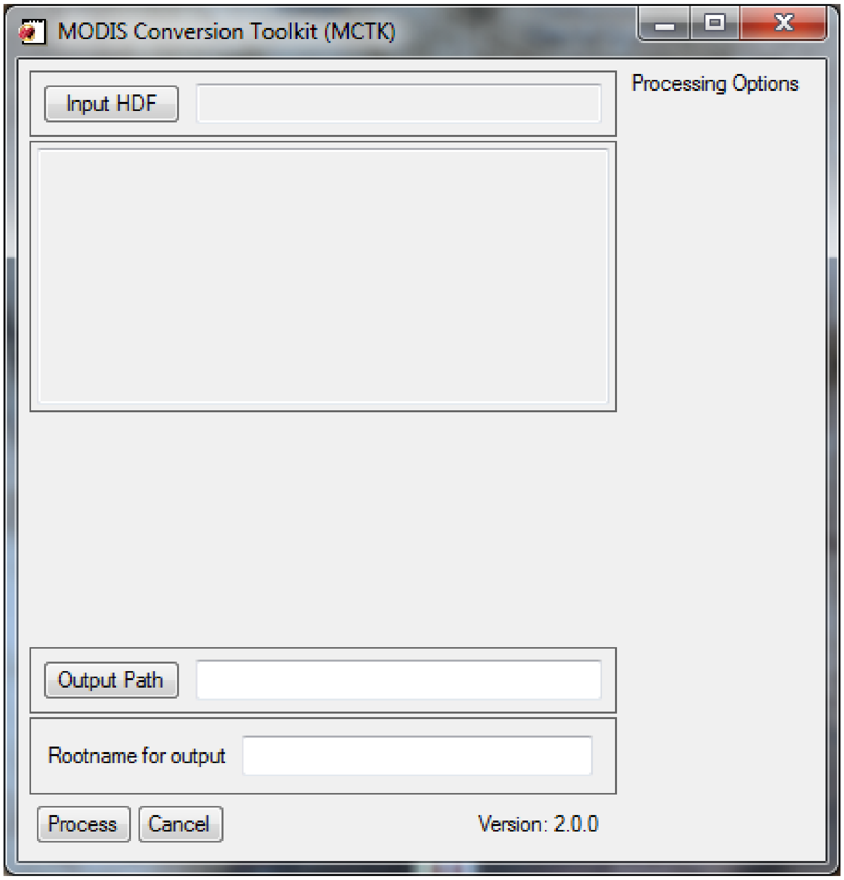


Figure 2. A "blank" instance of MCTK. The various fields and sections will update with information and options that are relevant to the supplied MODIS product. To ensure that you have the most recent version of MCTK, check the displayed version number.

To select where converted data should be placed, click on the Output Path button and select a folder. The folder where the input file resides is chosen by default. You must also provide a rootname for the outputted data. The string value you choose will be used as the first part of longer filenames automatically built by the tool during the conversion process. Since multiple files can be generated by a single conversion process, it is useful to choose an intuitive and descriptive rootname so data from the same input file can be easily grouped afterwards.

Note: With the exception of Level 1A datasets, all converted data produced by MCTK is stored in single precision floating point—regardless of original data type. This is done to store converted data in as few files as possible and, in general, does not result in any loss of precision. The exceptions are Quality Assurance / Quality Control (QA/QC) datasets, which can lose some precision during conversion. For those datasets, it is recommended that you set the "Use Double Precision" option to Yes. After conversion, recast the QA/QC data back to its original type (e.g., unsigned long integer) prior to examining individual bits.

A. Level 1A Uncalibrated Radiance

When a Level 1A Uncalibrated Radiance file is provided as input, you will be presented with several processing options. On the right side, you will see the four datasets stored inside of the HDF that contain image data at three spatial resolutions (250m, 500m, and 1000m). MCTK recognizes the fact that there are multiple resolutions within the file and displays them in the metadata window under Pixel Size. You can choose to output any combination of the available datasets, but each will be placed in a separate file due to how they are processed by the tool. Each output file will contain appropriate band number designations and wavelength values. After clicking on Process, you will see two ENVI progress bars: one related to the conversion of the current dataset and one related to the overall conversion process.

The tool also recognizes that Level 1A data does not contain georeferencing information (indicated by the Native Projection being set to None in the metadata viewer). However, if you have access to the related Geolocation product (MOD03/MYD03), you can use it to project the Level 1A data. To do so, select Projected or Standard and Projected under Output Type and then click on Input Geolocation File. You will be prompted to supply an appropriate file. A filter is provided to aid you in finding the correct product and the current Level 1A filename will show up in the title bar of the file selection dialog. In order to proceed, the second, third and fourth sections of the Level 1A filename and geolocation filename have to match. For example, a Level 1A file with the name "MYD01.A2006007.0300.005.2007078081622.hdf" requires a geolocation file with the name "MYD03.A2006007.0300.005.2006125230829.hdf." If the supplied filenames do not match, the projection options section will be greyed out and you will not be allowed to proceed with the conversion. If the filenames do match, the most appropriate UTM zone for the supplied data is automatically calculated and made available (Figure 3). Please note that for scenes in polar regions, Universal Polar Stereographic (UPS) will be selected instead. Standard resampling methods (Nearest Neighbor, Bilinear, and Cubic Convolution) are available. Bowtie correction is performed automatically. Output pixel size is automatically determined based on product type and dataset. For projections that do not use meters, the meter-based pixel size is automatically converted to one that is appropriate. You also have the option of providing your own fill value to use during the conversion process and your own background value to use during the projection process. The default value for both is 0. If a value less than zero is provided, zero is used instead. Note: An alternative pixel size can be provided through the programmatic interface.

Filenames for converted data

For Level 1A files, two types of filenames are possible. They are constructed as follows:

- Rootname + Dataset Name + Raw_DN.img (unprojected data)
- Rootname + Dataset Name + Raw_DN_georef.img (projected data)

A Note on Output Type

Because MCTK is a conversion utility, you will always receive at least one ENVI format file as output. If you choose to output projected data using the Projected or Standard and Projected option, two sets of output files will be generated. The first set is unprojected (Standard) and is used to create the second set (Projected). The difference between the two options is that when you choose Projected, the first set of files (Standard) is deleted once the projection process is complete.

A Note on Projecting 250m Data

In order to perform bowtie correction on 250m data, you must change your Image Tile Size in the ENVI Preferences dialog (under Miscellaneous) to a value of at least 10.0 MB. If this is not done, you will likely receive an error message stating that the interpolation method did not have enough data to successfully carry out the correction.

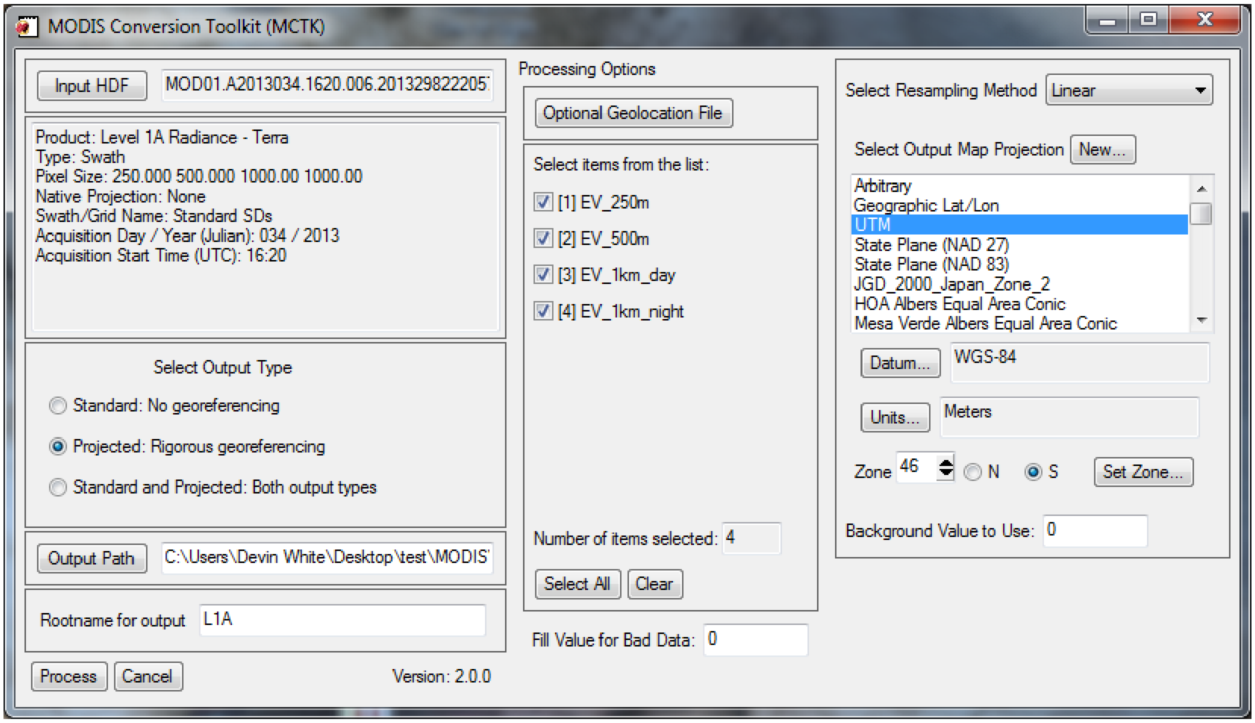


Figure 3. MCTK with a Level 1A file supplied as input, along with a matching geolocation file.

B. Level 1B Calibrated Radiance

When a Level 1B Calibrated Radiance file is provided as input, you will be presented with several processing options that will vary depending on the product you are working with. In all cases, you will have the option to output projected data using the internal 1km-resolution geolocation fields in a fashion similar to that for Level 1A data (see above discussion). You do not need to supply a matching MOD03/MYD03 geolocation file, but you can, if desired, using the same process outlined above for Level 1A. For a MOD02QKM file there is only one possible dataset to select for output, but multiple datasets are available for MOD02HKM, MOD021KM, and MOD02SSH. Output will always be consolidated into one file (before projection takes place) due to the fact that the spatial resolutions are the same for each dataset within a file. Appropriate band numbers and wavelengths will be attached to the output file as well. If you want to project MOD02QKM data, please refer to the above note regarding 250m Level 1A data. Apart from georeferencing and dataset selection options, MCTK also gives you the ability to choose which type of calibration to perform on the stored data (see Figure 4): radiance & emissivity, TOA reflectance & emissivity, or radiance and brightness temperature. Radiance is returned in units of W/m^2/µm/sr, reflectance is returned as unitless values between 0.0 and 1.0, and brightness temperature is returned in degrees Kelvin. Brightness temperature values are calculated using IDL code provided by Liam Gumley, Space Science and Engineering Center, University of Wisconsin-Madison. Calibration for emissivity data is only carried out on 1km products that contain an emissive dataset. You also have the option of providing your own fill value to use during the conversion process and your own background value to use during the projection process. These values can be specified as integer or floating point and the default value for both is NaN (not a number).

Filenames for converted data

For Level 1B files, two types of filenames are possible. They are constructed as follows:

- Rootname + Calibration Method + .img (unprojected data)
- Rootname + Calibration Method + georef.img (projected data)

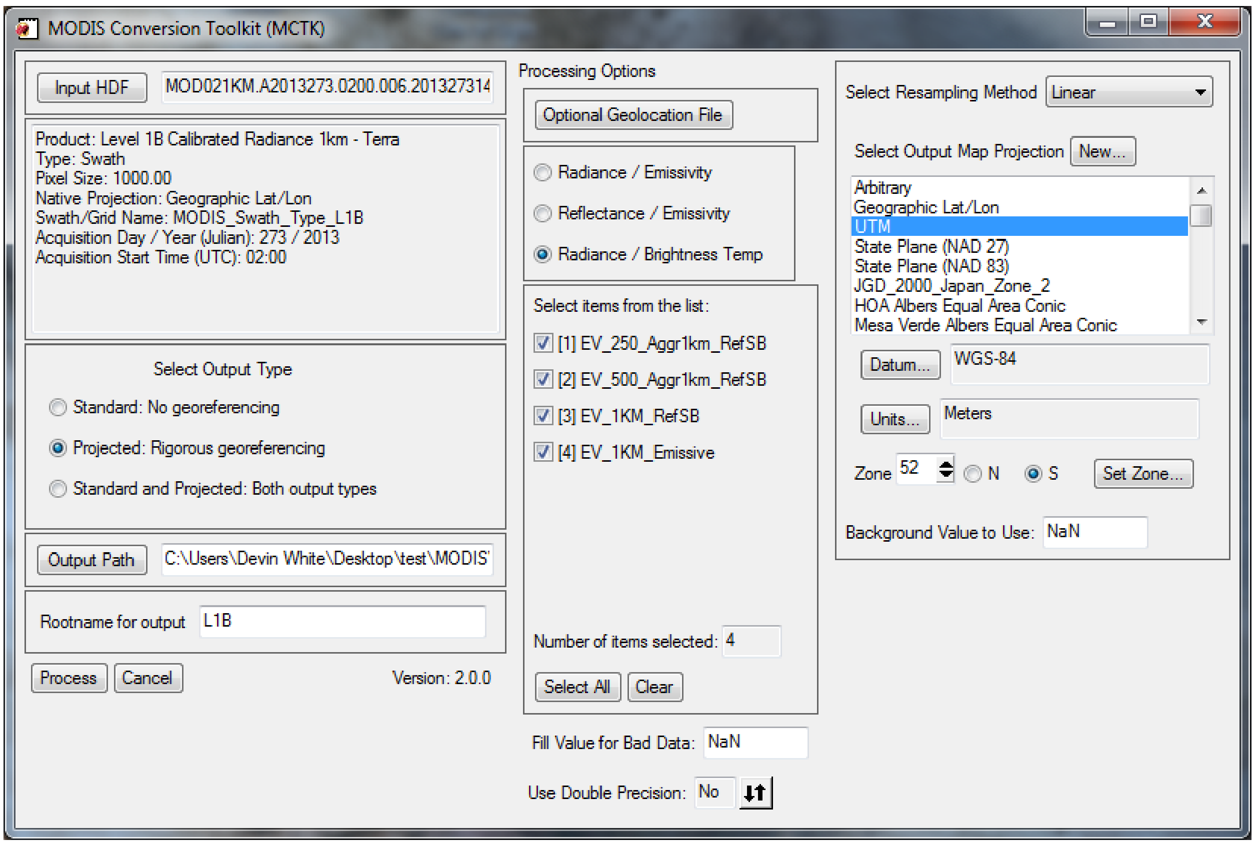


Figure 4. MCTK with a Level 1B file supplied as input (MOD021KM). Multiple datasets have been selected for georeferenced output, Reflectance / Brightness Temp has been chosen as the calibration method.

C. Level 2 Swath

When a Level 2 Swath file is provided as input, the available output options will be very similar to those for Level 1B files. However, there are a few important exceptions related to available datasets and converted output. As with Level 1A/B files, you will be presented with a list of datasets contained within the file that can be processed. The list is determined by scanning all datasets present in the file and determining which ones contain data that are stored in at least two dimensions (Figure 5). The dimensionality of each dataset appears to the left of the dataset name in the list (2D or 3D). If scale and offset factors are present for a particular dataset, they are automatically applied during the conversion process. Depending on the datasets chosen and the number of spatial resolutions present, you may receive multiple output files. Datasets are grouped by spatial resolution and dimensionality prior to processing. For example, if you are working with MOD05_L2 (Precipitable Water), datasets exist at both 1000m and 5000m spatial resolutions and in two and three dimensions. All two dimensional data at 1000m are grouped into one multiband output file, where each band name is the name of an individual dataset. Each three dimensional dataset at 1000m receives its own output file. The process is then repeated for 5000m datasets. The filenames automatically generated by MCTK will reflect this process. You also have the option of providing your own fill value to use during the conversion process and your own background value to use during the projection process. These values can be specified as integer or floating point and the default value for both is NaN (not a number). As with Level 1A and Level 1B swaths, an MOD03/MYD03 geolocation file can be supplied, if desired. This is especially useful for MOD14 datasets, which are not distributed with internal geolocation bands.

Filenames for converted data

For Level 2 Swath files, two types of filenames are possible. They are constructed as follows:

- Rootname + Swath + Dimensionality + Resolution Index + Output File Number + .img (unprojected data)
- Rootname + Swath + Dimensionality + Resolution Index + Output File Number + georef.img (projected data)

where Dimensionality will be 2D or 3D, Resolution Index is an incremented value from 1 to the total number of spatial resolutions present (starting with the highest resolution), and Output File Number is an incremented value from 1 to the total number of files outputted for a particular dimensionality within a particular spatial resolution. There is currently no way within MCTK to tell which datasets will map to a particular spatial resolution prior to starting the conversion process.

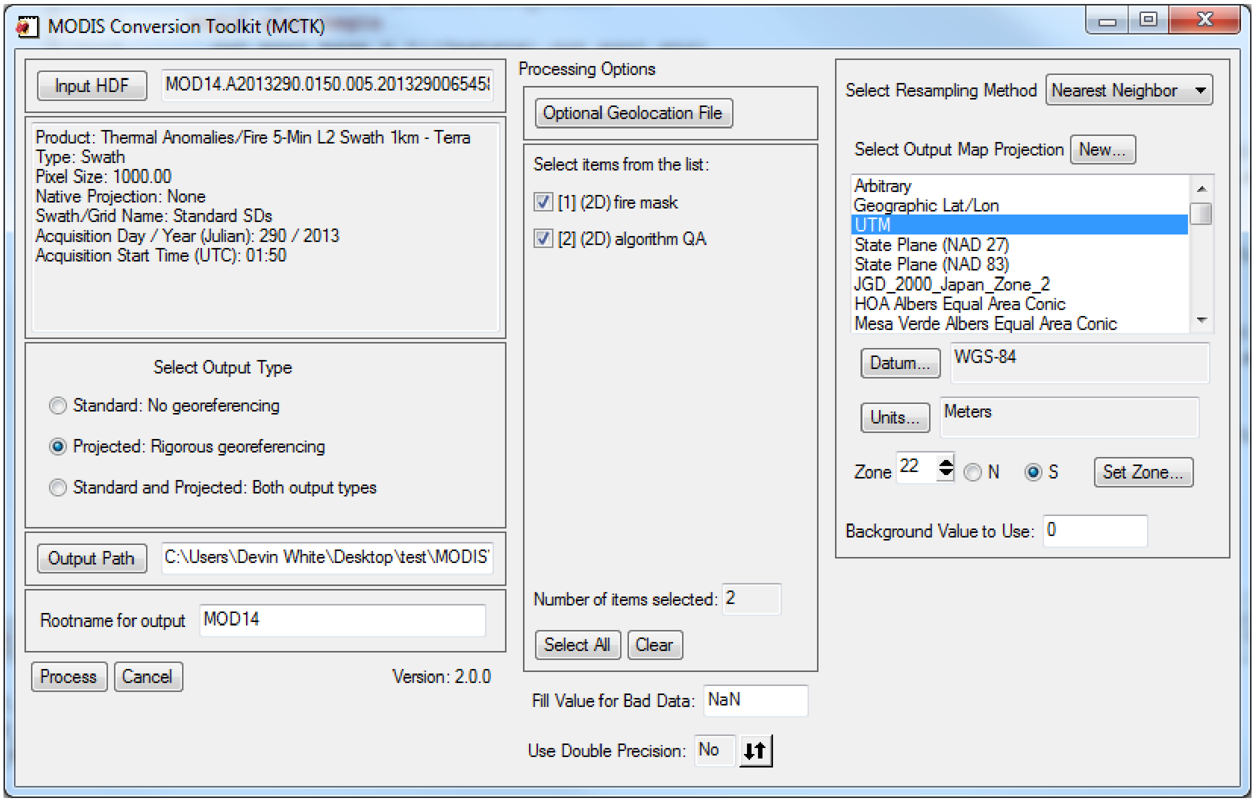


Figure 5. MCTK with a MOD14 Level 2 Swath file supplied as input. Multiple datasets have been selected for processing. Beginning with MCTK 2.0.0, MOD14 can be projected like any other swath by supplying an external geolocation file (MOD03/MYD03).

D. Level 2/3/4 Grid

When a Level 2G, Level 3 or Level 4 Grid file is provided as input, you may encounter an additional dialog which will prompt you to select which grid to process (Figure 6). While the occurrence of multiple grids within a file is rare, it can happen.

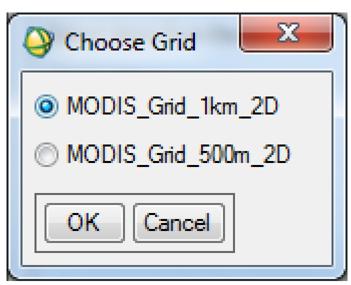


Figure 6. When inputting a file that contains more than one grid,
you will automatically be prompted to select which one to process.

Once a grid is selected, the output options are almost identical to those for Level 2 Swath data. There are two major differences. First, grid data are already projected, so Standard output will use the native map information stored in the HDF file (usually Sinusoidal or Geographic Lat/Lon, but EASE Grid is also supported for NSIDC datasets). As a result of this fact, the usual Projected option is listed as Reprojected and gives you the chance to put your data in another map projection. This is a common practice with Sinusoidal data, which is generally put into Geographic Lat/Lon or UTM. When the Reprojected option is chosen, the map projection output options will show up with Geographic Lat/Lon chosen by default (Figure 7). As with swath datasets, an appropriate output pixel size is automatically calculated in the correct units, based on the input pixel size for the product (usually meters). If you change the output projection, the pixel size is automatically recalculated. If desired, an alternative pixel size can be provided through the programmatic interface. Note that if the grid’s native projection is Geographic Lat/Lon, that projection is still the default Reprojection option. Choosing to reproject using the default values in this case will essentially create the same output as choosing Standard. You also have the option of providing your own fill value to use during the conversion process and your own background value to use during the reprojection process. These values can be specified as integer or floating point and the default value for both is NaN (not a number).

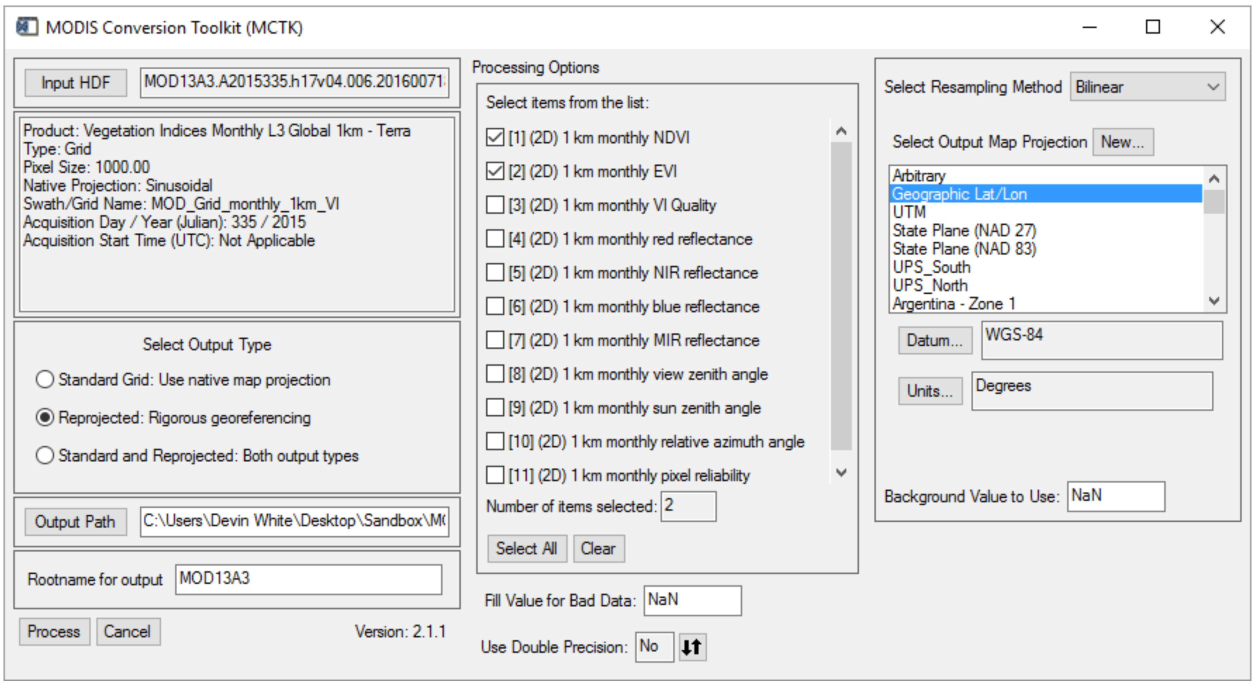


Figure 7. MCTK with a higher level grid file supplied as input. Multiple datasets are selected for processing and the reprojection option is set for Geographic Lat/Lon.

Beginning with version 2.0.0, MCTK no longer requires you to select the number of grid points to use for reprojection. That is because a rigorous option is now employed, one that considers each pixel individually instead of relying on bulk processing estimates via triangulation. It is much more accurate, but does require a bit more computation.

Filenames for converted data

For Level 2G, Level 3 and Level 4 Grid files, four types of filenames are possible. They are constructed as follows:

- Rootname + Grid + Dimensionality + Output File Number + .img (unprojected 2D or 3D data)
- Rootname + Swath + Dimensionality + Output File Number + reprojected.img (projected 2D or 3D data)

- Rootname + Grid + Dimensionality + Dataset Index + Dimension Index + .img (unprojected 4D data)
- Rootname + Swath + Dimensionality + Dataset Index + Dimension Index + reprojected.img (projected 4D data)

where Dimensionality will be 2D, 3D, or 4D; Dimension Index is an incremented value from 1 to the total number of "bands" in the fourth dimension (each one maps to a 3D data cube); Output File Number is an incremented value from 1 to the total number of files outputted for 2D and 3D datasets; and Dataset Index is an incremented value from 1 to the total number of 4D datasets chosen for output. The naming convention for 4D output is potentially headache-inducing due to the complexities of the HDF file structure for that type of data, so an example would be as follows. If you inputted a MOD43B3 file, selected both the 4D "Albedo" dataset and 3D "Albedo_Quality" dataset for conversion, provided "albedo" as your rootname, and opted to reproject the converted data, the resulting files would look like this:

albedo_Grid_4D_1_1_reprojected.img (first 4D dataset, first 3D cube of data)
albedo_Grid_4D_1_2_reprojected.img (first 4D dataset, second 3D cube of data)
albedo_Grid_3D_1_reprojected.img (first 3D dataset)

Since ENVI cannot handle 4D datasets, they are broken down into more manageable 3D cubes. In this example, the original 4D dataset had dimensions of 1200x1200x10x2, so two 3D datasets were generated—each one consisting of a 1200x1200x10 cube. A 4D dataset with dimensions of 1200x1200x10x20 would result in 20 3D cubes (and 20 output files).

V. Converting MODIS data programmatically in ENVI using MCTK

All of MCTK's functionality is programmatically available. The interactive version is simply a way to gather information about the inputted file and assist the user with selecting the data they want to output and how the output should be handled. Once all of this information is collected by the widget, it is handed off to the same processing routine discussed here (CONVERT_MODIS_DATA). The processing routine can be called like any other IDL procedure as long as both mctk.sav and modis_products.scsv are in your ENVI save_add or extensions folder. There are many keywords associated with the procedure, but not all of them are required for every type of MODIS data. Consult the keyword definitions and example programs on the following pages to determine which ones you will need to use. Multiple file conversion must be carried out one file at a time, so running CONVERT_MODIS_DATA on multiple files will require the construction of a FOR loop that passes each file of interest into the routine sequentially.

Beginning with version 2.0.0, the API for MCTK has been substantially simplified. If you have already developed applications against the original API, please carefully review the following documentation and make adjustments to your code as needed. In the examples below, please note the use of two new helper routines, MCTK_CREATE_BRIDGES and MCTK_DESTROY_BRIDGES, which work with the multithreaded swath projection engine to speed up processing.

CONVERT_MODIS_DATA

Syntax

CONVERT_MODIS_DATA [,IN_FILE=*string*] [,OUT_PATH=*string*] [,OUT_ROOT=*string*] [,SWT_NAME=*string*] [,GD_NAME=*string*] [,SD_NAMES=*string array*] [,OUT_METHOD={0 | 1 | 2}] [,GEOLOC_FILE=*string*] [,OUT_PROJ=*ENVI projection structure*] [,OUT_PS =*double array*] [,INTERP_METHOD={0 | 1 | 2}] [,CALIB_METHOD={0 | 1 | 2}] [,SD_POS=*integer array*] [,/NO_MSG] [,BACKGROUND=*integer or float*] [,FILL_REPLACE_VALUE=*integer or float*] [,R_FID_ARRAY=*variable*] [,R_FNAME_ARRAY=*variable*] [,/USE_DOUBLE] [,/DEFAULT_UTM] [,BRIDGES=*object array*] [,MSG=*variable*] [,/PROGRESS]

Keywords

IN_FILE

Use this keyword to specify the name and path of the MODIS file. IN_FILE is a string variable that ENVI will use to open the MODIS file for reading.

OUT_PATH

Use this keyword to specify a string with the output path for the resulting converted data. The specified string must end with the appropriate path separation character for your operating system ("\" for Windows, "/" for UNIX, Linux, and Mac).

OUT_ROOT

Use this keyword to specify a string that will be used in building filenames for the resulting converted data. The specified value will appear at the beginning of generated filenames.

SWT_NAME (optional)

Use this keyword to specify a string that contains the *exact* name of the EOS swath from which data will be extracted (it is also case sensitive). This keyword is ignored unless a Level 2 swath dataset is provided. It is not necessary to supply the swath name for MOD14 datasets.

GD_NAME (optional)

Use this keyword to specify a string that contains the *exact* name of the EOS grid from which data will be extracted (it is also case sensitive). This keyword is ignored unless a grid dataset is provided.

SD_NAMES (optional)

Use this keyword to specify a string array that contains the *exact* names of the datasets to extract from the provided MODIS file (it is also case sensitive). This keyword is ignored unless a Level 2 swath dataset or a grid dataset is supplied.

OUT_METHOD (optional)

Set this keyword to one of the following values to specify the output method to use when converting data.

- 0 — Standard (no projection/reprojection is carried out, one set of output files)
- 1 — Projected (rigorous projection/reprojection is carried out, one set of output files)
- 2 — Standard and Projected (two sets of output files)

GEOLOC_FILE (optional)

Use this keyword to specify the name and path of the MODIS Geolocation file (MOD03/MYD03) you want to use for projecting Level 1A, Level 1B, or Level 2 swath data. This keyword is ignored unless a swath dataset is provided. It is only required for Level 1A and MOD14 datasets. All other swaths contain at least coarse geolocation bands.

OUT_PROJ (optional)

Use this keyword to specify the map projection to use when projecting/reprojecting data. OUT_PROJ is a projection structure returned from ENVI_GET_PROJECTION or ENVI_PROJ_CREATE. If the DEFAULT_UTM keyword is set, OUT_PROJ is ignored.

OUT_PS (optional)

Set this keyword to a two-element double-precision array containing the X and Y pixel sizes of the output image. You should specify the pixel sizes in the units contained in the projection structure passed via the OUT_PROJ keyword or set by the DEFAULT_UTM keyword. This keyword is ignored for Level 1A swath datasets and its use with all other swath datasets is strongly discouraged.

CALIB_METHOD (optional)

Set this keyword to one of the following values to specify which calibration method to use when converting Level 1B Radiance data.

- 0 — Radiance / Emissivity

- 1 — Reflectance / Emissivity
- 2 — Radiance / Brightness Temperature

This keyword is ignored unless a Level 1B file is provided.

SD_POS (optional)

Use this keyword to specify which datasets within a Level 1A Uncalibrated Radiance file or Level 1B Calibrated Radiance file to process. The datasets are specified by providing an integer array to the procedure using the following positional values, which are different for each spatial resolution.

Product: MOD01 / MYD01 (250m, 500m, 1000m)
Datasets: EV_250m, EV_500m, EV_1km_day, EV_1km_night
Array: [0, 1, 2 ,3]

Product: MOD02QKM / MYD02QKM (250m)
Datasets: EV_250_RefSB
Array: [0]

Product: MOD02HKM / MYD02HKM (500m)
Datasets: EV_250_Aggr500_RefSB, EV_500_RefSB
Array: [0,1]

Product: MOD021KM / MYD021KM (1000m)
Datasets: EV_250_Aggr1km_RefSB, EV_500_Aggr1km_RefSB, EV_1KM_RefSB, EV_1KM_Emissive
Array: [0, 1, 2, 3]

Product: MOD02SSH / MYD02SSH (5000m)
Datasets: EV_250_Aggr1km_RefSB, EV_500_Aggr1km_RefSB, EV_1KM_RefSB, EV_1KM_Emissive
Array: [0, 1, 2, 3]

For example, to process only the "EV_500_Aggr1km_RefSB" and "EV_1KM_Emissive" datasets for a MOD021KM file, the array would be [1, 3]. NOTE: array values *must* be specified in ascending order from left to right. This keyword is ignored unless a Level 1A or Level 1B file is provided.

INTERP_METHOD (optional)

Set this keyword to one of the following values to specify the resampling method to use with the rigorous projection/reprojection process.
.

- 0 — Nearest neighbor
- 1 — Bilinear
- 2 — Cubic convolution

The values of 6, 7, and 8 that were used in the original API are no longer valid.

/NO_MSG (optional)

Set this keyword to suppress the display of the lat/lon geofields interpolation status window during the swath projection process. Window suppression is useful when processing large numbers of files in non-interactive batch mode. This keyword is ignored unless a swath file is supplied.

BACKGROUND (optional)

Use this keyword to specify the value for all background pixels that result from a projection or reprojection process. The default is 0 for Level 1A and NaN for all other products. The value can be specified as an integer or floating point number. If a value less than zero is supplied for Level 1A data, zero will be used instead.

FILL_REPLACE_VALUE (optional)

Use this keyword to specify the fill value to use when the toolkit encounters a pixel flagged as a "fill" or "bad data" within the original dataset. This is a common occurrence with Level 2, 3, and 4 data. The default is 0 for Level 1A and NaN for all other products. The value can be specified as an integer or floating point number. If a value less than zero is supplied for Level 1A data, zero will be used instead.

R_FID_ARRAY (optional)

Use this keyword to specify the name of a variable that, upon completion of calling CONVERT_MODIS_DATA, will contain the ENVI File IDs (FIDs) for every generated output file, in the order in which they were generated. Note: If you choose to output both standard and projected/reprojected products, FIDs are returned in ordered pairs as follows: [standard_1, projected_1, standard_2, projected_2,…]. The order used is the same as for R_FNAME_ARRAY. If the conversion process fails, the first element in the array will be -1. In that case, the MSG keyword can be used to retrieve the associated error message.

R_FNAME_ARRAY (optional)

Use this keyword to specify the name of a variable that, upon completion of calling CONVERT_MODIS_DATA, will contain the fully qualified filenames for every generated output file, in the order in which they were generated. Note: If you choose to output both standard and projected/reprojected products, filenames are returned in ordered pairs as follows: [standard_1, projected_1, standard_2, projected_2,…]. The order used is the same as for R_FID_ARRAY. If the conversion process fails, the first element in the array will be a null string. In that case, the MSG keyword can be used to retrieve the associated error message.

USE_DOUBLE (optional)

Set this keyword to indicate that you want MCTK to produce output in double precision floating point instead of single precision. This is usually not necessary unless you are converting Quality Assurance / Quality Control (QA/QC) datasets. It does not apply to L1A datasets.

DEAFULT_UTM (optional)

Set this keyword to indicate that you want MCTK to automatically determine a reasonable UTM zone to use during projection or reprojection. If this keyword is set, it is not necessary to supply an output projection via OUT_PROJ, but you will have to supply the output pixel sizes via OUT_PS. Please note that for swaths in polar regions, Universal Polar Stereographic (UPS) will be used instead.

BRIDGES (optional)

Use this keyword to provide an array of IDL-IDL Bridge objects if you want to take full advantage of the multithreaded swath projection engine. The array can be generated by calling the MCTK_CREATE_BRIDGES function and destroyed by calling the MCTK_DESTROY_BRIDGES procedure. Examples of how to use the routines can be found below. The array can and should be reused if you are going to convert multiple files. DO NOT CREATE AND DESTROY BRIDGES WITHIN A LOOP.

MSG (optional)

Use this keyword to provide a variable that, upon completion of a call to CONVERT_MODIS_DATA, will contain a message about any errors encountered. This should not be confused with the legacy NO_MSG keyword, which controls the behavior of the swath geofield interpolation popup window.

PROGRESS (optional)

Set this keyword to see progress bars during the conversion process.

EXAMPLES

```
;Level 1A example
pro test_batch_modis_conversion_level_1a
  compile_opt idl2
```

```
  modis_l1a_file = 'C:\MCTK_Input\MOD01.A2013034.1620.006.2013298222057.hdf'

  ;The specified output location MUST end in the appropriate path
  ;separator for your OS
  output_location = 'C:\MCTK_Output\'

  output_rootname = 'level_1a'

  ;Output method schema is:
  ;0 = Standard, 1 = Projected, 2 = Standard and Projected
  out_method = 1

  ;Specify MOD03/MYD03 file to use for georeferencing
  geoloc_file = 'C:\MCTK_Input\MOD03.A2013034.1620.006.2013035002707.hdf'

  output_projection = envi_proj_create(/geographic)

  ;Choosing linear interpolation
  interpolation_method = 1

  ;do not put the bridge creation/destruction code inside a loop
  bridges = mctk_create_bridges()

  convert_modis_data, in_file=modis_l1a_file, out_path=output_location, $
    out_root=output_rootname, out_method=out_method, $
    geoloc_file=geoloc_file, out_proj=output_projection, $
    interp_method=interpolation_method, $
    sd_pos=[0,1,2,3], /no_msg, r_fid_array=r_fid_array, $
    r_fname_array=r_fname_array, bridges=bridges, msg=msg

  mctk_destroy_bridges, bridges

end


;Level 1B example
pro test_batch_modis_conversion_level_1b
  compile_opt idl2

  modis_l1b_file = 'C:\MCTK_Input\MOD021KM.A2013273.0200.006.2013273140519.hdf'

  ;The specified output location MUST end in the appropriate path
  ;separator for your OS
  output_location = 'C:\MCTK_Output\'

  output_rootname = 'level_1b'

  ;Calibration method schema is:
  ;0 = Radiance / Emissivity, 1 = Reflectance / Emissivity, 2 = Radiance / Brightness
Temp
  calib_method = 2

  ;Output method schema is:
  ;0 = Standard, 1 = Projected, 2 = Standard and Projected
  out_method = 1

  output_projection = envi_proj_create(/geographic)

  ;do not put the bridge creation/destruction code inside a loop
  bridges = mctk_create_bridges()

  ;Choosing linear interpolation
  interpolation_method = 1
```

```
  convert_modis_data, in_file=modis_l1b_file, out_path=output_location, $
    out_root=output_rootname, out_method=out_method, $
    interp_method=interpolation_method, $
    out_proj=output_projection, calib_method=calib_method, $
    sd_pos=[1,3], /no_msg, background=0.0, r_fid_array=r_fid_array, $
    r_fname_array=r_fname_array, bridges=bridges, msg=msg

  mctk_destroy_bridges, bridges

end


;MOD14 example
pro test_batch_modis_conversion_mod14
  compile_opt idl2

  modis_mod14_file = 'C:\MCTK_Input\MOD14.A2013290.0150.005.2013290065458.hdf'

  ;The specified output location MUST end in the appropriate path
  ;separator for your OS
  output_location = 'C:\MCTK_Output\'

  output_rootname = 'fire_mask'

  sd_names = ['fire mask','algorithm QA']

  ;Since MOD14/MYD14 files have no geofields, georeferencing is
  ;not possible with this product unless you supply separate MOD03/MYD03 files
  out_method = 1
  geoloc_file = 'C:\MCTK_Input\MOD03.A2013290.0150.005.2013290074930.hdf'

  ;use nearest neighbor interpolation
  interpolation = 0

  ;do not put the bridge creation/destruction code inside a loop
  bridges = mctk_create_bridges()

  ;use default UTM projection
  convert_modis_data, in_file=modis_mod14_file, $
    out_path=output_location, out_root=output_rootname, $
    sd_names=sd_names, out_method=out_method, geoloc_file=geoloc_file, $
    /default_utm, interp_method=interpolation, r_fid_array=r_fid_array, $
    r_fname_array=r_fname_array, bridges=bridges, msg=msg

  mctk_destroy_bridges, bridges

end


;Level 2 swath example
pro test_batch_modis_conversion_l2_swath
  compile_opt idl2

  modis_swath_file = 'C:\MCTK_Input\MOD07_L2.A2013173.0710.006.2013173195131.hdf'

  ;The specified output location MUST end in the appropriate path
  ;separator for your OS
  output_location = 'C:\MCTK_Output\'

  output_rootname = 'atm_profile'

  swath_name = 'mod07'
```

```
  sd_names = ['Retrieved_Temperature_Profile','Total_Ozone','Water_Vapor']

  ;Output method schema is:
  ;0 = Standard, 1 = Projected, 2 = Standard and Projected
  out_method = 1

  output_projection = envi_proj_create(/geographic)

  ;Choosing nearest neighbor interpolation
  interpolation_method = 0

  ;do not put the bridge creation/destruction code inside a loop
  bridges = mctk_create_bridges()

  convert_modis_data, in_file=modis_swath_file, $
    out_path=output_location, out_root=output_rootname, $
    swt_name=swath_name, sd_names=sd_names, $
    out_method=out_method, out_proj=output_projection, $
    interp_method=interpolation_method, /no_msg, $
    r_fid_array=r_fid_array, r_fname_array=r_fname_array, $
    bridges=bridges, msg=msg

  mctk_destroy_bridges, bridges

end


;Grid example
pro test_batch_modis_conversion_grid
  compile_opt idl2

  modis_grid_file = 'C:\MCTK_Input\MOD09GA.A2014108.h17v06.005.2014110053957.hdf'

  ;The specified output location MUST end in the appropriate path
  ;separator for your OS
  output_location = 'C:\MCTK_Output\'

  output_rootname = 'surf_refl'

  grid_name = 'MODIS_Grid_500m_2D'

  sd_names = ['sur_refl_b01_1','sur_refl_b02_1','sur_refl_b03_1',$
    'sur_refl_b04_1','sur_refl_b05_1','sur_refl_b06_1','sur_refl_b07_1']

  ;Output method schema is:
  ;0 = Standard, 1 = Reprojected, 2 = Standard and reprojected
  out_method = 1

  output_projection = envi_proj_create(/geographic)

  ;OPTIONALLY specify the output X and Y pixel sizes in double precision floating
  ;point. Sizes must be in units relevant to selected output projection
  ;(degrees in this example).
  out_ps = [0.004187d,0.004187d]

  ;Choosing cubic convolution interpolation.
  interpolation_method = 2

  ;Set reprojection background and any native fill values to NaN
  nan_fill = float('NaN')
  convert_modis_data, in_file=modis_grid_file, $
    out_path=output_location, out_root=output_rootname, $
```

```
    gd_name=grid_name, sd_names=sd_names, $
    out_method=out_method, out_proj=output_projection, $
    out_ps=out_ps, interp_method=interpolation_method, $
    background=nan_fill, fill_replace_value=nan_fill, $
    r_fid_array=r_fid_array, r_fname_array=r_fname_array, $
    msg=msg

end
```

VI. Supported MODIS Products

SYMBOL	SENSOR	LEVEL	TYPE	NAME	GSD
MCD12C1	Combined	3	G	Land Cover Type Yearly L3 Global 0.05Deg CMG	0.05
MCD12Q1	Combined	3	G	Land Cover Type Yearly L3 Global 500m	500.00
MCD12Q2	Combined	3	G	Land Cover Dynamics Yearly L3 Global 1km	1000.00
MCD15A2	Combined	4	G	Leaf Area Index - Fraction of Photosynthetically Active Radiation 8-Day L4 Global 1km	1000.00
MCD15A2H	Combined	4	G	Leaf Area Index/FPAR 8-Day L4 Global 500 m SIN Grid	500.00
MCD15A3	Combined	4	G	Leaf Area Index - Fraction of Photosynthetically Active Radiation 4-Day L4 Global 1km	1000.00
MCD15A3H	Combined	4	G	Leaf Area Index/FPAR 4-Day L4 Global 500 m SIN Grid	500.00
MCD19A1	Combined	2G	G	MAIAC Land Surface BRF Daily L2G Global 500m and 1km SIN Grid	1000.00,500.00,5000.00
MCD19A2	Combined	2G	G	MAIAC Land Aerosol Optical Depth Daily L2G 1km SIN Grid	1000.00,5000.00
MCD43A1	Combined	3	G	BRDF/Albedo Model Parameters 16-Day L3 Global 500m	500.00
MCD43A2	Combined	3	G	BRDF/Albedo Quality 16-Day L3 Global 500m	500.00
MCD43A3	Combined	3	G	Albedo 16-Day L3 Global 500m - Combined	500.00
MCD43A4	Combined	3	G	Nadir BRDF-Adjusted Reflectance 16-Day L3 Global 500m	500.00
MCD43B1	Combined	3	G	BRDF/Albedo Model Parameters 16-Day L3 Global 1km	1000.00
MCD43B2	Combined	3	G	BRDF/Albedo Quality 16-Day L3 Global 1km	1000.00
MCD43B3	Combined	3	G	Albedo 16-Day L3 Global 1km	1000.00
MCD43B4	Combined	3	G	Nadir BRDF-Adjusted Reflectance 16-Day L3 Global 1km	1000.00
MCD43C1	Combined	3	G	BRDF/Albedo Parameters 16-Day L3 0.05Deg CMG	0.05
MCD43C2	Combined	3	G	BRDF/Albedo Snow-Free Quality 16-Day L3 Global 0.05Deg CMG	0.05
MCD43C3	Combined	3	G	Albedo 16-Day L3 Global 0.05Deg CMG	0.05
MCD43C4	Combined	3	G	Nadir BRDF-Adjusted Reflectance 16-Day L3 0.05Deg CMG	0.05
MCD43D01	Combined	3	G	BRDF/Albedo Parameter 1 Band 1 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D02	Combined	3	G	BRDF/Albedo Parameter 2 Band 1 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D03	Combined	3	G	BRDF/Albedo Parameter 3 Band 1 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D04	Combined	3	G	BRDF/Albedo Parameter 1 Band 2 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D05	Combined	3	G	BRDF/Albedo Parameter 2 Band 2 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D06	Combined	3	G	BRDF/Albedo Parameter 3 Band 2 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D07	Combined	3	G	BRDF/Albedo Parameter 1 Band 3 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D08	Combined	3	G	BRDF/Albedo Parameter 2 Band 3 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D09	Combined	3	G	BRDF/Albedo Parameter 3 Band 3 Daily L3 Global 30 ArcSec CMG	1000.00

MCD43D10	Combined	3	G	BRDF/Albedo Parameter 1 Band 4 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D11	Combined	3	G	BRDF/Albedo Parameter 2 Band 4 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D12	Combined	3	G	BRDF/Albedo Parameter 3 Band 4 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D13	Combined	3	G	BRDF/Albedo Parameter 1 Band 5 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D14	Combined	3	G	BRDF/Albedo Parameter 2 Band 5 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D15	Combined	3	G	BRDF/Albedo Parameter 3 Band 5 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D16	Combined	3	G	BRDF/Albedo Parameter 1 Band 6 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D17	Combined	3	G	BRDF/Albedo Parameter 2 Band 6 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D18	Combined	3	G	BRDF/Albedo Parameter 3 Band 6 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D19	Combined	3	G	BRDF/Albedo Parameter 1 Band 7 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D20	Combined	3	G	BRDF/Albedo Parameter 2 Band 7 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D21	Combined	3	G	BRDF/Albedo Parameter 3 Band 7 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D22	Combined	3	G	BRDF/Albedo Parameter 1 VIS Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D23	Combined	3	G	BRDF/Albedo Parameter 2 VIS Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D24	Combined	3	G	BRDF/Albedo Parameter 3 VIS Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D25	Combined	3	G	BRDF/Albedo Parameter 1 NIR Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D26	Combined	3	G	BRDF/Albedo Parameter 2 NIR Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D27	Combined	3	G	BRDF/Albedo Parameter 3 NIR Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D28	Combined	3	G	BRDF/Albedo Parameter 1 Shortwave Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D29	Combined	3	G	BRDF/Albedo Parameter 2 Shortwave Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D30	Combined	3	G	BRDF/Albedo Parameter 3 Shortwave Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D31	Combined	3	G	BRDF/Albedo QA BRDFQuality Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D32	Combined	3	G	BRDF/Albedo Local Solar Noon Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D33	Combined	3	G	BRDF/Albedo ValidObs Band 1 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D34	Combined	3	G	BRDF/Albedo ValidObs Band 2 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D35	Combined	3	G	BRDF/Albedo ValidObs Band 3 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D36	Combined	3	G	BRDF/Albedo ValidObs Band 4 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D37	Combined	3	G	BRDF/Albedo ValidObs Band 5 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D38	Combined	3	G	BRDF/Albedo ValidObs Band 6 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D39	Combined	3	G	BRDF/Albedo ValidObs Band 7 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D40	Combined	3	G	BRDF/Albedo QA SnowStatus Daily L3 Global 30 ArcSec CMG	1000.00

MCD43D41	Combined	3	G	BRDF/Albedo Uncertainty Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D42	Combined	3	G	BRDF/Albedo BSA Band 1 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D43	Combined	3	G	BRDF/Albedo BSA Band 2 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D44	Combined	3	G	BRDF/Albedo BSA Band 3 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D45	Combined	3	G	BRDF/Albedo BSA Band 4 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D46	Combined	3	G	BRDF/Albedo BSA Band 5 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D47	Combined	3	G	BRDF/Albedo BSA Band 6 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D48	Combined	3	G	BRDF/Albedo BSA Band 7 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D49	Combined	3	G	BRDF/Albedo BSA Vis Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D50	Combined	3	G	BRDF/Albedo BSA Nir Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D51	Combined	3	G	BRDF/Albedo BSA ShortWave Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D52	Combined	3	G	BRDF/Albedo WSA Band 1 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D53	Combined	3	G	BRDF/Albedo WSA Band 2 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D54	Combined	3	G	BRDF/Albedo WSA Band 3 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D55	Combined	3	G	BRDF/Albedo WSA Band 4 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D56	Combined	3	G	BRDF/Albedo WSA Band 5 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D57	Combined	3	G	BRDF/Albedo WSA Band 6 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D58	Combined	3	G	BRDF/Albedo WSA Band 7 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D59	Combined	3	G	BRDF/Albedo WSA Vis Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D60	Combined	3	G	BRDF/Albedo WSA NIR Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D61	Combined	3	G	BRDF/Albedo WSA ShortWave Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D62	Combined	3	G	BRDF/Albedo NBAR Band 1 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D63	Combined	3	G	BRDF/Albedo NBAR Band 2 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D64	Combined	3	G	BRDF/Albedo NBAR Band 3 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D65	Combined	3	G	BRDF/Albedo NBAR Band 4 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D66	Combined	3	G	BRDF/Albedo NBAR Band 5 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D67	Combined	3	G	BRDF/Albedo NBAR Band 6 Daily L3 Global 30 ArcSec CMG	1000.00
MCD43D68	Combined	3	G	BRDF/Albedo NBAR Band 7 Daily L3 Global 30 ArcSec CMG	1000.00
MCD45A1	Combined	3	G	Burned Area Monthly L3 Global 500m	500.00
MOD01	Terra	1A	S	Level 1A Radiance	250.00,500.00,1000.00,1000.00
MOD021KM	Terra	1B	S	Level 1B Calibrated Radiance 1km	1000.00

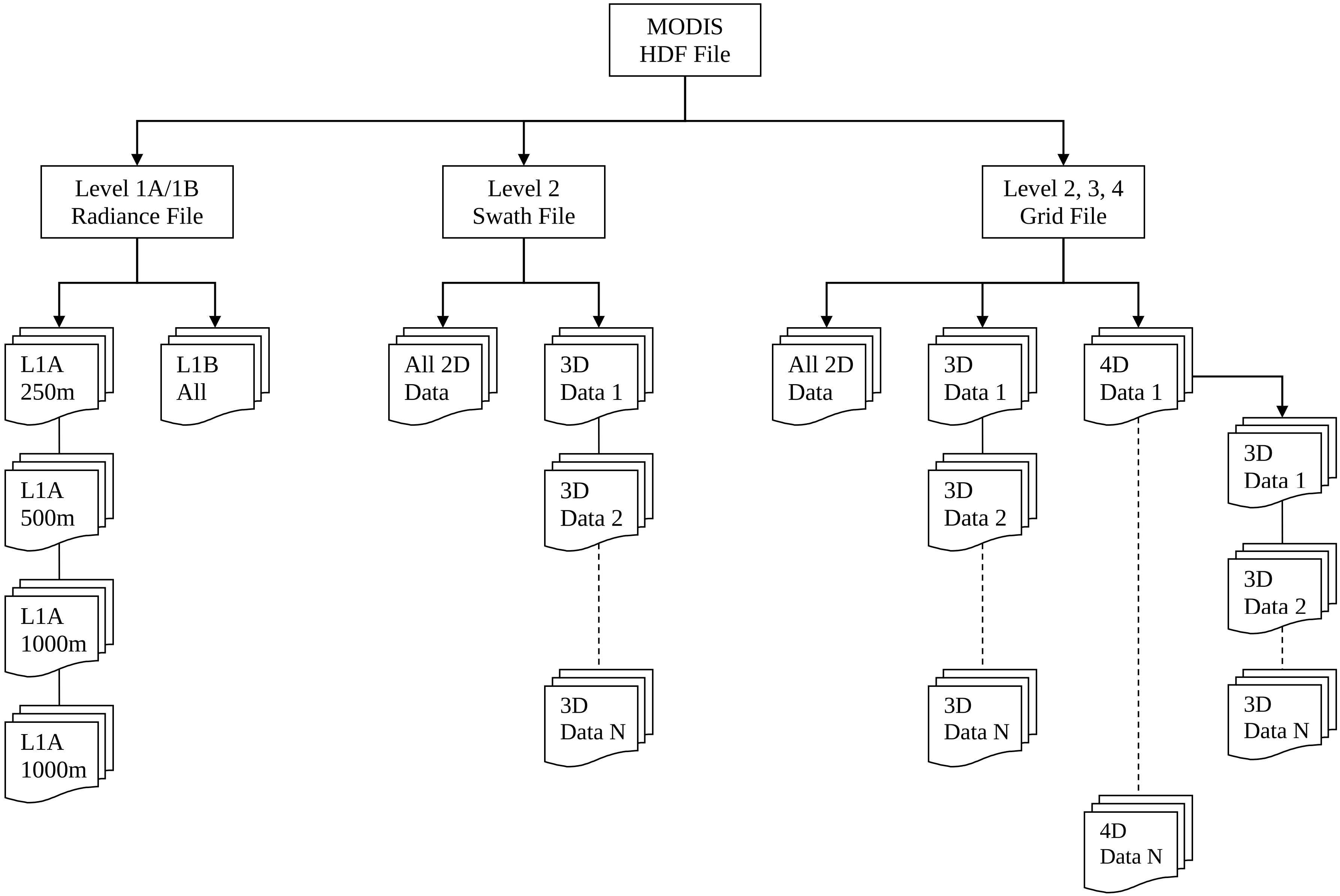
MOD02HKM	Terra	1B	S	Level 1B Calibrated Radiance 500m	500.00
MOD02QKM	Terra	1B	S	Level 1B Calibrated Radiance 250m	250.00
MOD02SSH	Terra	1B	S	Level 1B Calibrated Radiance 5km	5000.00
MOD03	Terra	1X	S	Geolocation Fields 1km	1000.00
MOD04_3K	Terra	2	S	Aerosol Product 3km	3000.00
MOD04_L2	Terra	2	S	Aerosol Product	1000.00
MOD05_L2	Terra	2	S	Precipitable Water	1000.00,5000.00
MOD06_L2	Terra	2	S	Cloud Product	1000.00
MOD07_L2	Terra	2	S	Atmospheric Profile	1000.00
MOD08_D3	Terra	3	G	Atmosphere Daily Global Product	1.00
MOD08_E3	Terra	3	G	Atmosphere Eight-Day Global Product	1.00
MOD08_M3	Terra	3	G	Atmosphere Monthly Global Product	1.00
MOD09	Aqua	2	S	Level 2 5-Min Land Surface Reflectance - 250m, 500m, 1km	250.00,500.00,1000.00
MOD09A1	Terra	3	G	Surface Reflectance 8-Day L3 Global 500m	500.00
MOD09CMG	Terra	3	G	Surface Reflectance Daily L3 Global 0.05Deg CMG	0.05
MOD09GA	Terra	2G	G	Surface Reflectance Daily L2G Global 1km and 500m SIN Grid	1000.00,500.00
MOD09GHK	Terra	2G	G	Surface Reflectance Daily L2G Global 500m	500.00
MOD09GQ	Terra	2G	G	Surface Reflectance Daily L2G Global 250m SIN Grid	250.00
MOD09GQK	Terra	2G	G	Surface Reflectance Daily L2G Global 250m	250.00
MOD09GST	Terra	2G	G	Surface Reflectance Quality Daily L2G	1000.00
MOD09Q1	Terra	3	G	Surface Reflectance 8-Day L3 Global 250m	250.00
MOD10_L2	Terra	2	S	Snow Cover 5-Min L2 Swath 500m	500.00
MOD10A1	Terra	3	G	Snow Cover Daily L3 Global 500m SIN Grid	500.00
MOD10A2	Terra	3	G	Snow Cover 8-Day L3 Global 500m SIN Grid	500.00
MOD10C1	Terra	3	G	Snow Cover CMG Daily L3 Global Product 0.05Deg	0.05
MOD10C2	Terra	3	G	Snow Cover 8-Day L3 Global 0.05Deg CMG	0.05
MOD10CM	Terra	3	G	Snow Cover CMG Monthly L3 Global Product 0.05Deg	0.05
MOD11_L2	Terra	2	S	Land Surface Temperature/Emissivity Daily 5-Min L2 Swath 1km	1000.00
MOD11A1	Terra	3	G	Land Surface Temperature/Emissivity Daily L3 Global 1km	1000.00
MOD11A2	Terra	3	G	Land Surface Temperature/Emissivity 8-Day L3 Global 1km	1000.00
MOD11B1	Terra	3	G	Land Surface Temperature/Emissivity Daily L3 Global 5km	5000.00

MOD11B2	Terra	3	G	Land Surface Temperature and Emissivity 8-Day L3 Global 6 km Grid SIN	0.05
MOD11B3	Terra	3	G	Land Surface Temperature and Emissivity Monthly L3 Global 6 km Grid SIN	0.05
MOD11C1	Terra	3	G	Land Surface Temperature/Emissivity Daily L3 Global 0.05Deg CMG	0.05
MOD11C2	Terra	3	G	Land Surface Temperature/Emissivity 8-Day L3 Global 0.05Deg CMG	0.05
MOD11C3	Terra	3	G	Land Surface Temperature/Emissivity Monthly L3 Global 0.05Deg CMG	0.05
MOD12C1	Terra	3	G	Land Cover Type Yearly L3 Global 0.05Deg CMG	0.05
MOD12Q1	Terra	3	G	Land Cover Type Yearly L3 Global 1km	1000.00
MOD12Q2	Terra	3	G	Land Cover Dynamics Yearly L3 Global 1km	1000.00
MOD13A1	Terra	3	G	Vegetation Indices 16-Day L3 Global 500m	500.00
MOD13A2	Terra	3	G	Vegetation Indices 16-Day L3 Global 1km	1000.00
MOD13A3	Terra	3	G	Vegetation Indices Monthly L3 Global 1km	1000.00
MOD13C1	Terra	3	G	Vegetation Indices 16-Day L3 Global 0.05Deg CMG	0.05
MOD13C2	Terra	3	G	Vegetation Indices Monthly L3 Global 0.05Deg CMG	0.05
MOD13Q1	Terra	3	G	Vegetation Indices 16-Day L3 Global 250m	250.00
MOD14	Terra	2	S	Thermal Anomalies/Fire 5-Min L2 Swath 1km	1000.00
MOD14A1	Terra	3	G	Thermal Anomalies/Fire Daily L3 Global 1km	1000.00
MOD14A2	Terra	3	G	Thermal Anomalies/Fire 8-Day L3 Global 1km	1000.00
MOD15A2	Terra	4	G	Leaf Area Index/FPAR 8-Day L4 Global 1km	1000.00
MOD15A2H	Terra	4	G	Leaf Area Index/FPAR 8-Day L4 Global 500 m SIN Grid	500.00
MOD16A2	Terra	4	G	Global Evapotranspiration 8-Day	1000.00
MOD16A3	Terra	4	G	Global Evapotranspiration Yearly	1000.00
MOD17A2	Terra	4	G	Gross Primary Productivity 8-Day L4 Global 1km	1000.00
MOD17A2H	Terra	4	G	Gross Primary Productivity 8-Day L4 Global 500 m SIN Grid	500.00
MOD17A3	Terra	3	G	Gross Primary Productivity Yearly L4 Global 1km	1000.00
MOD17A3H	Terra	4	G	Net Primary Production Yearly L4 Global 500 m SIN Grid	500.00
MOD29	Terra	2	S	Sea Ice Extent 5-Min L2 Swath 1km	1000.00
MOD29E1D	Terra	3	G	Sea Ice Extent and IST Daily L3 Global 4km EASE-Grid Day	4000.00
MOD29P1D	Terra	3	G	Sea Ice Extent Daily L3 Global 1km EASE-Grid Day	1000.00
MOD29P1N	Terra	3	G	Sea Ice Extent Daily L3 Global 1km EASE-Grid Night	1000.00
MOD35_L2	Terra	2	S	Cloud Mask	250.00,1000.00
MOD43A1	Terra	4	G	BRDF/Albedo Model Parameters 16-Day L3 Global 500m	500.00

MOD43A2	Terra	4	G	BRDF/Albedo Quality 16-Day L3 Global 500m	500.00
MOD43A3	Terra	4	G	Albedo 16-Day L3 Global 500m	500.00
MOD43A4	Terra	4	G	Nadir BRDF-Adjusted Reflectance 16-Day L3 Global 500m	500.00
MOD43B1	Terra	3	G	BRDF/Albedo Model Parameters 16-Day L3 Global 1km	1000.00
MOD43B2	Terra	4	G	BRDF/Albedo Quality 16-Day L3 Global 1km	1000.00
MOD43B3	Terra	3	G	Albedo 16-Day L3 Global 1km	1000.00
MOD43B4	Terra	3	G	Nadir BRDF-Adjusted Reflectance 16-Day L3 Global 1km	1000.00
MOD43C1	Terra	3	G	BRDF/Albedo Parameters 16-Day L3 0.05Deg CMG	0.05
MOD43C2	Terra	4	G	BRDF/Albedo Snow-Free Quality 16-Day L3 Global 0.05Deg CMG	0.05
MOD43C3	Terra	3	G	Albedo 16-Day L3 Global 0.05Deg CMG	0.05
MOD43C4	Terra	4	G	Nadir BRDF-Adjusted Reflectance 16-Day L3 0.05Deg CMG	0.05
MOD44A	Terra	3	G	Vegetation Cover Conversion Quarterly L3 Global 250m	250.00
MOD44B	Terra	3	G	Vegetation Continuous Fields Yearly L3 Global 250m	250.00
MOD44W	Terra	3	G	Land Water Mask Derived from MODIS and SRTM L3 Yearly Global 250 m SIN Grid	250.00
MOD45A1	Terra	3	G	Burned Area Monthly L3 Global 500m	500.00
MODATML2	Terra	2	S	Aerosol, Cloud and Water Vapor Subset 5-Min L2 Swath 5km and 10km	5000.00,10000.00
MODMGGAD	Terra	2G	G	Geolocation Angles Daily L2G Global 1km Day	1000.00
MODOCGA	Terra	2G	G	Ocean Reflectance Daily L2G-Lite Global 1 km SIN Grid	1000.00
MODPT1KD	Terra	2G	G	Observation Pointers Daily L2G Global 1km Day	1000.00
MODPTHKM	Terra	2G	G	Observation Pointers Daily L2G Global 500m	500.00
MODPTQKM	Terra	2G	G	Observation Pointers Daily L2G Global 250m	250.00
MODTBGA	Terra	2G	G	Thermal Bands Daily L2G Global 1 km SIN Grid	1000.00
MYD01	Aqua	1A	S	Level 1A Radiance	250.00,500.00,1000.00,1000.00
MYD021KM	Aqua	1B	S	Level 1B Calibrated Radiance 1km	1000.00
MYD02HKM	Aqua	1B	S	Level 1B Calibrated Radiance 500m	500.00
MYD02QKM	Aqua	1B	S	Level 1B Calibrated Radiance 250m	250.00
MYD02SSH	Aqua	1B	S	Level 1B Calibrated Radiance 5km	5000.00
MYD03	Aqua	1X	S	Geolocation Fields 1km	1000.00
MYD04_3K	Aqua	2	S	Aerosol Product 3km	3000.00
MYD04_L2	Aqua	2	S	Aerosol Product	1000.00
MYD05_L2	Aqua	2	S	Precipitable Water	1000.00,5000.00

MYD06_L2	Aqua	2	S	Cloud Product	1000.00
MYD07_L2	Aqua	2	S	Atmospheric Profile	1000.00
MYD08_D3	Aqua	3	G	Atmosphere Daily Global Product	1.00
MYD08_E3	Aqua	3	G	Atmosphere Eight-Day Global Product	1.00
MYD08_M3	Aqua	3	G	Atmosphere Monthly Global Product	1.00
MYD09	Aqua	2	S	Level 2 5-Min Land Surface Reflectance - 250m, 500m, 1km	250.00,500.00,1000.00
MYD09A1	Aqua	3	G	Surface Reflectance 8-Day L3 Global 500m	500.00
MYD09CMG	Aqua	3	G	Surface Reflectance Daily L3 Global 0.05Deg CMG	0.05
MYD09GA	Aqua	2G	G	Surface Reflectance Daily L2G Global 1km and 500m SIN Grid	1000.00,500.00
MYD09GHK	Aqua	2G	G	Surface Reflectance Daily L2G Global 500m	500.00
MYD09GQ	Aqua	2G	G	Surface Reflectance Daily L2G Global 250m SIN Grid	250.00
MYD09GQK	Aqua	2G	G	Surface Reflectance Daily L2G Global 250m	250.00
MYD09GST	Aqua	2G	G	Surface Reflectance Quality Daily L2G	1000.00
MYD09Q1	Aqua	3	G	Surface Reflectance 8-Day L3 Global 250m	250.00
MYD10_L2	Aqua	2	S	Snow Cover 5-Min L2 Swath 500m	500.00
MYD10A1	Aqua	3	G	Snow Cover Daily L3 Global 500m SIN Grid	500.00
MYD10A2	Aqua	3	G	Snow Cover 8-Day L3 Global 500m SIN Grid	500.00
MYD10C1	Aqua	3	G	Snow Cover CMG Daily L3 Global Product 0.05Deg	0.05
MYD10C2	Aqua	3	G	Snow Cover 8-Day L3 Global 0.05Deg CMG	0.05
MYD10CM	Aqua	3	G	Snow Cover CMG Monthly L3 Global Product 0.05Deg	0.05
MYD11_L2	Aqua	2	S	Land Surface Temperature/Emissivity Daily 5-Min L2 Swath 1km	1000.00
MYD11A1	Aqua	3	G	Land Surface Temperature/Emissivity Daily L3 Global 1km	1000.00
MYD11A2	Aqua	3	G	Land Surface Temperature/Emissivity 8-Day L3 Global 1km	1000.00
MYD11B1	Aqua	3	G	Land Surface Temperature/Emissivity Daily L3 Global 5km	5000.00
MYD11B2	Aqua	3	G	Land Surface Temperature and Emissivity 8-Day L3 Global 6 km Grid SIN	0.05
MYD11B3	Aqua	3	G	Land Surface Temperature and Emissivity Monthly L3 Global 6 km Grid SIN	0.05
MYD11C1	Aqua	3	G	Land Surface Temperature/Emissivity Daily L3 Global 0.05Deg CMG	0.05
MYD11C2	Aqua	3	G	Land Surface Temperature/Emissivity 8-Day L3 Global 0.05Deg CMG	0.05
MYD11C3	Aqua	3	G	Land Surface Temperature/Emissivity Monthly L3 Global 0.05Deg CMG	0.05
MYD13A1	Aqua	3	G	Vegetation Indices 16-Day L3 Global 500m	500.00
MYD13A2	Aqua	3	G	Vegetation Indices 16-Day L3 Global 1km	1000.00

MYD13A3	Aqua	3	G	Vegetation Indices Monthly L3 Global 1km	1000.00
MYD13C1	Aqua	3	G	Vegetation Indices 16-Day L3 Global 0.05Deg CMG	0.05
MYD13C2	Aqua	3	G	Vegetation Indices Monthly L3 Global 0.05Deg CMG	0.05
MYD13Q1	Aqua	3	G	Vegetation Indices 16-Day L3 Global 250m	250.00
MYD14	Aqua	2	S	Thermal Anomalies/Fire 5-Min L2 Swath 1km	1000.00
MYD14A1	Aqua	3	G	Thermal Anomalies/Fire Daily L3 Global 1km	1000.00
MYD14A2	Aqua	3	G	Thermal Anomalies/Fire 8-Day L3 Global 1km	1000.00
MYD15A2	Aqua	4	G	Leaf Area Index/FPAR 8-Day L4 Global 1km	1000.00
MYD15A2H	Aqua	4	G	Leaf Area Index/FPAR 8-Day L4 Global 500 m SIN Grid	500.00
MYD17A2	Aqua	4	G	Gross Primary Productivity 8-Day L4 Global 1km	1000.00
MYD17A2H	Aqua	4	G	Gross Primary Productivity 8-Day L4 Global 500 m SIN Grid	500.00
MYD17A3	Aqua	4	G	Gross Primary Productivity Yearly L4 Global 1km	1000.00
MYD17A3H	Aqua	4	G	Net Primary Production Yearly L4 Global 500 m SIN Grid	500.00
MYD29	Aqua	2	S	Sea Ice Extent 5-Min L2 Swath 1km	1000.00
MYD29E1D	Aqua	3	G	Sea Ice Extent and IST Daily L3 Global 4km EASE-Grid Day	4000.00
MYD29P1D	Aqua	3	G	Sea Ice Extent Daily L3 Global 1km EASE-Grid Day	1000.00
MYD29P1N	Aqua	3	G	Sea Ice Extent Daily L3 Global 1km EASE-Grid Night	1000.00
MYD35_L2	Aqua	2	S	Cloud Mask	250.00,1000.00
MYDATML2	Aqua	2	S	Aerosol, Cloud and Water Vapor Subset 5-Min L2 Swath 5km and 10km	5000.00,10000.00
MYDMGGAD	Aqua	2G	G	Geolocation Angles Daily L2G Global 1km Day	1000.00
MYDOCGA	Aqua	2G	G	Ocean Reflectance Daily L2G-Lite Global 1 km SIN Grid	1000.00
MYDPT1KD	Aqua	2G	G	Observation Pointers Daily L2G Global 1km Day	1000.00
MYDPTHKM	Aqua	2G	G	Observation Pointers Daily L2G Global 500m	500.00
MYDPTQKM	Aqua	2G	G	Observation Pointers Daily L2G Global 250m	250.00
MYDTBGA	Aqua	2G	G	Thermal Bands Daily L2G Global 1 km SIN Grid	1000.00


MODIS
HDF File
Level 1A/1B
Radiance File
Level 2
Swath File
Level 2, 3, 4
Grid File
L1A
250m
L1B
All
All 2D
Data
3D
Data 1
All 2D
Data
3D
Data 1
4D
Data 1
L1A
500m
3D
Data 2
3D
Data 2
3D
Data 1
L1A
1000m
3D
Data 2
L1A
1000m
3D
Data N
3D
Data N
3D
Data N
4D
Data N