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 V. 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 IV 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 4.3: Windows: c:\rsi\idl63\products\envi43\save_add
UNIX\Linux: /usr/local/rsi/idl_6.3/products/envi_4.3/save_add
Mac: /applications/rsi/idl_6.3/products/envi_4.3/save_add

ENVI 4.4-4.8: Windows: c:\program files\itt\idlXX\products\enviXX\save_add
UNIX\Linux: /usr/local/itt/idl_X.X/products/envi_X.X/save_add
Mac: /applications/itt/idl_X.X/products/envi_X.X/save_add

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 4.3-4.8 and 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.

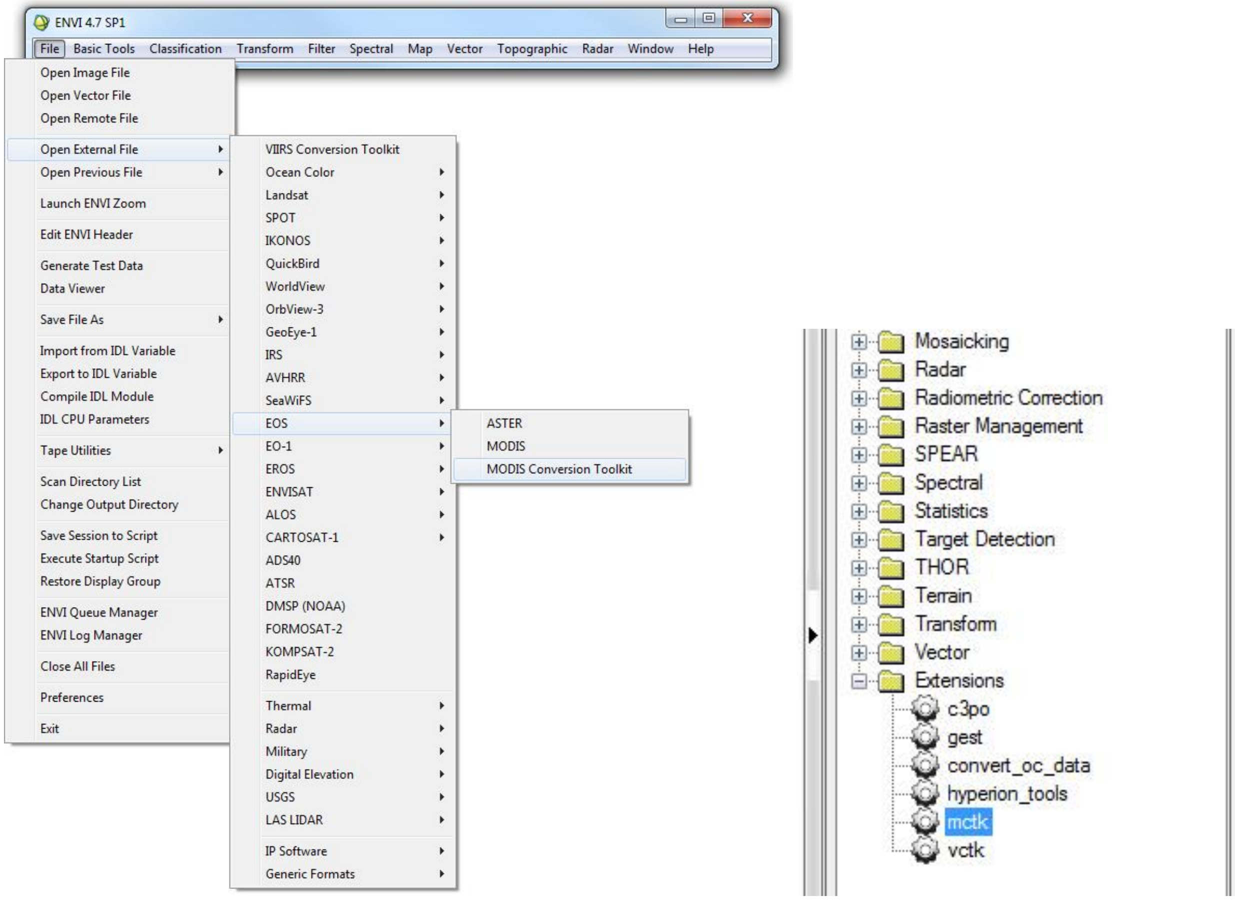


Figure 1. The plugin creates a button in the EOS group in ENVI Classic (left) and the Extensions folder in ENVI 5.0+ (right), allowing for easy access to data sets.

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. 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).

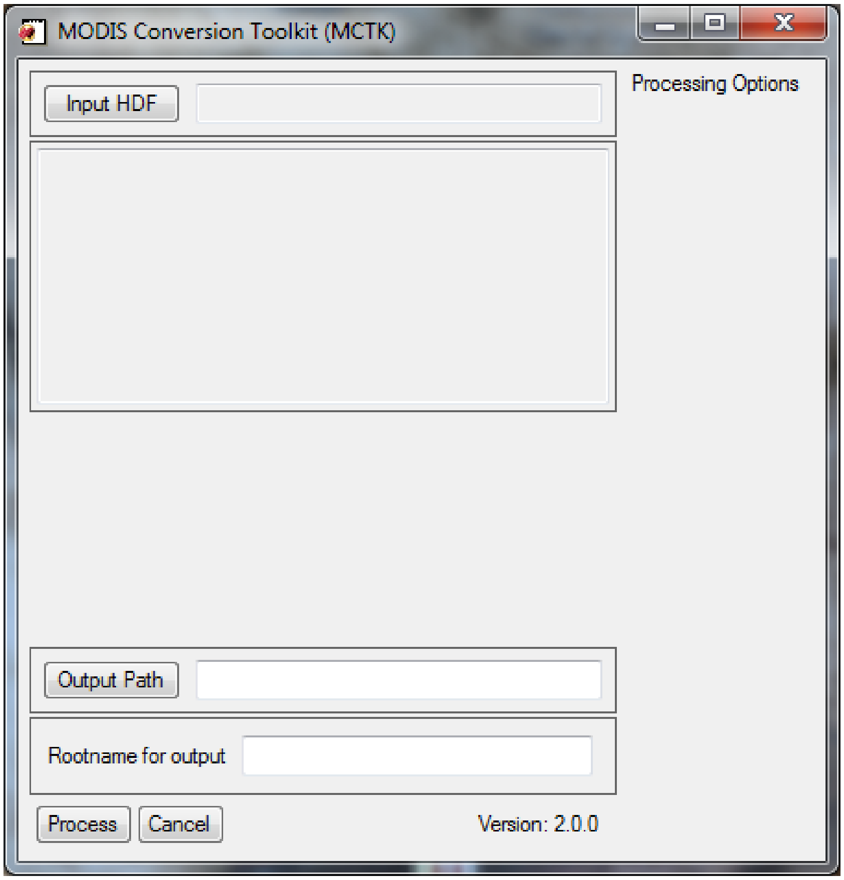


Figure 2. A "blank" instance of MCTK. The various fields and sections will update with information and options that are relevant to the supplied MODIS product. To ensure that you have the most recent version of MCTK, check the displayed version number.

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.

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.

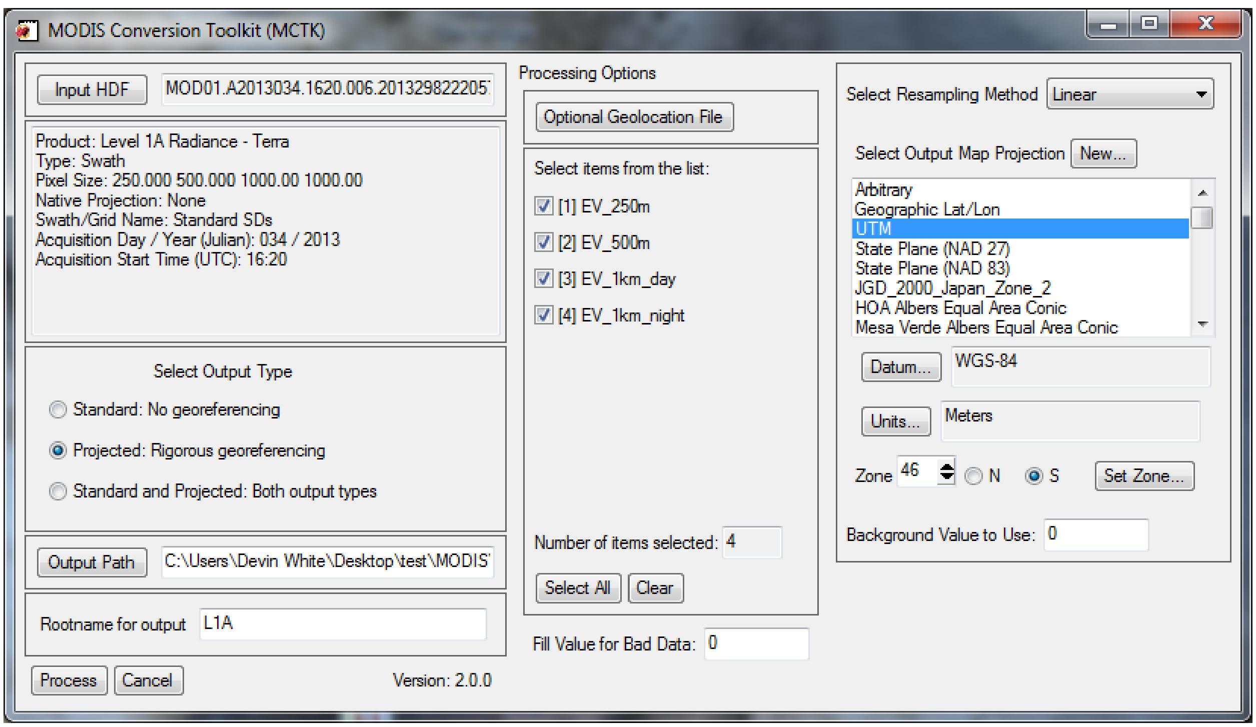


Figure 3. MCTK with a Level 1A file supplied as input, along with a matching geolocation file.

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)

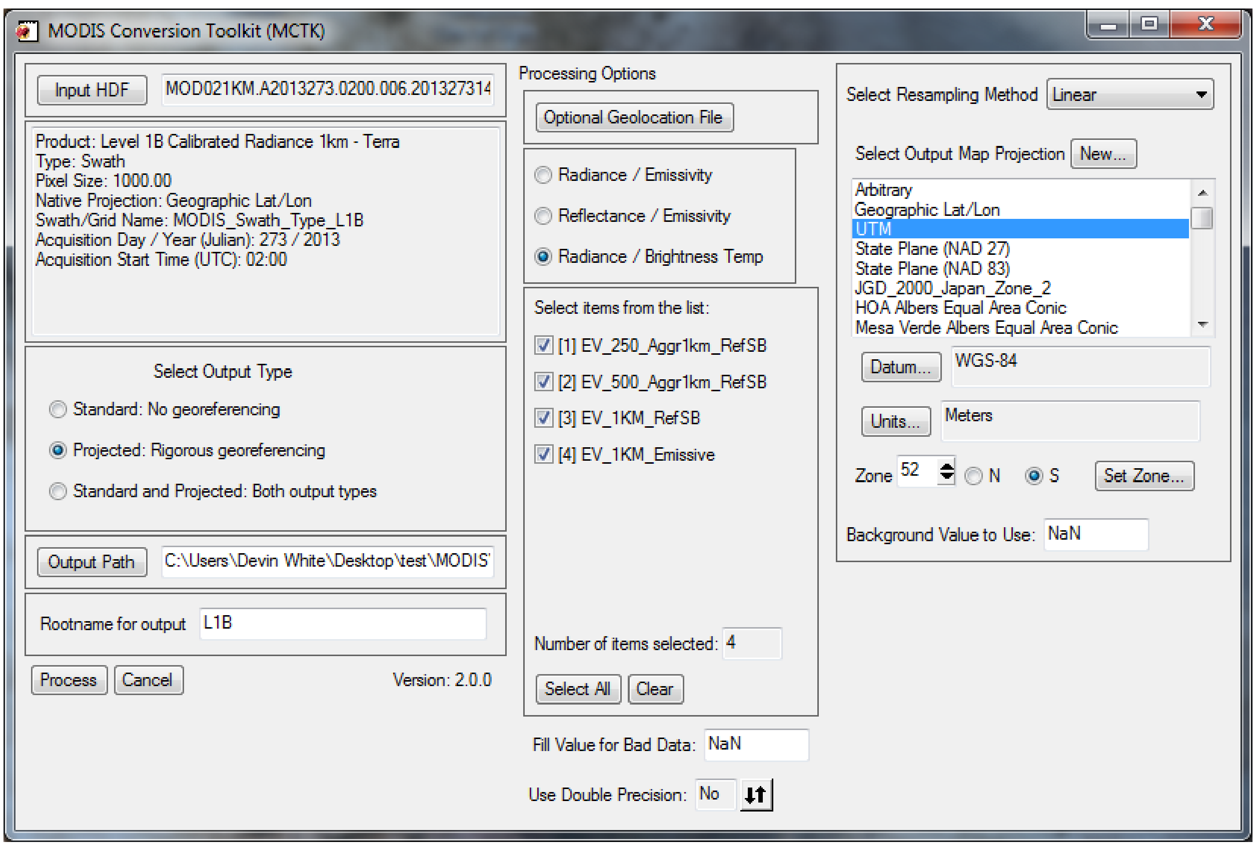


Figure 4. MCTK with a Level 1B file supplied as input (MOD021KM). Multiple datasets have been selected for georeferenced output, Reflectance / Brightness Temp has been chosen as the calibration method.

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.

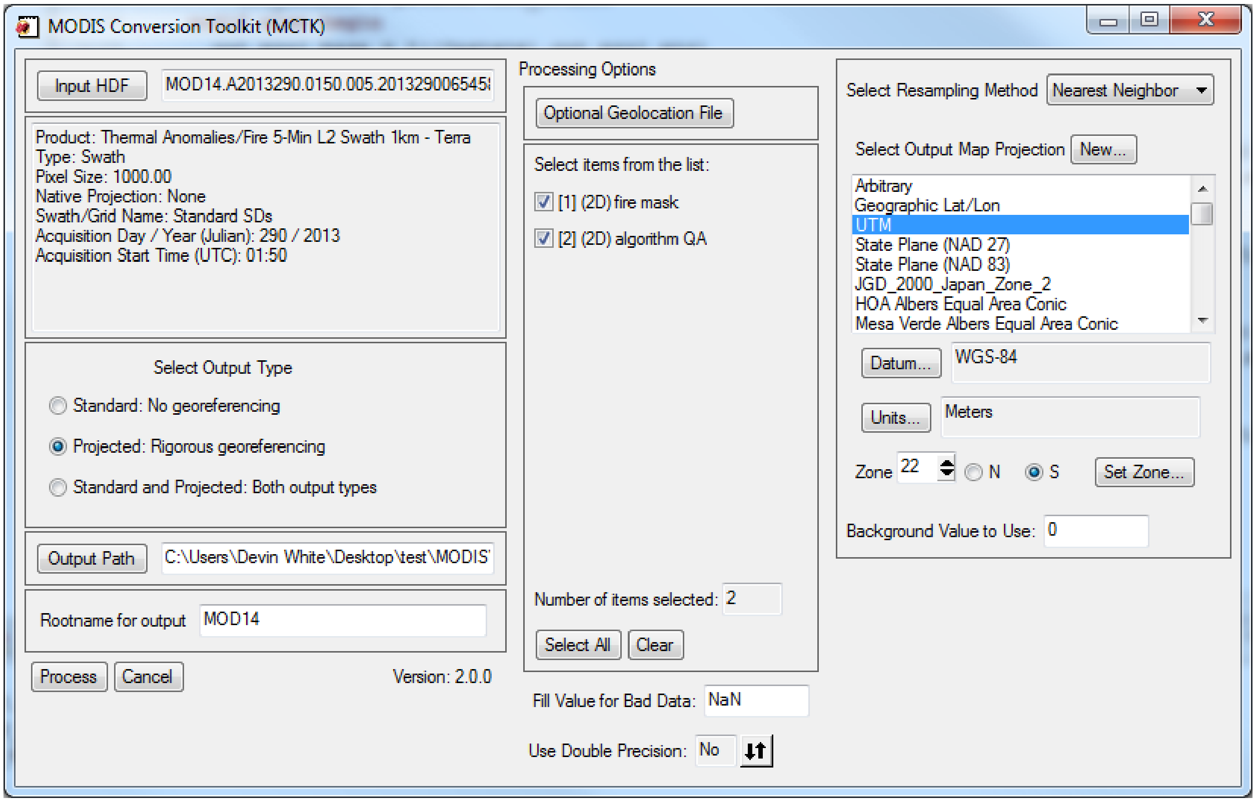


Figure 5. MCTK with a MOD14 Level 2 Swath file supplied as input. Multiple datasets have been selected for processing. Beginning with MCTK 2.0.0, MOD14 can be projected like any other swath by supplying an external geolocation file (MOD03/MYD03).

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.

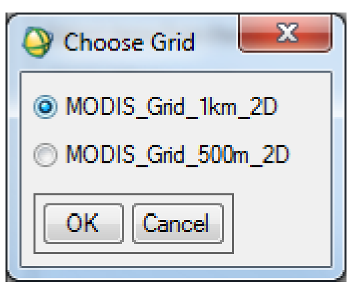


Figure 6. When inputting a file that contains more than one grid, you will automatically be prompted to select which one to process.

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). A default output pixel size (in degrees) is also automatically calculated in the appropriate units, based on the input pixel size for the product (usually meters). If you change the output projection, you will have to supply new pixel size values. 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. A useful thing to do in this situation, since most Geographic Lat/Lon data is global in scale, would be to choose a larger output pixel size, which in essence shrinks the size of the resulting output file but retains the same projection as the original input. 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).

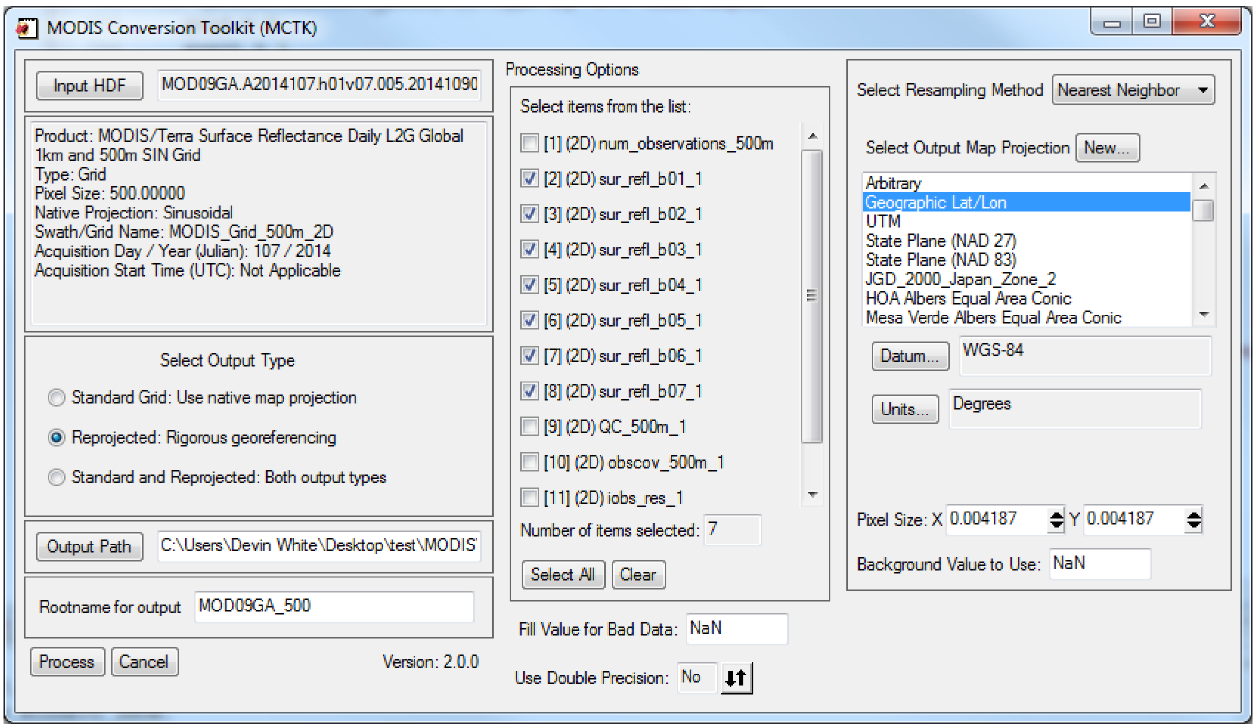


Figure 7. MCTK with a higher level grid file supplied as input. Multiple datasets are selected for processing, including one for Quality Control (with the Use Double Precision option set to Yes), and the reprojection option is set for Geographic Lat/Lon.

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).

IV. 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*]

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 <u>*exact*</u> 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 <u>*exact*</u> 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.

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.

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)

  ;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
```

V. Supported MODIS Products

Product	Level	Type	GSD (m or deg)	Product Name	Group	Supported
MOD01	1	S	250-1000	Level 1A Radiance - Terra	Calibration	Yes
MYD01	1	S	250-1000	Level 1A Radiance - Aqua	Calibration	Yes
MOD021KM	1	S	1000	Level 1B Calibrated Radiance 1km - Terra	Calibration	Yes
MYD021KM	1	S	1000	Level 1B Calibrated Radiance 1km - Aqua	Calibration	Yes
MOD02HKM	1	S	500	Level 1B Calibrated Radiance 500m - Terra	Calibration	Yes
MYD02HKM	1	S	500	Level 1B Calibrated Radiance 500m - Aqua	Calibration	Yes
MOD02QKM	1	S	250	Level 1B Calibrated Radiance 250m - Terra	Calibration	Yes
MYD02QKM	1	S	250	Level 1B Calibrated Radiance 250m - Aqua	Calibration	Yes
MOD02OBC	1	S	N/A	Level 1B On-Board Calibrator - Terra	Calibration	No
MYD01OBC	1	S	N/A	Level 1B On-Board Calibrator - Aqua	Calibration	No
MOD02SSH	1	S	5000	Level 1B Calibrated Radiance 5km - Terra	Calibration	Yes
MYD02SSH	1	S	5000	Level 1B Calibrated Radiance 5km - Aqua	Calibration	Yes
MOD03	1	S	1000	Geolocation Fields 1km - Terra	Calibration	Yes
MYD03	1	S	1000	Geolocation Fields 1km - Aqua	Calibration	Yes
MOD04_L2	2	S	1000	Aerosol Product - Terra	Atmosphere	Yes
MYD04_L2	2	S	1000	Aerosol Product - Aqua	Atmosphere	Yes
MOD04_3K	2	S	3000	Aerosol Product 3km - Terra	Atmosphere	Yes
MYD04_3K	2	S	3000	Aerosol Product 3km - Aqua	Atmosphere	Yes
MOD05_L2	2	S	1000 or 5000	Precipitable Water - Terra	Atmosphere	Yes
MYD05_L2	2	S	1000 or 5000	Precipitable Water - Aqua	Atmosphere	Yes
MOD06_L2	2	S	1000	Cloud Product - Terra	Atmosphere	Yes
MYD06_L2	2	S	1000	Cloud Product - Aqua	Atmosphere	Yes
MOD07_L2	2	S	1000	Atmospheric Profile - Terra	Atmosphere	Yes
MYD07_L2	2	S	1000	Atmospheric Profile - Aqua	Atmosphere	Yes
MOD35_L2	2	S	250 or 1000	Cloud Mask - Terra	Atmosphere	Yes
MYD35_L2	2	S	250 or 1000	Cloud Mask - Aqua	Atmosphere	Yes
MODATML2	2	S	5000 or 10000	Atmosphere Joint Product - Terra	Atmosphere	Yes
MYDATML2	2	S	5000 or	Atmosphere Joint Product - Aqua	Atmosphere	Yes

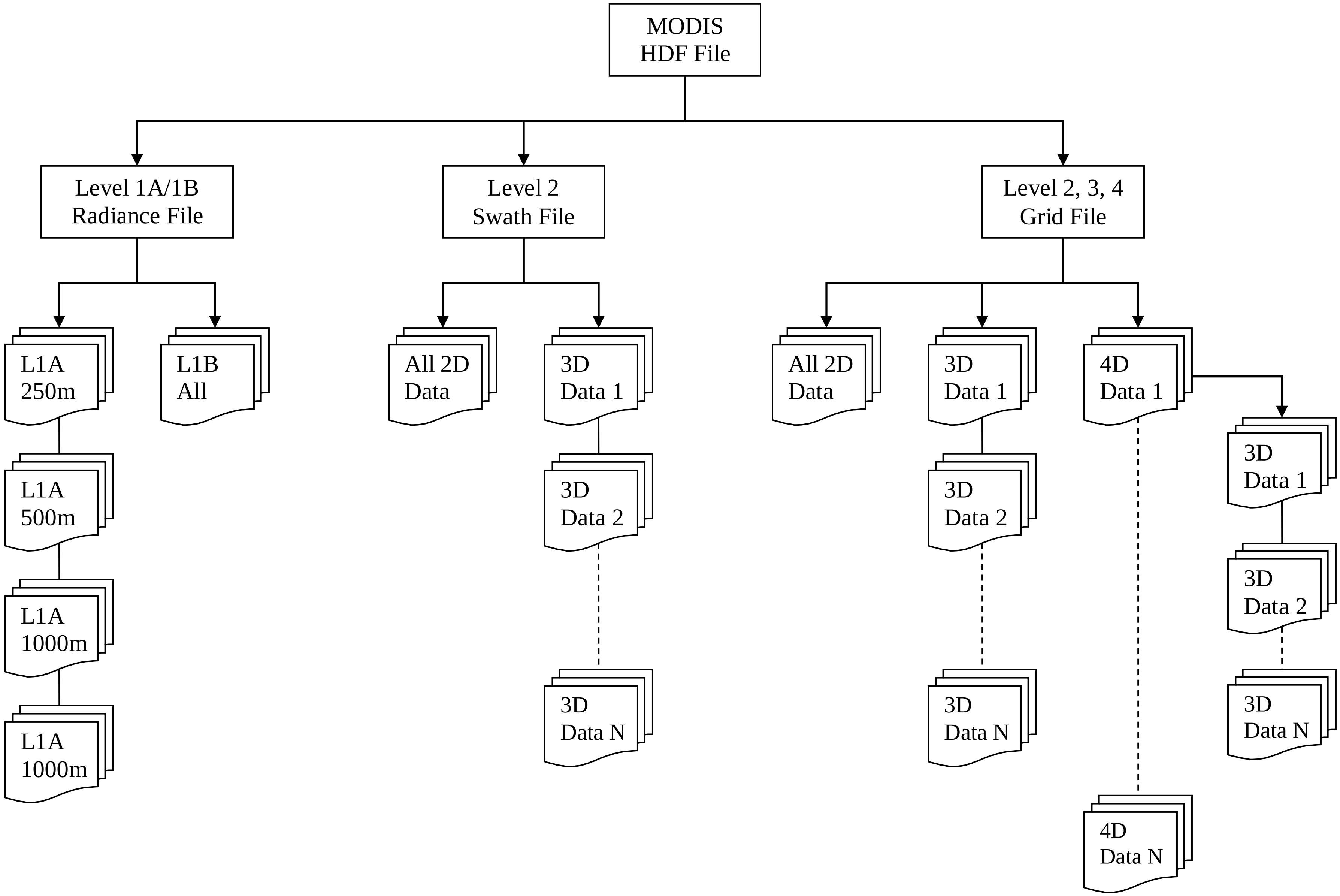
			10000			
MOD08_D3	3	G	1	Atmosphere Daily Global Product - Terra	Atmosphere	Yes
MYD08_D3	3	G	1	Atmosphere Daily Global Product - Aqua	Atmosphere	Yes
MOD08_E3	3	G	1	Atmosphere Eight-Day Global Product - Terra	Atmosphere	Yes
MYD08_E3	3	G	1	Atmosphere Eight-Day Global Product - Aqua	Atmosphere	Yes
MOD08_M3	3	G	1	Atmosphere Monthly Global Product - Terra	Atmosphere	Yes
MYD08_M3	3	G	1	Atmosphere Monthly Global Product - Aqua	Atmosphere	Yes
MOD09	2	S	250-1000	Level 2 5-Min Land Surface Reflectance - 250m, 500m, 1km - Terra	Land	Yes
MYD09	2	S	250-1000	Level 2 5-Min Land Surface Reflectance - 250m, 500m, 1km - Aqua	Land	Yes
MOD09GQ	2G	G	250	Surface Reflectance Daily L2G Global 250m - Terra	Land	Yes
MYD09GQ	2G	G	250	Surface Reflectance Daily L2G Global 250m - Aqua	Land	Yes
MOD09GA	2G	G	500 or 1000	MODIS/Terra Surface Reflectance Daily L2G Global 1km and 500m SIN Grid	Land	Yes
MYD09GA	2G	G	500 or 1000	MODIS/Aqua Surface Reflectance Daily L2G Global 1km and 500m SIN Grid	Land	Yes
MOD09CMG	3	G	0.05	Surface Reflectance Daily L3 Global 0.05Deg CMG - Terra	Land	Yes
MYD09CMG	3	G	0.05	Surface Reflectance Daily L3 Global 0.05Deg CMG - Aqua	Land	Yes
MOD09A1	3	G	500	Surface Reflectance 8-Day L3 Global 500m - Terra	Land	Yes
MYD09A1	3	G	500	Surface Reflectance 8-Day L3 Global 500m - Aqua	Land	Yes
MOD09Q1	3	G	250	Surface Reflectance 8-Day L3 Global 250m - Terra	Land	Yes
MYD09Q1	3	G	250	Surface Reflectance 8-Day L3 Global 250m - Aqua	Land	Yes
MOD09GHK	2G	G	500	Surface Reflectance Daily L2G Global 500m - Terra	Land	Yes
MYD09GHK	2G	G	500	Surface Reflectance Daily L2G Global 500m - Aqua	Land	Yes
MOD09GQK	2G	G	250	Surface Reflectance Daily L2G Global 250m - Terra	Land	Yes
MYD09GQK	2G	G	250	Surface Reflectance Daily L2G Global 250m - Aqua	Land	Yes
MOD09GST	2G	G	1000	Surface Reflectance Quality Daily L2G - Terra	Land	Yes
MYD09GST	2G	G	1000	Surface Reflectance Quality Daily L2G - Aqua	Land	Yes
MOD11A1	3	G	1000	Land Surface Temperature/Emissivity Daily L3 Global 1km - Terra	Land	Yes
MYD11A1	3	G	1000	Land Surface Temperature/Emissivity Daily L3 Global 1km - Aqua	Land	Yes
MOD11A2	3	G	1000	Land Surface Temperature/Emissivity 8-Day L3 Global 1km - Terra	Land	Yes
MYD11A2	3	G	1000	Land Surface Temperature/Emissivity 8-Day L3 Global 1km - Aqua	Land	Yes
MOD11B1	3	G	5000	Land Surface Temperature/Emissivity Daily L3 Global 5km - Terra	Land	Yes
MYD11B1	3	G	5000	Land Surface Temperature/Emissivity Daily L3 Global 5km - Aqua	Land	Yes

MOD11_L2	2	S	1000	Land Surface Temperature/Emissivity Daily 5-Min L2 Swath 1km - Terra	Land	Yes
MYD11_L2	2	S	1000	Land Surface Temperature/Emissivity Daily 5-Min L2 Swath 1km - Aqua	Land	Yes
MOD11C1	3	G	0.05	Land Surface Temperature/Emissivity Daily L3 Global 0.05Deg CMG - Terra	Land	Yes
MYD11C1	3	G	0.05	Land Surface Temperature/Emissivity Daily L3 Global 0.05Deg CMG - Aqua	Land	Yes
MOD11C2	3	G	0.05	Land Surface Temperature/Emissivity 8-Day L3 Global 0.05Deg CMG - Terra	Land	Yes
MYD11C2	3	G	0.05	Land Surface Temperature/Emissivity 8-Day L3 Global 0.05Deg CMG - Aqua	Land	Yes
MOD11C3	3	G	0.05	Land Surface Temperature/Emissivity Monthly L3 Global 0.05Deg CMG - Terra	Land	Yes
MYD11C3	3	G	0.05	Land Surface Temperature/Emissivity Monthly L3 Global 0.05Deg CMG - Aqua	Land	Yes
MOD12C1	3	G	0.05	Land Cover Type Yearly L3 Global 0.05Deg CMG	Land	Yes
MOD12Q1	3	G	1000	Land Cover Type Yearly L3 Global 1km	Land	Yes
MOD12Q2	3	G	1000	Land Cover Dynamics Yearly L3 Global 1km	Land	Yes
MCD12Q1	3	G	500	Land Cover Type Yearly L3 Global 500m - Combined	Land	Yes
MCD12Q2	3	G	1000	Land Cover Dynamics Yearly L3 Global 1km - Combined	Land	Yes
MCD12C1	3	G	0.05	Land Cover Type Yearly L3 Global 0.05Deg CMG - Combined	Land	Yes
MOD13Q1	3	G	250	Vegetation Indices 16-Day L3 Global 250m - Terra	Land	Yes
MYD13Q1	3	G	250	Vegetation Indices 16-Day L3 Global 250m - Aqua	Land	Yes
MOD13A1	3	G	500	Vegetation Indices 16-Day L3 Global 500m - Terra	Land	Yes
MYD13A1	3	G	500	Vegetation Indices 16-Day L3 Global 500m - Aqua	Land	Yes
MOD13A2	3	G	1000	Vegetation Indices 16-Day L3 Global 1km - Terra	Land	Yes
MYD13A2	3	G	1000	Vegetation Indices 16-Day L3 Global 1km - Aqua	Land	Yes
MOD13A3	3	G	1000	Vegetation Indices Monthly L3 Global 1km - Terra	Land	Yes
MYD13A3	3	G	1000	Vegetation Indices Monthly L3 Global 1km - Aqua	Land	Yes
MOD13C1	3	G	0.05	Vegetation Indices 16-Day L3 Global 0.05Deg CMG - Terra	Land	Yes
MYD13C1	3	G	0.05	Vegetation Indices 16-Day L3 Global 0.05Deg CMG - Aqua	Land	Yes
MOD13C2	3	G	0.05	Vegetation Indices Monthly L3 Global 0.05Deg CMG - Terra	Land	Yes
MYD13C2	3	G	0.05	Vegetation Indices Monthly L3 Global 0.05Deg CMG - Aqua	Land	Yes
MOD14	2	S	1000	Thermal Anomalies/Fire 5-Min L2 Swath 1km - Terra	Land	Yes
MYD14	2	S	1000	Thermal Anomalies/Fire 5-Min L2 Swath 1km - Aqua	Land	Yes
MOD14A1	3	G	1000	Thermal Anomalies/Fire Daily L3 Global 1km - Terra	Land	Yes
MYD14A1	3	G	1000	Thermal Anomalies/Fire Daily L3 Global 1km - Aqua	Land	Yes
MOD14A2	3	G	1000	Thermal Anomalies/Fire 8-Day L3 Global 1km - Terra	Land	Yes

MYD14A2	3	G	1000	Thermal Anomalies/Fire 8-Day L3 Global 1km - Aqua	Land	Yes
MOD15A2	4	G	1000	Leaf Area Index/FPAR 8-Day L4 Global 1km - Terra	Land	Yes
MYD15A2	4	G	1000	Leaf Area Index/FPAR 8-Day L4 Global 1km - Aqua	Land	Yes
MCD15A2	4	G	1000	Gridded 1KM FPAR and LAI (8-day composite)	Land	Yes
MCD15A3	4	G	1000	Gridded 1KM FPAR and LAI (4-day composite)	Land	Yes
MOD16A2	4	G	1000	Global Evapotranspiration 8-Day	Land	Yes
MOD16A3	4	G	1000	Global Evapotranspiration Yearly	Land	Yes
MOD17A2	4	G	1000	Gross Primary Productivity 8-Day L4 Global 1km - Terra	Land	Yes
MYD17A2	4	G	1000	Gross Primary Productivity 8-Day L4 Global 1km - Aqua	Land	Yes
MOD17A3	3	G	1000	Gross Primary Productivity Yearly L4 Global 1km - Terra	Land	Yes
MYD17A3	3	G	1000	Gross Primary Productivity Yearly L4 Global 1km - Aqua	Land	Yes
MOD43A1	4	G	500	BRDF/Albedo Model Parameters 16-Day L3 Global 500m - Terra	Land	Yes
MCD43A1	4	G	500	BRDF/Albedo Model Parameters 16-Day L3 Global 500m - Combined	Land	Yes
MOD43A2	4	G	500	BRDF/Albedo Quality 16-Day L3 Global 500m - Terra	Land	Yes
MCD43A2	4	G	500	BRDF/Albedo Quality 16-Day L3 Global 500m - Combined	Land	Yes
MOD43A3	4	G	500	Albedo 16-Day L3 Global 500m - Terra	Land	Yes
MCD43A3	4	G	500	Albedo 16-Day L3 Global 500m - Combined	Land	Yes
MOD43A4	4	G	500	Nadir BRDF-Adjusted Reflectance 16-Day L3 Global 500m - Terra	Land	Yes
MCD43A4	4	G	500	Nadir BRDF-Adjusted Reflectance 16-Day L3 Global 500m - Combined	Land	Yes
MOD43B1	3	G	1000	BRDF/Albedo Model Parameters 16-Day L3 Global 1km - Terra	Land	Yes
MCD43B1	3	G	1000	BRDF/Albedo Model Parameters 16-Day L3 Global 1km - Combined	Land	Yes
MOD43B2	4	G	1000	BRDF/Albedo Quality 16-Day L3 Global 1km - Terra	Land	Yes
MCD43B2	4	G	1000	BRDF/Albedo Quality 16-Day L3 Global 1km - Combined	Land	Yes
MOD43B3	3	G	1000	Albedo 16-Day L3 Global 1km - Terra	Land	Yes
MCD43B3	3	G	1000	Albedo 16-Day L3 Global 1km - Combined	Land	Yes
MOD43B4	3	G	1000	Nadir BRDF-Adjusted Reflectance 16-Day L3 Global 1km - Terra	Land	Yes
MCD43B4	3	G	1000	Nadir BRDF-Adjusted Reflectance 16-Day L3 Global 1km - Combined	Land	Yes
MOD43C1	3	G	0.05	BRDF/Albedo Parameters 16-Day L3 0.05Deg CMG - Terra	Land	Yes
MCD43C1	3	G	0.05	BRDF/Albedo Parameters 16-Day L3 0.05Deg CMG - Combined	Land	Yes
MOD43C2	4	G	0.05	BRDF/Albedo Snow-Free Quality 16-Day L3 Global 0.05Deg CMG - Terra	Land	Yes
MCD43C2	4	G	0.05	BRDF/Albedo Snow-Free Quality 16-Day L3 Global 0.05Deg CMG - Combined	Land	Yes

MOD43C3	3	G	0.05	Albedo 16-Day L3 Global 0.05Deg CMG - Terra	Land	Yes
MCD43C3	3	G	0.05	Albedo 16-Day L3 Global 0.05Deg CMG - Combined	Land	Yes
MOD43C4	4	G	0.05	Nadir BRDF-Adjusted Reflectance 16-Day L3 0.05Deg CMG - Terra	Land	Yes
MCD43C4	4	G	0.05	Nadir BRDF-Adjusted Reflectance 16-Day L3 0.05Deg CMG - Combined	Land	Yes
MOD44A	3	G	250	Vegetation Cover Conversion Quarterly L3 Global 250m	Land	Yes
MOD44B	3	G	500	Vegetation Continuous Fields Yearly L3 Global 500m	Land	Yes
MOD45A1	3	G	500	Burned Area Monthly L3 Global 500m - Terra	Land	Yes
MCD45A1	3	G	500	Burned Area Monthly L3 Global 500m - Combined	Land	Yes
MODMGGAD	2G	G	1000	Geolocation Angles Daily L2G Global 1km Day - Terra	Land	Yes
MYDMGGAD	2G	G	1000	Geolocation Angles Daily L2G Global 1km Day - Aqua	Land	Yes
MODPT1KD	2G	G	1000	Observation Pointers Daily L2G Global 1km Day - Terra	Land	Yes
MYDPT1KD	2G	G	1000	Observation Pointers Daily L2G Global 1km Day - Aqua	Land	Yes
MODPTHKM	2G	G	500	Observation Pointers Daily L2G Global 500m - Terra	Land	Yes
MYDPTHKM	2G	G	500	Observation Pointers Daily L2G Global 500m - Aqua	Land	Yes
MODPTQKM	2G	G	250	Observation Pointers Daily L2G Global 250m - Terra	Land	Yes
MYDPTQKM	2G	G	250	Observation Pointers Daily L2G Global 250m - Aqua	Land	Yes
MOD10A1	3	G	500	Snow Cover Daily L3 Global 500m SIN Grid - Terra	Cryosphere	Yes
MYD10A1	3	G	500	Snow Cover Daily L3 Global 500m SIN Grid - Aqua	Cryosphere	Yes
MOD10A2	3	G	500	Snow Cover 8-Day L3 Global 500m SIN Grid - Terra	Cryosphere	Yes
MYD10A2	3	G	500	Snow Cover 8-Day L3 Global 500m SIN Grid - Aqua	Cryosphere	Yes
MOD10C1	3	G	0.05	Snow Cover CMG Daily L3 Global Product 0.05Deg - Terra	Cryosphere	Yes
MYD10C1	3	G	0.05	Snow Cover CMG Daily L3 Global Product 0.05Deg - Aqua	Cryosphere	Yes
MOD10C2	3	G	0.05	Snow Cover 8-Day L3 Global 0.05Deg CMG - Terra	Cryosphere	Yes
MYD10C2	3	G	0.05	Snow Cover 8-Day L3 Global 0.05Deg CMG - Aqua	Cryosphere	Yes
MOD10CM	3	G	0.05	Snow Cover CMG Monthly L3 Global Product 0.05Deg - Terra	Cryosphere	Yes
MYD10CM	3	G	0.05	Snow Cover CMG Monthly L3 Global Product 0.05Deg - Aqua	Cryosphere	Yes
MOD10_L2	2	S	500	Snow Cover 5-Min L2 Swath 500m - Terra	Cryosphere	Yes
MYD10_L2	2	S	500	Snow Cover 5-Min L2 Swath 500m - Aqua	Cryosphere	Yes
MOD29	2	S	1000	Sea Ice Extent 5-Min L2 Swath 1km - Terra	Cryosphere	Yes
MYD29	2	S	1000	Sea Ice Extent 5-Min L2 Swath 1km - Aqua	Cryosphere	Yes
MOD29E1D	3	G	4000	Sea Ice Extent and IST Daily L3 Global 4km EASE-Grid Day - Terra	Cryosphere	Yes

MYD29E1D	3	G	4000	Sea Ice Extent and IST Daily L3 Global 4km EASE-Grid Day - Aqua	Cryosphere	Yes
MOD29P1D	3	G	1000	Sea Ice Extent Daily L3 Global 1km EASE-Grid Day - Terra	Cryosphere	Yes
MYD29P1D	3	G	1000	Sea Ice Extent Daily L3 Global 1km EASE-Grid Day - Aqua	Cryosphere	Yes
MOD29P1N	3	G	1000	Sea Ice Extent Daily L3 Global 1km EASE-Grid Night - Terra	Cryosphere	Yes
MYD29P1N	3	G	1000	Sea Ice Extent Daily L3 Global 1km EASE-Grid Night - Aqua	Cryosphere	Yes
OceanColor	1-3	S,G	1000 to 9000	More than 150 products can be generated through SeaDAS - Use EPOC	Ocean	Yes


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