



Users Guide for the MapImage Reprojection Software Package

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U.S. Geological Survey

Contents

Background	1
General Input Information	2
Running <i>mapping</i>	3
Troubleshooting	9
References	10

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Background

Scientists routinely accomplish small-scale geospatial modeling in the raster domain, using high-resolution datasets for large parts of continents and low-resolution to high-resolution datasets for the entire globe. Recently, Usery and others (2003a) expanded on the previously limited empirical work with real geographic data by compiling and tabulating the accuracy of categorical areas in projected raster datasets of global extent. Geographers and applications programmers at the U.S. Geological Survey's (USGS) Mid-Continent Mapping Center (MCMC) undertook an effort to expand and evolve an internal USGS software package, MapImage, or *mapimg*, for raster map projection transformation to the state documented here (Usery and others, 2003a).

Daniel R. Steinwand of Science Applications International Corporation, Earth Resources Observation Systems Data Center in Sioux Falls, S. Dak., originally developed *mapimg* for the USGS, basing it on the USGS's General Cartographic Transformation Package (GCTP). It operated as a command line program on the Unix operating system. Through MCMC efforts, and in coordination with Mr. Steinwand, this program has been transformed from an application based on a command line into a software package based on graphic user interface for Windows, Linux, and Unix machines.

Usery and others (2003b) pointed out that many commercial software packages do not use exact projection equations and that even when exact projection equations are used, the software often results in error and sometimes does not complete the transformation for specific projections, at specific resampling resolutions, and for specific singularities. Direct implementation of point-to-point transformation with appropriate functions yields the variety of projections available in these software packages, but implementation with data other than points requires specific adaptation of the equations or prior preparation of the data to allow the transformation to succeed.

Additional constraints apply to global raster data. It appears that some packages use the USGS's GCTP or similar point transformations without adaptation to the specific characteristics of raster data (Usery and others, 2003b). It is most common for programs to compute transformations of raster data in an inverse fashion. Such a mapping can result in an erroneous position and replicate data or create pixels not in the original space. As Usery and others (2003a) showed, *mapimg* performs a corresponding forward transformation to ensure the same location results from both methods. The primary benefit of this function is to mask cells outside the domain.

MapIMG 1.0 is now on the Web. You can download the draft Users Guide, source, and binaries from the following site:

http://mcmcweb.er.usgs.gov/carto_research/projection/acc_proj_data.html

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General Input Information

Ensure that all *INPUT* files are in Generic Binary format. No other file type is supported in the current version, 1.0, of *mapimg*. If necessary, export your image into this format before proceeding.

Band interleaved by line (BIL) is a storage format for image data. For a single band of data, BIL is the same as band sequential (BSQ) and band interleaved by pixel (BIP) (Slater, 1980). Generic Binary, as we use it (consistent with ERDAS Imagine), is any of these single-band formats that store data in a left-to-right, top-to-bottom row order (ERDAS, 1999). (It does allow for varying data types—for example, from 8 to 64 bit).

CAUTION: The Generic Binary file must use the same byte ordering (endian) as the computer running *mapimg*. The file is a raw image with absolutely no metadata, not even the dimensions of the image, which must be known by the user. The output will also be in the same raw format.

A common naming convention is recommended to keep track of your files: in particular, the format *(type)_(proj)_(pix_size).img*, where *type* represents the type of file being used, *proj* represents the projection used, and *pix_size* represents the output file's pixel size. For example, you would use *glc_sine_30sec.img* to represent a global land cover image in the sinusoidal projection with a pixel size of 30 arc-seconds. Notice that the file name always ends in *.img*, signifying a generic binary image. Although these conventions are not mandatory for proper program execution, they provide a useful and reliable way to keep track of your files.

Anytime *mapimg* is run on a file, an associated *.info* file will be created from the parameters selected by the user for both the input and the output image. For an input/output file called *filename.img*, the associated *.info* file will be named *filename.img.info*. It is not absolutely necessary to save these files, but it is *highly* recommended. If the input/output files are to be used again in the future, the *.info* files will make sure the correct projection parameters are used. These “.info” files function as a type of metadata.

This version of *mapimg*, 1.0, does not include all major projections (for example, Universal Transverse Mercator and State Plane projections are not currently supported). These projections will be supported in a later version. GeoTIFF format will also be supported in a later version.

Running *mapimg*

MapImage is a stand-alone program available for Windows, Linux, and Solaris. All images are of the Windows version, but Linux and Solaris versions will look similar. Double click the *mapimg* executable (*mapimg.exe*) to begin execution of the program. Upon startup, the dialog box shown in figure 1 will appear.

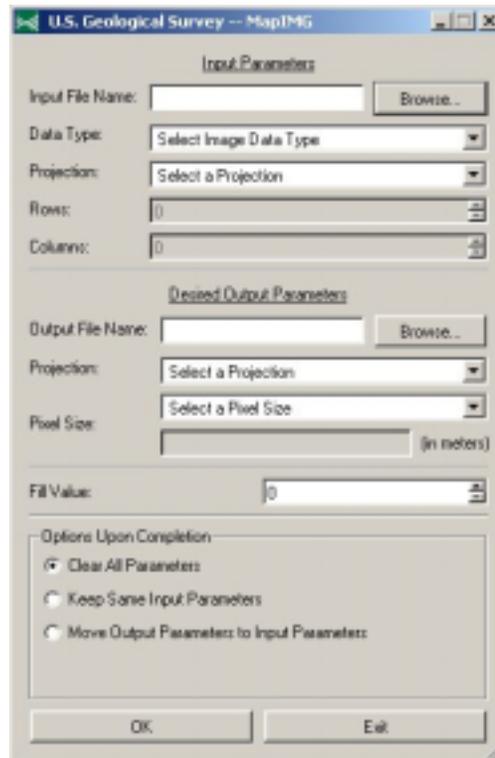


Figure 1. Startup screen.

To perform your projection transformation, complete the following steps:

- (1) Setup the *Input Parameters*:
 - a. Select an appropriate *Input File Name* by using the *Browse* button and navigating to the appropriate file or by typing the appropriate path and file name. This file **MUST** be in Generic Binary format. If required parameters can be determined, the input parameters will be set for you, and you may skip to step 2a.
 - b. Select the *Data Type* of the input file from the *Data Type Drop Down Menu* (fig. 2).

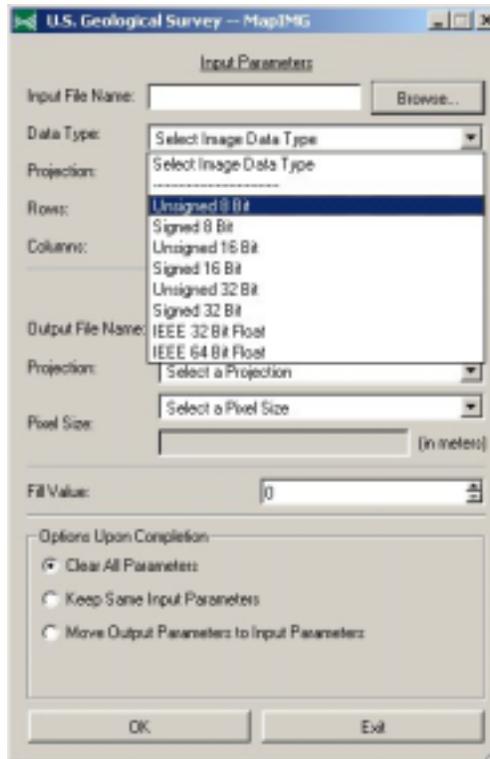


Figure 2. Data Type drop down menu.

- c. Select the *Projection* that your input file represents from the *Projection Drop Down Menu* (fig. 3).

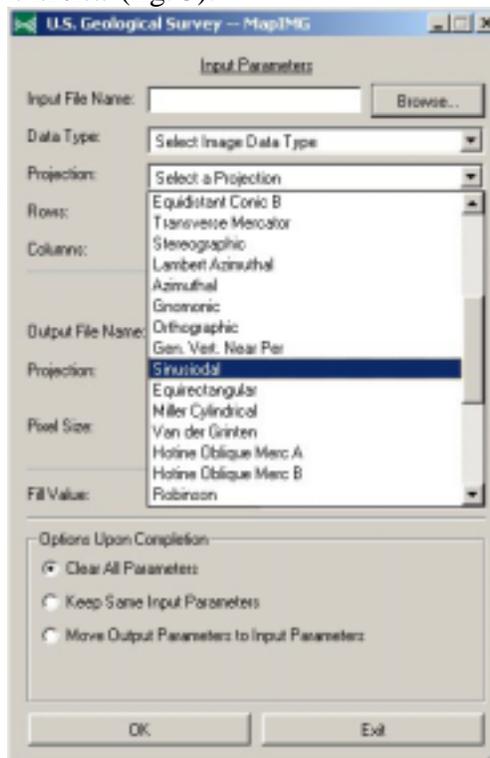


Figure 3. Projection drop down menu.

After a projection has been selected, a secondary dialog box such as the following may appear (fig. 4). If this screen does not appear, an associated .info file has already been found for this input file.

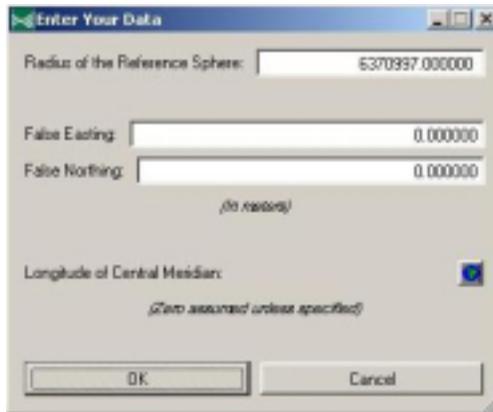


Figure 4. Secondary dialog.

Figure 4 shows an example of a Sinusoidal projection. It is in this dialog that you may make all changes to reflect the proper parameters of your input file. In this instance, the *Radius of the Reference Sphere*, *False Easting*, and *False Northing* may be changed by entering a new value into the respective *edit boxes*.

To change the *Longitude of Central Meridian*, click the globe button. This will bring up the dialog shown in figure 5.



Figure 5. Longitude input screen.

At this time, the *Degrees*, *Minutes*, and *Seconds* of the desired longitude may be entered. Press *OK* to accept the values or *Cancel* to ignore the change. A similar process can be used for entering latitudes as well.

Once the changes have been either accepted or ignored, the previous dialog (fig. 4) will again become active. At this time, press **OK** to accept the changes, or **Cancel** to ignore the changes.

- d. If necessary, input the number of rows/columns; the **Number of Rows** and **Number of Columns** boxes will be activated (fig. 1). To input the **Number of Rows/Columns**, simply enter the values into the appropriate boxes. This information is available in the “.info” file or from the original metadata.

(2) Set up the **Desired Output Parameters**:

- a. Create an appropriate **Output File Name** by using the **Browse** button to navigate to an appropriate save location. To create a file with a new name, simply enter the name and press **Save**. To overwrite an existing file, simply click the file to be overwritten and press **Save**. A file name may also be typed manually into the **edit box**. The output image will be in the same raw data format as the input. Also, the output will have the same data type. However, the dimensions may change depending on which projection and pixel sizes are used.
- b. Select the **Projection** of the desired output projection from the **Projection Drop Down Menu**. Secondary dialogs similar to those seen previously will be available. In this instance, the secondary dialogs can be used to make any changes that need to be reflected in the output file.
- c. When the secondary dialogs have been completed, the main dialog will become active again. Select an output file **Pixel Size** from the **Pixel Size Drop Down Menu** (fig. 6).

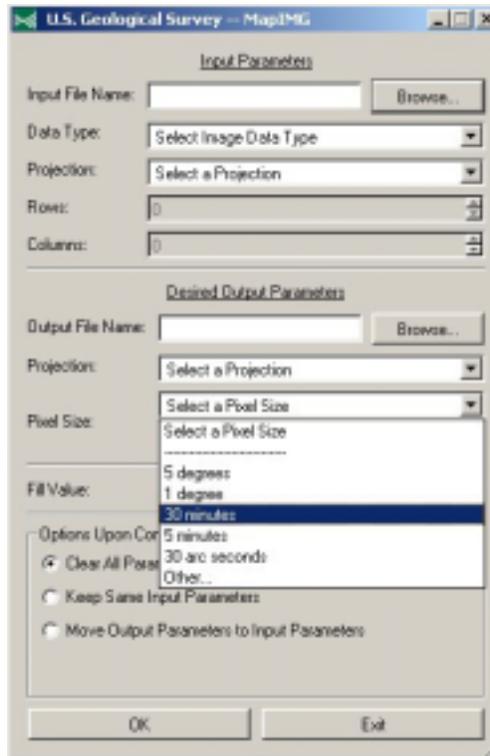


Figure 6. Pixel drop down menu.

Predetermined options are available for *5 degrees, 1 degree, 30 minutes, 5 minutes, and 30 arc-seconds*. If *Other* is selected, the *Pixel Size Text Box* (fig. 1) will be activated and any other size may then be entered. It is important to note that this value may only be entered in meters.

- (3) Assign a correct **Fill Value**. The Fill Value may be any value that is not currently being used as a data value. Experience has shown that for categorical data, the fill value can be calculated as follows:

$$(\# \text{ of input file classes} + n), n = \text{any integer} > 0$$

The recommended value for n is 2.

For example:

Category Number	Category Name	Histogram
0	Background	0
10	Urban	39042
41	Mature Deciduous	363609
42	Mature Planted Pine	17172
43	Mixed Deciduous / Pine	20655
50	Water	14823

In this case, the highest category number is 50. The recommended fill value would be 52.

(4) Choose your *Options Upon Completion* (fig. 1).

- a. Choose *Clear All Parameters* to clear all information once the reprojection is completed. This is the default selection.
- b. Choose *Keep Same Input Parameters* to leave the current input parameters active. This option is useful when performing multiple reprojections on the same input file.
- c. Choose *Move Output Parameters to Input Parameters* to make your created output parameters your new input parameters. This option is useful when performing a multiple reprojection. For example: Geographic -> Sinusoidal -> Mercator -> Hammer.

(5) Press *OK* to perform the transformation. Once started, the transformation can be aborted by pressing the *Abort* button (fig. 7).



Figure 7. Abort screen.

If the transformation is allowed to finish, the *Output Rows/Columns* will be shown. It is important to record these values for later use (fig. 8).

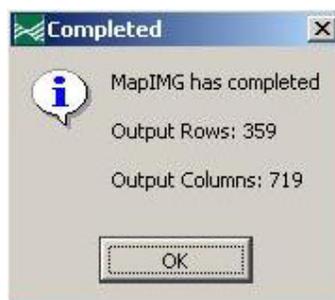


Figure 8. Output Rows/Columns.

(6) Repeat process for other files if desired.

Troubleshooting

Listed below are some common errors that may occur and possible remedies.

MapIMG – Overwrite file?

- Output image or .info file already exists for the name specified. Choose “Yes” to overwrite and continue or “No” to cancel.

This projection is not currently supported!

- The projection you’ve selected is not currently available.
- Please check the Web site periodically for newer versions of *mapimg* with additional projections.

An internal error has occurred while trying to open designated output file.

- Check that the output file and associated .info file do not exist and are not write protected.
- Make sure that there is enough available disk space for reprojection.

An internal error has occurred while trying to open (read) the designated project file.

- Check that the input file exists.
- Make sure that there is enough available disk space for reprojection.

An internal error has occurred while trying to allocate the input image buffer!

- There is not currently enough free memory to execute the projection. Try freeing memory by using a combination of the following:
 1. closing unnecessary programs
 2. selecting a smaller output pixel size
 3. using a smaller input image

REFERENCES

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