

ENVI EX Tutorial: RPC Orthorectification

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RPC Orthorectification Workflow

In this tutorial, you will use the RPC Orthorectification workflow to perform orthorectification of a single-scene QuickBird image using the rational polynomial coefficients (RPC) model.

Orthorectification geometrically corrects the data to remove distortions that occur during image capture, typically removing the effects of sensor tilt and terrain relief. ENVI EX supports data from the following sensors:

- GeoEye-1
- IKONOS
- OrbView-3
- QuickBird
- WorldView-1

Data from each of these sensors typically include an ancillary RPC file. In this exercise, you will use QuickBird data of Phoenix, Arizona,

ENVI EX also support the ENVI format with `RPC INFO` defined in the header and the NITF file with RPC information in the metadata.

References

RPC Orthorectification:

Jacek Grodecki and Gene Dial, "Block Adjustment of High-Resolution Satellite Images Described by Rational Polynomials," *Photogrammetric Engineering and Remote Sensing*, 69(1):59-68.

EGM96 Data:

The Development of the Joint NASA GSFC and NIMA Geopotential Model EGM96", NASA/TP-1998-206861. National Geospatial-Intelligence Agency Web site: <http://earth-info.nga.mil/GandG/wgs84/gravitymod/egm96/egm96.html>.

Files Used in this Tutorial

ENVI Resource DVD: Data\rpc_ortho

File	Description
Phoenix_AZ.TIF	QuickBird imagery over Phoenix, Arizona
Phoenix_AZ.HDR	Header file for above
Phoenix_AZ.RPB	Ancillary RPC file for above

Using the RPC Orthorectification Workflow

In the RPC Orthorectification workflow panels, you will open an input image and a digital elevation model (DEM) file, and set output and orthorectification parameters.

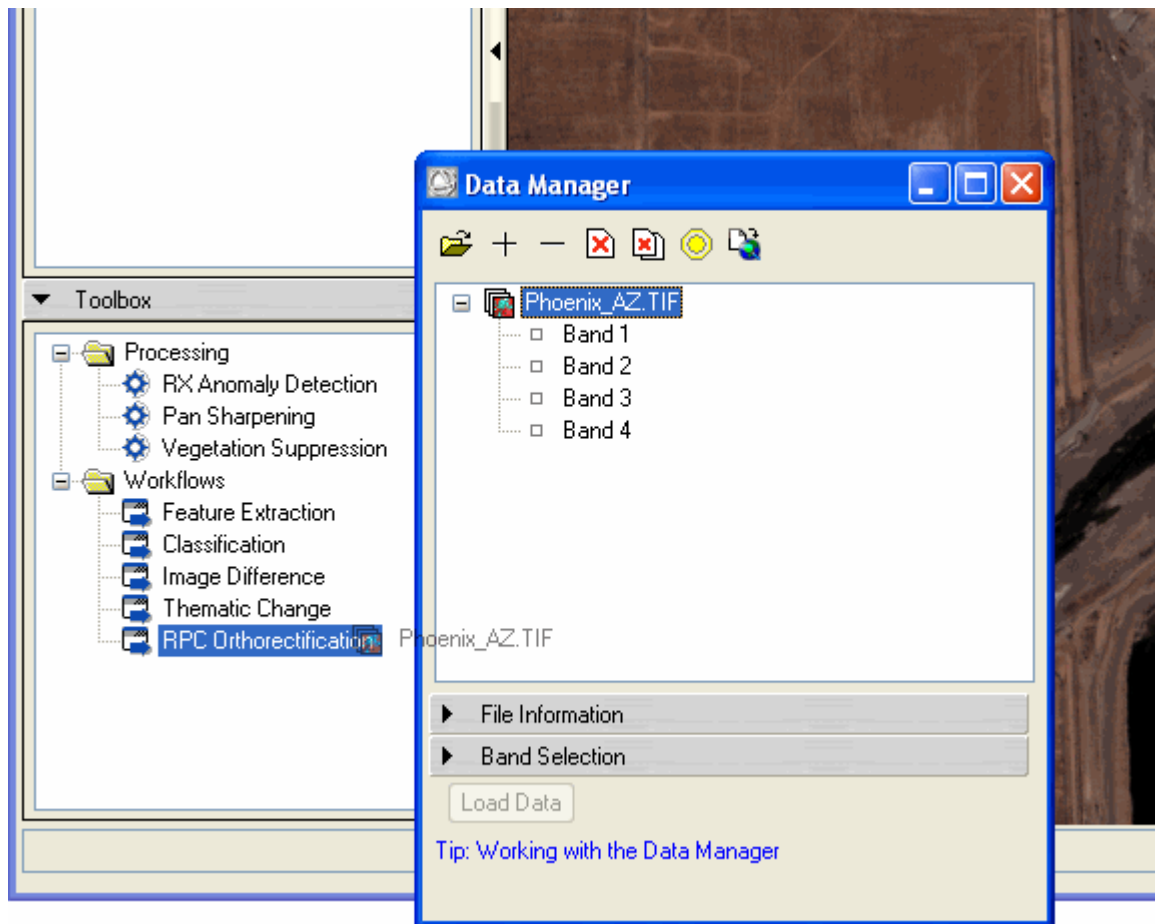
Copy the GTOPO30 data `GTOPO30\GTOPO30.jp2` file from the ENVI Resource DVD to `C:\Program Files\ITT\IDLxx\products\envidata`, where `xx` is the current version of IDL. When the file is copied to your machine, the RPC Orthorectification workflow uses it by default.

Selecting Files for RPC Orthorectification

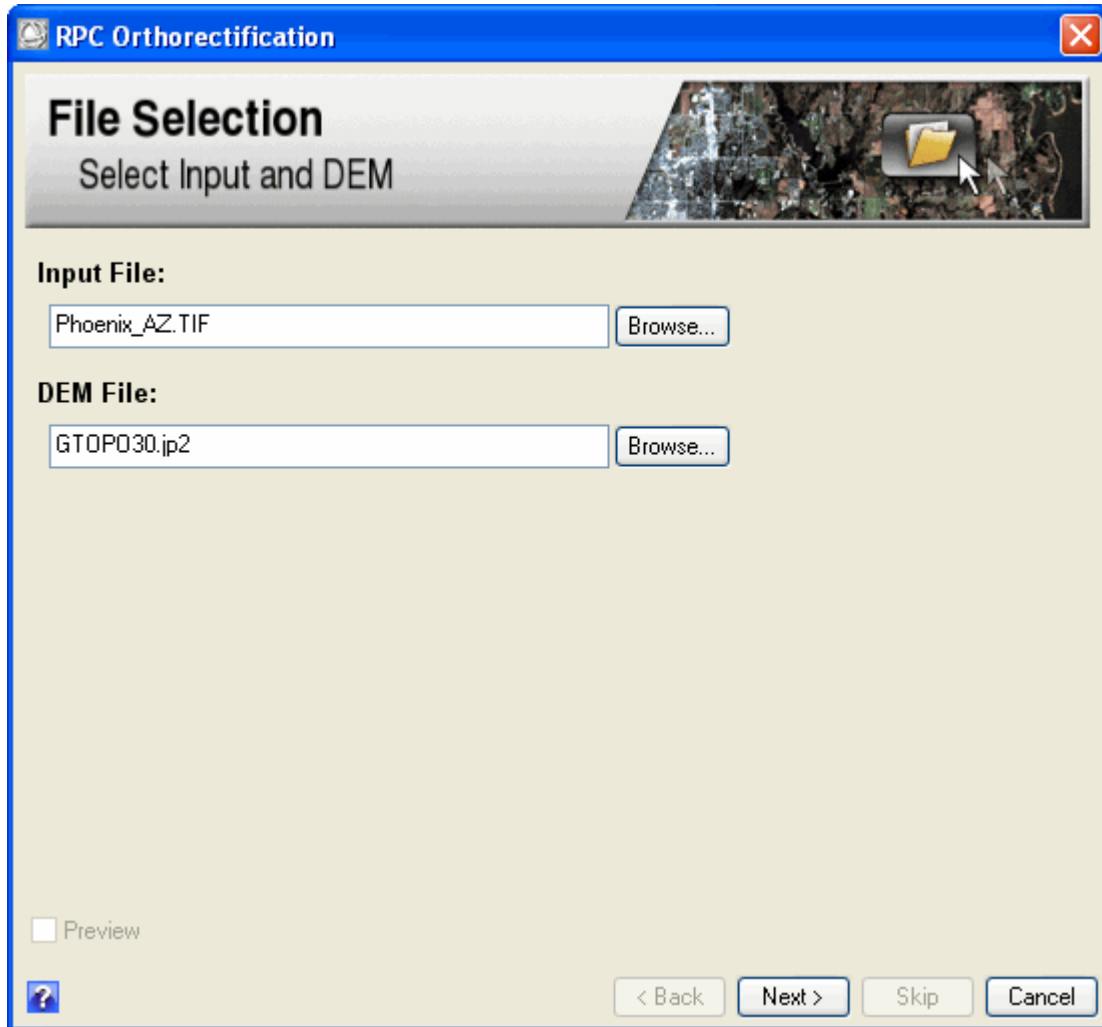
The input image must have the associated RPC information. These coefficients are required for the rational function expansion to convert ground coordinates into image coordinates. When you select a file for input, ENVI EX searches for the RPC coefficients. Since you are using QuickBird data in this exercise, the RPC Orthorectification workflow searches for an RPC filename consisting of the root name of the source data file appended with the extension `.rpb`.

To select the files:

1. Start ENVI EX.
2. Select **File > Open** from the menu bar. The Open dialog appears.
3. Navigate to `Data\RPCOrtho`, select `Phoenix_AZ.TIF`, and click **Open**. This image is a QuickBird image. You can create spatial subset for use with RPC orthorectification, but you will not perform those steps in this exercise.
4. In the Data Manager, select `Phoenix_AZ.TIF` drag and drop the it onto RPC Orthorectification in the Toolbox. The File Selection panel opens, with the file you selected listed in the Input File field.



5. In File Selection panel, click **Browse** next to the **DEM File** field. The Select DEM File dialog appears. Click **Open File**. The Open dialog appears. You can open a remote dataset for the DEM file, but you will not do that in this exercise, as the *GTOPO30* data will be used by default.
6. *GTOPO30* data was used by default. There are also websites that provide DEM data with higher resolution:
 - The National Map Seamless Server: <http://seamless.usgs.gov/index.php>
 - ASTER Global Digital Elevation Map (GDEM): <http://www.gdem.aster.ersdac.or.jp/>



7. Click **Next**. The RPC Orthorectification panel appears.

Setting RPC Orthorectification Parameters

1. In the **Output** tab of the RPC Orthorectification panel, enter the path and filename for the orthorectified image as follows:



2. Leave the **Output File** type as **ENVI**.
3. Select the **Advanced** tab.



4. By default, the **Geoid Correction** check box is enabled. The RPC Orthorectification workflow performs geoid correction by using the Earth Gravitational Model 1996 to automatically determine the geoid offset value.


Generally, leave the check box enabled. Most DEM data contains elevation that is above mean sea level (MSL), and the geoid correction is a constant value that is added to every value in the DEM. The geoid height value is the height of the geoid above the WGS-84 ellipsoid. The value accounts for the difference between the elevation above MSL and the elevation above the ellipsoid (ellipsoid height). RPC orthorectification requires the ellipsoid height for each pixel. Geoid correction is necessary to provide accurate orthorectification if the DEM data is the elevation above MSL.

5. Use the output pixel size of 2.50 meters. (The default is close to the input pixel size, in meters.)

6. Use the default **Bilinear:** for the **Image Resampling** technique. Bilinear resampling performs a linear interpolation using four pixels to resample. The resampling technique determines the pixel values in the input image when it is converted from its current orientation into the new orientation.
7. To preview how the orthorectification will look before processing, enable the **Preview** check box. A Preview Portal appears. You can change the **Geoid Correction** option and preview the results again, as needed.
8. Click **Finish**. ENVI EX processes the input image, and adds the orthorectified image to the Layer Manager.

Comparing RPC Orthorectification Output to Input

Compare the orthorectified image with the input image using a Portal

1. In the **Go To** field, type 4880, 1360, then press the **Enter** key.
2. Click the **Portal** button . A portal appears, with the input image displayed inside it.



The Portal shows the image before orthorectification. In the example above, the left side of the building boundary is straightened after orthorectification. As you move the portal around the Image window, the offset is visible.

Close ENVI EX. Select **File > Exit** from the menu bar.