

Automatic DEM Extraction

The Automatic DEM Extraction module allows you to create Digital Elevation Models (DEMs) from stereo airphotos, stereo images and RADAR data. Image correlation is used to extract matching pixels in two overlapping images and then use the sensor geometry from a computed math model to calculate x, y, and z positions. Automatic DEM extraction allows you to batch epipolar generation, batch the DEM extraction process, geocode DEMs, and create absolute or relative DEMs.

PCI Module Prerequisites

OrthoEngine Automatic DEM Extraction requires Geomatica Core or Geomatica Prime, plus one of the associated sensor suites (Air Photo Ortho, Satellite Ortho, or Radar Ortho).

Supported Sensors

The Automatic DEM Extraction module supports the following aerial, satellite and RADAR sensor types.

Aerial Sensors

- All digital and video frame images
- All scanned, standard air photos

Satellite Sensors

In general terms, DEM extraction should work for any satellite sensor that produces stereo data. The following list is known sensors that have been tested:

- ALOS PRISM
- ASTER
- CARTOSAT
- DEIMOS-2
- EROS
- GEOEYE-1
- IKONOS
- IRS
- Kazeosat-1
- KOMPSAT-2
- KOMPSAT-3
- PLEIADES
- QUICKBIRD
- SPOT 1-7
- TH-01
- WORLDVIEW 1, 2, 3
- ZY-3
- ZY3-2

RADAR Sensors

- ASAR
- KOMPSAT-5
- RADARSAT 1 / 2
- RISAT-1



Epipolar Pairs

Epipolar pairs increase the correlation process speed and reduce the possibility of incorrect matches. Stereo pairs are reprojected, ensuring that the left and right images have a common orientation, and matching features between the images appear along a common x-axis.

Using epipolar pairs, you can:

- Choose from the following pairs:
 - User Select – selects a pair manually
 - Maximum Overlapping Pairs – selects the pair with the highest amount of overlap
 - Minimum Percentage Overlap – specifies the lowest percentage of acceptable overlap
 - All Overlapping Pairs – selects all pairs that overlap above a minimum percentage
- Limit the amount of memory used to generate epipolar pairs
- Define a Down-sample factor to reduce an epipolar image resolution
- Define a Down-sample filter
- Set up epipolar-pair start times

DEM Extraction

Using DEM extraction, you can:

- Specify the minimum and maximum elevation to estimate a search-area correlation
- Specify a failure value to represent any failed (uncorrelated) pixel values in the resulting DEM
- Specify a background value to represent any 'no-data' pixel values
- Set the DEM detail to high, medium, or low for the needed level of detail
- Select an output DEM channel type to 16-bit signed or 32-bit real
- Specify a pixel sampling interval for the number of image pixels and lines used to extract one DEM pixel
- Use a clip region to process a specific area only
- Fill holes and filter interpolated failed values and filter elevation values automatically
- Create a score channel to represent the correlation score for each DEM pixel
- Delete an epipolar pair after use
- Create a Geocoded DEM by using geocoding stored in the project
- Set up DEM extraction start times

DEM Editing

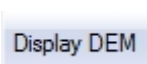

Digital elevation models (DEMs) may contain pixels with failed or incorrect values. You can edit a DEM to smooth out irregularities and create a more accurate model, and in turn, generate more accurate orthorectified images. For example, areas such as lakes often contain misleading elevation values; setting those areas to a constant value improves the model that will produce a more accurate representation of the lake in the ortho image.







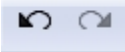
Using the Focus DEM Editing window requires only a DEM; that is, a raster channel in a writable format. To fully use all the functionality available in the DEM Editing window, however, and to produce the best possible DEM, the DEM file should contain additional information. In particular, if the DEM file was extracted from epipolar images, you can make use of that imagery to help with your editing.

DEM files created using PCI technology contain extra information that facilitates DEM editing, including a cutline vector segment and file-level metadata.

The main toolbar on the DEM Editing window provides quick access to several functions that facilitate working with the DEM.

The following table describes the buttons on the DEM Editing toolbar:

Button	Label	Description
	Display DEM	Toggles the display of the digital elevation model layer in the Focus viewer.
	DEM Display Options	<p>Allows you to set display options for the DEM layer. Choose from:</p> <ul style="list-style-type: none"> • <i>Grayscale Shaded Relief</i>: displays the DEM using grayscale hill-shading, where a top-left light source and the elevation values are used to cast shadows. • <i>Color Shaded Relief</i>: displays the DEM using colored hill-shading, where a top-left light source and the elevation values are used to cast shadows. • <i>Dynamic Color Shade Relief</i>: displays the DEM using colored hill-shading, where a top-left light source and the elevation values are used to cast shadows. This option, the default setting, automatically re-renders the color display of the DEM as you pan or zoom across the viewer so that only the pixels currently being viewed are the basis of the colorization. <p>Typically, editing is most effective when the DEM is displayed as a <i>Dynamic Color Shaded Relief</i>.</p>

Button	Label	Description
	Enhancements	<p>Allows you to apply enhancements to the images automatically loaded in the Focus viewer. Available enhancements are:</p> <ul style="list-style-type: none"> • None • Linear • Root • Adaptive • Equalize • Infrequency • Tail Trim (toggle) • Exclude Min/Max (toggle) • Set Trim % <p>Select the Auto Re-enhance option so that, as you pan across the data, the view is automatically refreshed in the Focus viewer to apply the selected enhancement.</p>
	View DEM Polygons	<p>Toggles the visibility of existing DEM polygons. If a Status layer exists, this option also displays polygons from that layer.</p>
	Set View As Verified	<p>Creates a status polygon using the full extents of the current display area and sets its status to <i>Verified</i>.</p>
	Define Preview Region	<p>Allows you to specify a rectangular region to be displayed in a separate viewer. After you define the preview region, the Full Res. Ortho Preview window opens, displaying a preview of the full-resolution ortho image computed using the modified DEM.</p>
	Open FLY!	<p>Launches the Geomatica FLY! application. FLY! uses the modified DEM and ortho imagery (when available) to allow interactive 3-D display. The FLY! view is centered on the current view, but is restricted to 4096 DEM pixels in x and y.</p>
	Save	<p>Saves the modified DEM and all other associated layers.</p>
	Undo/Redo	<p>Allows you to undo or redo previous actions.</p>



Functions

With a license for the Automatic DEM Module, the following functions can be executed either independently or sequentially via an EASI™ or Python™ script. They may also be available in the Algorithm Librarian in Geomatica Focus and the PCI Modeler.

- AUTODEM - Generates a digital elevation model from stereo images – OpenMP enabled
- DEMADJUST - Adjusts (raises/lowers) a raster DEM to elevation points held in a vector layer so that it better fits the elevation points.
- DEMEDPREP - Prepares a digital elevation model (DEM) for manual editing in Geomatica Focus by either copying or linking its elevation channel to a new file.
- DEMMETA - Adds the PCI standard digital elevation model (DEM)-related metadata tags to an existing DEM raster.
- DSM2DTM – Convert a DSM to DTM
- ELEVRMS - Reads elevations from a digital elevation channel and compares the elevations with elevation values from a given GCP (ground control point) segment or from a vector segment
- EPIPOLAR - Generates epipolar images from stereo pairs or raw images – OpenMP enabled
- EPIPOLARDSM - Creates a raster digital surface model (DSM) from epipolar stereo pairs using the Semi-Global Matching (SGM) method.
- GEOCODEDEM2 - geocodes epipolar digital elevation models by reprojecting to the ground coordinate system – OpenMP enabled

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