RADAR ORTHO SUITE

The Radar Ortho Suite includes rigorous and rational function models developed to compensate for distortions and produce orthorectified radar images. Distortions caused by the platform (position, velocity, and orientation), the sensor (orientation, integration time, and field of view) the Earth (geoid, ellipsoid, and relief), and the cartographic projection (ellipsoid and cartographic) are all taken into account using these models. The models reflect the physical reality of the complete viewing geometry and correct all distortions generated during the image formation.

MODULE PREREQUISITES

The Radar Ortho Suite is an add-on to Geomatica. It requires Geomatica Core or Geomatica Prime as a pre-requisite.

SUPPORTED RADAR FORMATS

The OrthoEngine Radar Models support the following radar sensors. For more details on specific sensors, see the Sensor support webpage.

- ASAR
  - ASAR 1B format
- COSMO-SkyMed
  - Level 0 (RAW)
  - Level 1A (SCS)
  - Level 1B (DGM)
- ERS (CEOS)
  - ERS CD provides different levels of processing. We recommend the georeferenced level for images produced in Canada and the PRI level produced by ESA.
- JERS1 (LGSOWG)
  - JERS-1 CD provides different levels of processing. We recommend that you use a georeferenced level or equivalent for highest accuracy. OrthoEngine only works for descending order images.
- ALOS PALSAR

  Geocoded products are not supported in OrthoEngine.

  - ERSDAC PALSAR georeference levels L1.5, L1.5 long, L4.1 and L4.2 are supported. When reading ERSDAC PALSAR data, select the .dat file.
  - JAXA PALSAR georeference level 1.5 is supported. When reading JAXA PALSAR data, select the IMG file. If you have more than one input channel, OrthoEngine reads the data in the following sequence: HH, HV, VH and VV.
- RADARSAT (CEOS):
  - SGC (SAR Georeferenced Coarse Resolution)
  - SGF (SAR Georeferenced Fine Resolution)
  - SGX (SAR Georeferenced Extra Fine Resolution)
  - SLC (Single Look Complex)

  - SCN (ScanSAR Narrow Beam Product)
  - SCW (ScanSAR Wide Beam Product)
- RADARSAT-2 (CEOS)
  - SLC (Single Look Complex)
  - SGF (SAR Georeferenced Fine, ScanSAR Narrow Beam, and ScanSAR Wide Beam)
  - SGX (SAR Georeferenced Extra Fine)
  - SGC (SAR Georeferenced Coarse)
  - SSG (SAR Systematic Geocorrected)
  - SPG (SAR Precision Geocorrected)
- TanDEM-X
  - Only the MGD product is supported for orthocorrection (The user should select the .xml file when reading the data.)
- TerraSAR-X (TIFF)
  - Only the MGD product is supported for orthocorrection (The user should select the .xml file when reading the data.)

Rigorous Math Model

Rigorous math models:

- Calculate the position and orientation of the sensor when an image is taken
- Accurately account for known distortions in an image
- Use ground control points (GCPs) and tie points, combined with the knowledge of rigorous geometry of sensors, to calculate best fit for all images in a project

RPC Models

The Rational Function is a simple math model that:

- Builds a correlation between the pixels and their ground locations
- Obtains RPC data with images and imports coefficients automatically
- Calculates the polynomial coefficients from GCPs
- Refine RPC data with one or more GCPs
- Zero- or first-order GCP refinement available

RPC-based corrections are available for the following types of imagery:

- RADARSAT-2

Ground Control

OrthoEngine supports GCP and tie-point ground controls.

GCP Collection

GCPs can be collected manually or by using:

- A geocoded image
- Geocoded vectors
- A chip database
- A digitizing tablet
- An imported text file

Other features include:

- Stereo-GCP collection
- Conversion of GCPs to check points to exclude from model calculation
- Display of individual and overall RMS error for GCPs
- Depending on the sensor, the following minimum number of GCPs is required:
- RADARSAT, ERS, JERS, ASAR, EROS:
- 8 per image (10-12 recommended)
- RADARSAT with RADARSAT-specific model:
- GCPs are optional (8 recommended)
- ASAR:
- GCPs are optional
- Rational Functions Computed from GCPs:
- 5 per image (19 per image is recommended)
- Rational Functions Extracted from Image File:
- None required (accuracy is improved with 1 or more GCPs)

Tie-Point Collection

Tie points:

- Extend ground control over areas without GCPs
- Identify how images in a project relate to each other
- Ensure the best fit for all images in a project
- Let you enter tie-point elevations manually or extract them from a DEM
- Let you import and export tie points
- Show individual and overall RMS errors

Residual Report

Using residual reports, you can:

- Show GCP, check point, tie point, and Stereo-GCP error information in one report
- Edit points in a residual report and update bundle adjustments
- View in ground units or pixel units
- Print the report to a file

Project Summary Information

Raw Image Summary Table

A summary of information about all of the images in your OrthoEngine project can be viewed in the Raw Image Summary Table window. This window provides information about the following:

- Total number of images in the project
- Total number of ground control points (GCPs), tie points (TPs), and check points (CPs)
- Image-specific information, including image ID, GCPs, TPs, CPs, root mean square (RMS) error, number of overlapping pairs connected by TPs, number of potential overlapping pairs that could be connected by TPs, and the percentage of all overlaps connected by TPs

The Raw Image Summary Table provides you with a dynamic view of your project, allowing you to better target your quality assurance efforts to achieve your desired project requirements.

Image-specific information is displayed in tabular format. The tabular contents can be sorted, making it easier for you to analyze the data in your project and identify areas on which to focus your quality assurance activities.

Project Overview

The Project Overview window displays the geocoded vector footprints or image centers for all images in your OrthoEngine project, and provides options for displaying ground control points (GCPs), check points (CPs), tie points (TPs), image IDs, and point IDs, for the selected image or images or for all images. This viewer helps you better assess your project using a graphical overview.

ORTHORECTIFICATION

Orthorectification:

- Lets you perform batch processes
- Utilizes a DEM for terrain correction
- Increases working cache for processing
- Increases sampling interval for faster processing
- Offers the following resampling methods:
    - Nearest Neighbor
    - Bilinear Interpolation
    - Cubic Convolution
    - 8-pt SinX/X
    - 16-pt Sin X/X
    - Average filter
    - Median filter
    - Gaussian filter
    - User-defined filter
- Clips the image size upon orthorectification
- Lets you set a starting time for processing
- Provides approximately one-third of a pixel accuracy for VIR satellite images, and approximately one pixel for radar images when quality ground control coordinates are used

MANUAL MOSAICKING

With manual mosaicking, you can:

- Define a mosaic area
- Collect cutlines manually by:
    - Importing and exporting cutlines
    - Blending seams using Blend Width

- Perform manual color balancing:
  - Based on samples identified in overlap between images
  - By using samples (match areas) to compute look-up tables (LUTs) to adjust new images to match an existing mosaic
  - By adjusting the dark end or light end
  - By importing and exporting LUTs for color balancing
- Mosaic unreferenced images

FUNCTIONS

With a license for the Radar Ortho Suite, the following functions are activated within the EASI and/or Modeler/Algorithm Librarian environments:

- RFMODEL – computes the math model of one or more images using the rational function math modeling method
- RSMODEL - computes the math model of one or more images using the radar-specific modeling method
- SATMODEL – calculates the math model for one or more images using the Rigorous math modeling method

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For more information, contact

PCI Geomatics
50 West Wilmot Street
Richmond Hill, ON L4B 1M5
Canada

Phone: 1 905 764 0614
Fax: 1 905 764 9604
Email: info@pcigeomatics.com
Web: www.pcigeomatics.com