**Preprocessing SPOT5 imagery in PCI**

Many of the projects undertaken by the CGA use SPOT5 imagery, typically obtained by the Satellite Application Centre (SAC) of the CSIR. Imagery provided by SAC can take three formats:

* Level 1 Raw - Separate pan and multispec images with no geometric, radiometric or atmospheric correction.
* Level 2a - Geometrically corrected and panfused. No radiometric or atmospheric correction.
* Level 2b - True colour mosaic. Level 2a images histogram equalised, mosaicked and compiled in a true colour format.

It is usually desirable to acquire either L1 or L2a (if available) products for spectral analysis, as the infrared bands are discarded during the creation of the true colour mosaic. Typically, images are provided in raw format, and require a significant amount of preprocessing before analysis can be undertaken. This document is a guide for performing the preprocessing steps of orthorectification (geometric correction), ATCOR3 (radiometric and atmospheric correction) and pansharpening of SPOT5 imagery.

**Orthorectification**

Orthorectification is the geometric correction of an image accounting for terrain distortion. SPOT imagery is geometrically corrected using knowledge of the satellite sensor at the time of capture, the identification of a number of unknown points on the imagery using referenced data, and an accurate DEM. The steps indicated in this guide are tailored for PCI OrthoEngine.

Launch **Start > Programs > PCI Geomatics > Geomatica *Vx.x* > OrthoEngine**

**Create Project**

* Click **File > New**.
* Designate the **Filename** according to an identifiable characteristic of the scene you are orthorectifying e.g. the KJ numbers - K116J418.prj.
* Provide some detail under **Name** e.g. "The Orthorectification of SPOT scene K116/J418 for project P13 Berg River Land Cover Classification".
* Select **Optical Satellite Modelling >** **Toutin’s Model.**

**Set Projection**

Projection is project specific - **Output Projection** specifies the projection of your orthoimages; **GCP Projection** specifies the projection of your reference imagery. Generally it is a good idea to specify your output projection as the projection of you reference data. For areas in southern Africa your projections will typically will be either LO or UTM related.

For LO:

* Click the down arrow for output projection and select **Other**.
* Click **User Projections** and find the series of ZA projections. Select the one most relevant to your project e.g. **ZALO19 D517**.
* Click **Earth Model** and select **D000 – WGS 1984 [Global Definition]** (you do this because the ZALo system in OrthoEngine has Cape Datum as default).

For UTM:

* Click the down arrow for output projection and select **UTM**.
* Click **Ellipsoids** and select **E012 - WGS84**.
* Select the relevant UTM **Zone** and **Row** for your project.

For the resolution:

* Set the **Output pixel spacing** and **Output line spacing** as 2.5m.
* Click **Set** **GCP Projection based on Output Projection**.

**Data Input**

For Orthorectification the **Spot 5 level 1A Data (DIMAP Format)** needs to be imported to **PCIDSK** Format. This can be done beforehand in Focus using the **CDSPOT5** function from thealgorithm librarian (or using *EASI script*) or in OrthoEngine under the **Data Input** processing step.

* Click the **Read CD-ROM Data** button
* Select **Spot 1-5 (DIMAP)** under **CD Format**. These import methods require that the metadata (METADATA.DIM) file be in the same folder as the image being imported. The .DIM file must be named **METADATA.DIM** (change the name of the .DIM file if it is not e.g. If the PAN and MS images are in the same folder rename .DIM file for the PAN image to METADATA.DIM and import the PAN image. Rename the PAN metadata file back to its original and then do the same to import the MS image).
* Click **Select**, and navigate and select the scene to be orthorectified.
* For **Requested channels** select the relevant number of channels (pan = 1, multispec = usually 4).
* For **PCIDSK filename**, provide a name which is specific to the scene. This may be a good time to rename the file according to the generic SPOT scene format e.g. 51184180911030847322T.
* Click **Read.**

If the data was imported in Focus, click the **read PCIDSK File** instead and load both the imported MS and PAN images.

**GCP Collection**

* Click the **Collect GCPs Manually** in the GCP/TP Collection Processing Step.
* **Open** Both the PAN and the MS images.

In the **GCP Collection** windowselect **Geocoded Imagery** browse to and select the Arial to use for GCP Collection (This can be changed later to collect more GCPs from multiple images).

Select the **DEM** to use**.**

**Auto locate** & **Compute Model** should be checked**.**

**GCP Collection Process:**

* Find appropriate GCP in the **Geocoded Image** window. click **use Point**
* Find the matching point on the PAN Image and click **use Point**
* Click **Extract Elevation**
* Find the same point on the MS image and click **use point**.
* Click Accept to accept the GCPs.

For Spot 5 image a Minimum of six GCPs is required and **at least 12 is** **recommended.** Collect enough GCPs to obtain appropriate RMS Error for the images. GCPs must be well distributed across the scene.

**Ortho Generation**

Go to the Ortho Generation Processing step.

Select **Only** the **PAN** image to process.

Select the correct DEM under **Ortho Generation options.**

IF necessary (warning message appears) set the DEM background value to the min value that appears on the warning message.

Click **Generate Orthos** to produce the Orthorectified **PAN** Image.

When the process is completed, go back to the **Project** processing step and click **Set output and GCP Projection.**

Set the **Output pixel spacing** and **Output line spacing** as 10m, click OK.

Click **Reset** on themessagethat appears.

Go back to the **Ortho Generation** **step and this time orthorectify** only the **MS image.**

**ATCOR 3**

## Setting up the DEM for ATCOR 3

The DEM to be used with ATCOR 3 must resampled to the same pixel size and clipped to the same area as the input image, and pixels must overlay exactly.

Load the 20m DEM Block, and the orthorectified PAN and MS mages in ArcMAp.

Use the **project raster** tool to the project to L019.

For the **MS** image: set the output pixel size to **10m**; **resampling technique**  to **Cubic**;

Click on **environments**; **general settings.**

Go to the **extent** dropdown menu and select the Orthorectified

MS image; If possible also select the image as the **snap raster.**

Runthe project tool; The output DEM should be usable for the

ATCOR 3 of the MS image

For the **PAN** image: set the output pixel size to **2.5m**; **resampling technique**  to **Cubic**;

Click on **environments**; **general settings.**

Go to the **extent** dropdown menu and select the Orthorectified

PAN image; If possible also select the image as the **snap raster.**

Runthe project tool; The output DEM should be usable for the

ATCOR 3 of the PAN image

**SPOT 5 MS**

**Edit Calibration File.**

Atcor uses a calibration file that contains the correct gains and biases of the imagery to be corrected.

Open the default SPOT 5 calibration file (C:\Program Files\PCI Geomatics\Geomatica\_V103\atcor\cal\spot5\ spot5\_test.cal) in a text editor.

Replace the biases with the biases found in the metadata file of the Spot imagery and Save the file as your own custom calibration (.cal) file.

**Atmospheric Correction**.

Open the **Atmospheric Correction** window (under Analysis).

Select the input image file (Orthorectified Spot 5 MS image).

Click **DEM (ATCOR3)** and select the DEM to use. (DEM must resampled to the same pixel size and clipped to the same area as the input image, and pixels must overlay exactly **see the section above: (**Setting up the DEM for ATCOR 3**)**) .

The units must be **meters.**

Select **SPOT-5 MS** under sensor type.

**IMPORTANT:** The band order of must be changed (bands 1 and 3 must switch).

Click **band Setup.**

Next to **Band Sensor # 1** changethe **input channel** to 3.

Next to **Band Sensor # 3** change the **input channel** to 1.

Click **OK.**

**Pixel Size** should be 10.

Set the Date of the image.

Set the option that is closest to the **view angle** in the metadata.

Select the **custom calibration file** that was created.

Select the most appropriate Atmospheric information paramaters (probably **Rural** & **Fall**)

Enter the **Solar Zenith** angle (Solar Zenith = 90 – Solar Elevation angle ; Solar Elevation can be found in metadata file)

Enter the **Solar Azimuth** (Found in metadata file).

Click **apply** and **OK**

Right click **ATCOR MetaLayer** and go to advanced options.

Select **empirical correction** for the BRDF correction.

Click **BRDF Options.** Enter the **threshold** **angle as: Solar Zenith angle + 20** (Rule of thumb geomatica help file).

Use default equation and lower boundary value.

Right click **ATCOR MetaLayer** and go **Run** **Atmospheric** **correction**.

Name the corrected output file and **Run Correction.**

**SPOT 5 PAN**

For ATCOR 3 on the SPOT-5 Panchromatic image use the same procedure described above for the MS image except:

Edit the calibration file (C:\Program Files\PCI Geomatics\Geomatica\_V103\atcor\cal\spot5\_pan\Spot5\_pan.cal)

Use values found in the Metadata file for the PAN image.

Set the pixel size to **2.5**.

**PANFUSING (SPOT 5 MS (10m) + SPOT 5 PAN (2.5m))**

Find the **PANSHARP** Algorithm in the Algorithm Librarian.

Under the **Files** tab select the four bands of the SPOT-5 MS image under **Input: Input Multispectral Image Channels.**

**InputRef: Input Reference Image channels *-*** *These channels and the channels of the panchromatic image span the same range of frequency (wavelength) response (****geomatica help file****).*

For SPOT-5 MS data this corresponds to bands 1 & 2.

Select bands 1 and 2 of the SPOT-5 MS image under **InputRef.**

**InputPan: Panchromatic Image Channel -** Select the band of the SPOT-5 PAN image.

Name (browse) the output Pansharpened Image under **output ports** and **check** the named file.

Keep the default values under the **Input Params 1** tab.

Run the Pansharp algorithm.

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Camping / cottage?

0861 227 362 or 021 483 0190

690 for cottage

980 pp 2 day trail,

800 bush camp

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