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# RADARSAT Toolbar for ArcMap 10.3.1 User Manual

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# RADARSAT Toolbar for ArcMap 10.3.1 User Manual

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## Document Revision History

| Document version | Date of changes | Change Description |
|---|---|---|
| 1.0 | 10/09/2015<br>14/09/2015<br>24/09/2015 | Original. Last SVN release number 299.<br>Draft submitted to Client<br>Added to CCM Tool |
| 1.1 | 16/02/2017 | - RADARSAT Toolbar s/w Version: 1.3.2<br>- SVN is no longer used.<br>- GIT Repository<br>- New tools: PTA, DTA, Quad Pol, Help, Bridge Measurement |
| 1.2 | 20/03/2017 | - RADARSAT Toolbar s/w Version: 1.3.3<br>- New tool: Tower/Building Measurement |
| 1.3 | 21/03/2017 | - RADARSAT Toolbar s/w Version: 1.3.4<br>- Toolbar re-organized |
| 1.4 | 23/03/2017<br><br>24/03/2017 | - RADARSAT Toolbar s/w Version: 1.3.5<br>- Delete all layers when user clicks on File - >New Document<br>- RADARSAT Toolbar s/w Version: 1.3.5.1<br>- Azimuth Range always the same size and not displaying in Layout View |
| 1.5 | 11/05/2017 | - RADARSAT Toolbar s/w Version: 1.3.5.1<br>- Full document reformatting |
| 1.6 | 19/07/2017 | - RADARSAT Toolbar s/w Version: 1.3.5.1<br>- Document updated based on comments received from DRDC on July 10. |
| 2.0 | November, 2017 | - RADARSAT Toolbar Version from 2.0.1 to now<br>- Regular Windows changed to ArcMap Windows Panels capable to be pinned and docked. ArcMap will then remember any panel position.<br>- All Windows have been re-designed<br>- New Nudge Tool<br>- New Tasks Manager<br>- New Speckle Tool<br>- New Nudge Batch Tool<br>- PTA Fixes<br>- New Toolbar buttons per Tool |
| 2.1 | March 2018 | - Final Technical Authority review |

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# 1. GETTING STARTED

## 1.1 Introduction

The RADARSAT Toolbar for ArcGIS provides a number of add-in tools designed specifically for analysis of RADARSAT-2 (R2) and RADARSAT Constellation Mission (RCM) images. The RADARSAT Toolbar has a number of add-in tools for metadata extraction and image preprocessing, and it has one add-in tool for generating Tactical Decision Aids (TDAs) in a standardized manner. The add-in tools for metadata extraction and image preprocessing are based in large part on functionality already existing in DRDC's Image Analyst Pro (IA Pro) software, and in DRDC's custom version of the Geospatial Data Abstraction Library (GDAL). These add-in tools are accessible via the customized RADARSAT Toolbar that can be installed via ArcMap's add-in management functionality. Note that future versions of the RADARSAT Toolbar will provide tools for the exploitation of RCM data.

## 1.2 Intended Audience

The intended audience is technical staff in DND and other government departments. It is assumed that the reader is familiar with the following:

- Standard Microsoft Windows components such as dialog boxes and buttons;
- Use of Esri ArcMap;
- RADARSAT-2 data and associated terminology; and
- Terrain analysis process and cross-country mobility (CCM) products.

## 1.3 System Requirements

The following are the system requirements for running the RADARSAT Toolbar.

- Processor speed: 2.2 GHz minimum; Hyper-threading (HTT) or Multi-core recommended
- Processor: x86 or x64 with SSE2 extensions
- Memory: 4 GB minimum
- Display: 24-bit color depth
- Disk: 256GB at 7200 rpm
- Screen resolution: 1024 x 768 recommended minimum at normal size (96 dpi)
- Video / graphics adapter: 512 MB minimum RAM, 1 GB RAM or higher recommended. NVIDIA, ATI, and Intel chipsets supported; 24-bit capable graphics accelerator; OpenGL version 2.0 runtime minimum is required, Shader Model 3.0 or higher is recommended

## 1.4 Software

- ArcGIS for Desktop 10.3.+ Advanced with Spatial Analyst and Data Interoperability extensions. The RADARSAT Toolbar has been tested primarily with this version
- ArcGIS for Desktop 10.4.+/10.5.+/ArcGIS Pro Advanced with Spatial Analyst and Data Interoperability extensions. The RADARSAT Toolbar will install but will NOT run on these versions
- RFT Reader such as Word
- PDF Reader such as Adobe Acrobat Reader

## 1.5 Installation Procedure

A distribution package (DRDC_RADARSAT2_x.x.x.ersiAddIn where x.x.x is the version number of the RADARSAT Toolbar to be deployed) contains a dynamic link library (*.dll) and all other files required for the successful installation of the RADARSAT Toolbar.

Use the following steps in order to install the RADARSAT Toolbar into ArcMap.

1. Click on the **Customize** option and then click on the **Add-In Manager** sub-option. The Add-In Manager dialog (Figure 2) will be displayed. Confirm that under **My Add-Ins** section the "DRDC_RADARSAT2" is not already showing; if so then proceed with Step 2 of the Uninstallation Procedure as provided on page 5 before proceeding with step 2 of this Installation Procedure.

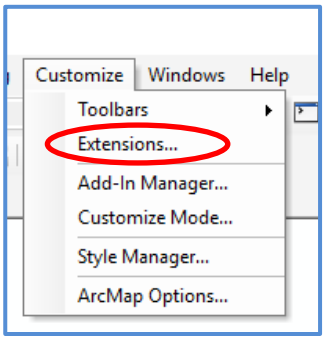



Figure 1 – Customize tab

2. From the Add-In Manager dialog in Figure 2, click on the **Customize…** button.

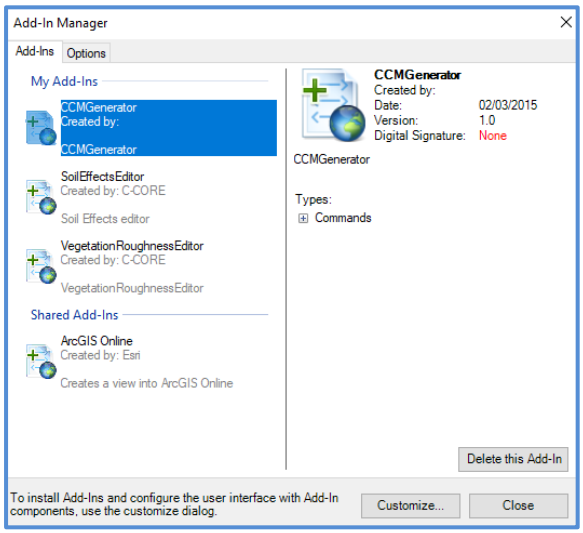



Figure 2 – Add-In Manager dialog

3. The Customize dialog will be displayed as shown in Figure 3. From the Customize dialog, click on the **Add From File** button.

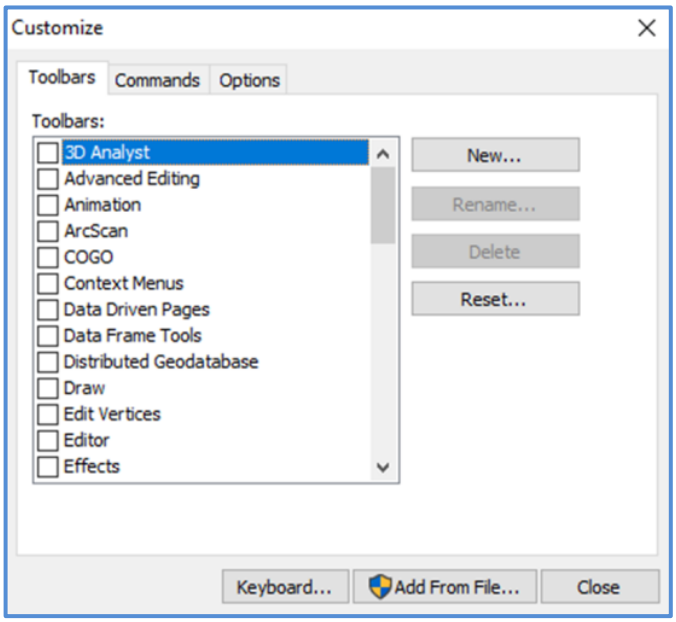



Figure 3 – Customize dialog

4. The Windows Open dialog (Figure 4) will be displayed with a list of DRDC RADARSAT distribution packages. Select the latest one to be installed and then click on the **Open** button.

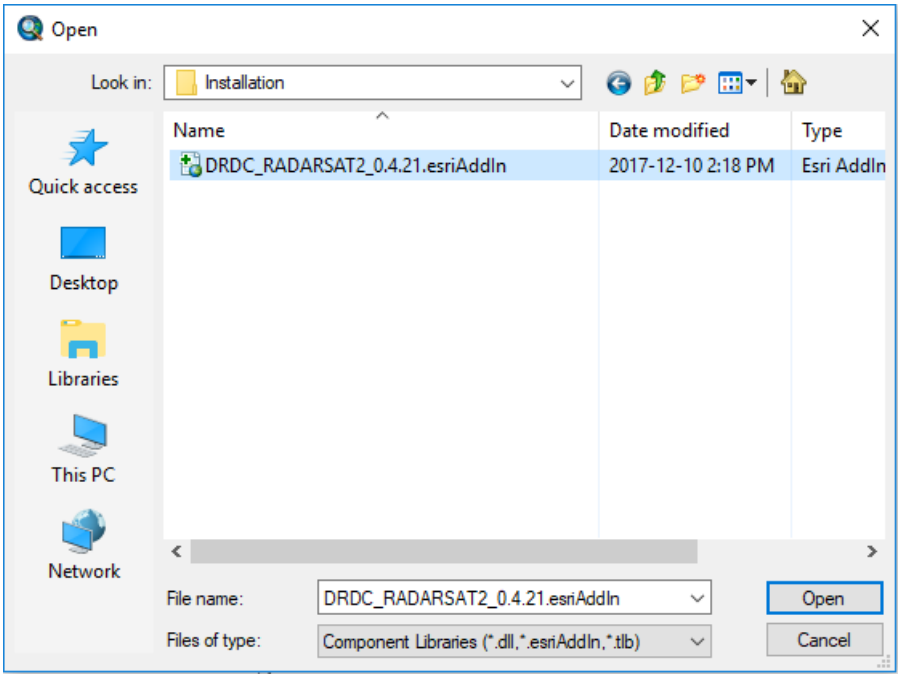



Figure 4 – Windows Open dialog

5. The Esri ArcGIS Add-In Installation Utility dialog (Figure 5) is displayed. Click on the **Install Add-In** button.

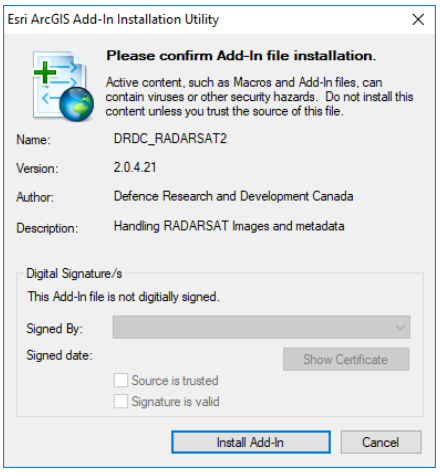



Figure 5 – Esri ArcGIS Add-In Installation Utility dialog

6. A pop-up box with Added Objects… (Figure 6) is displayed with the list of the objects that were added for the installation. Click on the **OK** button.

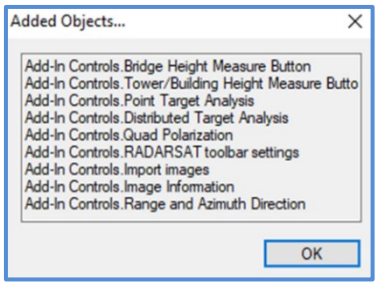



Figure 6 – Added Objects…

7. Back on the Customize dialog (Figure 7), check the box beside RADARSAT Toolbar and then click on the **Close** button.

   At this point the RADARSAT Toolbar will be displayed on your ArcMap windows.

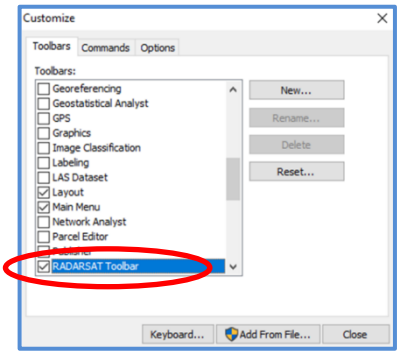



Figure 7 – Customize dialog with RADARSAT Toolbar

Uninstallation Procedure

The following steps may be used to uninstall the RADARSAT Toolbar.

1. As shown in Figure 8, from the Windows toolbar, click on the **Customize** option and then click on the **Add-In Manager** sub-option.

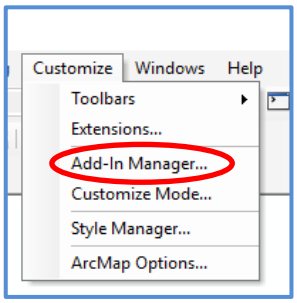



Figure 8 – Windows Toolbar

2. In the Add-In Manager dialog (Figure 9), look for the "DRDC_RADARSAT" and click on it to select and then click on the **Delete this Add-In** button.

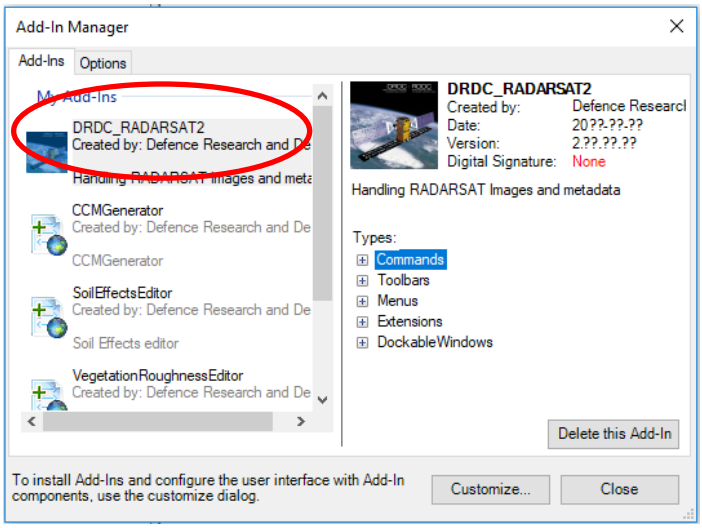



Figure 9 – Add-In Manager dialog

3. A confirmation pop-up box (Figure 10) will be displayed. Click on the **Yes** button.

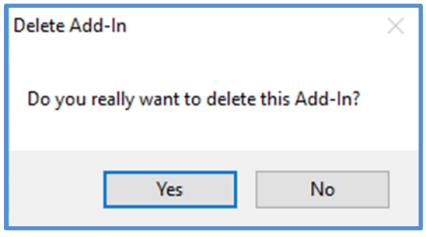



Figure 10 – Delete Add-In pop-up box

4. Go back to the Add-In Manager dialog (Figure 11) and from there, click on the **Close** button to exit the dialog.

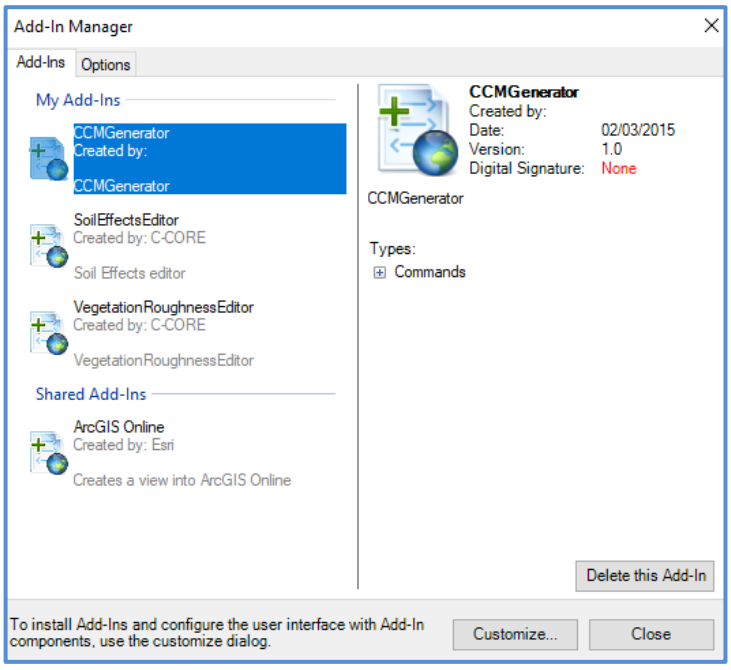



Figure 11 – Add-In Manager without DRDC_RADARSAT

***NOTE:***

Occasionally, you will need to clear the cache to install the toolbar properly.

Open Windows Explore and place the following (don't forget to change {username} to your own)

```
C:\Users\{username}\AppData\Local\ESRI\Desktop10.3\AssemblyCache
```

Delete any folders that are present

The folder \AssemblyCache may not be apparent since it is hidden. An alternative is to use the Windows Command line to delete the entire folder (It will be re-written). For example:

```
C:\> cd C:\Users\{username}\AppData\Local\ESRI\Desktop10.3\
C:\Users\{username}\AppData\Local\ESRI\Desktop10.3> rmdir AssemblyCache /s
```

## 1.6 Acronyms

Table 1 provides a list of the acronyms used throughout this document along with their definitions.

Table 1 - Acronyms

| Acronym | Definition |
|---|---|
| CCM | Cross-country mobility |
| DEM | Digital Elevation Model |
| DN | Digital Number |
| DRDC | Defence Research and Development Canada |
| DTA | Distributed Target Analysis |
| ESRI | Environmental Systems Research Institute |
| IA Pro | Image Analyst Pro |
| NESZ | Noise Equivalent Sigma Zero |
| PTA | Point Target Analysis |
| R2 | RADARSAT-2 |
| RCM | RADARSAT Constellation Mission |
| SLC | Single-Look Complex |
| TDA | Tactical Decision Aid |

## 1.7 Terms and References

Table 2 provides a list of the acronyms used throughout this document along with their definitions.

Table 2 - Terms and References

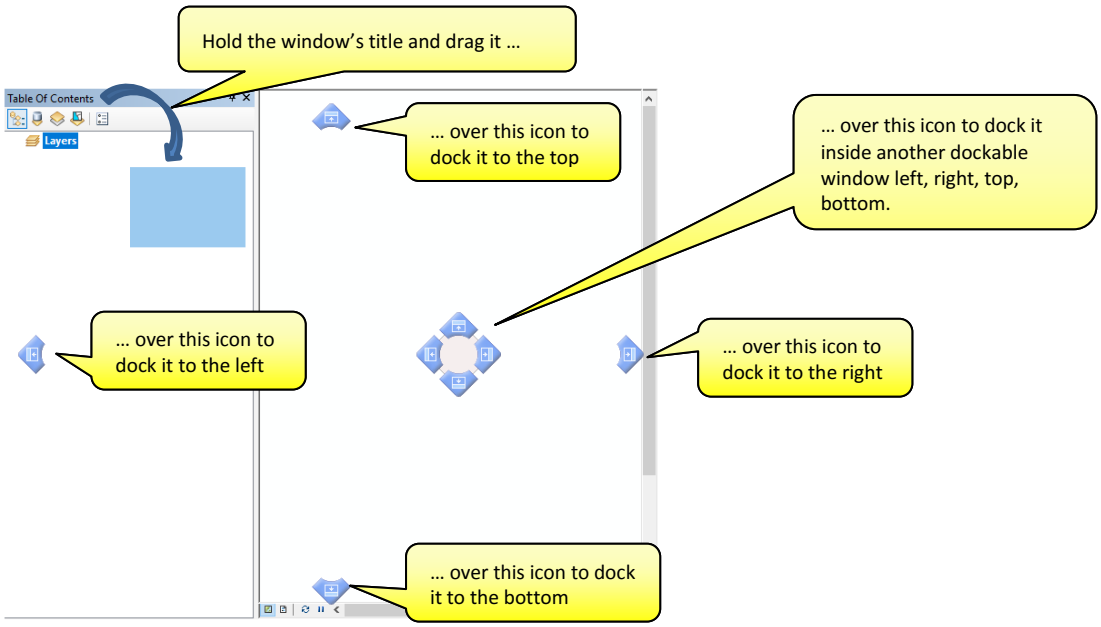
| Terms | Definition |
|---|---|
| Click | The term “click” refers to pressing the left mouse button. |
| Right-click | “Right-click” is used where necessary to specify a press of the right mouse button. |
| Table Of Contents | Refers to the ArcMap screen interface, not the TOC of the User Guide. |

# 2. RADARSAT TOOLBAR

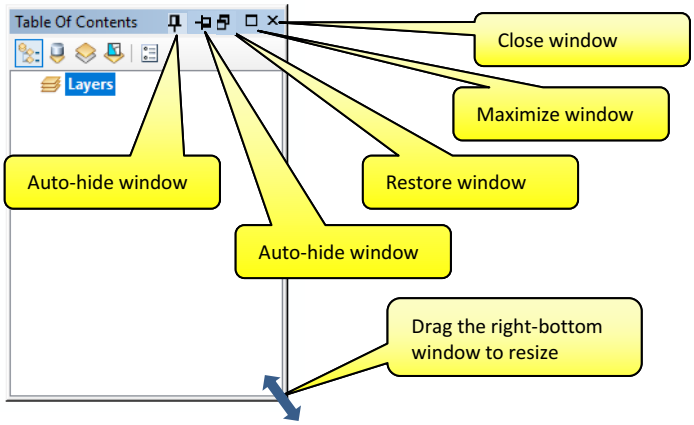
## 2.1 Dockable Window Principal

A ***dockable*** window is a window that can exist in a floating state or be attached to the ArcMap window. The Table of Contents in ArcMap is a good example of a dockable window. RADARSAT Tools behave the same way:

How to dock the window:




How to resize a window:



## 2.2 Toolbar Overview

### 2.2.1 Splash Screen

If the RADARSAT (RS) Toolbar is installed properly, when you launch ArcMap, a splash screen window will pop up indicating that the functionalities are loading up.

You can check the box **Don't show it anymore** to avoid displaying this window every time you launch ArcMap. Refer to Adjust Settings for more options.


Figure 12 – Splash Screen

**Option 1**

Removing the layers one by one by right-clicking a layer and clicking on the **Remove** option from the pop-up menu as shown in Figure 13.

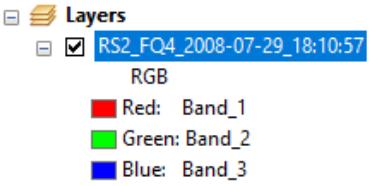



Figure 13 – Remove a single layer

**Option 2**

Removing all layers by creating a new document.

1. From the ArcMap menu (Figure 14), click on the **File** option then click on the **New…** sub-option.

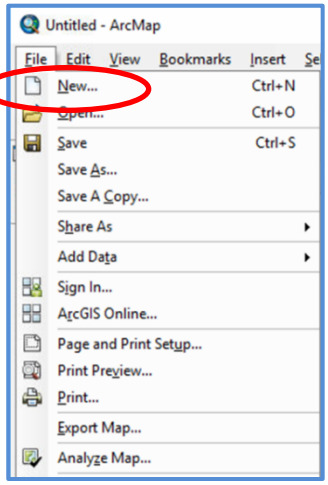



Figure 14 – ArcMap menu

2. From the New Document dialog (Figure 15), click on the **OK** button.

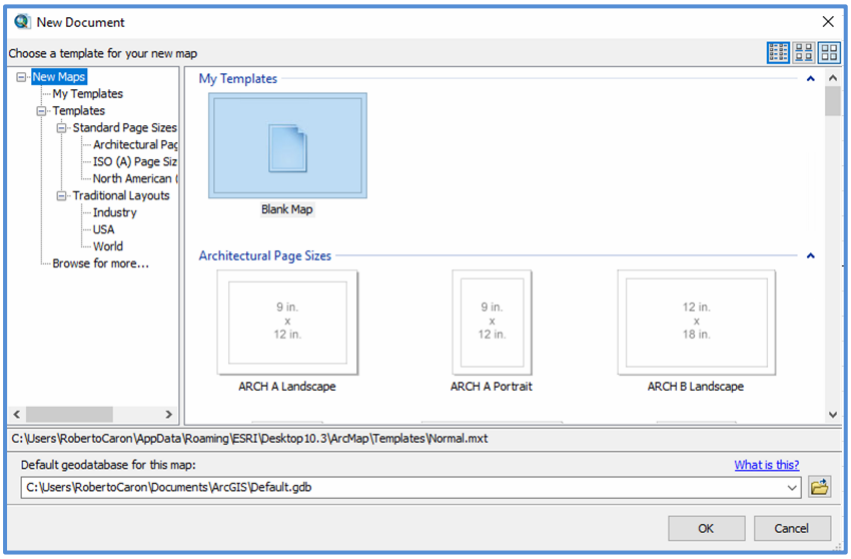



Figure 15 – New Document dialog

3. A confirmation pop-up box (Figure 16) is displayed. Click on the **Yes** button.

   At this point, the focus is returned to the ArcMap windows and all previously imported layers are gone.

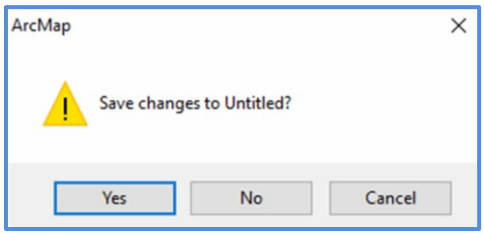



Figure 16 – ArcMap confirmation pop-up

### 2.2.2 Tools

The RS Toolbar does not interact with other ArcMap toolbars; it has its own set of functionalities.

The RS Toolbar is shown in Figure 17.

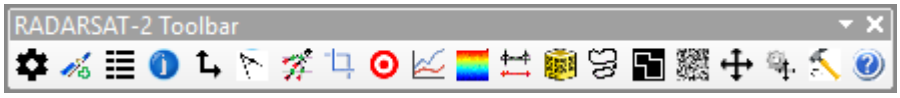



Figure 17 – RADARSAT Toolbar

Table 3 provides the toolbar buttons and the links to jump to the specific section of this User Guide document that explain the tool function. Note that the document is also used as part of the Help function of the RS Toolbar which is where the links to jump to specific section will be used.

Table 3 – RADARSAT Toolbar Function List

| Button | Section and Function Name |
|---|---|
|  | 2.3 Function – Adjust Settings page 15 |
|  | 2.4 Function – Import Radarsat-2 images for use with DRDC RS Toolbar page 19 |
|  | 2.5 Function – View Image Information page 23 |
|  | 2.6 Function – View Pixel Information page 26 |
|  | 2.7 Function – Display Range and Azimuth Direction page 28 |
|  | 2.8 Function – Add Corner Coordinates page 29 |
|  | 2.9 Function – Orthorectification page 30 |
|  | 2.10 Function – Resampling page 34 |
|  | 2.11 Function – Point Target Analysis (PTA) page 36 |
|  | 2.12 Function – Distributed Target Analysis (DTA) page 41 |
|  | 2.13 Function – Quad-pol image page 54 |
|  | 2.14 Function – Bridge Clearance Estimation page 58 |
|  | 0<br>Function – Tower/Building Height Estimation page 65 |
|  | 2.16 Function – Shoreline page 72 |
|  | 2.17 Function – Edge Detection (Canny) page 76 |
|  | 2.18 Function – Speckle Filter page 81 |
|  | 2.19 Function – Nudge page 84 |

| Button | Section and Function Name |
|---|---|
|  | 2.20 Function – Tasks in progress page 88 |
|  | 2.21 Function – Help page 89 |
|  | 2.22 Function – Batch Nudge page 90 |

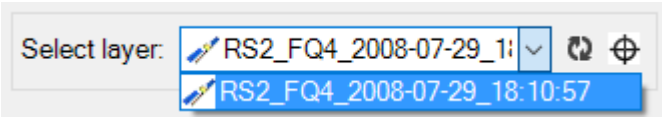
### 2.2.3 Selector Layer

The RS Toolbar has several buttons. Each button when clicked, is related to a window. A window could be either “modal dialog” or “Dockable”.

**Modal dialog** is a window that forces the user to interact with it before they can go back to using the parent application. Tools are Settings, Add Image, Add Corner Coordinates, Tasks in progress and Help.

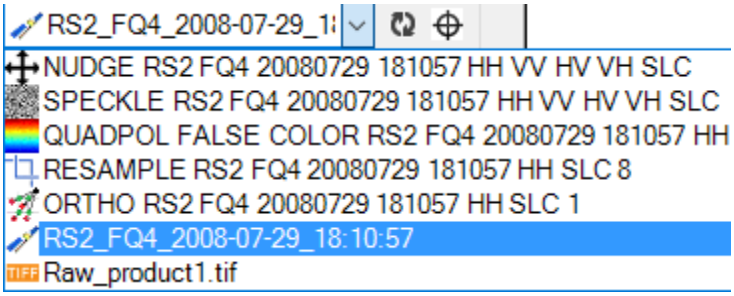
#### 2.2.3.1 Drop-down selector layer

From the Table Of Contents, the select layer drop-down shows any layer related to a RADARSAT-2 image format. The button  will refresh the drop-down layer list from the TOC. The button  will focus and show the selected layer on the map. The image present in front of the layer name indicates the type of the RADARSAT-2 Image:

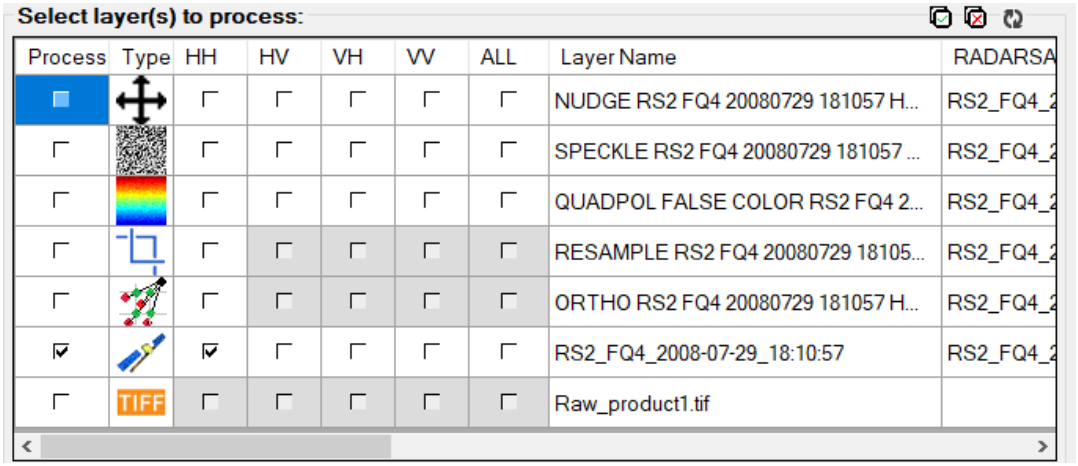


| | |
|---|---|
|  | This is a typical RADARSAT-2 Image. The metadata file product.xml |
|  | This is a GeoTIFF image (extension .tif). GeoTIFF is a metadata standard containing georeferencing information embedded within a TIFF file. This type of image is only supported by these 3 following tools: Speckle, Nudge, Shoreline Extractor |
|  | The RS Toolbar QuadPol Tool (2.13 Function – Quad-pol image page 54). Using this will process and generate a new QuadPol RADARSAT-2 Image |
|  | The RS Toolbar Orthorectification Tool (2.9 Function – Orthorectification page 30). Using this tool will process and generate a new Orthorectification RADARSAT-2 Image |
|  | The RS Toolbar Resampling Tool (2.10 Function – Resampling page 34). Using this tool will process and generate a new Resampling RADARSAT-2 Image |
|  | The RS Toolbar Speckle Tool (2.18 Function – Speckle page 81). Using this tool will process and generate a new despeckled RADARSAT-2 Image |
|  | The RS Toolbar Nudge Tool (2.19 Function – Nudge page 84). Using this tool will process and generate a new Nudge RADARSAT-2 Image |

Figure 18 – RADARSAT-2 Image Type




NB: Tiff image will be shown only if the RS Toolbar can process



## 2.3 Function – Adjust Settings

### 2.3.1 Overview

The **Adjust Settings** tool is used to adjust toolbar functions that are common to all imported images. Only one setting is currently available for adjustment and it is the location of the cached files that are generated for imported images. As shown in Figure 19 by default the cache is stored in the subdirectory of the current user's **My Documents** folder; this subdirectory is called **RADARSAT toolbar for ArcGIS**, which is created by the toolbar.

The **Adjust Settings** tool from the RS Toolbar displays the dialog shown in Figure 19.

Refer to Figure 17 – RADARSAT Toolbar

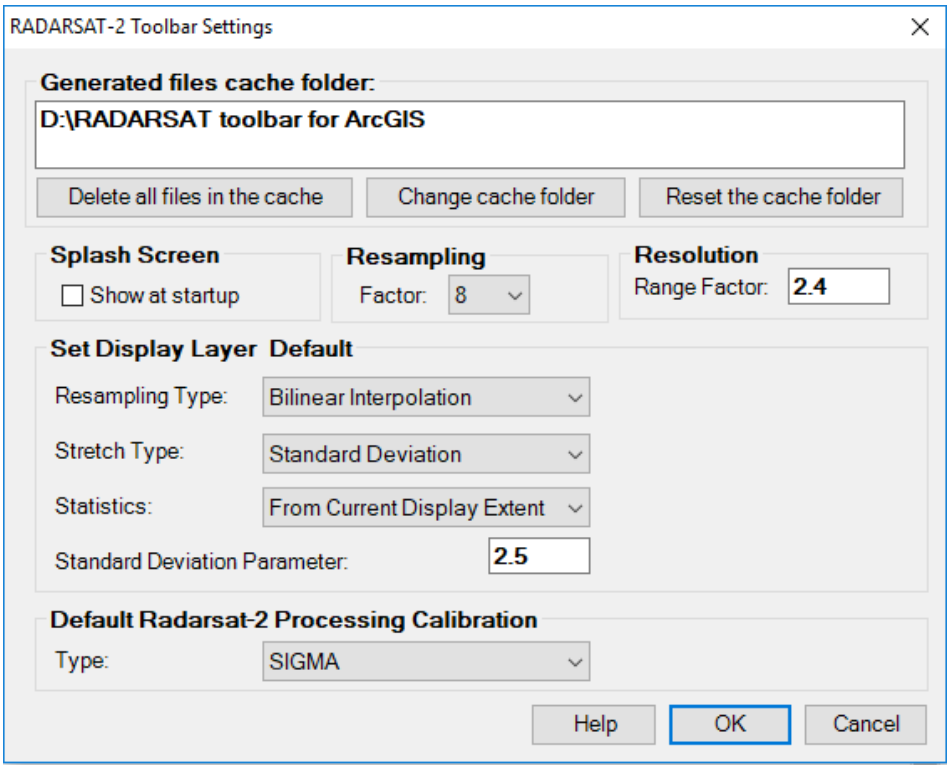
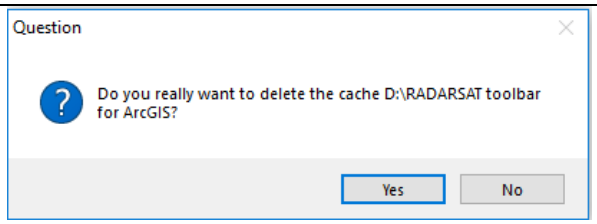
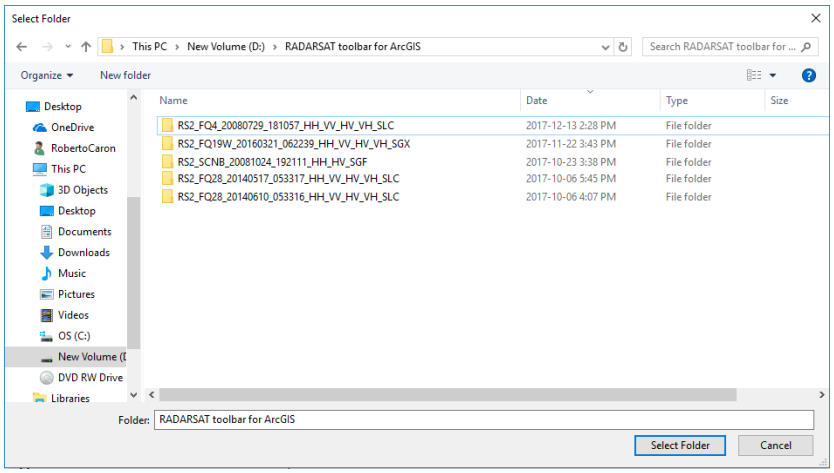



Figure 19 - RADARSAT Toolbar Settings dialog

| | |
|---|---|
| **Delete all files in the cache** button | **Be careful!** This button will delete the entire cache folder if you click the **Yes** button to the following question. |

| | |
|---|---|
| |  |
| **Reset the cache folder** button | This button restores all settings displayed in the dialog to their default values. It will set this following way which **{username}** is your windows user name.<br>C:\Users**\{username}**\Documents\RADARSAT toolbar for ArcGIS |
| **Change cache folder** button | This button allows changing the location of the cached. Explorer the folder and then click the **Select Folder** button.<br>  <br>Alternate process: An existing folder location path can also be pasted into the toolbar settings dialog. |
| **Show at startup** checkbox | If checked, when launching ArcMap, a Splash Screen will be displayed indicating that the RS Toolbar is loading up |
| Resampling **Factor** dropdown list | Search region on the original image for peak detection is always a power of two used by the tools Resampling, Point Target Analysis (PTA) and Distributed Target Analysis (DTA) |
| **Range factor** numeric box | Calculate uncertainly used by the tools Tower/Building Height Measure and Bridge Clearance Estimation |
| **Resample type** dropdown list | Applies this default resample technique when adding an image:<br>• Nearest Neighborhood. The fastest resampling method, minimizing changes to pixel values. Suitable for discrete data such as land cover.<br>• Bilinear Interpolation. Calculates the value of each pixel by averaging (weighted for distance) the values of the surrounding 4 pixels. Suitable for continuous data. |

| | |
|---|---|
| | • Cubic Convolution. Calculates the value of each pixel by fitting a smooth curve based on the surrounding 16 pixels. Produces the smoothest image, but can create values outside of the range found in the source data. Suitable for continuous data. |
| **Stretch Type** dropdown list | Applies the default stretch when adding an image:<br><br>• None. No stretch will occur. The pixel values will be mapped from the possible minimum and maximum values of the data type and depth stored in the raster to the beginning and end of the color ramp.<br>• Minimum-maximum. The minimum and maximum values of the calculated statistics will be used as the minimum and maximum values of the color ramp; all values in between will be interpolated linearly.<br>• Standard deviation. A standard deviation stretch will be applied. You can also specify the n value for the number of standard deviations to use. This method is used to emphasize how much feature values vary from the mean value; it is best when used on normally distributed data.<br>• Histogram equalization. A histogram equalization contrast stretch will be applied. This method is good when there are a lot of pixel values that are closely grouped together.<br>• Percent clip. A stretch is applied without using the top and bottom extreme percent values. You need to specify the minimum and maximum percentage values to exclude from the stretch. Valid values for the minimum and maximum are 0 to 100. |
| **Statistics** dropdown list | Applies this default statistics when adding an image:<br>• From Current Display Extent. Uses the statistics only from the pixels that are currently displayed in the display view. This allows for better contrast in areas where the pixel values are similar.<br>• From Each Raster Dataset. Uses the statistics from the entire raster dataset. This ensures that the same statistics are used for each raster dataset. |
| **Standard Deviation Parameter** numeric box | This number of values is applied if the Stretch Type Standard deviation is selected. |
| **Calibration Type** dropdown list | The objective of SAR calibration is to provide imagery in which the pixel values can be directly related to the radar backscatter of the |

| | |
|---|---|
| | scene. Applies this default calibration when adding an image.<br>• Sigma nought $\sigma^0$: Use Sigma nought lookup value from product metadata.<br>• Gamma nought $\gamma^0$: Use Gamma nought lookup value from product metadata.<br>• Beta nought $\beta^0$: Use Beta nought lookup value from product metadata.<br>• NONE. It uses DN (uncalibrated) value lookup from product metadata. |
| **OK** button | This button saves changes made to the settings. |
| **Cancel** button | This button cancels changes made to the settings. |
| **Help** button | This button invokes the User Guide |

## 2.4 Function – Import Radarsat-2 images for use with DRDC RS Toolbar

### 2.4.1 Overview

The **Import Radarsat-2 images for use with DRDC Radarsat Toolbar** tool displays the dialog shown in Figure 20 and allows selecting multiple images to import.

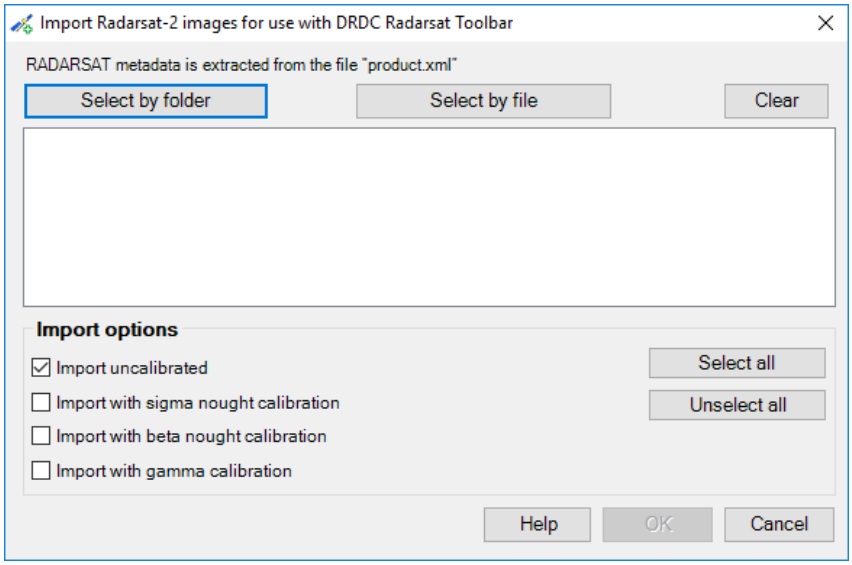



Figure 20 – Import Radarsat-2 images for use with DRDC RS Toolbar dialog

| | |
|---|---|
| **Select images by folder** button | The **Select images by folder** button enables the selection of the folder(s) where the product file is located. |
| **Select image by file** button | The **Select image by file** button enables the selection of individual RADARSAT-2 product files via the standard Windows Open dialog. |
| **Clear** button | The **Clear** button clears all entries from the list of selected files. |
| Import options group box | All the selected images can be opened as uncalibrated data, or with sigma nought, beta nought, or gamma calibration applied. |
| **Select all** button | The **Select all** button applies all calibrations on import. |
| **Unselect all** button | The **Unselect all** button unchecks calibrations on import with the exception of the Import uncalibrated (DN). |
| **OK** button | The **OK** button proceeds with the import of the image(s).<br>Note that importing may take some time if the images have not been cached. |
| **Cancel** button | The **Cancel** button closes the dialog and returns to the ArcMap main screen. |

### 2.4.2 Use Case 1 – Selecting Images by Folder

To import images by folder, follow the steps listed below:

1. Click on the **Import Radarsat-2 images for use with DRDC Radarsat Toolbar** tool from the RADARSAT Toolbar as shown in Figure 21.

Figure 21 - RADARSAT Toolbar – Import Radarsat-2 images for use with DRDC Radarsat Toolbar

2. From this Import RADARSAT dialog, click on the **Select images by folder** button, which displays the Select Folder dialog as shown in Figure 23.

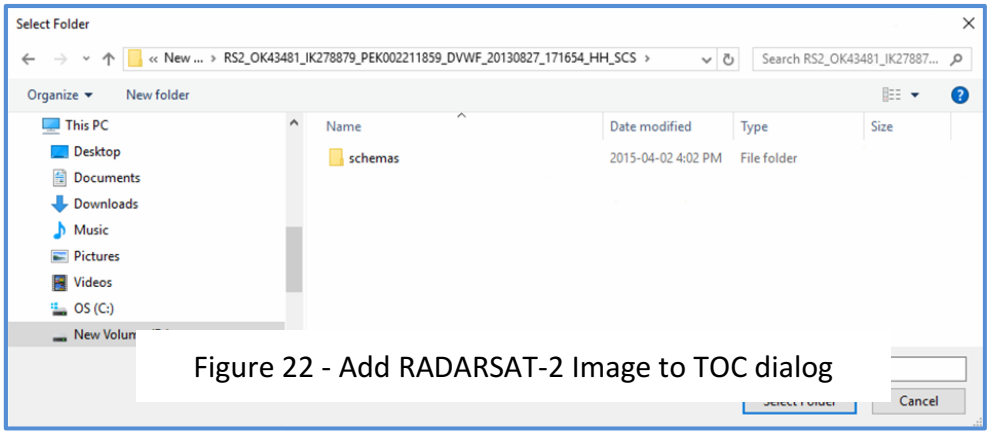



Figure 22 - Add RADARSAT-2 Image to TOC dialog

Figure 23 - Select Folder dialog

- In this Select Folder dialog, only the folders containing radar imagery can be selected.
- If the selected folder does not contain radar imagery then the Import Radarsat-2 images for use with DRDC RS Toolbar dialog will be empty.
- If the selected folder is a parent folder, one that contains multiple sub-folders then the Add RADARSAT-2 Image to TOC dialog will contain all product files found underneath the parent folder.
- Multiple folders can also be selected by holding down the **Ctrl** key on the keyboard while making selections with the mouse.

- This Select Folder dialog only shows folders, not individual files (such as RADARSAT-2 *.xml metadata files). When the **Select Folder** button is clicked, the RS Toolbar searches the selected folder(s) for product files that can be opened.

3. Select a folder by clicking on the desired folder followed by a click on the **Select Folder** button.
4. The Import RADARSAT-2 images for use with DRDC RS Toolbar dialog is displayed again, and lists in its central area the product header file(s) found in the selected folder (Figure 24).

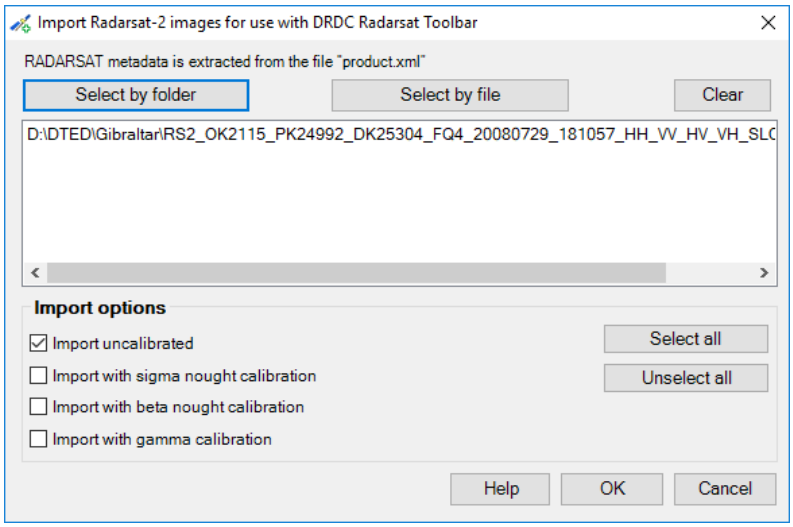
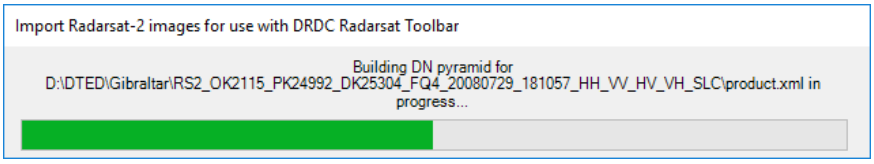



Figure 24 - Import Radarsat-2 images for use with DRDC RS Toolbar dialog with selected product file

5. From this dialog box, select the required Import options, in this case, select all calibrations and then click on the **OK** button. The following progress bar will indicate the file that is currently processing. Each image will be applied the default options present in the Function – Adjust Settings Dialog, and will become a layer added to the Table Of Contents.




Once the import is completed, the ArcMap main screen is displayed showing the imported image as in Figure 25.

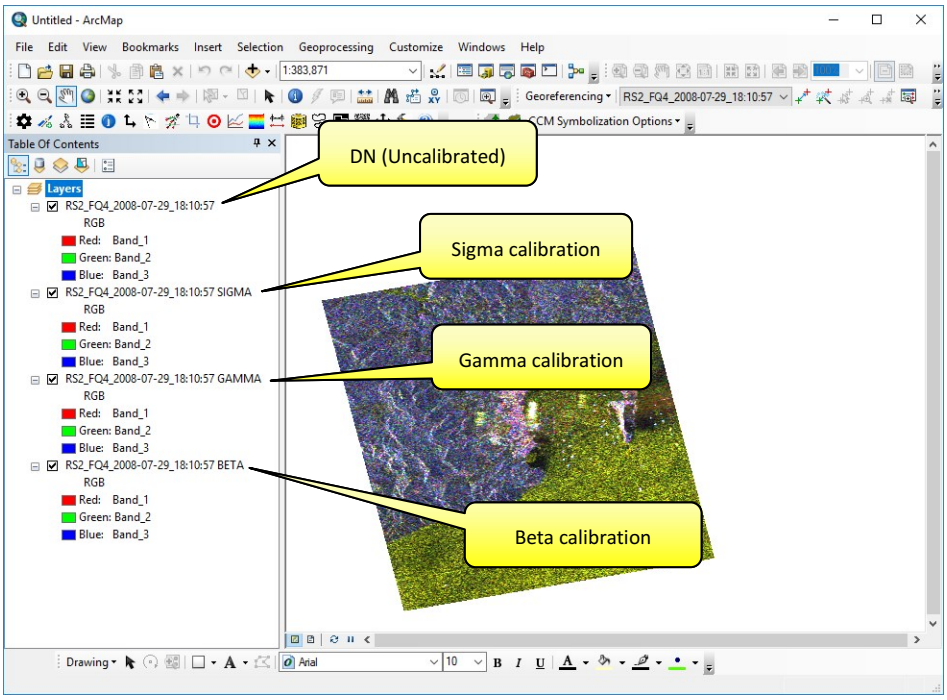



Figure 25 - ArcMap with added imagery layers

Each layer name is given by the following naming convention.

| [sensor]_[beam mode]_[acquisition date]_[acquisition time] [calibration] |
|---|
| (yyyymmdd) (hhmmss) |

## 2.5 Function – View Image Information

### 2.5.1 Overview

The **View Image Information** tool displays metadata as shown in Figure 26.

This display shows product-level information about the selected image in the Table Of Contents. In order for the information to be displayed, a layer in the Table of Contents below the level of Product Identifier must be selected. The information is not layer-specific, so any layer belonging to the product can be selected.

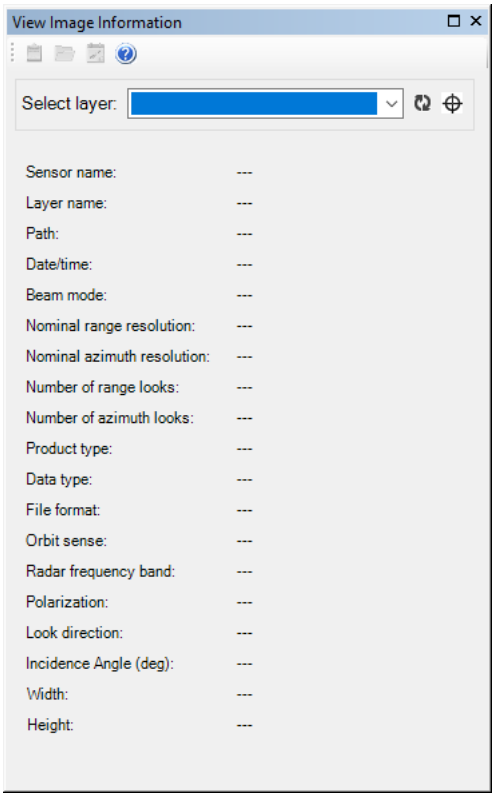



Figure 26 - Image information display

### 2.5.2 Use Case 1 – View Image Information

1. Import a RADARSAT-2 Image using the RS Toolbar. See page 19 for the detailed steps.


Figure 27 - Table Of Contents

   For this example, select the Gibraltar Radarsat-2 complex image "RS2_OK2115_PK24992_DK25304_FQ4_20080729_181057_HH_VV_HV_VH_SLC". The corresponding layer name will be renamed to "RS2_FQ4_2008-07-29_18:10:57" as discussed on Page 22.

2. From the **Table of Contents**, select a layer under the Product Identifier as shown in Figure 27.
3. Click on the **View Image Information** tool from the RS Toolbar as shown in Figure 28.

Figure 28 - RS Toolbar – View Image Information

4. There are 4 buttons available from the top toolbar when a layer is selected

   - **Copy to Clipboard** button copies all information present including labels and values to the Windows Clipboard to be later pasted into any text editing program. Also, right-click anywhere on the window will produce the same behavior.
   - **Open Metadata file** button opens the XML file related to the image.
   - **Show Process History** button will be enabled and will show all processes that have been applied to an image.
   - **Help** button will invoke this User Guide

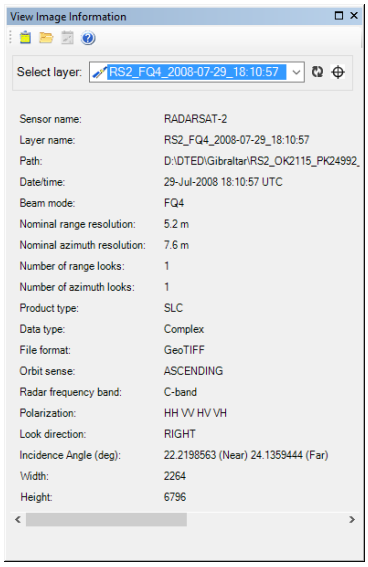



Figure 29 – View Image Information

5. Using Special Radarsat Toolbar Tools

Tools such as Orthorectification, Resampling, Quad-pol image, Speckle and/or Nudge will produce an history of all the parameters used in order to run the tool. Such Tools could be running recursively on the same imagery output producing more histories. It helps to trace and to understand how the imagery was processed. Following an example when the Nudge has been processed.

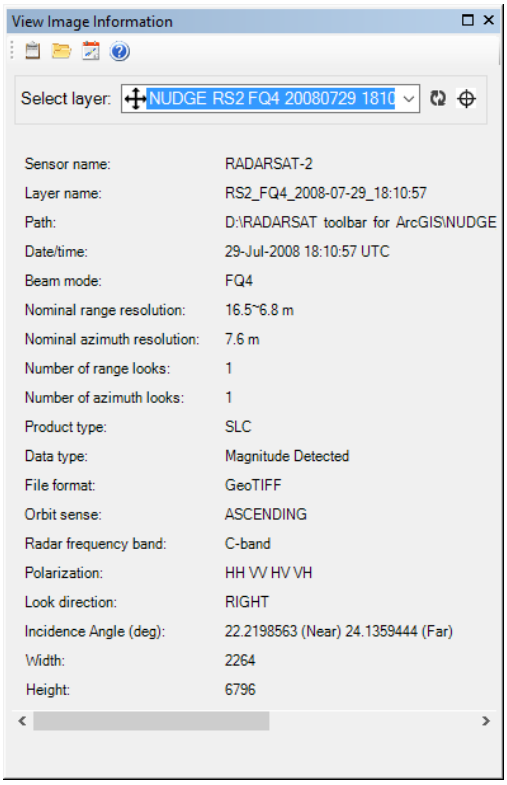



Figure 30 – Nudge History Imagery

Click on the button  . It will display the following dialog (Figure 31 – Nudge History Information), with a history of processing steps.

First column: Image correspond to the tool

Second column: Radarsat Tool Name

Third column: Band(s) used

Forth column: Date processed (local time)

Fifth column: Options, all values entered and/or selected in order to execute the tool.

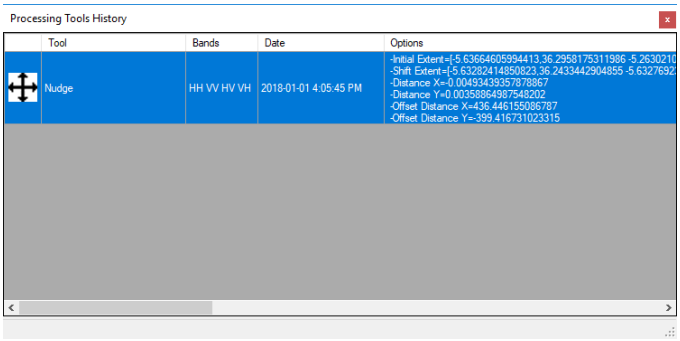



Figure 31 – Nudge History Information

## 2.6 Function – View Pixel Information

### 2.6.1 Overview

The **View Pixel Information** tool activates the pixel information bar shown in Figure 32.

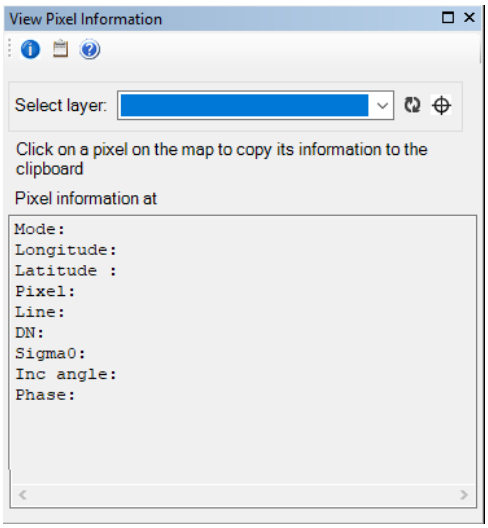



Figure 32 – View Pixel Information

When this is active, the status bar at the bottom of the ArcMap window displays data about the pixel currently under the mouse cursor. This data includes:

- The X/Y screen position;
- Bean Mode;
- Line and Pixel;
- Latitude and Longitude (in decimal degrees);
- Digital number (DN);
- Sigma nought (in decibels);
- Incidence angle (in degrees); and
- Phase (for SLC data).

Note that each pixel requires a small amount of computation, so there may be a slight delay in refreshing the displayed data when the mouse cursor is moved quickly.

### 2.6.2 Use Case – View Pixel Information

1. Import a RADARSAT-2 Image using the RS Toolbar. See section Use Case 1 – View Image Information page 24 for the detailed steps.
2. Click on the **View Pixel Information** tool from the RS Toolbar as shown in Figure 33.

Figure 33 - RADARSAT Toolbar – View Pixel Information

3. There are 3 buttons available from the top toolbar when a layer is selected

- **View Pixel Information** button activates a cross cursor. In moving the mouse on the map, it reads pixel information underneath. Clicking again on the button will deactivate the tool and the cursor will be defaulted.
- **Copy to Clipboard** button copies all information present including labels and values to the Windows Clipboard to be later pasted into any text editing program. Also, clicking anywhere on the window will produce the same behavior.
- **Help** button will invoke this User Guide.

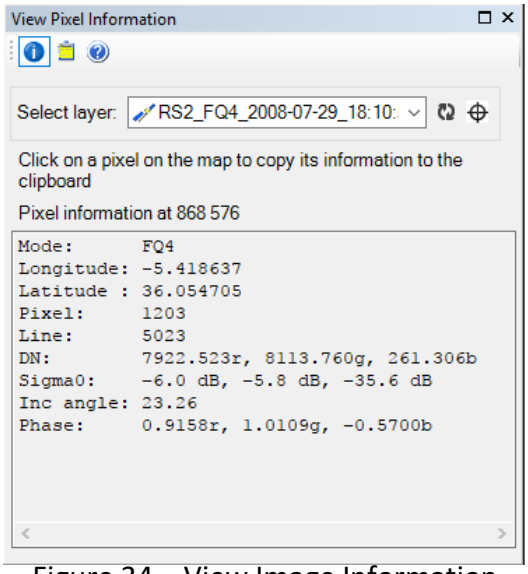



Figure 34 – View Image Information

## 2.7 Function – Display Range and Azimuth Direction

### 2.7.1 Overview

The **Display Range and Azimuth Direction** tool shows the range and azimuth directions box as shown in Figure 35. The directions are drawn as labeled arrows ("R" for range and "A" for azimuth) and are displayed in the lower right corner of the ArcMap map viewing area.

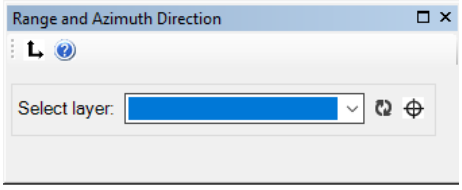



Figure 35 – Display Range and Azimuth Direction

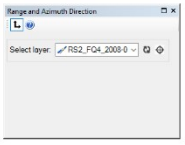
### 2.7.2 Use Case – Display Range and Azimuth Direction

1. Import a RADARSAT-2 Image using the RS Toolbar. See section Use Case 1 – View Image Information page 24 for the detailed steps.
2. Click on the **Display Range and Azimuth Direction** tool from the RS Toolbar as shown in Figure 36.

Figure 36 - RADARSAT Toolbar – Display Range and Azimuth Direction

3. There are 2 buttons from the top toolbar when a layer is selected

- **Range and Azimuth Direction** button activates a graphic layer that shows the arrows "R" for range and "A" for azimuth. Clicking again on the button will remove the arrows.
- **Help** button will invoke this User Guide



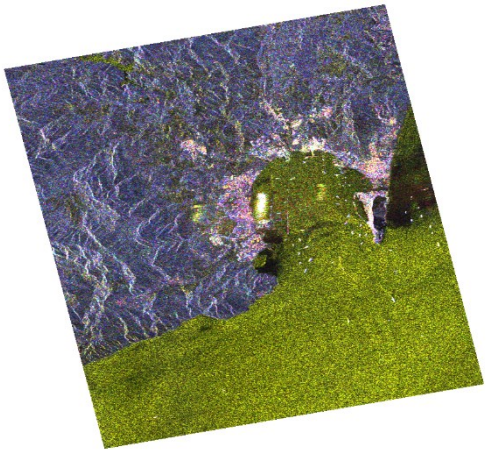


Figure 37 - ArcMap with range and azimuth direction

## 2.8 Function – Add Corner Coordinates

### 2.8.1 Overview

The **Add Corner Coordinates** tool displays latitude/longitude from the current layer selected. When you click on the tool button, it shows the coordinates in four yellow boxes.


.

Clicking again on the same button will remove the boxes.

As you zoom in/out, the yellow boxes might disappear. You have to click twice the tool button to refresh the coordinates.

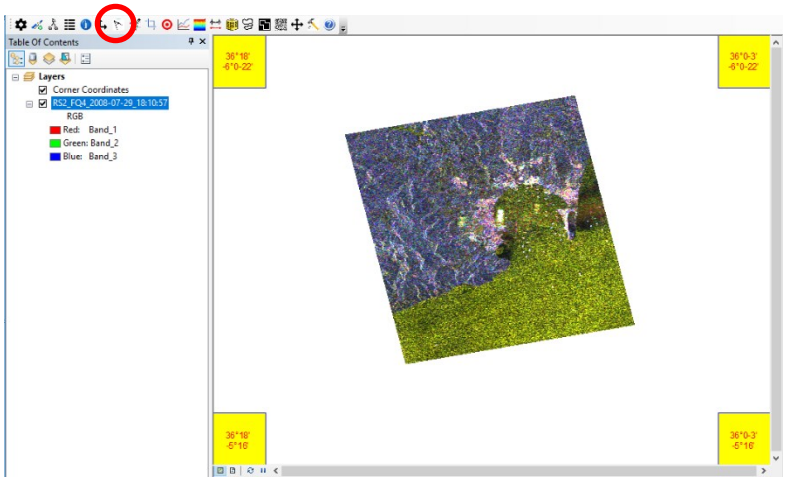



Figure 38 – Add Corner Coordinates

## 2.9 Function – Orthorectification

### 2.9.1 Overview

The **Orthorectification** tool displays the Orthorectification window as shown in Figure 39.

The tool is used to specify settings for any layer selected located in the grid. For each layer (row), all available polarizations (bands) will be listed. A greyed-out column (either band 1,2,3,4) indicates that the polarization does exist for that layer. The column "All Bands" will be available only with a layer having two or four polarizations.

The Orthorectification tool is a batch process allowing a user to process several layers (rows) with different columns (Bands option) in a series of tasks. Each task executes sequentially in the background.

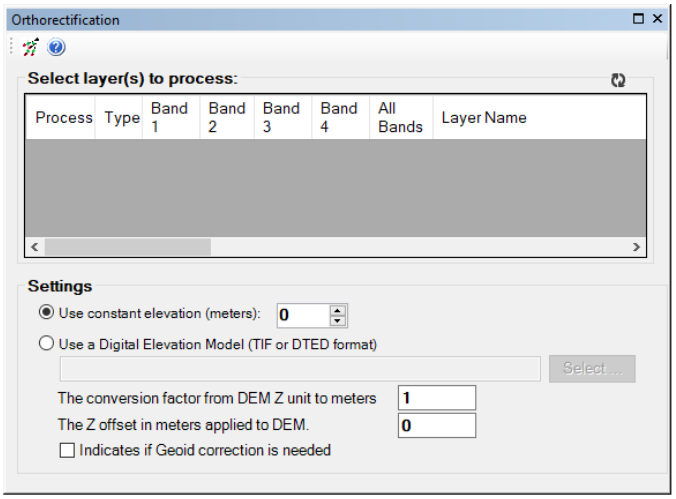



Figure 39 - Orthorectification window

| | |
|---|---|
| **Select layer(s) to process** | The central area of the window displays a list of layer identifiers from the TOC.<br>**Process**: Checking this box indicates to process the layer<br>**Type**: A RADARSAT-2 Image Type. See Figure 18 – RADARSAT-2 Image Type page 14<br>**Band 1**: According to the internal polarization list order (usually HH)<br>**Band 2**: According to the internal polarization list order (usually HV)<br>**Band 3**: According to the internal polarization list order (usually VV)<br>**Band 4**: According to the internal polarization list order (usually VH)<br>**All Bands**: Combine all bands in one image output<br>**Layer Name**: The Layer Name present in the TOC<br>**RADARSAT2 Code**: The RADARSAT-2 "true" layer name according to convention.<br>**File Location**: The XML metadata file full path |
| **Load pre-build orthorectified image if available** option | This option allows loading pre-built orthorectified images.<br>This can save substantial time when an orthorectified image is viewed repeatedly. |

| | |
|---|---|
| | For each selected layer, the most recently built orthorectified image is loaded if it exists. |
| **Use constant elevation (meters)** option | Orthorectification can be run with a constant elevation.<br>An elevation value in meters may be entered directly into the corresponding entry field by clicking in the field and typing the number, or by using the small up and down arrows to adjust the value. |
| **Use a Digital Elevation Model (TIF or DTED format)** option | Orthorectification can be run with a digital elevation model (DEM).<br>To use a DEM/TIF, click on the **Use DEM** button and click the **Set** button. A standard Windows file dialog is displayed and can be used to select a *.dem or *.tif file. When the **OK** button is clicked in the Windows file dialog then the path of the DEM/TIF file appears in the corresponding entry field of the Orthorectification Images dialog.<br>Alternatively, the path of the DEM/TIF file can be copied from the Windows file manager and pasted in the DEM/TIF file entry field by right-clicking in the field and selecting Paste.<br>Note that only a single DEM/TIF file can be used at a time for orthorectification. If a DEM/TIF does not cover the entire image area, then a constant elevation of zero is used for the non-covered area. |
| **Select** button | |
| **The conversion factor from DEM Z unit to meters** text box | The scaling factor used to convert the elevation values in the DEM/TIF.<br>If your vertical units are in meters, the Z Factor should be set to 1. If your vertical units are in feet, the Z Factor should be set to 0.3048. If any other vertical units are used, use the Z Factor to scale the units to meters. |
| **The Z offset in meters applied to DEM** text box | Z Offset (optional)<br>The base value to be added to the elevation value in the DEM/TIF. This could be used to offset elevation values that do not start at sea level. |
| **Indicates if Geoid correction is needed** check box | Geoid (optional)<br>The geoid correction is required by RPCs that reference ellipsoidal heights. Most elevation datasets are referenced to sea level orthometric heights, so this correction would be required in these cases to convert to ellipsoidal heights.<br><br>Unchecked—No geoid correction is made. Use this option only if your DEM is already expressed in ellipsoidal heights.<br>Checked—A geoid correction will be made to convert orthometric heights to ellipsoidal heights (based on EGM96 geoid). |

### 2.9.2 Use Case - Orthorectification

1. Import a RADARSAT-2 Image using the RS Toolbar. See section Use Case 1 – View Image Information page 24 for the detailed steps.
2. Click on the **Orthorectification** tool from the RS Toolbar as shown in Figure 40.

Figure 40 - RADARSAT Toolbar – Orthorectification

3. There are 2 buttons available from the top toolbar
   - **Perform Batch Orthorectification** button activates the batch processing according to the options selected
   - **Help** button will invoke the following window

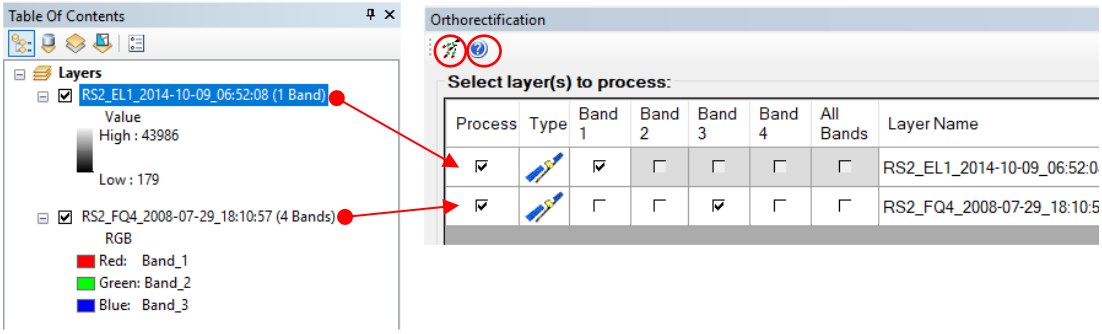



Figure 41 - Orthorectification window showing 2 layers that have been selected with one band selected each

If at least one "Process" check box is not selected, the following message will be displayed (Figure 42).

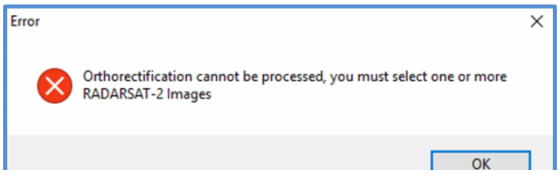



Figure 42 – Orthorectification Error message

4. After clicking on the **Perform Batch Orthorectification** button, each layer to orthorectify will be queued and processed in the background. When a layer is orthorectified, the image will appear automatically in the Table Of Contents as shown in Figure 43.

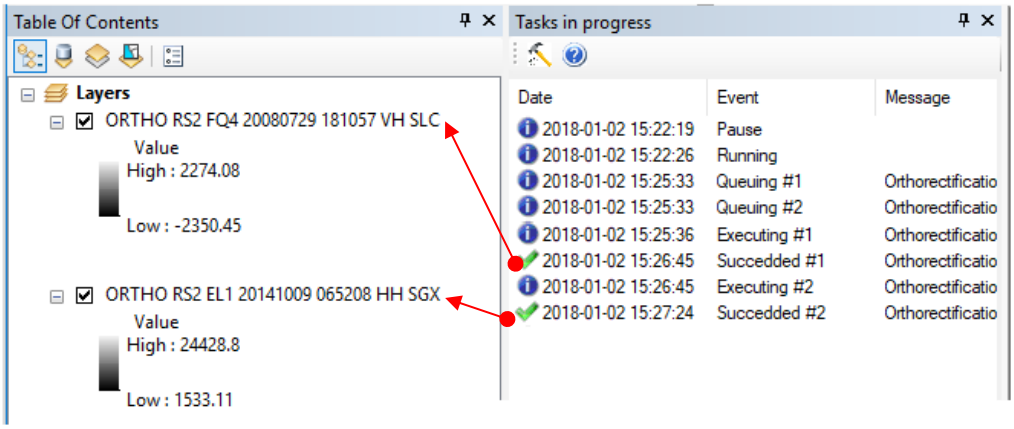



Figure 43 – Layers orthorectified

## 2.10 Function – Resampling

### 2.10.1 Overview

The **Resampling** tool displays the Resample window as shown in Figure 44 – Resample window

The tool is used to improve image quality for features being viewed at the sub-pixel level. It allows the user to resample the data to take full advantage of the resolution of the input image.

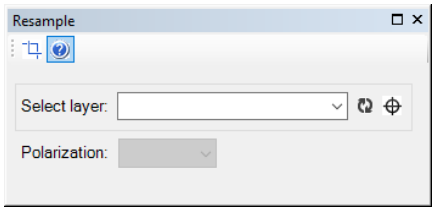



Figure 44 – Resample window

| | |
|---|---|
| **Select layer** | Drop Down List of Radarsat-2 layers listed from the Table Of Contents |
| **Polarization** | Selecting a layer will refresh automatically the Drop List Polarization showing all possible polarizations found.<br>**Band 1**: According to the internal polarization list order (usually HH)<br>**Band 2**: According to the internal polarization list order (usually HV)<br>**Band 3**: According to the internal polarization list order (usually VV)<br>**Band 4**: According to the internal polarization list order (usually VH) |

### 2.10.2 Use Case - Resampling

1. Import a RADARSAT-2 Image using the RS Toolbar. See section Use Case 1 – View Image Information page 24 for the detailed steps.
2. Click on the **Resample** tool from the RS Toolbar as shown in Figure 45.

Figure 45 - RADARSAT Toolbar – Resample

3. There are 2 buttons available from the top toolbar
   - **Resample** button captures the current visible layer extent. It is necessary to zoom into a subarea of the image (this is due to memory limitations of the resampling algorithm). If the viewed area is too large, then the toolbar shows a message to this effect, and it will be necessary to zoom in an additional amount. See Figure 46

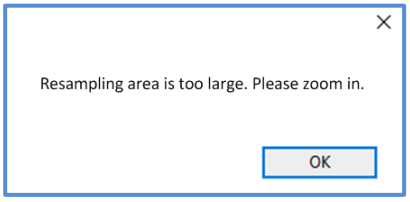



Figure 46 - Message to zoom in

- **Help** button will invoke the following window

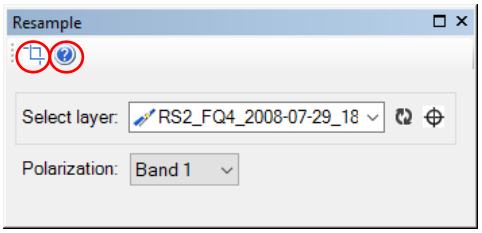



Figure 47 - Resample window showing a layer with a list of bands

4. After clicking on the Resample button, the image will be resampled and will appear automatically in the Table Of Contents as shown in Figure 48

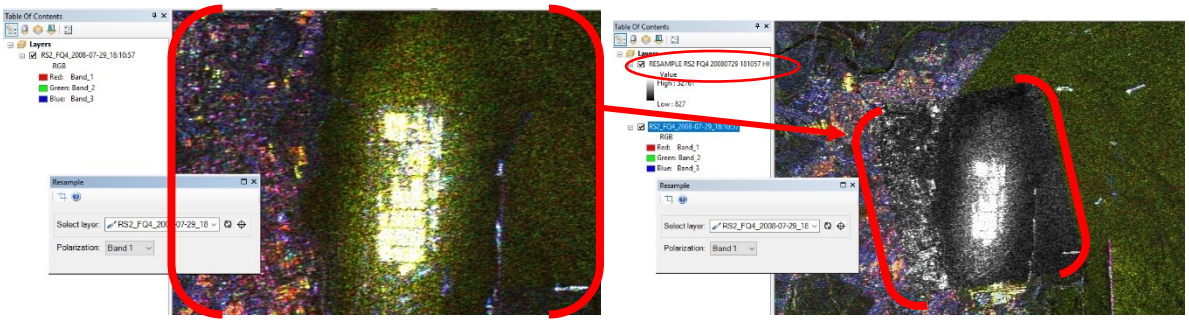


Figure 48 – ArcMap with zoomed image before and after resampling

## 2.11 Function – Point Target Analysis (PTA)

### 2.11.1 Overview

The **Point Target Analysis** tool opens the Point Target Analysis window as shown in Figure 49. This dialog provides a range of measurements for a selected target. The target subscene is interpolated by a user-configurable power of 2 (i.e., 8x8, 16x16, 32x32, 64x64 pixels) to provide increased measurement accuracy. The Point Target Analysis allows the user to click on a SAR Image and to calculate point statistics.

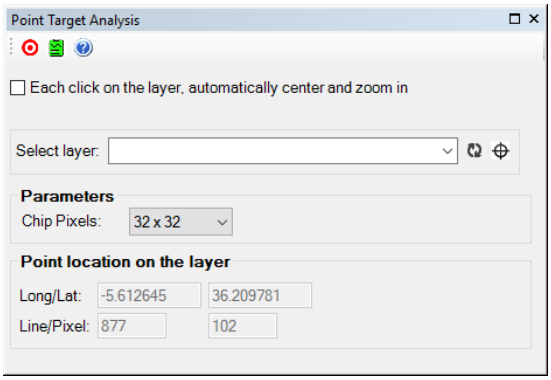



Figure 49 - Point Target Analysis window

| | |
|---|---|
| **Select layer** | Drop Down List of RADARSAT-2 layers listed from the Table Of Contents. |
| **Chip Pixels** | Selecting a larger value for Chip Pixels will slow down computing. |
| **Each click on the layer, automatically center and zoom in** | The layer will zoom-in to the center of the current map view. |
| Long/Lat and Line/Pixel | Long/Lat of the pixel clicked on the map and the corresponding values in line and pixel (column). |

### 2.11.2 Use Case – Point Target Analysis – Single Polarization

1. Import a RADARSAT-2 Image using the RS Toolbar. See section Use Case 1 – View Image Information page 24 for the detailed steps.

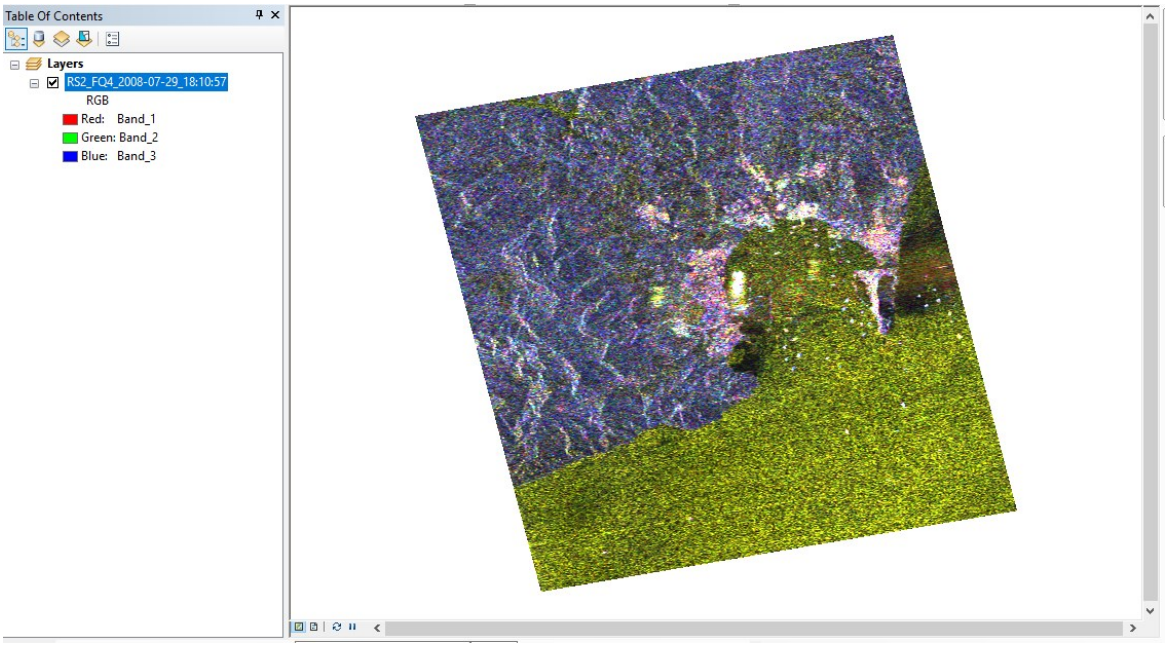



Figure 50 - Image for the Point Target Analysis

2. Click on the **Point Target Analysis** tool from the RS Toolbar as shown in Figure 51.

Figure 51 - RADARSAT Toolbar – Point Target Analysis

3. There 3 buttons available from the top toolbar

   3.1. Click **Start analysis for selected Image** button tool to activate PTA, then click anywhere inside the map boundaries. A red cross appears where you have clicked. The calculation results are displayed for all existing polarizations (one polarization per column). For each click on the map, PTA data is automatically re-calculated. A new layer will be shown on the TOC, indicating that the area was processed.

   3.2. Whenever **Show results of Point Target Analysis** button is clicked, it will show the last calculation results.

   3.3. **Help** button will invoke this User Guide

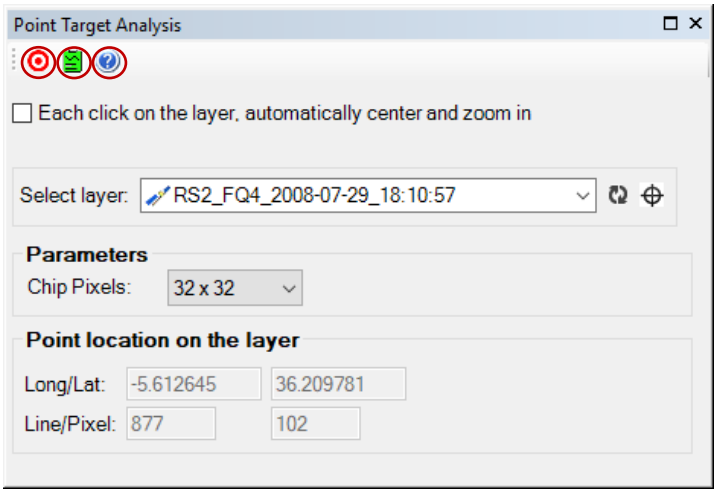
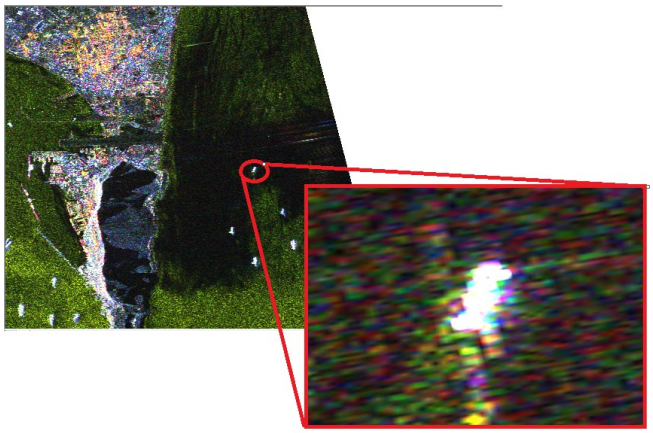


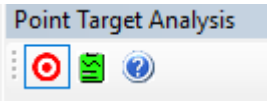

Figure 52 - Point Target Analysis window displayed with layer selected

4. Steps to calculate PTA

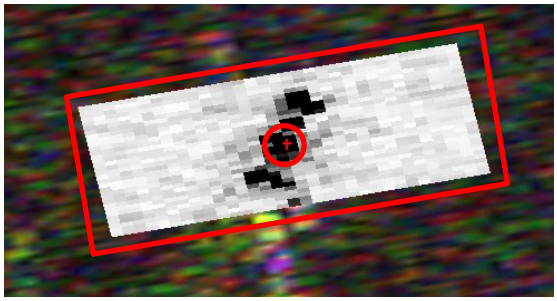
4.1. Zoom into an area for more precision on the target that you want to calculate. If possible, the target should be the only bright object in the area (for example, a ship).



4.2. Click the PTA button . A blue box surrounds the button indicating that the tool is activated.

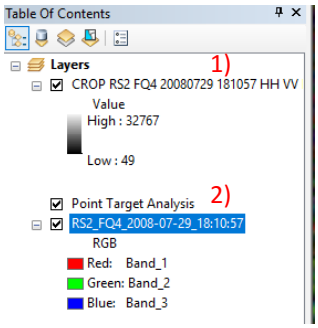



4.3. Click at the approximate center. Notice the red "+" icon indicating the pixel selected, and the grey rectangle area used for the calculation. The size of the area depends on the chip sizing.



The actual location of the "+" is selected by the algorithm. It finds the maximum value of the point target selected.

From the Table Of Contents window, a new layer is added to show the grey rectangle (1). Another graphic layer type called “Point Target Analysis” (2) appears showing the cross. You may check or uncheck the box to make it visible.

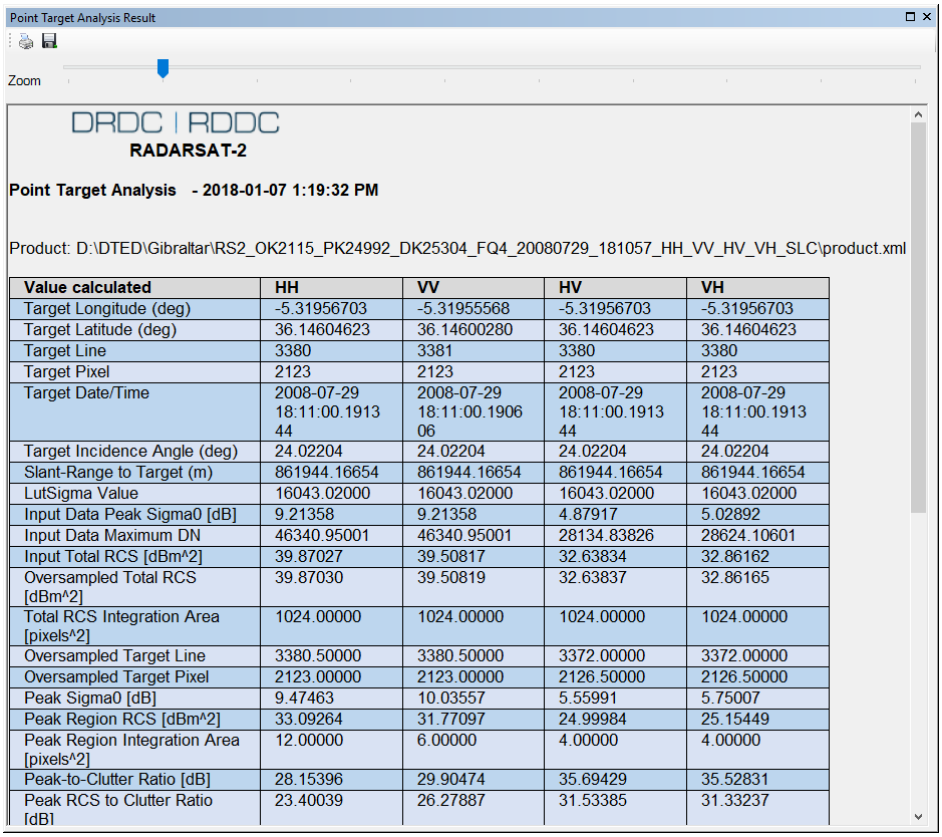



4.4. A Result window (Figure 53) will pop-up after the calculation is done. It can also be accessed from the Show Point Of Target Analysis button . The text is formatted using the RTF standard (Rich Text Format).

4.4.1. **print** the result to a printer.

4.4.2. **save** the result to a file. It can be opened by any tool supporting RTF.

4.4.3. Zoom **Zoom** allows to change the font size. Drag the cursor left or right.




| Value calculated | HH | VV | HV | VH |
|---|---|---|---|---|
| Target Longitude (deg) | -5.31956703 | -5.31955568 | -5.31956703 | -5.31956703 |
| Target Latitude (deg) | 36.14604623 | 36.14600280 | 36.14604623 | 36.14604623 |
| Target Line | 3380 | 3381 | 3380 | 3380 |
| Target Pixel | 2123 | 2123 | 2123 | 2123 |
| Target Date/Time | 2008-07-29 18:11:00.191344 | 2008-07-29 18:11:00.190606 | 2008-07-29 18:11:00.191344 | 2008-07-29 18:11:00.191344 |
| Target Incidence Angle (deg) | 24.02204 | 24.02204 | 24.02204 | 24.02204 |
| Slant-Range to Target (m) | 861944.16654 | 861944.16654 | 861944.16654 | 861944.16654 |
| LutSigma Value | 16043.02000 | 16043.02000 | 16043.02000 | 16043.02000 |
| Input Data Peak Sigma0 [dB] | 9.21358 | 9.21358 | 4.87917 | 5.02892 |
| Input Data Maximum DN | 46340.95001 | 46340.95001 | 28134.83826 | 28624.10601 |
| Input Total RCS [dBm^2] | 39.87027 | 39.50817 | 32.63834 | 32.86162 |
| Oversampled Total RCS [dBm^2] | 39.87030 | 39.50819 | 32.63837 | 32.86165 |
| Total RCS Integration Area [pixels^2] | 1024.00000 | 1024.00000 | 1024.00000 | 1024.00000 |
| Oversampled Target Line | 3380.50000 | 3380.50000 | 3372.00000 | 3372.00000 |
| Oversampled Target Pixel | 2123.00000 | 2123.00000 | 2126.50000 | 2126.50000 |
| Peak Sigma0 [dB] | 9.47463 | 10.03557 | 5.55991 | 5.75007 |
| Peak Region RCS [dBm^2] | 33.09264 | 31.77097 | 24.99984 | 25.15449 |
| Peak Region Integration Area [pixels^2] | 12.00000 | 6.00000 | 4.00000 | 4.00000 |
| Peak-to-Clutter Ratio [dB] | 28.15396 | 29.90474 | 35.69429 | 35.52831 |
| Peak RCS to Clutter Ratio [dB] | 23.40039 | 26.27887 | 31.53385 | 31.33237 |

Figure 53 - Point Target Analysis Result window

## 2.12 Function – Distributed Target Analysis (DTA)

### 2.12.1 Overview

The **Distributed Target Analysis** tool opens the Distributed Target Analysis (DTA) window as shown in Figure 54. DTA allows the user to either crop an extent, draw a line, or draw a polygon within a SAR Image to specify an area for analysis.

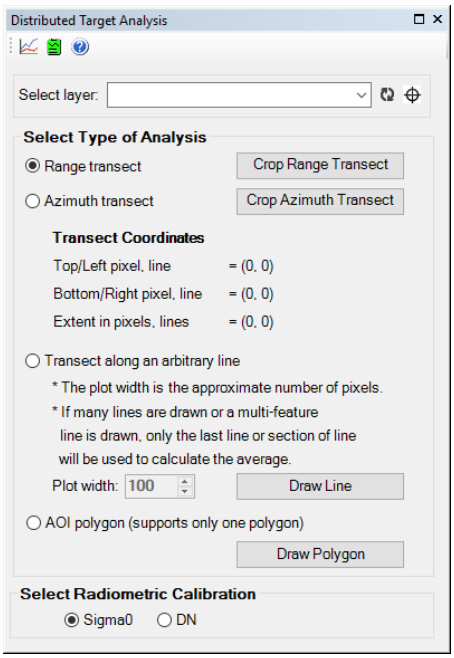



Figure 54 - Distributed Target Analysis window

| | |
|---|---|
| **Select layer** | Drop Down List of RADARSAT-2 layers from the Table Of Contents |
| **Select Type of Analysis** group box | 1. **Range transect**: y axis is the DN or Sigma0 along a Range Line, and the x axis is the Incident Angles (from left to right across the image width)<br><br>Plots two subplots:<br>a. the first (top) one plots an array defined by [AOI min pixel: AOI max pixel] x [AOI min line: AOI max line]<br>b. the second (bottom) one shows the entire swath defined by [0: image width] x [AOI min line: AOI max line]<br><br>2. **Azimuth transect**: y axis is the DN or Sigma0 along an Azimuth Line, and the x axis is the Range Line Number (from top to bottom across the image height)<br><br>Plots two subplots:<br>a. the first (top) one plots an array defined by [AOI min pixel: AOI max pixel] x [AOI min line: AOI max line]<br>b. the second (bottom) one shows the entire swath defined by [AOI min pixel: AOI max pixel] x [0: image height]<br><br>3. **Transect along an arbitrary line**: y axis is the interpolated DN or Sigma0 along the line defined by the user, and the x axis is the interpolated pixel number of this line.<br><br>Plots all polarizations and noise equivalent Sigma0 (NESZ)<br><br>**4. AOI Polygon:** Calculates amplitude statistics, power statistics, and Sigma0 statistics of the SAR data enclosed within the first polygon of the vector layer.<br><br>No plot is shown with this option. |
| **Select Radiometric Calibration** | Sigma0 or DN option |

The output plot generated by the Distributed Target Analysis tool consists of two graphs:

- The top graph plots the average sigma nought transects in dB vs Incidence Angle in degrees over the user-selected region of interest (the pixel start (Pstart) and pixel stop (Pstop) are given in the title).
- The bottom graph plots average sigma nought transects in dB vs Incidence Angle in degrees for the full swath in range.

### 2.12.2 Use Case 1 - Range Transect with DN Option

1. Import a RADARSAT-2 Image using the RS Toolbar.

   See page 19 for the detailed steps.


Figure 55 – TOC RS2_DVWF_2013-08-27_17:16:55

For this example, select the Gibraltar Radarsat-2 complex image "RS2_OK43481_IK278879_PEK002211859_DVWF_20130827_171654_HH_SCS". The corresponding layer name will be renamed to "RS2_DVWF_2013-08-27_17:16:55" according to the convention on Page 22.

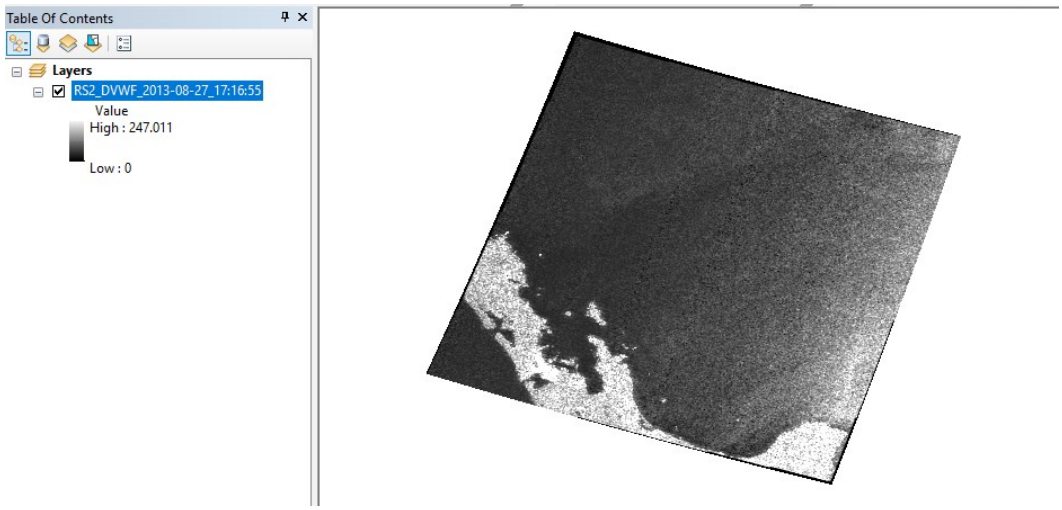



Figure 56 - Image for the Distributed Target Analysis

2. Click on the **Distributed Target Analysis** tool from the RS Toolbar as shown in Figure 57.

Figure 57 - RS Toolbar – Distributed Target Analysis

3. There 3 buttons available from the top toolbar

3.1 Click **Start analysis for selected image** button tool to calculate the Distributed Target Analysis according to the Type of Analysis option. The calculation results are displayed.

3.2 Whenever the **Show results of Distributed Target Analysis** button is clicked, it will display the last calculation results.

3.3 **Help** button will invoke this User Guide

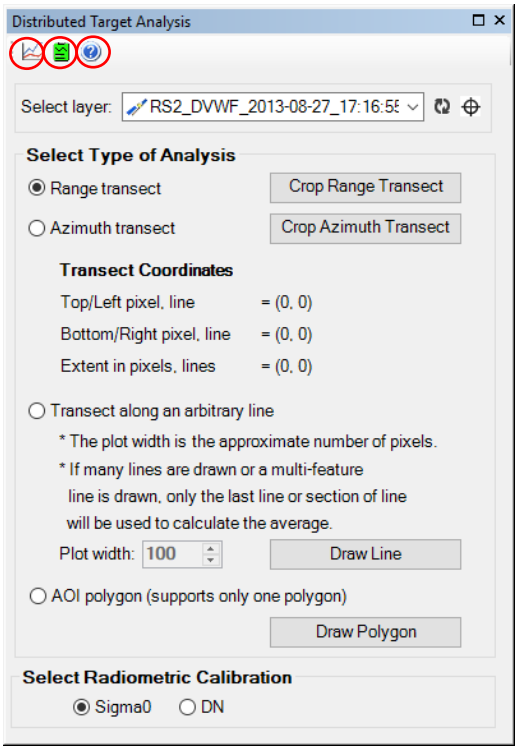



Figure 58 - Distributed Target Analysis window displayed with layer selected

4. On the Distributed Target Analysis window (Figure 59),
   - ✓ click on the **Type of Analysis->Range transect** option;
   - ✓ click on the **Radiometric Calibration->DN** option.

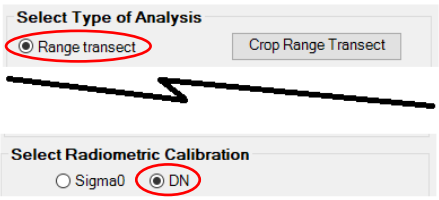



Figure 59 – DTA Range Transect with DN Option selected

5. Zoom to a smaller extent area similar to the picture shown in Figure 60.

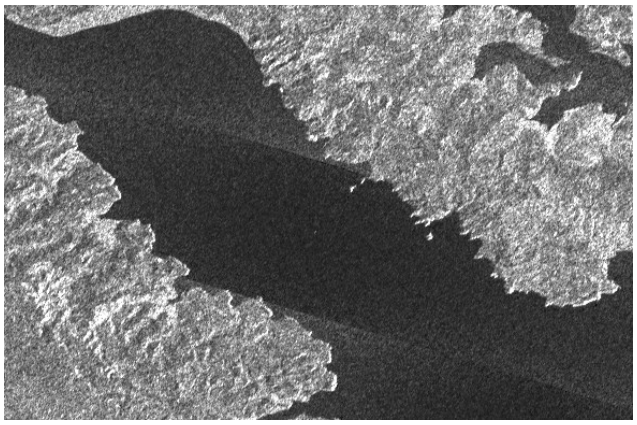


Figure 60 – DTA Range Transect zoomed area

6. From Select Type of Analysis group box of the Distributed Target Analysis dialog, click on the **Crop Range Transect** button. The following area (Figure 61*)* is selected according to the direction.

   *NB: if you don't zoom in enough, the message "The extend area is too large. Please zoom in." will be displayed.*

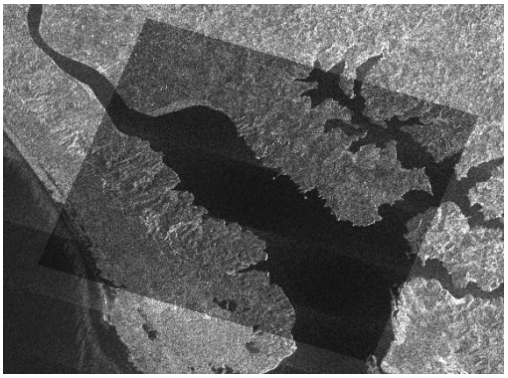


Figure 61 – DTA Range Transect area cropped

7. From the Distributed Target Analysis window, click on the **Calculate** button to initiate the computation. When complete, this message will appear:

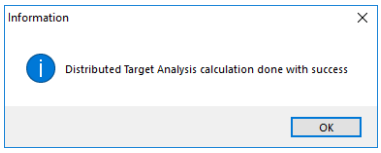
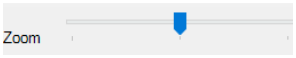



Figure 62 – DTA Calculation done warning message

8. A Result window will pop-up after the calculation is done. It can also be accessed from the Show Distributed Target Analysis button. The text is formatted using the RTF standard (Rich Text Format). The “Mid-scene” data will always appear in the first table. For multi-pol data (i.e., HH, HV, VH, VV), each polarization data set will be shown sequentially in its own table.

8.1 **print** result to a printer.

8.2 Button to save the result to a file. It could be opened by any tool supporting RTF.

8.3 

Zoom allows to change the font size. Drag the cursor left or right.

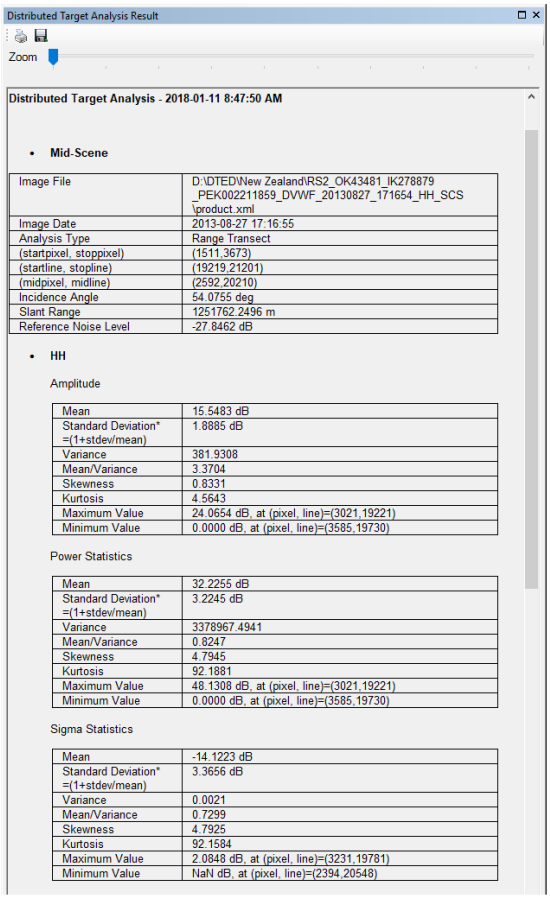



Figure 63 – DTA Crop Range Transect Result

9. A Graphic window will pop-up after the calculation is done. It can also be accessed from the Show Distributed Target Analysis button. When multiple polarizations (HH, HV, VH, and VV) are displayed, then each color represents a specific polarization. The legend on the right side of the

graph identifies which color is associated with which polarization. The bottom graph represents the entire band of the map. The top graph in yellow represents the area selected when zooming.

9.1 Reset Initial Scale The **Reset Initial Scale** to show the graph at its initial view.

9.2 Save Image The **Save Image** button to save either the top or bottom image in .PNG format.

9.3 Mouse functionality:

- Use mouse wheel to zoom in and out
- Scroll graph from side-to-side by right-click and selecting the bottom row number (x-axis)
- Scroll graph up and down by right-click and selecting the left row number (y axis)

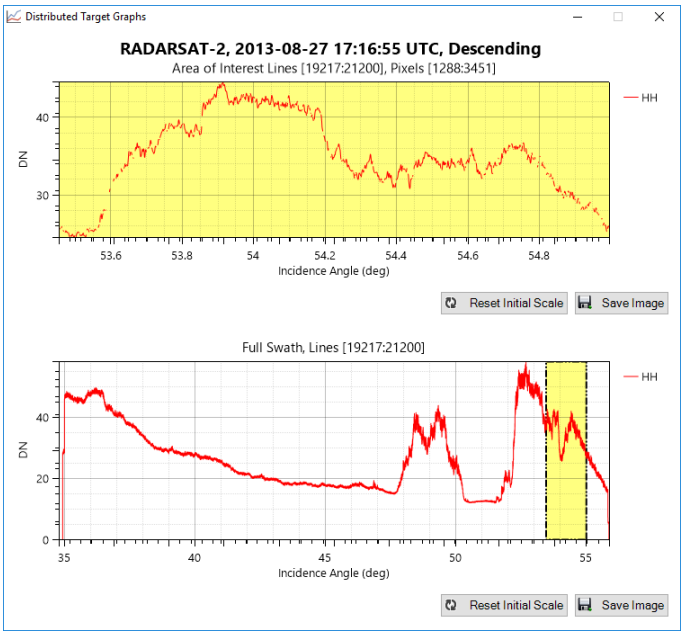
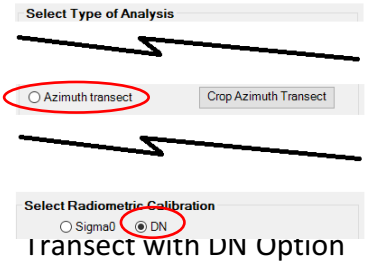



Figure 64 – DTA Range Transect Graphs

### 2.12.3 Use Case 2 - Azimuth Transect with DN Option

1. Add the same image shown in Use Case 1 - Range Transect with DN Option page 43.
2. On the Distributed Target Analysis window (Figure 65),
   - ✓ click on the **Type of Analysis->Azimuth transect** option;
   - ✓ click on the **Radiometric Calibration->DN** option.




Transect with DN Option selected

3. Zoom to a smaller extent area. From Select Type of Analysis group box of the Distributed Target Analysis dialog, click on the **Crop Azimuth Transect** button. The following area (Figure 66) is selected according to the direction.

   NB: if you don't zoom in enough, the message "The extend area is too large. Please zoom in." will be displayed.

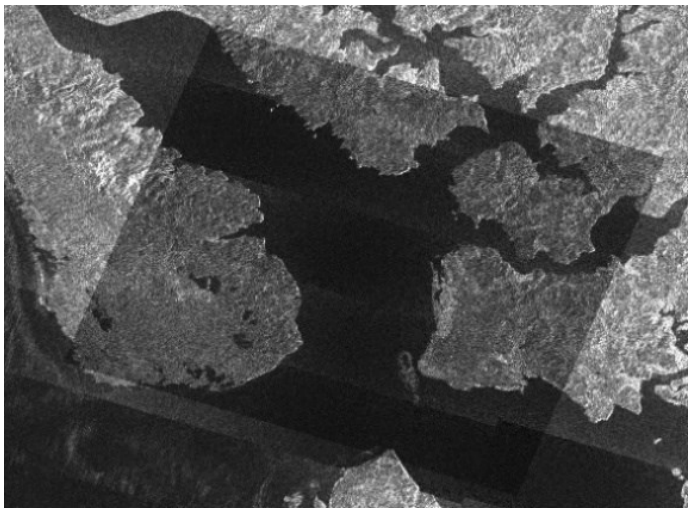


Figure 66 – DTA Azimuth Transect zoomed area cropped

4. From the Distributed Target Analysis window, click on the **Calculate** button to initiate the computation.

5. A Result window will pop-up after the calculation is done (Figure 67).

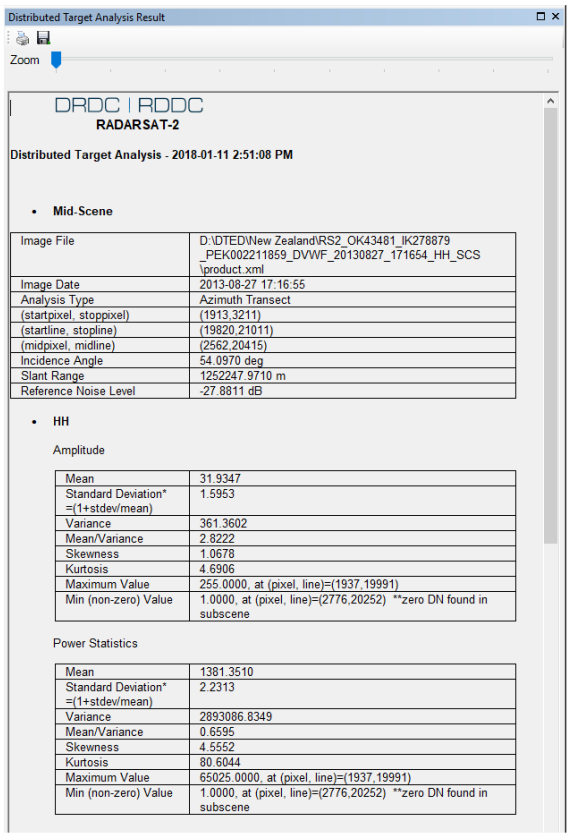



Figure 67 – DTA Crop Azimuth Transect Result

6. A Graphic window will also pop-up after the calculation is done.

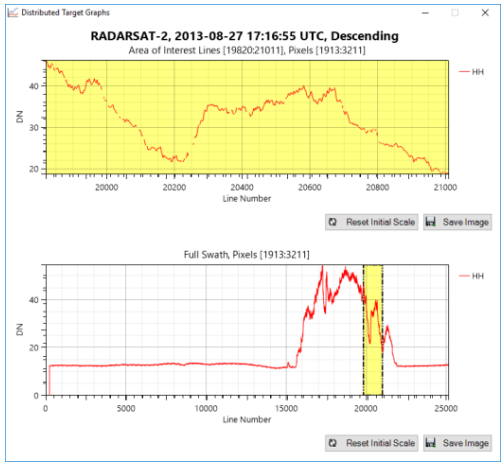
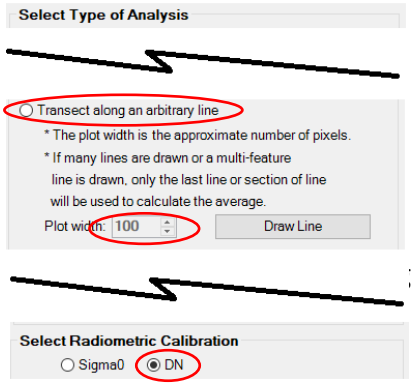



Figure 68 – DTA Crop Azimuth Transect Graphs

### 2.12.4 Use Case 3 - Transect along an arbitrary line with DN Option

1. Add the same image shown in Use Case 1 - Range Transect with DN Option page 43.

2. On the Distributed Target Analysis window (Figure 69),
   - ✓ click on the **Type of Analysis->Transect along an arbitrary line** option;
   - ✓ click on the **Radiometric Calibration->DN** option.




3. Zoom to a smaller extent area. Adjust the **Plot width** in pixels, which defines the width of pixels to be sampled, then click on the **Draw Line** button to begin. Click on the map once to define the initial point, then move the mouse to another point. Double-click on the map to finish drawing. From the new area drawn, you can still change the **Plot width** and the area will growth or shrink. The following (Figure 70) shows a completed transect.

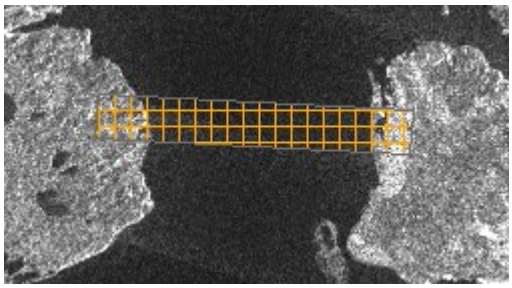


Figure 70 – DTA Transect along an arbitrary line

4. From the Distributed Target Analysis window, click on the **Calculate** button to initiate the computation.

5. A Result window will pop-up after the calculation is done.

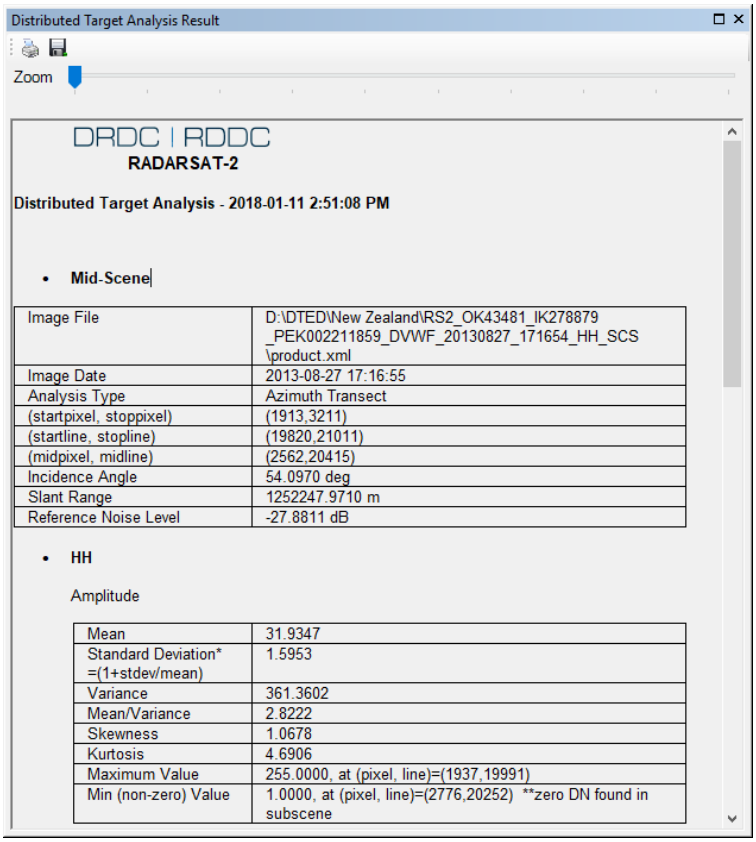



Figure 71 – DTA Transect along an arbitrary line Result

6. A Graphic window will also pop-up after the calculation is done (Figure 72).

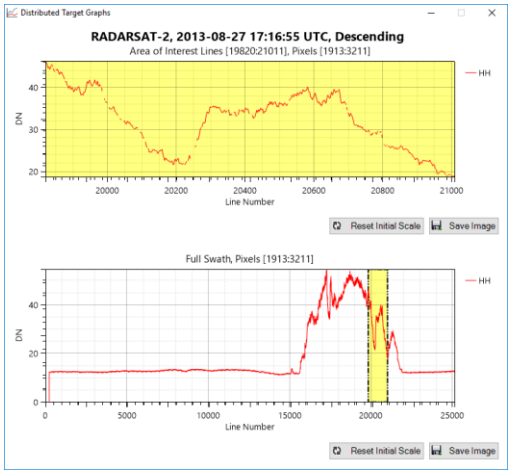



Figure 72 – Plots for DTA Transect along an arbitrary line

### 2.12.5 Use Case 4 – AOI polygon with DN Option

1. Add the same image shown in Use Case 1 - Range Transect with DN Option page 43.

2. On the Distributed Target Analysis window (Figure 73),
   - ✓ click on the **Type of Analysis-> AOI polygon** option;
   - ✓ click on the **Radiometric Calibration->DN** option.

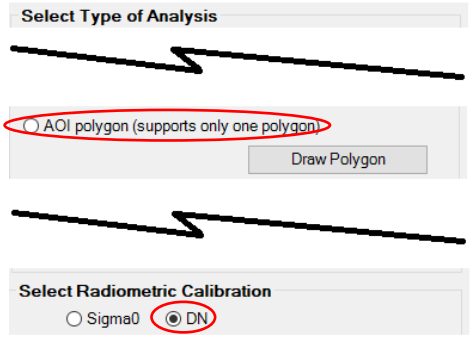



Figure 73 – DTA AOI polygon with DN Option selected

3. Zoom to a smaller extent area. Click on the **Draw Polygon** button to begin to draw a polygon. Click on the map once to define the initial point, then move the mouse to click another point on the map, click as many point to make a polygon. Double-click on the map to finish drawing. The following area (Figure 74) drawn.

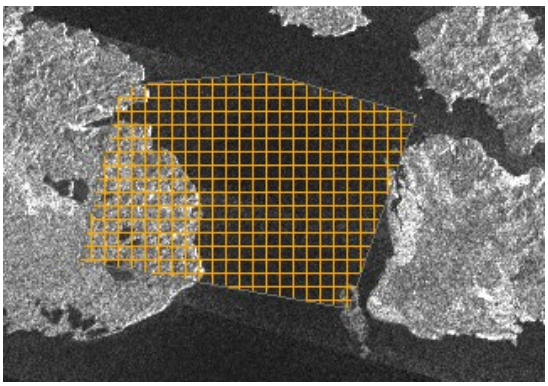


Figure 74 – DTA AOI polygon drawn

4. From the Distributed Target Analysis window, click on the **Calculate** button to initiate the computation.

5. A Result window will pop-up after the calculation is done.

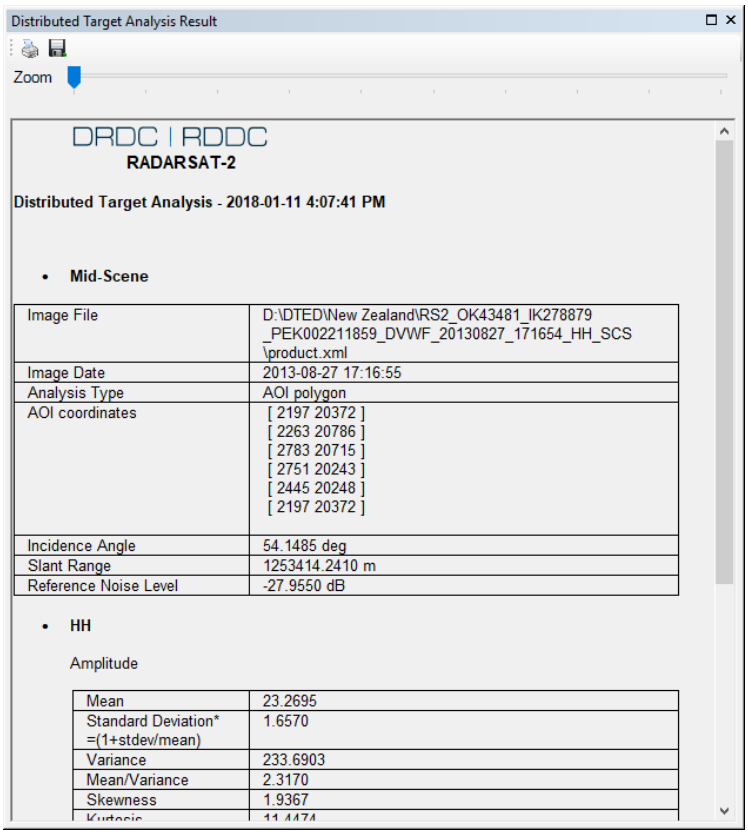



Figure 75 – DTA AOI polygon Result

6. There is no cross-section plot in this case.

## 2.13 Function – Quad-pol image

### 2.13.1 Overview

The **Quad-pol image** tool displays a parameter window as shown in Figure 76. This tool employs batch processing, allowing the user to process several layers in a series. Each task is executed one by one in the background.

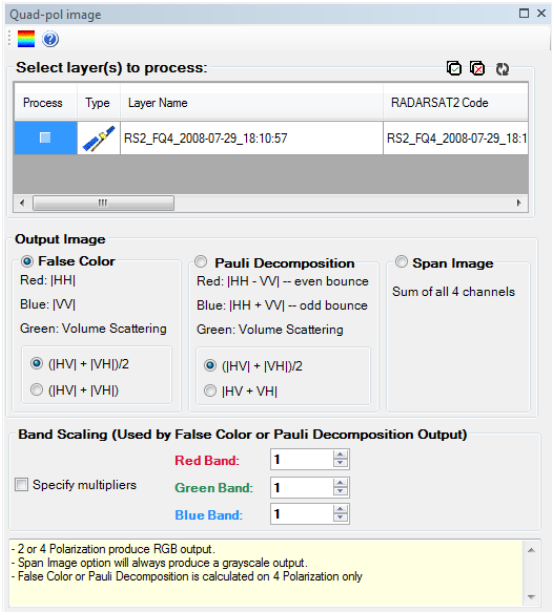



Figure 76 - Quad Polarization window

| | |
|---|---|
| **Select layer(s) to process** | The central area of the window displays a list of layer identifiers from the TOC.<br>**Process**: Checking this box to process layer<br>**Type**: A RADARSAT-2 Image Type. See Figure 18 – RADARSAT-2 Image Type page 14<br>**Layer Name**: Name of the layer present in the ToC<br>**RADARSAT2 Code**: The RADARSAT-2 "true" layer name according to convention.<br>**File Location**: The XML metadata file full path (not visible in Figure 76) |
| **Output Image** | There are 3 options:<br>**False Color:** Images are displayed in an arbitrary color scheme that helps the analyst distinguish different areas in the image.<br>**Pauli Decomposition:** Separates polarimetric radar measurements with respect to basic scattering mechanisms<br>**Span Image:** Aggregates all bands in one, producing a greyscale output |
| **Band Scaling** | User can set weighting on the different bands for False Color or Pauli |

| | |
|---|---|
| | Decomposition |
| Rules | The tool can handle a variety of polarization configurations:<br>• 1 polarization state: The output is always in grayscale. RGB is not supported<br>• 1, 2 or 4 polarization states: Using the Span Image option will always produce a grayscale output.<br>• 4 polarization states: Only the False Color or Pauli Decomposition option is applicable to produce a RGB output. The user can only specify multipliers for this configuration. |

### 2.13.2 Use Case 1 - 4 Polarizations RADARSAT Image

1. Import a RADARSAT-2 Image using the RS Toolbar (See section Use Case 1 – View Image Information page 24 for the detailed steps).
2. Click on the **Quad-pol image** tool from the RS Toolbar as shown in Figure 77.

Figure 77 - RADARSAT Toolbar – Quad Polarization window

3. There are 2 buttons available from the top toolbar

   3.1. **Perform Batch Quad-pol image** button activates the batch processing according to the options selected

   3.2. **Help** button will invoke this User Guide

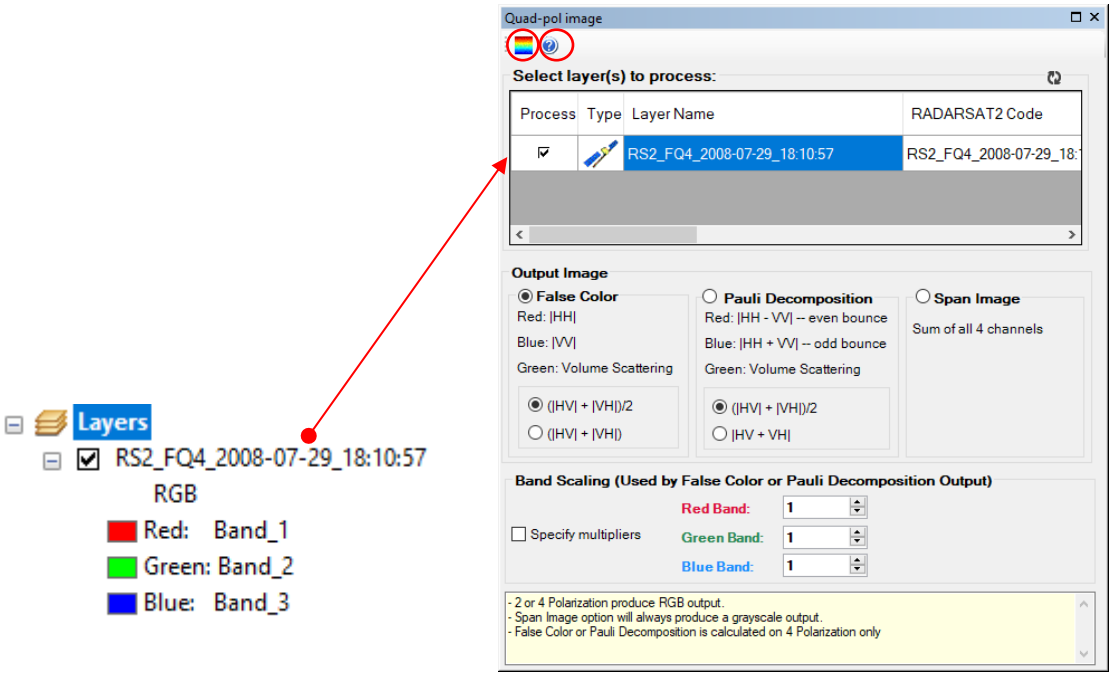



Figure 78 – Quad-pol image window showing selected layer

If at least one of the "Process" check boxes is not selected, the following message will be shown (Figure 79).

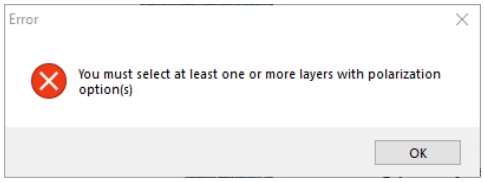



Figure 79 – Quad-pol image Error message

4. Click on the **False Color** option from the Output Image group box and click on the **(|HV| + |VH|)/2** option. Click on the **Perform Batch Quad-pol image** button. Each layer to process will be queued and processed in the background.

5. Meanwhile, click on the **Pauli Decomposition** option from the Output Image group box and click on the **(|HV| + |VH|)/2** option. Click on the **Perform Batch Quad-pol image** button. Each layer to process will be queued and processed in the background.

6. And finally, click on the **Span Image** option from the Output Image group. Click on the **Perform Batch Quad-pol image** button. Each layer to process will be queued and processed in the background.

7. When all Quad-pol image processes are done, all images will appear automatically in the Table Of Contents as shown in Figure 80, Figure 81 and Figure 82. The Tasks in progress window shows process state going from Queuing, Executing and Succeeded.

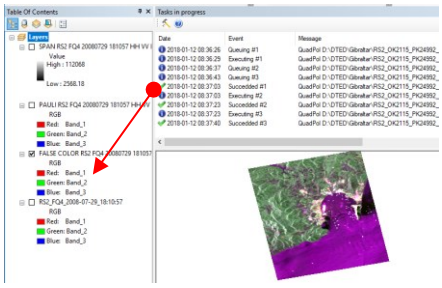


Figure 80 – Quad Polarization False Color Output

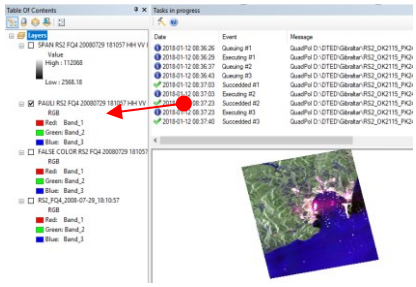


Figure 81 – Quad Polarization Pauli Decomposition Output

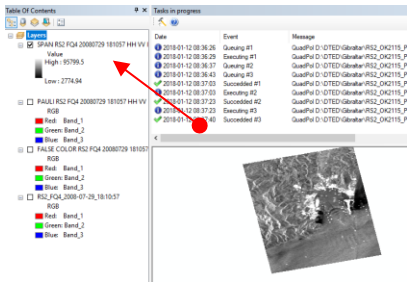


Figure 82 – Quad Span Image Output

## 2.14 Function – Bridge Clearance Estimation

### 2.14.1 Overview

The **Bridge Clearance Estimation** tool opens the dialog window as shown in Figure 83. This allows the user to estimate the bridge height above water. For the most accurate results, the bridge should be oriented approximately perpendicular to the radar range direction. Water surface should be smooth so that bridge reflections are observable.

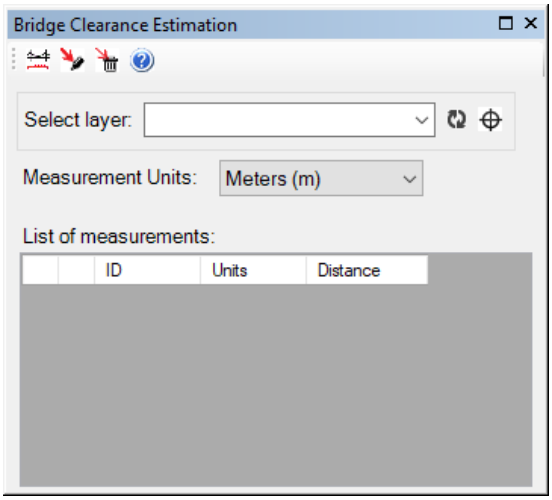



Figure 83 - Bridge Clearance Estimation window

| | |
|---|---|
| **Select layer** | Drop Down List of RADARSAT layers listed from the Table Of Contents |
| **Measurement Units** option | Two options:<br>• Meters (m)<br>• Feet (ft) |

### 2.14.2 Use Case – Bridge Clearance Estimation

1. Import a RADARSAT-2 Image using the RS Toolbar.
   See page 19 for the detailed steps.


Figure 84 – TOC
RS2_SLA75_2010-01-04_10:32:11

For the purpose of this example, select RS-2 complex image of the Macdonald Bridge in Halifax, Nova Scotia "RS2_OK59628_PK555152_DK489823_SLA75_20100104_103211_HH_SLC". The corresponding layer name will be "RS2_SLA75_2010-01-04_10:32:11" according to the convention Page 22.

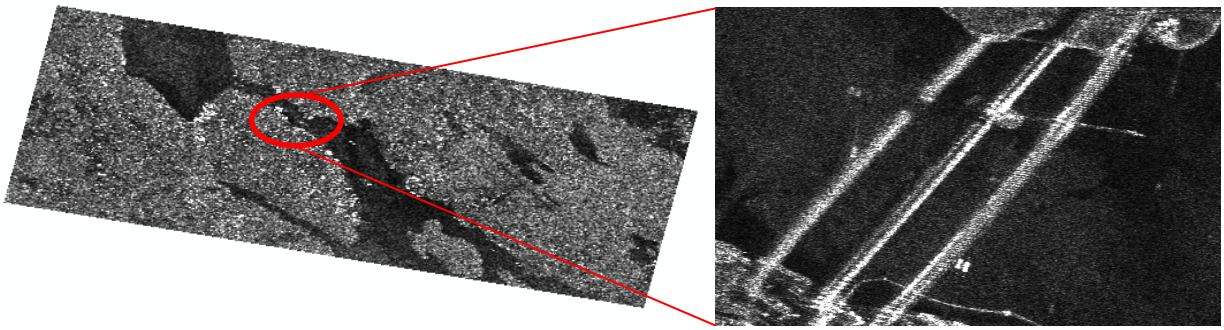


Figure 85 - RS2_SLA75_2010-01-04_10:32:11 Layer zoomed

The SAR signature from the bridge can consist of three nearly parallel strips, although sometimes more can be seen. We only concern ourselves with the first three.

2. Click on the **Bridge Clearance Estimation** tool from the RS Toolbar as shown in Figure 86.

Figure 86 - RADARSAT Toolbar – Bridge Clearance Estimation tool

As shown in Figure 87, the Bridge Clearance Estimation window is displayed on the ArcMap main screen and a new layer called "Bridge Measure" is added to the Table Of Contents.

Any lines drawn belong to the "Bridge Measure" layer. You may uncheck the layer to hide from view. The Bridge Measure Layer remains in the Table Of Contents even when the Tool is closed. You may delete the layer at any time.

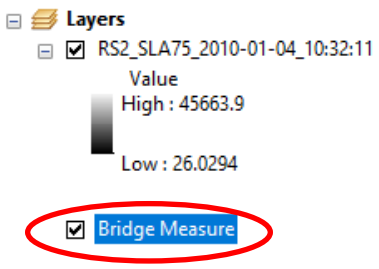



Figure 87 – TOC Bridge Measure Graphic Layer

3. There are 4 buttons available from the top toolbar

   3.1. Click the **Create a bridge height measurement** to begin drawing a line. Click on the map to select an initial point, then move the mouse to another location, and click the map again to stop drawing. It is best to go in the range direction, and select the leading edge of each return (see Figure 89).

   ✓ There is no need to hold the mouse button down

   ✓ The line will be constrained to move along the range direction

   3.2. Click **Hover** to highlight a measurement as you pass the mouse cursor over it.

   3.3. **Delete all measurements** present in the Bridge Measure Graphic Layer

   3.4. **Help** button will invoke this User Guide

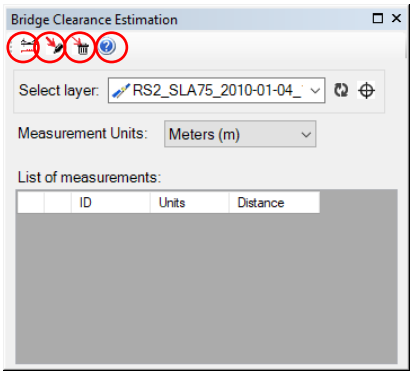



Figure 88 – Bridge Clearance Estimation window displayed with layer selected

4. Zoom to a smaller area to place the line more precisely.

5. As an example, two measurements were obtained in the following. Notice that the List of measurements will be added as each new line is drawn. The column ID matches the label on the map. You can change the units for each measurement, but when the line is drawn, it retains the original units.

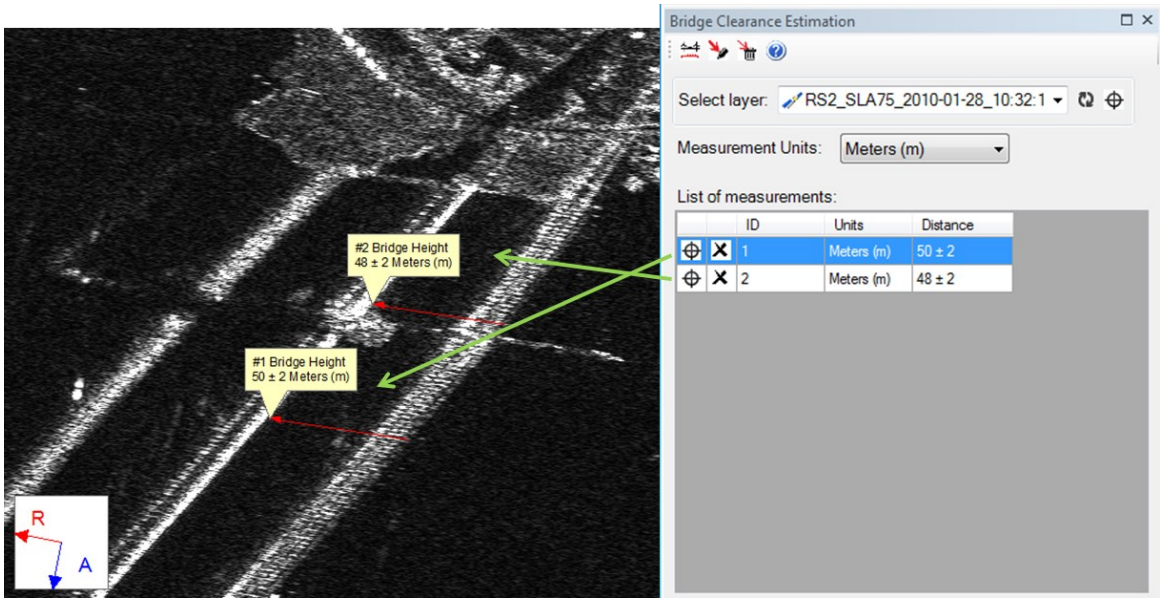
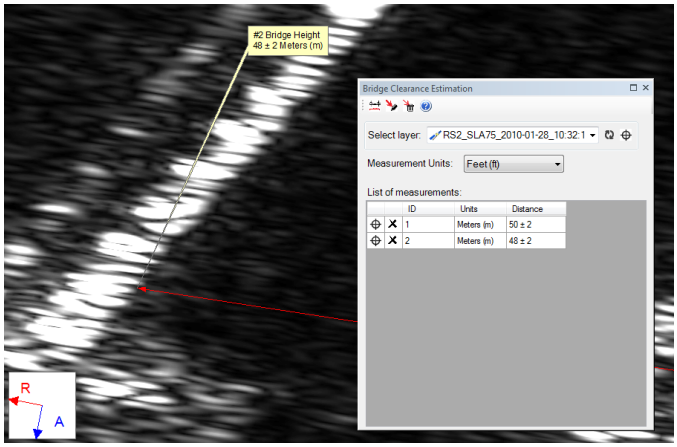



Figure 89 – Bridge Clearance Estimation lines drawn showing measurements on the map and within dialog box.

6. List of measurements

6.1. ⊕ The “target” button when clicked, *zooms* to the line drawn




6.2. ✕ The “delete” button when clicked, deletes the line

### 2.14.3 Additional Information about Bridge Clearance Estimation

Estimating the height of a bridge above water is possible if the bridge is oriented approximately perpendicular to the radar range direction, and the water surface is calm so that backscatter is minimized. When these conditions are met, the SAR signature from the bridge can consist of three nearly parallel strips, as can be seen in Figure 90.

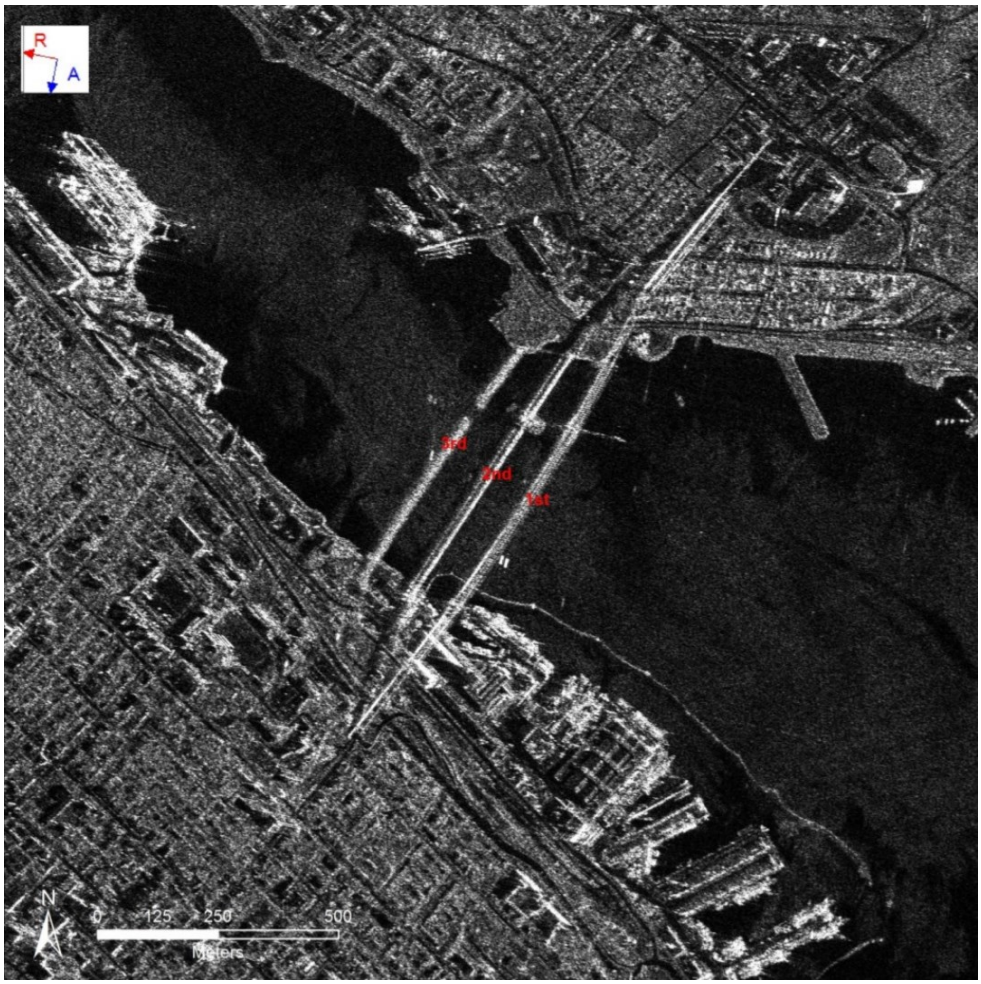



Figure 90 - SAR image with triple reflections from the bridge indicated in red.

The first return, $s_1$, the one nearest to the radar, is simply the direct backscatter from the bridge and represents layover. The observed curvature is due to the arched bridge structure apparent in the photograph shown in Figure 91.


Figure 91 - A photo of the Macdonald Bridge in Halifax, Nova Scotia (corresponding to the SAR image in Figure 90), used here for demonstration purposes. Published clearance is 47 m. Permission granted under the terms of the GNU Documentation License 1.2. Picture source: Francis Mullins, photographer

The second return, $s_2$, is due to the double-bounce from the water to the side of the bridge facing the radar and back to the sensor. An equivalent ray path is from the side of the bridge to the water and back to the sensor. For either case, the propagation delay is the same as if a signal were reflected off of a point on the surface of the water at the base of the bridge. Since the side of the bridge is planar, the radar signature is linear.

The third return, $s_3$, is due to a triple-bounce from the water surface to the bottom of the bridge, back to the water, and finally returning to the sensor. Again, the bridge arch is observed in the SAR image. Note that it is sometimes possible to see a fourth bridge signature in very calm conditions.

## 2.15 Function – Tower/Building Height Estimation

### 2.15.1 Overview

The **Tower/Building Height Estimation** tool opens the dialog box as shown in Figure 92. This tool allows the user to estimate the height of a tower by measuring the length of the shadow or the layover.

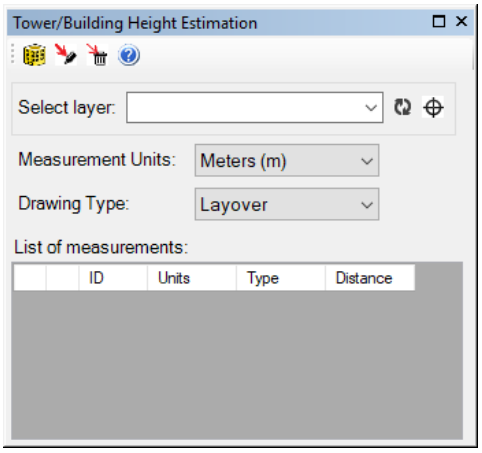



Figure 92 - Tower/Building Height Estimation window

| | |
|---|---|
| **Select layer** | Drop Down List of RADARSAT layers listed from the Table Of Contents |
| **Measurement Units** option | Two options:<br>• Meters (m)<br>• Feet (ft) |
| **Drawing Type** option | Two options:<br>• Layover<br>• Shadow |

### 2.15.2 Use Case – Tower/Building Height Estimation

1. Import a RADARSAT-2 Image using the RS Toolbar. See page 19 for the detailed steps.

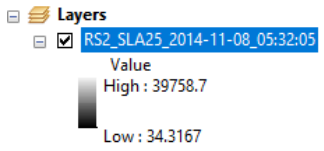



Figure 93 – TOC RS2_SLA25_2014-11-08_05:32:05

For this example, select the RADARSAT-2 SLC image from Papenburg, Germany, showing an 8-element tower installation "RS2_OK58580_IK359049_PEK004295623_SLA25_20141108_053205_HH_SGX". The corresponding layer name is "RS2_SLA25_2014-11-08_05:32:05" according to the convention on Page 22.

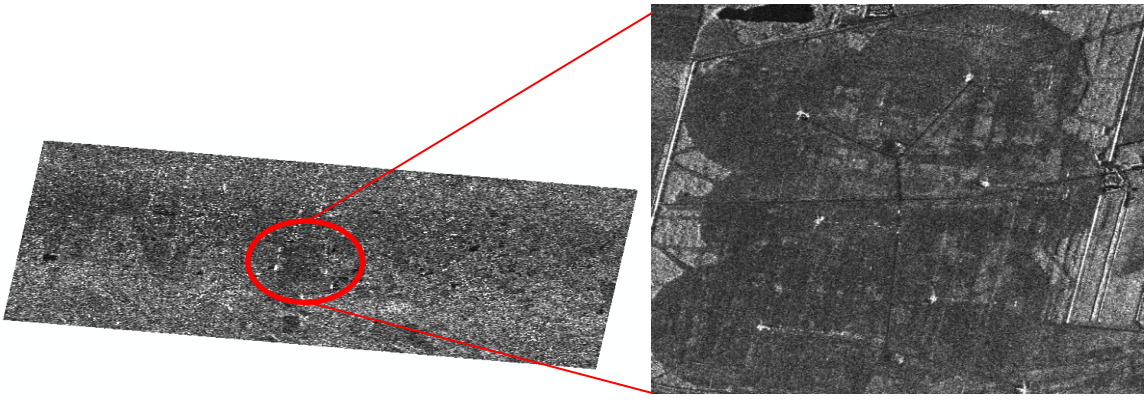


Figure 94 - RS2_SLA25_2014-11-08_05:32:05 Layer zoomed

2. Click on the **Tower/Building Height Estimation** tool from the RS Toolbar as shown in Figure 95.

Figure 95 - RADARSAT Toolbar – Tower/Building Height Estimation tool

As shown in Figure 96, the Tower/Building Height Estimation window is displayed on the ArcMap main screen and a new layer called "Tower/Building Measure" is added to the Table Of Contents.

Any lines drawn belong to the "Tower/Building Measure" layer. You may uncheck the layer to hide it from view. The Tower/Building Measure Layer remains in the Table Of Contents even when the Tool is closed. You can delete the layer at any time.

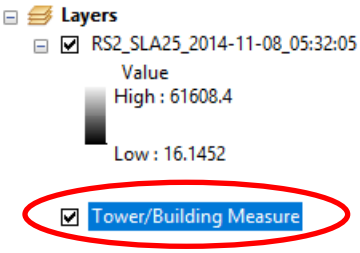



Figure 96 – TOC Tower/Building Measure Graphic Layer

3. There are 4 buttons available from the top toolbar

3.1. Click **Create tower height measurement** to begin drawing a line. Click on the map at the base of the tower to give an initial point, then move the mouse to another location (either the tip of the shadow or the layover). Click the map again to stop drawing.

- ✓ There is no need to hold the mouse button down
- ✓ The line will be constrained to move along the range direction

6.3. Click **Hover** to highlight a measurement as you pass the mouse cursor over it.

3.2. **Delete all measurements** present in the Tower/Building Measure Graphic Layer

3.3. **Help** button will invoke this User Guide

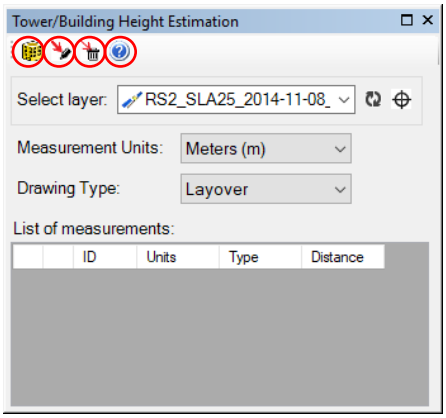



Figure 97 – Tower/Building Height Estimation window displayed with layer selected

4. Zoom to a smaller area to place the line more precisely.

### 2.15.3 Layover/Shadow

1. Select **Drawing Type** to **Layover** or **Shadow**

2. Locate the tower base and begin a new line (Refer to 3.1). Notice that the List of measurements will be appended to for each new line drawn. The column ID matches the label on the map. You can change the units for each measurement, but when the line is drawn, it retains the original units.

   Layover is indicated in yellow and the corresponding shadow in red. The height estimate is shown in the callout.

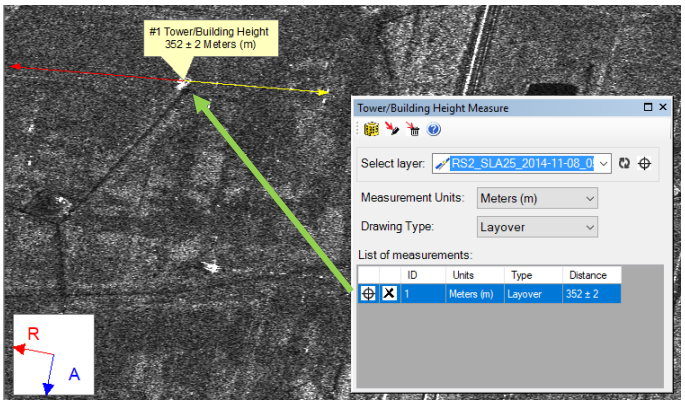



Figure 98 – Tower/Building Height Estimation layover line drawn that shows measurements on the map and in the grid

3. List of measurements

   3.1. ⊕ The “target” button when clicked, *zooms in* to the line

   3.2. ✕ The “delete” button when clicked, deletes the line

### 2.15.4 Additional Information – Tower/Building

Estimating the height of a tower is done by measuring the length of the tower shadow, or the tower layover. The geometry of this is illustrated in Figure 99, for a tower of height $h_t$. Both shadow and layover are related to the SAR incidence angle, $\theta$. We see from direct inspection that $h_t = x_{shadow} / tan(\theta)$. To obtain tower height from layover, note that the lower interior angle associated with layover is $\theta$, and it follows that $h_t = x_{layover} tan(\theta)$.

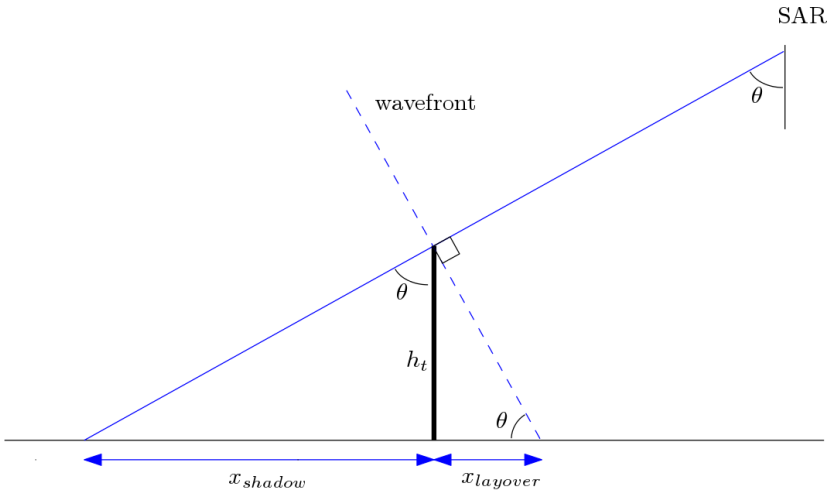



Figure 99 – Geometry of a SAR sensor imaging a tower of height $h_t$ with an incidence angle of $\theta$.

If needed, the slant range distance can be converted to a ground range distance using $d_{ground\ range} = d_{slant\ range}\ sin(\theta)$.

Using this tool requires that either the layover or shadow be visible in the image. An example tower (photo and known height of 352.8 m) is shown in Figure 100. The corresponding tower layover and shadow in the RADARSAT-2 image is illustrated in Figure 101. In this figure, the layover is more readily apparent than shadow, and Figure 102 shows the resulting measurements.

Figure 100 - A photo of the tower in Papenburg, Germany. Permission granted under the terms of the GNU Documentation License 1.2. Picture source: Christian Brinkmann, photographer.

In the RADARSAT-2 Spotlight mode image of the Papenburg tower in Figure 101, the tower base, layover and shadow are indicated in red. The Range and Azimuth directions for this image are indicated in the box on the top left. The RADARSAT-2 Spotlight mode image was acquired using the SLA25 beam position (incidence angle approx. 48°) and the image is shown with a Universal Transverse Mercator (UTM) projection.

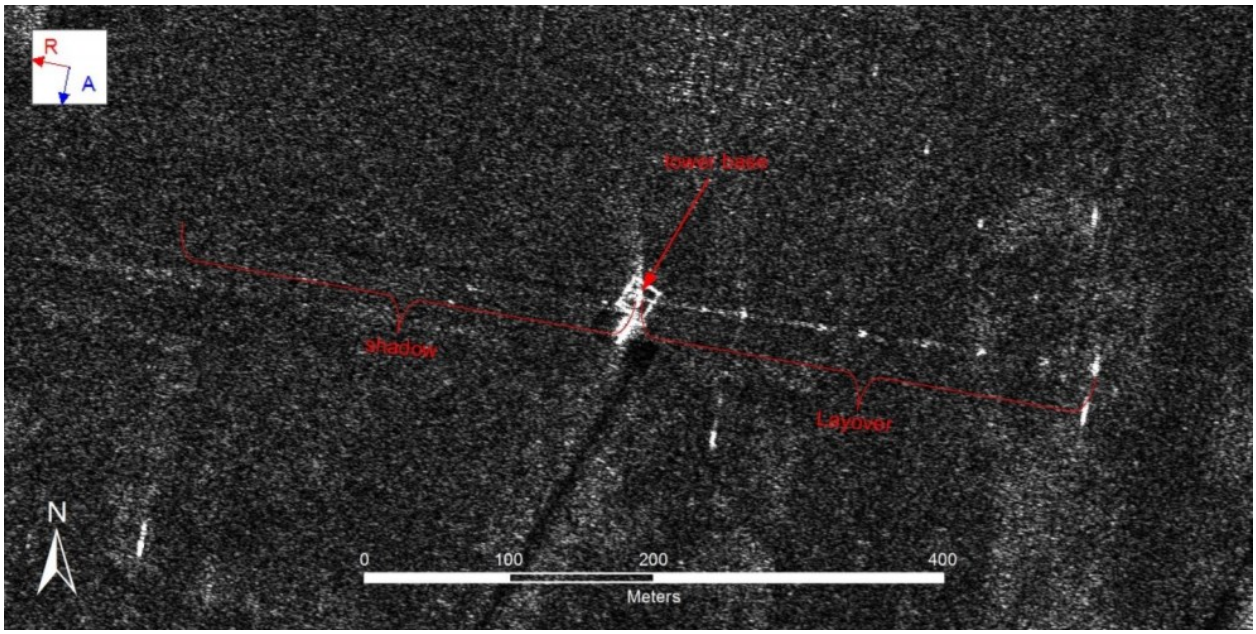



Figure 101 - RADARSAT-2 Spotlight mode image of the Papenburg tower pictured in Figure 100

The estimated tower height is shown in yellow. Here, the estimated height in the callout is 350.0 ±2 m and the known tower height is 352.8 m.

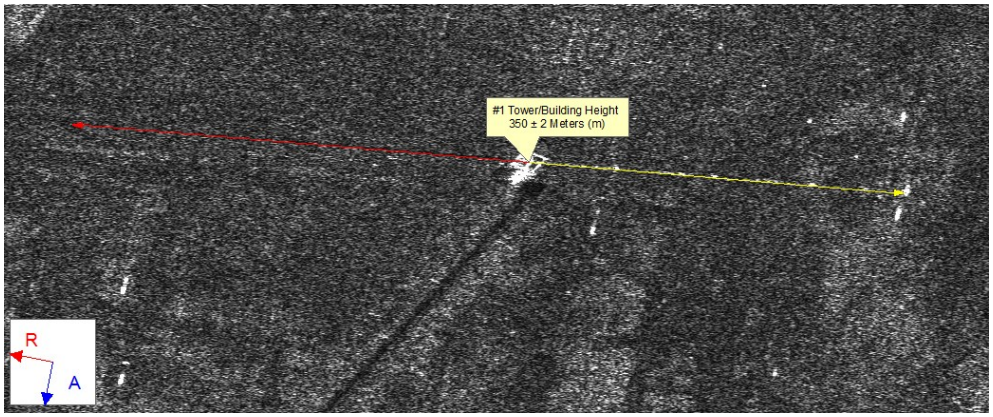



Figure 102 - Measuring the tower height using the IA Pro tool

Depending on incidence angle, the relative proportions of the layover distance and shadow distance will vary as indicated in Figure 103.

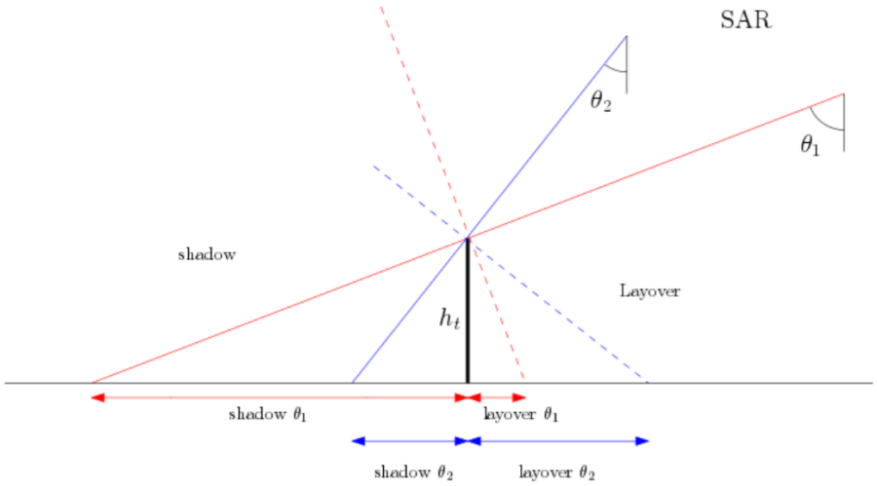



Figure 103 - Ray diagram illustrating geometry of tower height for varying incidence angles ($\theta_1 > \theta_2$).

## 2.16 Function – Shoreline Extraction

### 2.16.1 Overview

The **Shoreline Extractor** tool displays a dialog box as shown in Figure 104. This tool employs batch processing, allowing the user to process several layers in a series. Each task is executed one by one in the background.

A speckle filter will be applied to the SAR image in order to assist with shoreline extraction.

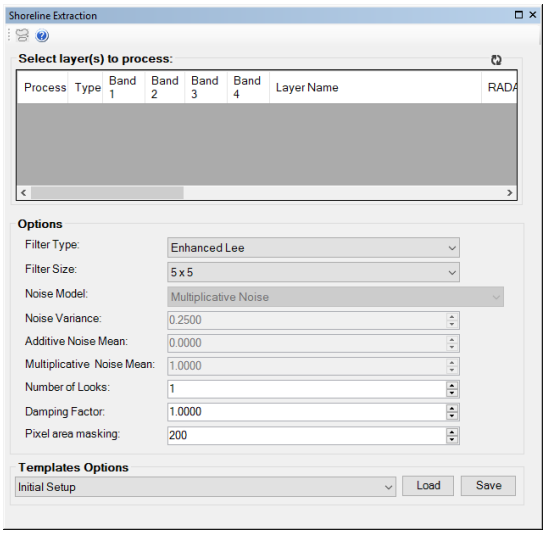



Figure 104 – Shoreline Extractor window

For each map layer, all available polarizations will be listed. A greyed-out column (either band 1,2,3,4) indicates that the polarization does exist for that layer.

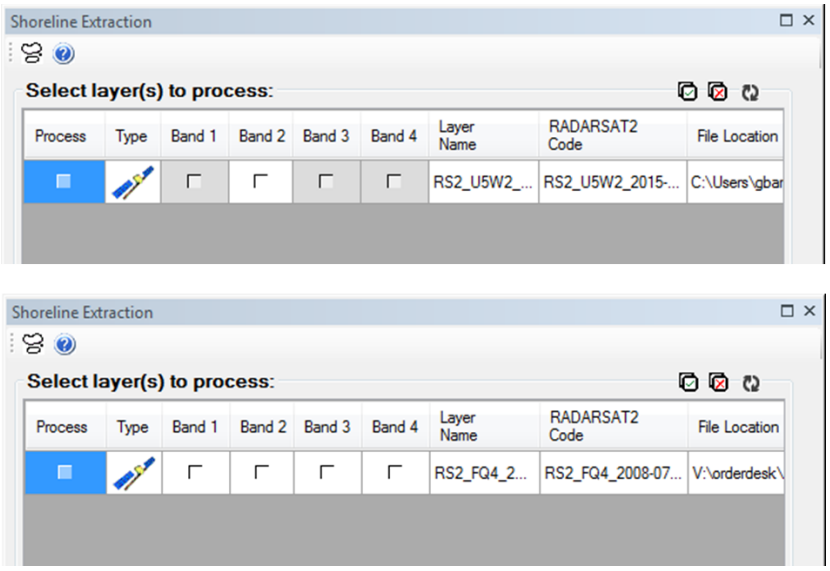



Figure 105 – Shoreline Extractor: Selecting layers to process
(top – single band, bottom – quad pol)

| | |
|---|---|
| **Select layer(s) to process** | The central area of the window displays a list of layer identifiers from the TOC.<br>**Process**: Check this box to process the layer<br>**Type**: A RADARSAT-2 Image Type. See page 14<br>**Bands 1 to 4**: According to the internal polarization list order<br>**Layer Name**: The Layer Name present in the TOC<br>**RADARSAT2 Code**: The RADARSAT-2 "true" layer name according to convention.<br>**File Location**: The XML metadata file full path |
| **Filter Type** | **Lee, Enhanced Lee, Frost, or Kuan**<br>• The **Lee** filter reduces the speckle noise by applying a spatial filter to each pixel in an image, which filters the data based on local statistics calculated within a sampling window. The value of the center pixel is replaced by a value calculated using the neighboring pixels.<br>• The **Enhanced Lee** filter is an modified version of the Lee filter to better preserve edge sharpness and detail.<br>• The **Frost** filter reduces speckle noise and preserves important image features at the edges with an exponentially damped circularly symmetric filter that uses local statistics within individual filter windows.<br>• The **Kuan** filter follows a similar filtering process to the Lee filter in reducing speckle noise. |
| **Filter Size** | 3 x 3, 5 x 5, 7 x 7, 9 x 9, 11 x 11 |
| **Noise Model** | Additive Noise, Multiplicative Noise, Both |
| **Noise Variance** | This is the noise variance of the image |
| **Additive Noise Mean** | Mean value of additive noise |
| **Multiplication Noise Mean** | Mean value of multiplicative noise |
| **Number of Looks** | Specifies the number of looks of the image |
| **Damping Factor** | Specifies the damping factor to define the extent of smoothing |
| **Pixel area masking** | Pixel size limit |
| **Templates Options** | The drop-down list shows all the templates saved.<br>Save button allows to save different options in a template name.<br>Load button allows to load a template name and reset options by the values saved in the template name. |

### 2.16.2 Use Case 1 – QuadPol RADARSAT Image

1. Import a RADARSAT-2 Image using the RS Toolbar. See page 24 for the detailed steps.
2. Click on the **Shoreline Extractor** tool from the RS Toolbar as shown in Figure 106.

Figure 106 - RADARSAT Toolbar – Shoreline Extractor window

3. There are 2 buttons available from the top toolbar

   3.1. Shoreline Extractor button activates batch processing according to the options selected

   3.2. **Help** button will invoke this User Guide

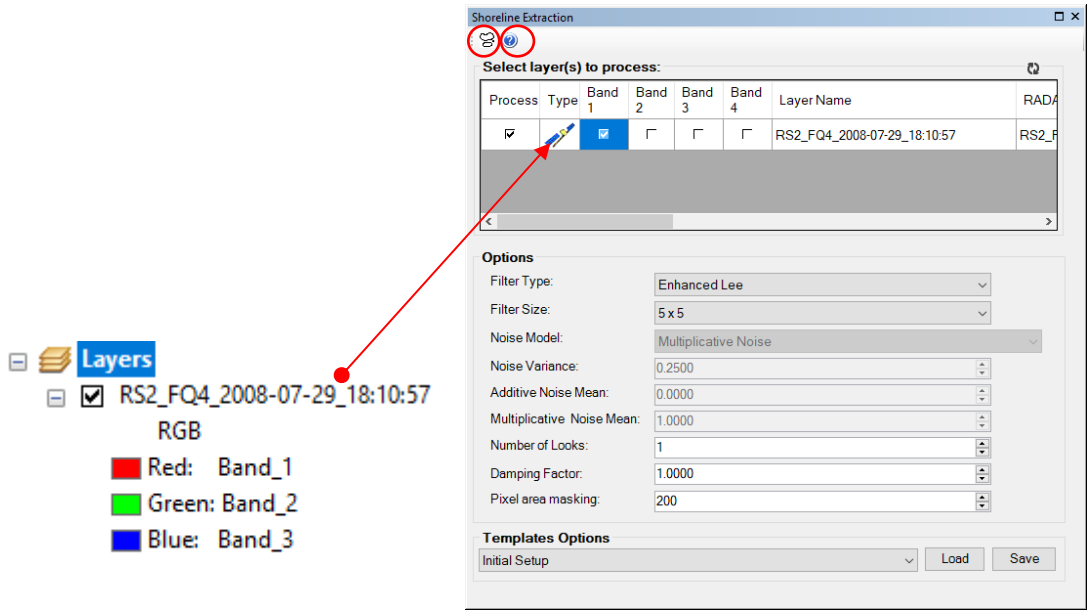



Figure 107 – Shoreline Extractor window showing 1 layer that has been selected

If at least one of the "Process" check boxes is not selected, the following message will be shown (Figure 108).

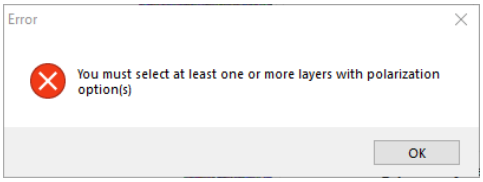



Figure 108 – Shoreline Extractor Error message

4. After clicking on the **Perform Batch Shoreline Extractor** button, each layer will be queued and processed in the background. When all shoreline extraction is complete, images will appear automatically in the Table Of Contents, as shown in Figure 109. The "Tasks in Progress" window displays processing states Queuing, Executing and Succeeded.

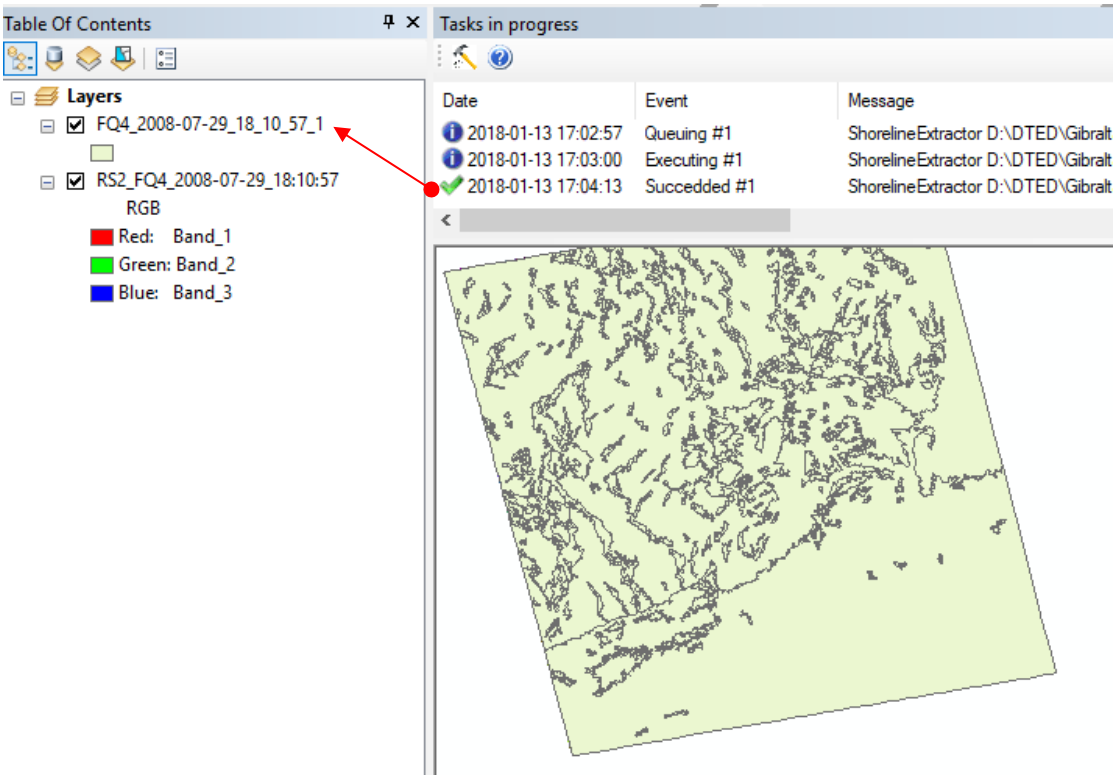



Figure 109 – Shoreline Extractor Output

## 2.17 Function – Edge Detection (Canny)

### 2.17.1 Overview

The **Edge Detection (Canny)** tool displays the dialog box as shown in Figure 110.

This algorithm employs three user-defined thresholds: a high/low value and Sigma, a smoothing parameter. A certain amount of trial-and-error is required to find the best settings for a given image.

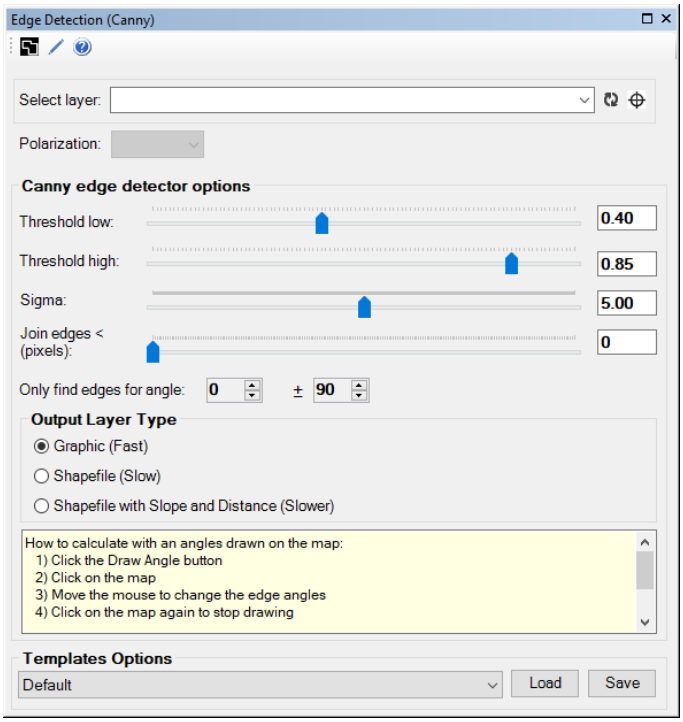



Figure 110 – Edge Detection (Canny) window

| | |
|---|---|
| **Select layer** | Drop Down List of RADARSAT layers listed from the Table Of Contents |
| **Polarization** | Selecting a layer will automatically refresh the Drop List, showing all possible polarizations found.<br>**Band 1**: According to the internal polarization list order (usually HH)<br>**Band 2**: According to the internal polarization list order (usually HV)<br>**Band 3**: According to the internal polarization list order (usually VV)<br>**Band 4**: According to the internal polarization list order (usually VH) |
| **Threshold low** | This threshold specifies the minimum gradient value for any point to be included in an edge. A lower value will create longer edges and a value closer to threshold high will make shorter edges. |
| **Threshold high** | The threshold value above which all pixels are counted as edges. It is also the minimum gradient value that at least one point in every edge must have. A higher value will return fewer edges. |
| **Sigma** | Used to reduce noise enabling more accurate gradient calculations. Higher values produce a pronounced blur. A good starting point is 5.0. |

| | |
|---|---|
| **Join edges < (pixels)** | The value used to connect touching or near edges. Any edges that pass within the specified value will be amalgamated into a single edge of maximum possible length. |
| **Find edges for angle** | The range is used to check the slope of the edges. If the slope of the entire edges does not fall within the range specified, the edge is deleted. The slope is measured relative to the orientation of the raster. Since this is non-intuitive, there is an option to draw the desired angle onto the image. |
| **Output Layer Type** | **Graphic**: The output is displayed directly in a ToC Graphic Layer. No file generated.<br>**Shapefile**: The output is generated in ESRI Shapefile file.<br>**Shapefile + Slope and Distance:** The output is generated in ESRI Shapefile file and will contain more values which are the slope and distance. |
| **Templates Options** | The drop-down list shows all the templates saved.<br>Save button allows different options in a template name.<br>Load button allows the user to load a template name and reset options by the values saved in the template name. |

### 2.17.2 Use Case – Edge Detection (Canny)

1. Import a RADARSAT-2 Image using the RS Toolbar. See page 24 for the detailed steps.

2. Click on the **Edge Detection (Canny)** tool from the RS Toolbar as shown in Figure 111.

Figure 111 - RADARSAT Toolbar – Edge Detection (Canny)

3. There are 3 buttons available from the top toolbar
   - **Perform Edge Detection (Canny)** button will process the selected layer. You need to zoom into a sub-area of the image (this is due to memory limitations of the algorithm). If the viewed area is too large, then the toolbar shows a message to this effect, and it will be necessary to zoom in an additional amount. See Figure 112

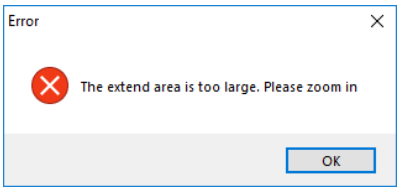



Figure 112 – Edge Detection (Canny) message to zoom in

- **Activate option to draw and angle on the map (optional)** button draws a red rectangle with a yellow arrow indicating the angle. This angle direction will automatically change the "edges for angle" first value. The "±" remains unchanged.
- **Help** button will invoke the following window

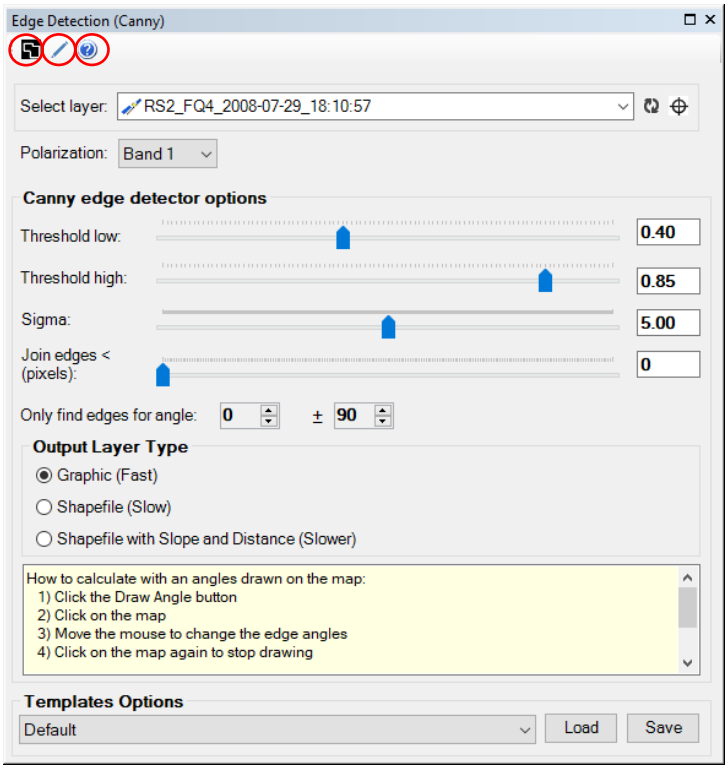



Figure 113 – Edge Detection (Canny) window showing layer with band listing

4. Zoom in to this location

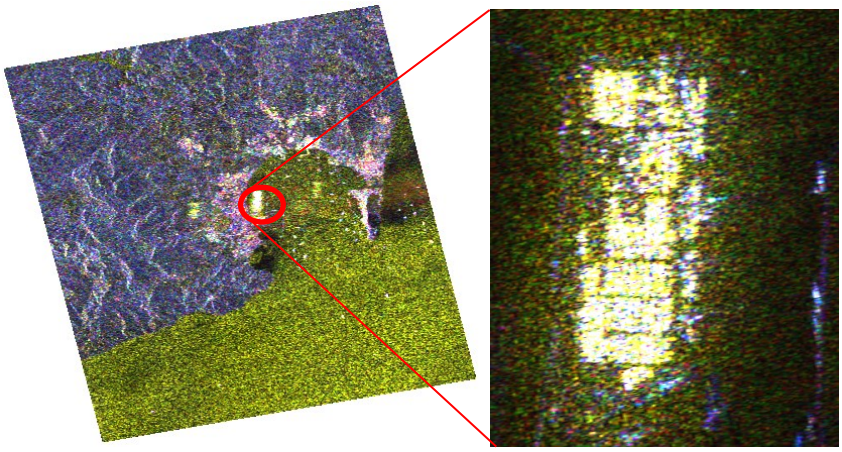


Figure 114 – Edge Detection (Canny) layer zoomed

5. Draw an angle. Click on this tool. Click on the map and then move. A red grid appears, with a yellow arrow showing the angle. This calculated angle value will refresh the “edges for angle” value. Click again the map to finish drawing.

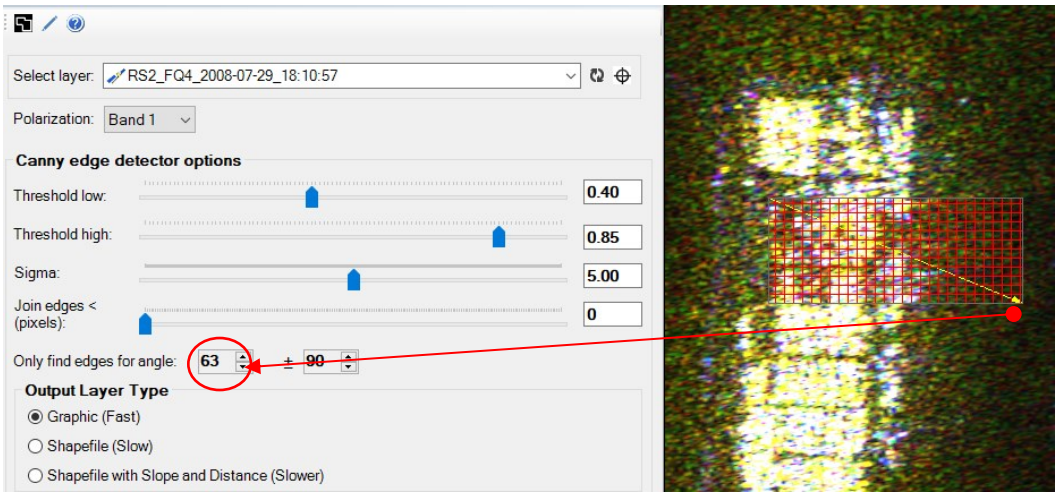



Figure 115 – Edge Detection (Canny) drawing a rectangle angle

6. Set **Output Layer Type** to **Graphic**

7. After clicking on the **Perform Edge Detection (Canny)** button, the calculation may take some time depending on the area selected and parameter settings. The “Canny Edge” layer will appear, displaying with blue lines. You may uncheck the layer to hide it from view. The Canny Edge Layer

remains in the Table Of Contents even when the Tool is closed. You may delete the layer at any time

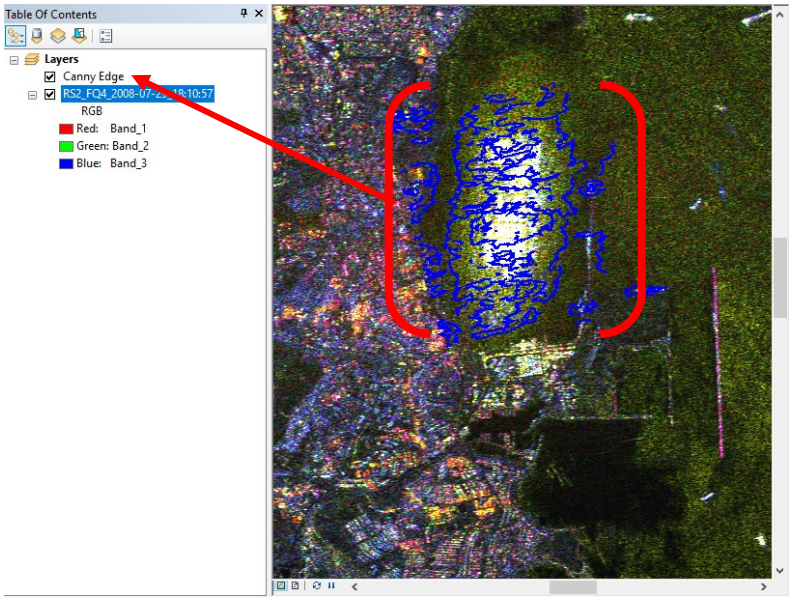



Figure 116 – TOC Canny Edge Graphic Layer

## 2.18 Function – Speckle Filter

### 2.18.1 Overview

The **Speckle Filter** tool displays a dialog box as shown in Figure 117.

The column "All Bands" will be available only with a layer having two or four polarizations.

This tool employs batch processing, allowing the user to process several layers in a series. Each task is executed one by one in the background.

The speckle filter and its parameter settings was discussed in the section on Shoreline Extraction (page 72).

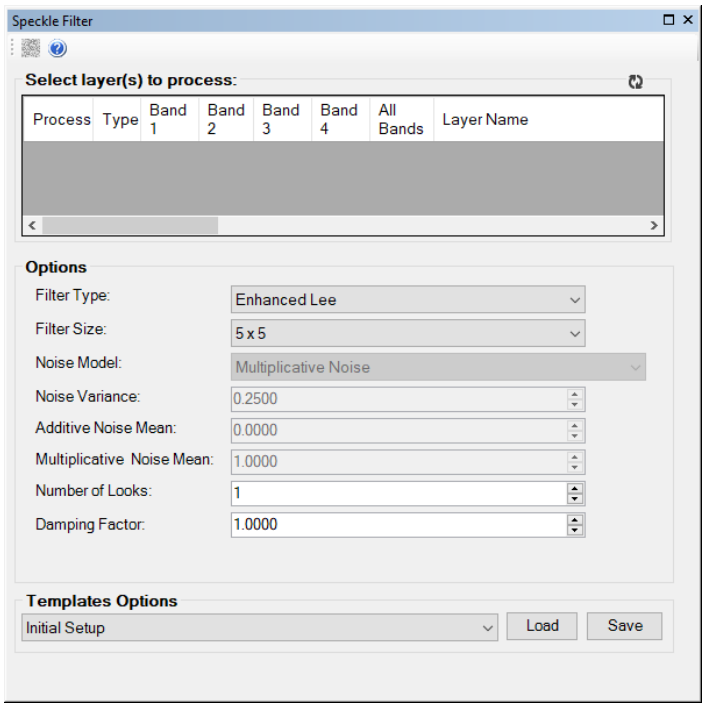



Figure 117 – Speckle Filter window

### 2.18.2 Use Case 1 - QuadPol RADARSAT-2 Image

1. Import a RADARSAT-2 Image using the RS Toolbar. See page 24 for the detailed steps.
2. Click on the **Speckle Filter** tool from the RS Toolbar as shown in Figure 118.

Figure 118 - RADARSAT Toolbar – Speckle Filter window

3. There are 2 buttons available from the top toolbar

   3.1. **Perform batch speckle filtering** button activates the batch processing according to the options selected

   3.2. **Help** button will invoke this User Guide

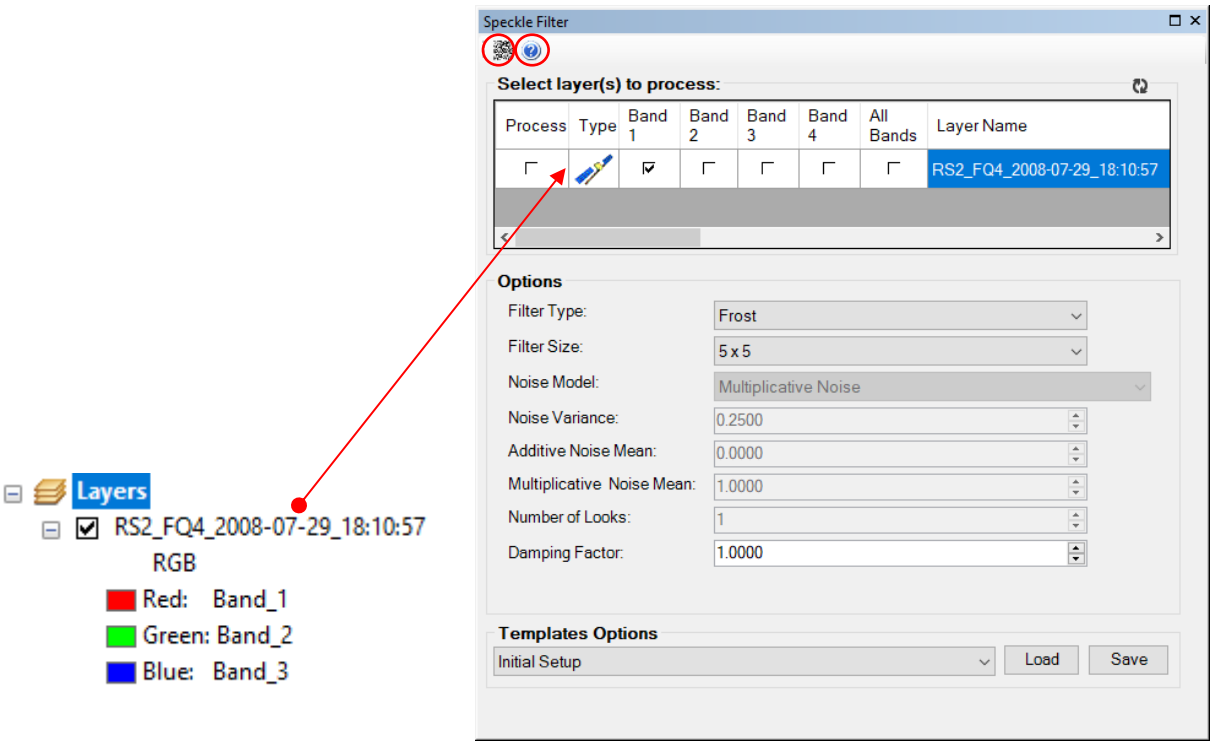



Figure 119 – Speckle Filter window showing 1 layer that has been selected

If at least one of the "Process" check boxes is not selected, the following message will be shown (Figure 120).

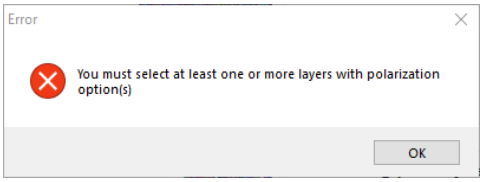



Figure 120 – Speckle Filter Error message

4. After clicking on the **Perform batch speckle filtering** button, each layer is queued and processed in the background. When all Speckle Filter processes are done, images will appear automatically in the Table Of Contents as shown in Figure 121. The "Tasks in Progress" window displays processing states Queuing, Executing and Succeeded.

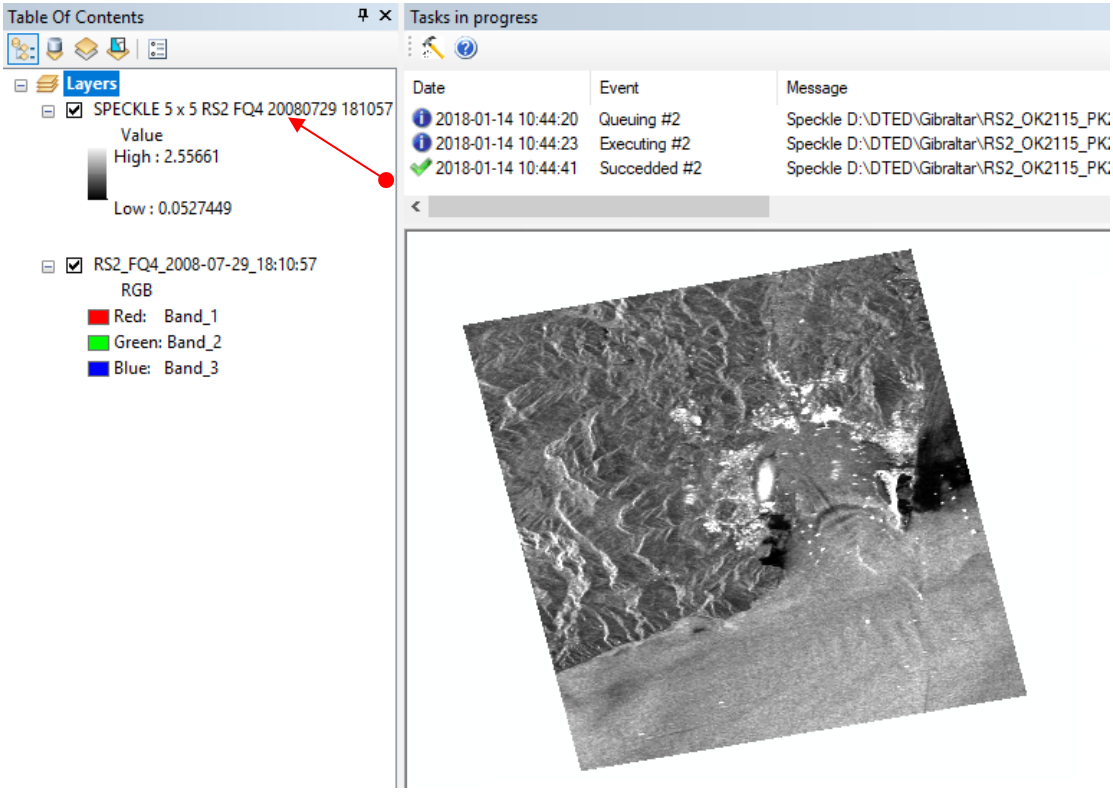



Figure 121 – Speckle Filter Output

## 2.19 Function – Nudge

### 2.19.1 Overview

The **Nudge** tool displays a dialog box as shown in Figure 122.

The Nudge tool shifts (nudges) the raster layer to a new geographic location, based on x and y shift values. This tool is helpful if your raster dataset needs slight adjustments to align with another data file.

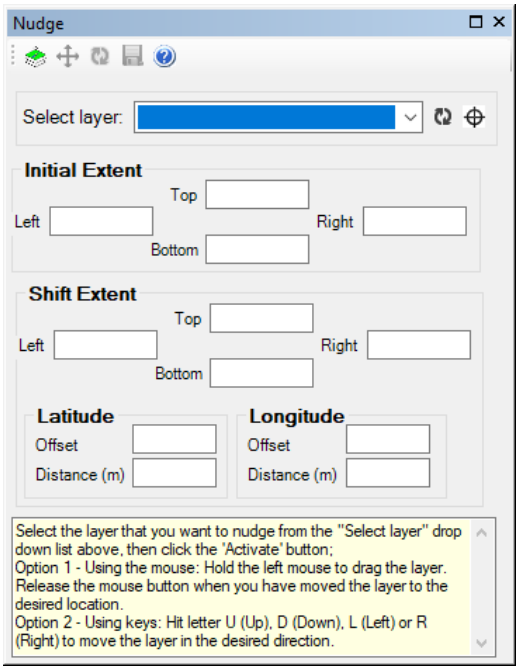



Figure 122 - Nudge window

| | |
|---|---|
| **Select layer** | Drop Down List of RADARSAT-2 layers listed from the Table Of Contents |
| **Initial Extent** | Extent of the raster layer as it was last in the map document |
| **Shift Extent** | As the raster layer is shifted with the mouse, it shows the new raster layer extent. |
| **Latitude**<br>- **Offset**<br><br>- **Distance (m)** | Difference between the initial latitude upper left and the nudge latitude upper left<br><br>Distance in meters between the initial latitude upper left and the nudge latitude upper left |
| **Longitude**<br>- **Offset**<br><br>- **Distance (m)** | Difference between the initial longitude upper left and the nudge longitude upper left<br><br>Distance in meters between the initial longitude upper left and the nudge longitude upper left |

### 2.19.2 Use Case 1 - QuadPol RADARSAT Image

1. Import a RADARSAT-2 Image using the RS Toolbar. See page 24 for the detailed steps.
2. Click on the **Nudge** tool from the RS Toolbar as shown in Figure 123.

Figure 123 - RADARSAT Toolbar – Nudge window

3. There are 5 buttons available from the top toolbar
   - 3.1. **Activate the nudge function for the selected image** button activates the layer to be nudged from the drop-down list
   - 3.2. **Nudge** (shift) the raster layer extent
   - 3.3. **Reset** the raster layer to its initial extent
   - 3.4. **Save the nudge result to a new file**
     - ✓ The cell size of the output raster will be the same as that of the input raster.
     - ✓ The number of rows and columns in the output raster will be the same as those of the input raster
     - ✓ The coordinates of the lower left corner of the output raster will be offset from the input raster by the x and y shift coordinate values specified
     - ✓ The output raster dataset is nudged according to the location of the input snap raster, so the new shifted raster dataset can be aligned with another raster dataset
   - 3.5. **Help** button will invoke this User Guide

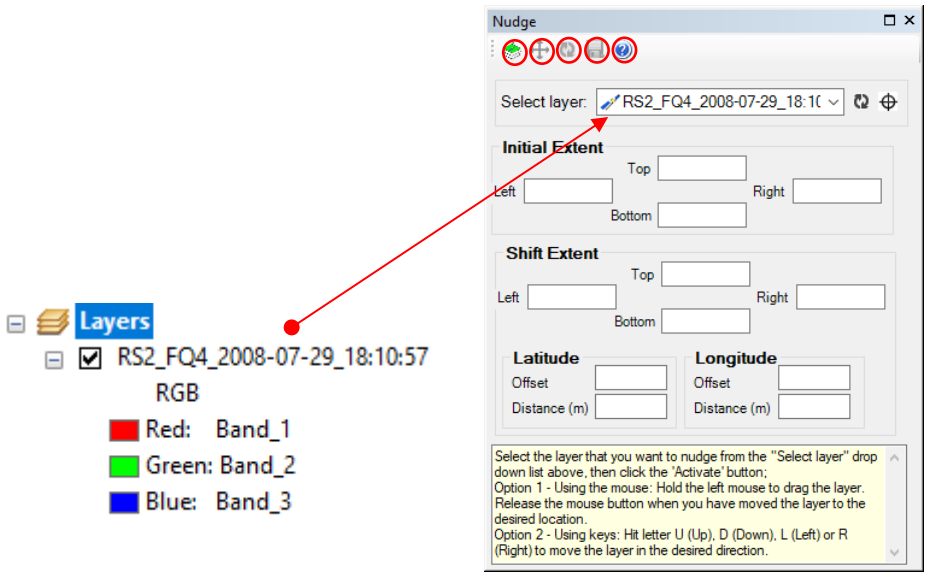



Figure 124 – Nudge window showing 1 layer that has been selected

4. Select the layer from the drop-down list

5. Select the **Activate the layer to nudge** button. A blue box surrounds the button indicating the tool is activated and the raster layer is ready to be nudged.

6. Usually, raster layer should be nudged few meters from another layer. Thus, zoom in close enough to a location to see the nudge movement. Click the Nudge button to start to shift the layer with the mouse either **u**p (hit letter **U**), **d**own (hit letter **D**), **l**eft (hit letter **L**) or **r**ight (hit letter **R**). Notice the **Initial Extent** does not change, the **Shift Extent** changes as the layer moves, and the **Offsets/Distances** values change according to the distance from **Initial** to **Shift Extent**.

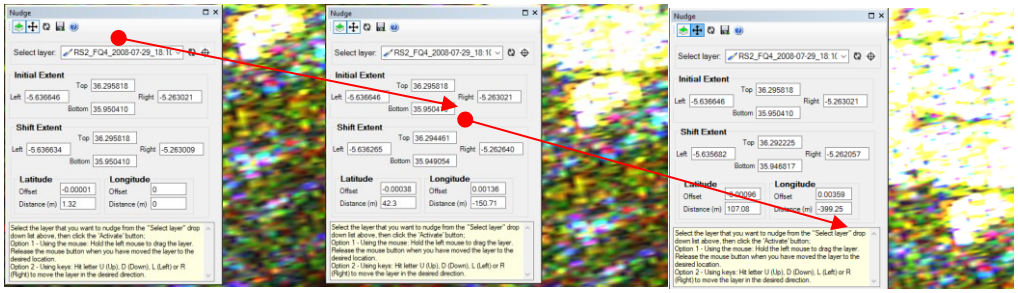


Figure 125 – Nudging a raster layer

7. Click the **Save** button. The progress bar appears. Then the new nudged raster layer will be automatically added to the Table Of Contents (Figure 127).

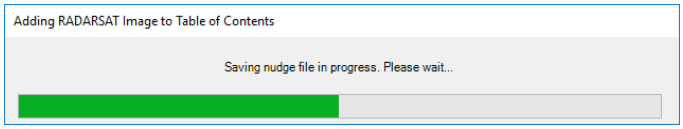



Figure 126 – Saving raster layer nudged


Figure 127 – Nudge output layer

## 2.20 Function – Tasks in progress

### 2.20.1 Overview

The **Tasks in progress** tool shows all processes that have been Queued, Executed or Succeeded. Tasks in progress window is shown in Figure 128.

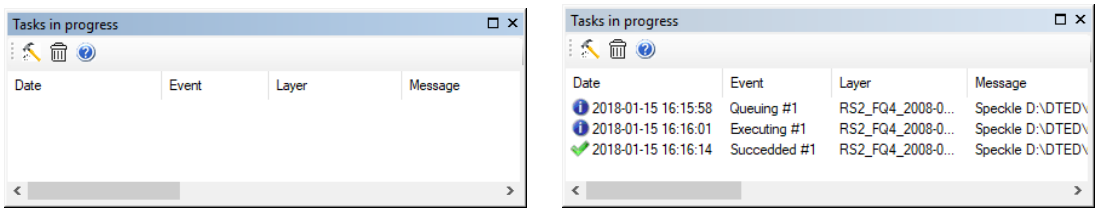



Figure 128 – Tasks in progress window example. Empty and with one process done

1. Click on the **Tasks in progress** tool from the RS Toolbar as shown in Figure 129.

Figure 129 - RADARSAT Toolbar – Tasks in progress window

2. There are 2 buttons available from the top toolbar

   2.1. This tool has 2 states either **Pause Tasks to be executed** OR **Restart Tasks to be executed.** These 2 states toggle each other

   - ✓ **Pause Tasks to be executed:** Stop to execute tasks queued.
   - ✓ **Restart Tasks to be executed:** Restart to execute task queued.

   Note: If there is a task already executing, it cannot be stopped.

   2.2. **Clear Tasks Messages** button will clear out all messages present in the window, but not the future messages that are queued

   2.3. **Help** button will invoke this User Guide

## 2.21 Function – Help

### 2.21.1 Display Overview

The **Help** tool from the RS Toolbar opens the Help dialog as shown in Figure 130.

| | |
|---|---|
| **Release x.y.z** | The number displayed at the bottom/left corner of the dialog is the release number of the software version currently installed. The release number is in the following format x.y.z where:<br>- x is the major revision number (incremented for major releases),<br>- y is the minor revision number (incremented for minor changes), and<br>- z is the release number (incremented for bug fixes). |
| **Register Geoprocessing (Administrator privileges required)** | This button will allow registration of four tools (Function – Orthorectification, Function – Quad-pol image, Function – Shoreline and Function – Speckle) in the Catalog Toolbox. |
| **Open User Guide (PDF)** | This button opens the user guide in PDF format using your system default viewer (Figure 131). |
| **Close** | The **Close** button closes the Help dialog. |


Figure 130 - Help Dialog

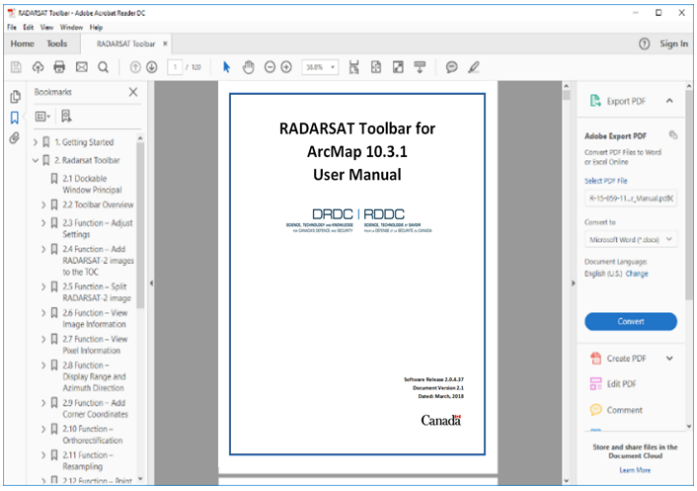



Figure 131 - RADARSAT Toolbar User Manual

## 2.22 Function – Batch Nudge

### 2.22.1 Overview

The Batch **Nudge** tool  displays a dialog box as shown in Figure 132

The Batch Nudge Tool is similar to the Nudge Tool, shifting all possible raster layers within the ToC to a new geographic location. This tool is helpful if you need to apply a latitude/longitude offset to a large number of raster files.

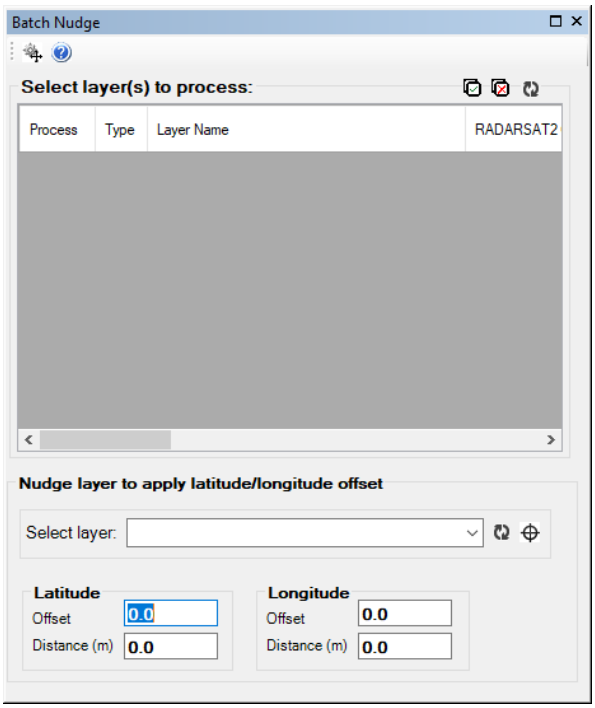


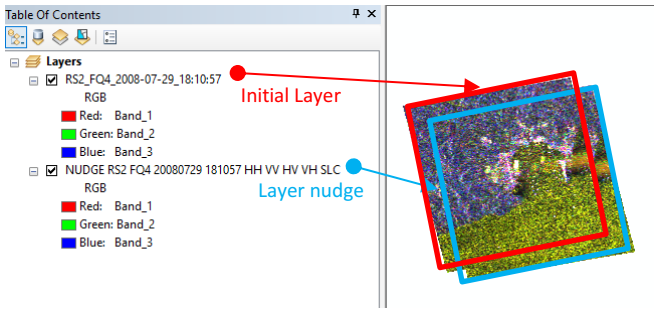

Figure 132 – Batch Nudge window

| | |
|---|---|
| **Select layer(s) to process** | The central area of the window displays a list of layer identifiers from the TOC.<br>**Process**: Check this box to process the layer<br>**Type**: A RADARSAT-2 Image Type. See page 14<br>**RADARSAT2 Code**: The RADARSAT-2 "true" layer name according to convention.<br>**File Location**: The XML metadata file full path |
| **Select layer** | Drop Down List of custom RADARSAT layers listed from the TOC that has been previously nudged. A Nudge raster layer will contain all information to populate Offsets and Distances fields. |

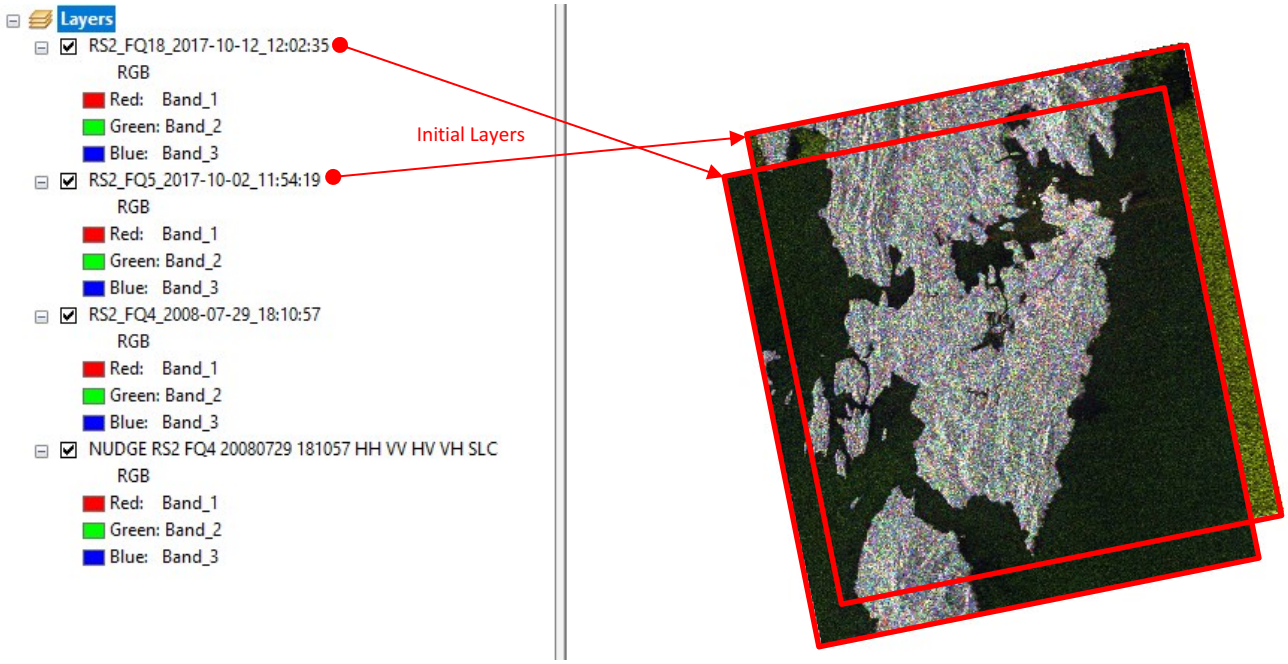
| | |
|---|---|
| **Latitude**<br>- **Offset**<br><br><br><br>- **Distance (m)** | From the initial extent raster layer, the new extent will be nudged according to the difference between both upper left.<br>**Changing manually the offset will update the distance in meters**<br><br>The distance in meters is determined by the offset.<br>**Changing manually the distance in meters will update the offset** |
| **Longitude**<br>- **Offset**<br><br><br><br>- **Distance (m)** | From the initial extent raster layer, the new extent will be nudged according to the difference between both upper left.<br>**Changing manually the offset will update the distance in meters**<br><br>The distance in meters is determined by the offset.<br>**Changing manually the distance in meters will update the offset** |

### 2.22.2 Use Case 1 - Several RADARSAT-2 Images and one Nudge Custom RADARSAT-2 Image

1. Using the Function – Nudge (page 84), create a Nudge Layer. Here is an example:




2. Import two RADARSAT-2 Images using the RS Toolbar. See page 24 for the detailed steps. Here is an example:




*3.* Click on the **Batch Nudge** tool from the RS Toolbar as shown in Figure 133.

Figure 133 - RADARSAT Toolbar – Batch Nudge window

4. There are 2 buttons available from the top toolbar

4.1. **Perform Batch Nudge** operates on any layer selected (Process checked) from the grid list. Based on the latitude/longitude offset, each raster layer will be nudged, saved and added to the Table Of Contents automatically.

4.2. **Help** button will invoke this User Guide

5. Check off the first 2 layers. These correspond to layers loaded in step 2.

6. From the "Select Layer" drop down, select the Nudge Layer. The Latitude/Longitude offset and the distance in meters will be automatically displayed according to the values registered in the Nudge file.

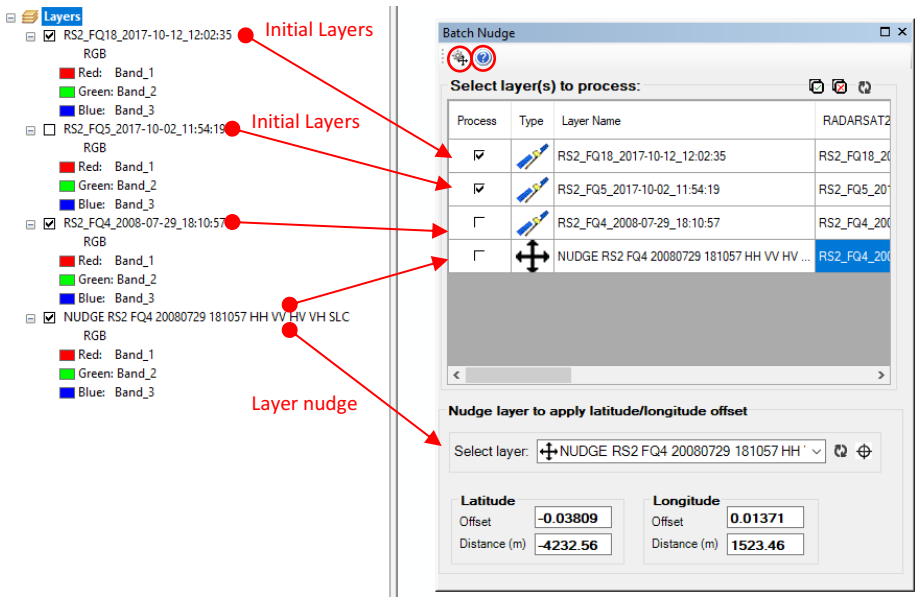



Figure 134 – Batch Nudge window showing layers selected

7. Offset/distance fields can be changed at any time before running the batch, and will be recalculated.

8. Click **Perform Batch Nudge** button.

9. After all layers are processed, they will be added to the Table Of Contents.

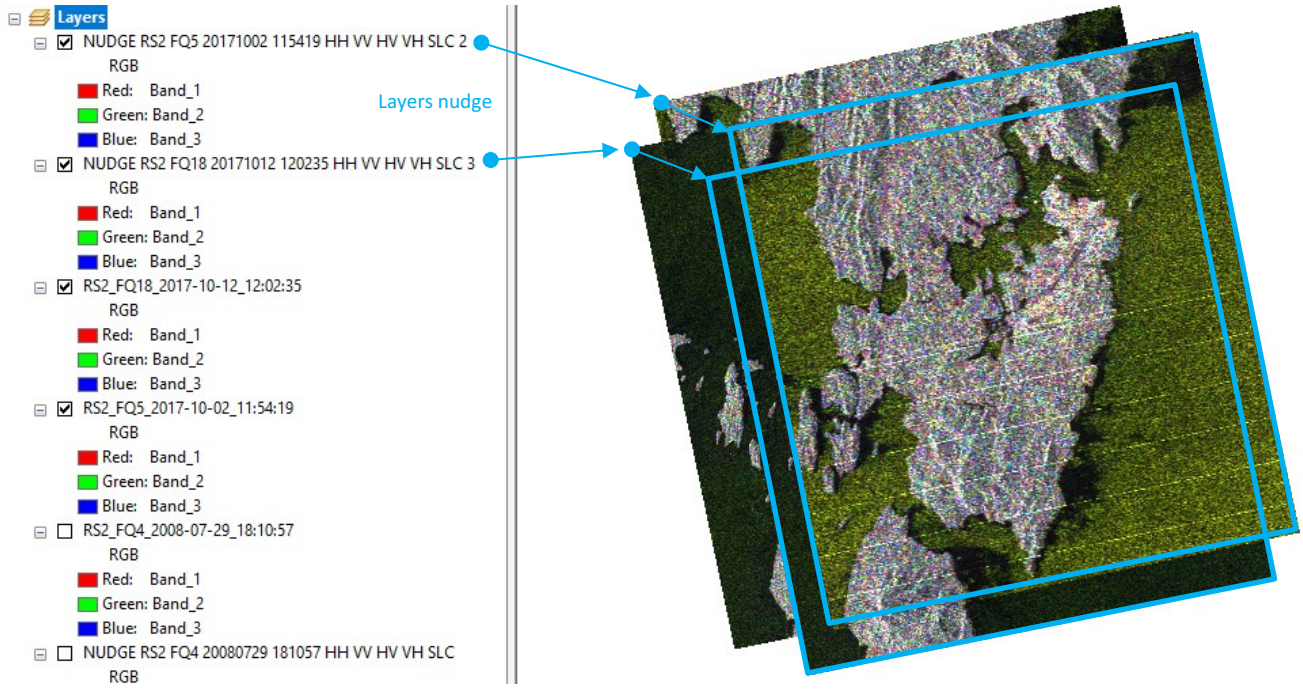



Figure 135 – Batch Nudge output layers

# 3. CROSS-COUNTRY MOBILITY TOOLBAR

## 3.1 Toolbar Overview

### 3.1.1 Buttons

The Cross-country Mobility Toolbar is shown in Figure 136.

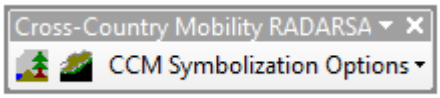



Figure 136 - Cross-country Mobility Toolbar

Table 4 provides the toolbar buttons and the links to the sections of this User Guide document that explain the tool function.

Table 4 – Cross-country Mobility Toolbar Function List

| Button | Section and Function Name |
|---|---|
|  | 3.2 Function – CCM Generator |
|  | 03.3 Function - Surface Roughness Editor |
| CCM Symbolization | 0<br><br>CCM Symbolization Options |

## 3.2 Function – CCM Generator

The CCM Generator button will open the main Cross-country mobility (CCM) generation dialog as shown in Figure 137. The CCM Generator enables a user to produce standardized Cross-country mobility (CCM) products in a semi-automated way. The CCM tool uses the same inputs as a CF Geo Tech would use for his or her terrain assessment. It evaluates the effect of vegetation, soil, obstacles, lines of communication, and elevation in the same fashion that would be done manually. However, the tool ensures that the Geo Tech follows a defined process in creating a standardized output. All final and intermediate products are available to the Geo Techs so that they can further manipulate them as required.

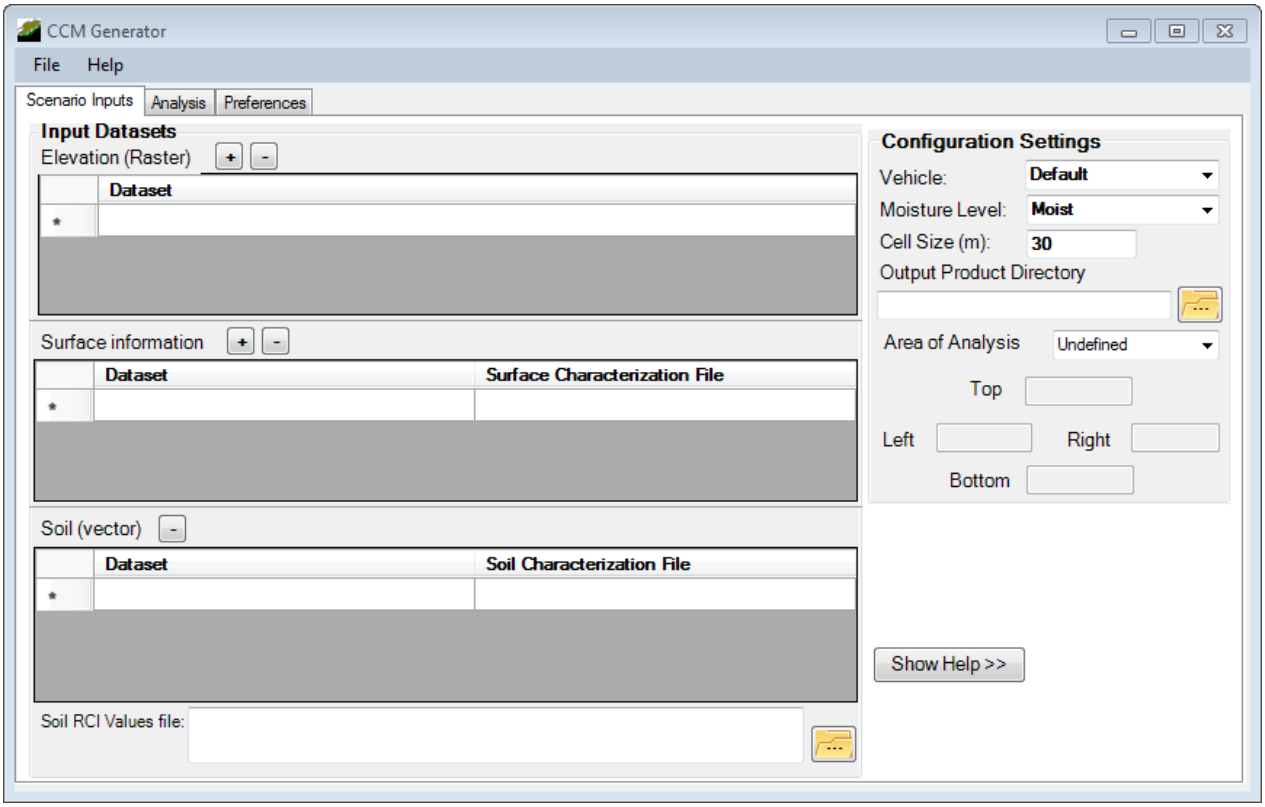



Figure 137 - CCM Generator dialog

Navigating to the "Scenario Inputs" tab, the **Elevation (Raster)** section lets you input raster datasets (DTED, SRTM, Applanix, etc.) that cover your AOI.

The **Surface Information** section allows you to input vector or raster datasets that represent surface classifications (e.g. polygon extents of forest, fields, roads, built up areas, etc). Different surface types represent different levels of impedance for different vehicles.

The Surface Characterization File is a .xml file that defines the impedence value for each different surface type. For every different dataset that you use in the toolbar you will need to create a different surface characterization file, and these xml files can also be created through the toolbar.

The **Soil (vector)** section allows a vector shapefile that represent different soil types (e.g. polygon extents of clay, gravel, loam, sand etc). Different soil types represent different levels of impedance for different vehicles.

The Soil Characterization File allows the user to associate their specific soil classes to the generic soil classes required by the toolbar for analysis. These associations are stored in an xml file, which can also be created through the toolbar.

The **Soil RCI Values file** is created for the generic soil types used in analysis.

On the right hand side of the CCM Generator dialog, you need to change some general configuration settings. This can include vehicle type, moisture level and cell size. Within this document, the values are left as default.

The "output product directory" must be set to a filename that has not been previously been used to run a CCM analysis. ArcMap will not overwrite it.

The Area of Analysis is based on a polygon extent. Use a .shp file as your polygon extent. The coordinates of the extent of this polygon are populated in the toolbar.

## 3.3 Function - Surface Roughness Editor

The Surface Roughness  button will open the Surface Roughness Editor dialog as shown in Figure 138. This editor enables a user to open feature sets, and to save, load, or edit roughness data.

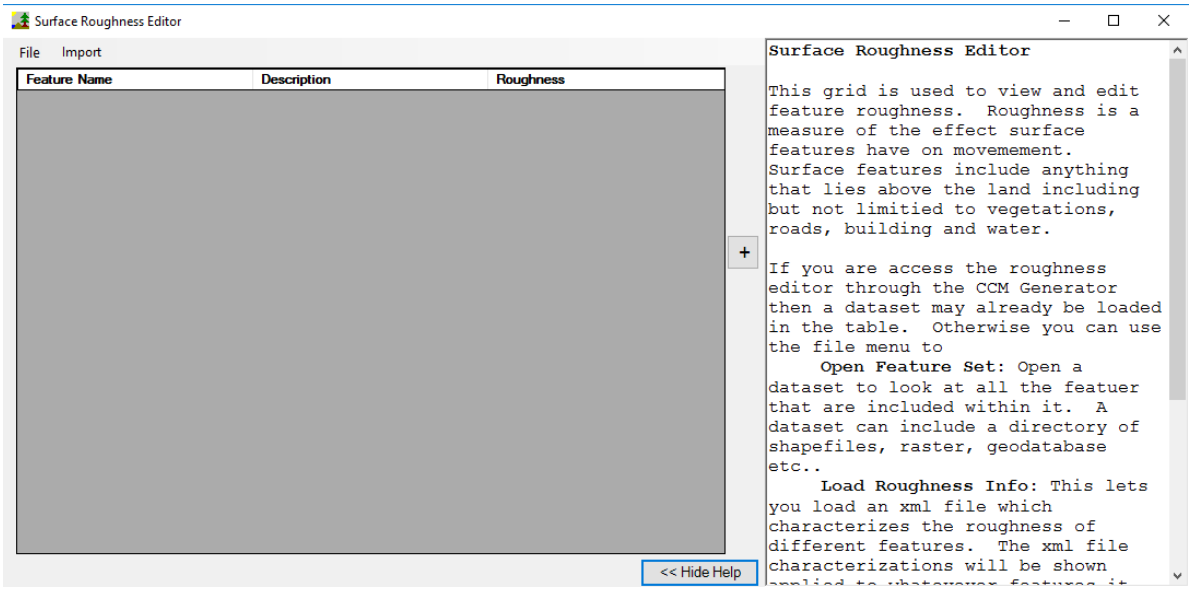



Figure 138 - Surface Roughness Editor dialog

### 3.3.1 CCM Symbolization Options

The CCM Symbolization Options gives the user several different output formatting options for displaying the CCM overlay. These include Traditional CCM formatting, CCM formatting with water, and Modern CCM formatting. Clicking the CCM Symbolization Options button will drop down these selectable options as shown in Figure 139. It also gives the user the ability to create a complete CCM map product using a generated CCM overlay by clicking the Map surround for a CCM option.

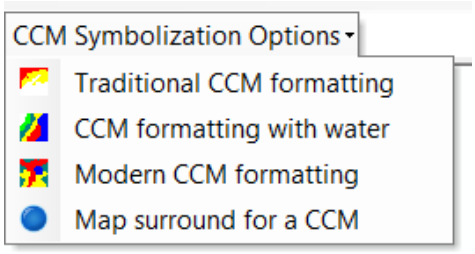



Figure 139 - CCM Symbolization Options

### 3.3.2 Select CCM Layer

The Select CCM Layer drop down list enables the user to select the layer for the CCM formatting to be applied. Clicking the Select CCM Layer control will drop down a list of selectable layers.

### 3.3.3 Procedure to Run CCM Generator

In order to test the CCM Generator, follow the procedures below (you should obtain the sample dataset contained in the folder “CCM_test”, distributed with the RS Toolbar release).

1. Place test data in the root directory (i.e. C:\CCM_test or D:\CCM_test) Here, we use D:\.
2. Within the RS Toolbar, click on 'CCM Generator' icon. The CCM Generator dialog will appear as in Figure 137.
3. Within the CCM Generator window, select **File**, then **Load Scenario**.
   - Select D:\CCM_test\data\CCM_input_scenario.xml. This populates the CCM Generator dialog with the appropriate input files and parameters (Figure 140).

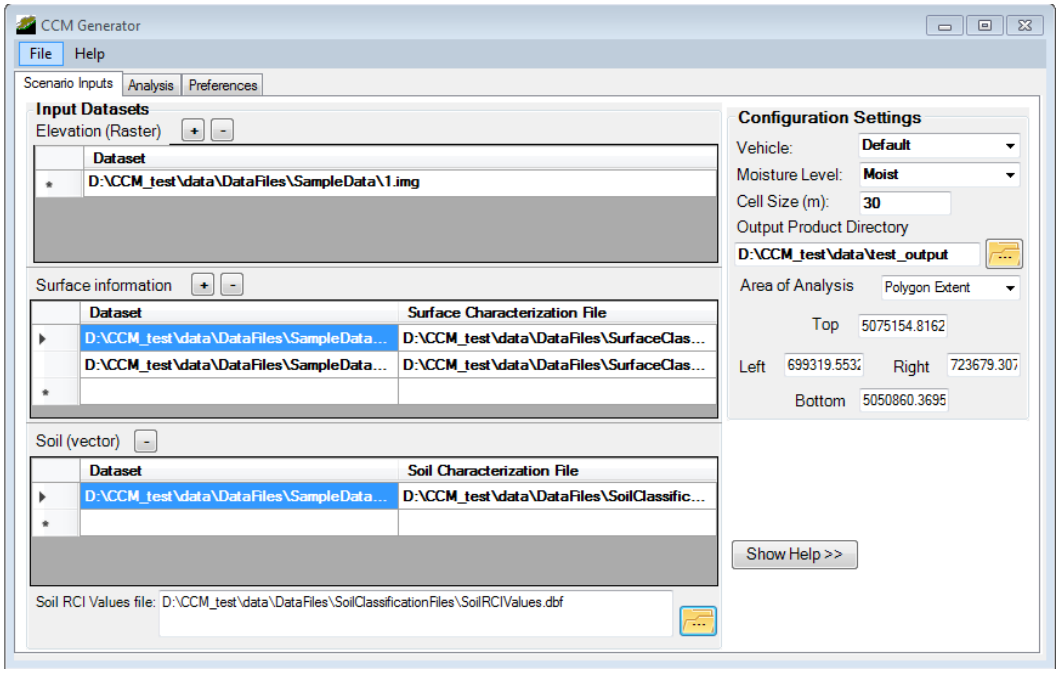



Figure 140 - CCM Generator (data sets loaded)

The .xml scenario file is simply a means to automate the process. For reference the input file is reproduced below (Figure 141). Alternatively, the user can manually load path data for each of the fields in the CCM Generator by double clicking on the white area and navigating to the dataset.

```
<?xml version="1.0" encoding="UTF-8"?>
- <Scenario>
    <TopoDataset
      RoughnessFile="D:\CCM_test\data\DataFiles\SurfaceClassificationFiles\RasterLandCoverMobilities.xml"
      Path="D:\CCM_test\data\DataFiles\SampleData\LCV_021G_AAFC_30M_2000.tif"/>
    <TopoDataset RoughnessFile="D:\CCM_test\data\DataFiles\SurfaceClassificationFiles\mobility_test.xml"
      Path="D:\CCM_test\data\DataFiles\SampleData\TAM"/>
    <SoilDataset Path="D:\CCM_test\data\DataFiles\SampleData\ForestSoilsMap.shp"
      ClassificationFile="D:\CCM_test\data\DataFiles\SoilClassificationFiles\NBSoilClass.xml"/>
    <ElevationDataset Path="D:\CCM_test\data\DataFiles\SampleData\1.img"/>
    <OutputDir Path="D:\CCM_test\data\test_output"/>
    <MoistureLevel Level="Moist"/>
    <CellSize size_in_meters="30"/>
    <AreaOfInterest Path="D:\CCM_test\data\inputdata\Clip_Polygon.shp" XMin="699319.553204947"
      XMax="723679.30751077" YMin="5050860.36958931" YMax="5075154.81624283"/>
    <SoilEffect Path=""/>
    <SurfaceEffect Path=""/>
    <SlopeEffect Path=""/>
    <CCM Path=""/>
    <MovementCost Path=""/>
    <LOCEffect Path=""/>
    <DrainageEffect Path=""/>
    <RidgeEffect Path=""/>
  </Scenario>
```

Figure 141 – Input scenario .xml file

4. Still within the CCM Generator window, select the **Analysis** tab. This will load the CCM Generator dialog as seen in Figure 142.

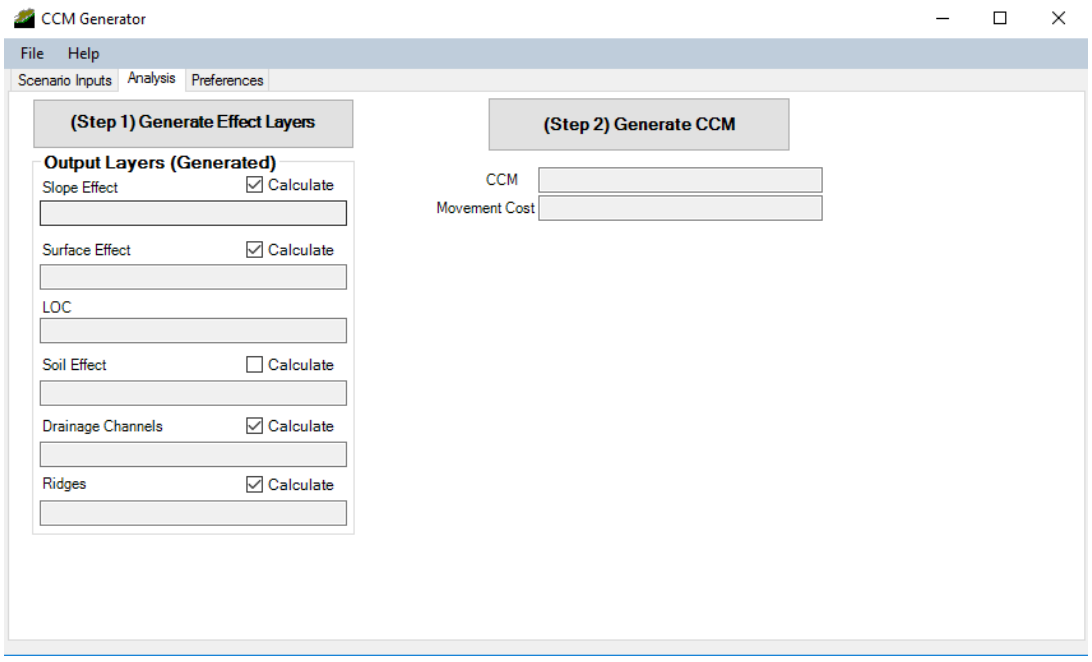



Figure 142 - CCM Generator (Analysis tab)

- Check **Calculate** for all output layers.
- Click the **Step 1** button (Generate Effect Layers) in order to generate the intermediate output layers.
- When **Step 1** processing is complete, click the **Step 2** button (Generate CCM) to produce the final CCM products.

All resulting CCM files will be automatically loaded into ArcMap as seen in Figure 143.

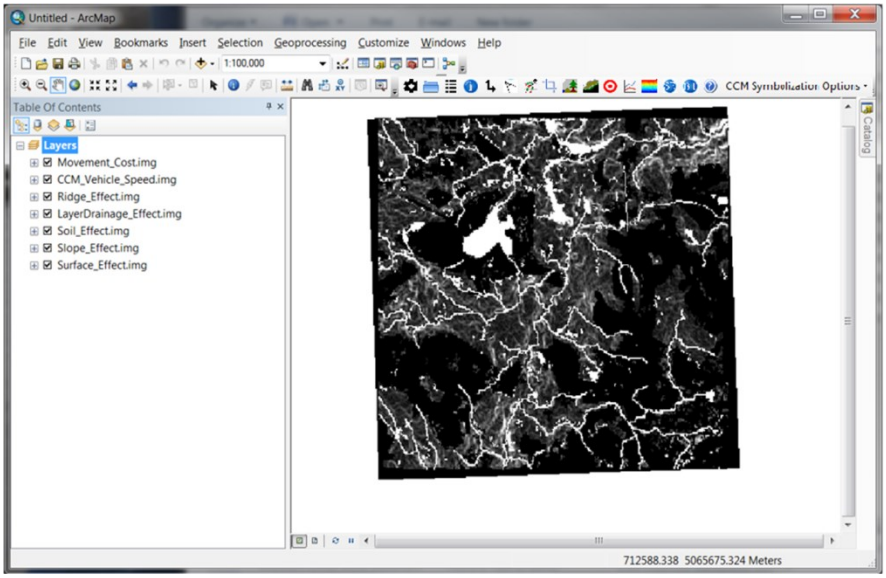



Figure 143 - ArcMap loaded with CCM-generated files

5. Within RS Toolbar, select 'CCM_Vehicle_Speed.img' from the far-right dropdown menu.

6. From the **CCM Symbolization Options** dropdown menu, select **Traditional CCM Formatting**. This will create a colorized CCM product as seen in Figure 144.

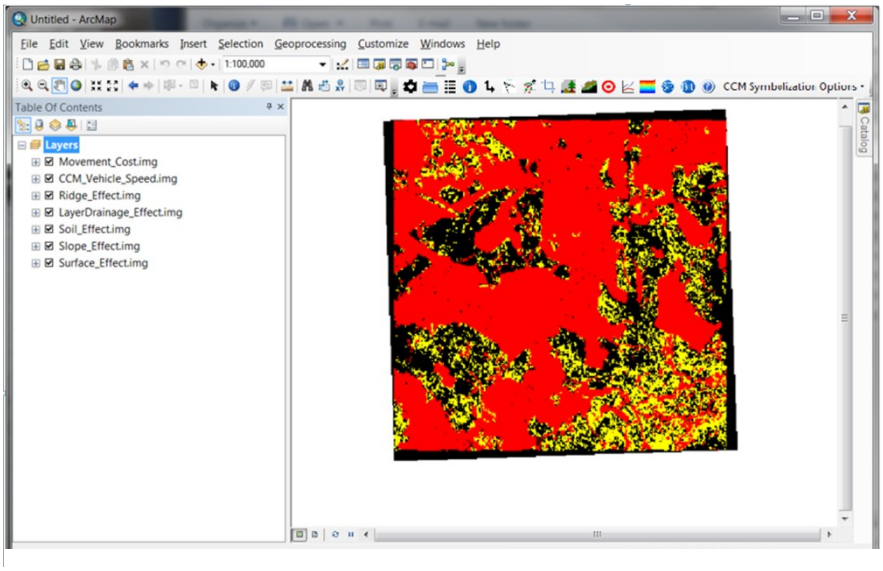



Figure 144 - ArcMap with Traditional CCM formatting applied

7. Within RS Toolbar, follow the procedures below:
   - From the **CCM Symbolization Options** dropdown menu, select **Map surround from a CCM**.
   - Select C:\CCM_test\data\DataFiles\Map Templates\TemplateOct1.mxd.
   - Select **Yes** for selecting reference layers.
   - Select C:\CCM_test\canada\clip_Composite_LC80100282014255LGN00_B432.tif.
   - Select **Cancel** for Add Data Window.
   - Select **Yes** for selecting Background map.
   - Select C:\CCM_test\canada\clip_Composite_LC80100282014255LGN00_B432.tif.
   - Select Cancel for Add Data Window.

The above procedures will create a layered product as seen in Figure 145.

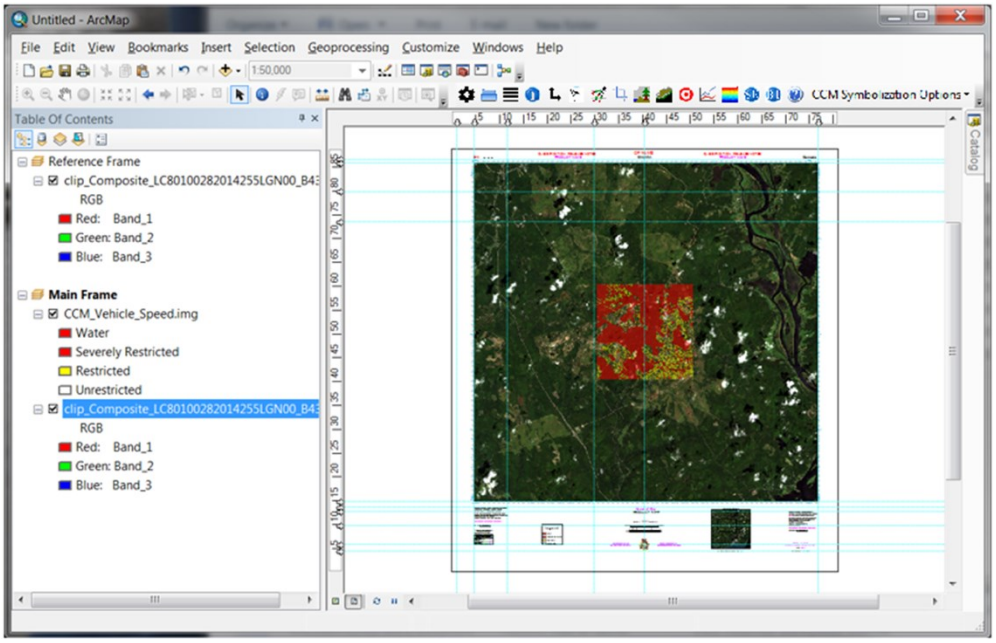



Figure 145 - ArcMap loaded with CCM result files

A more detailed user manual for the CCM tool is provided within the CCM Generator dialog under the menu item **Help** / **Tutorial**.

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