Create a Mosaic of Two Sentinel-1 Products in the Same Swath

Source: Adapted from ESA (https://www.youtube.com/watch?time_continue=13&v=2bRU8Ktdu8I)

In this document you will find:

A) Background

In order to facilitate the use of Sentinel-1 products and avoid unruly image sizes, the swaths of data collected by the satellite are divided into more manageable slices of smaller areas. In some instances, the edge of these slices fall on top of our desired region of study making it more challenging to analyze. Luckily, they can be seamlessly combined using the toolbox's Slice Assembly tool. This tutorial will go over the preprocessing steps to accomplish this slice assembly and the subsequent sub-setting of the border zone.

In this recipe, we want to look at the region of the Amazon bounded in red, in the timeframe of May 2018. However, no single product covers this area at this point in time. Instead, we will assemble two vertical adjacent products and then create a subset of the desired area.

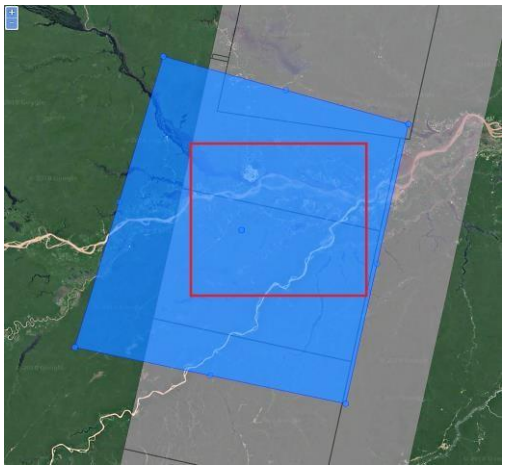

Figure 1. Product outlines in gray shown on ASF's Vertex data portal.

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B) System Requirements

- Windows, Mac OS X, Unix
- 16GB RAM
- Enough hard disk space to store processed data (approximately 25 GB)

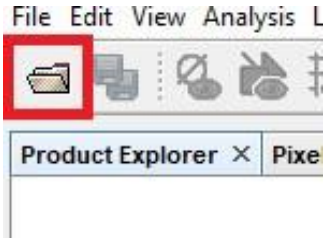
Note: A Solid State Drive will perform significantly faster than a Hard Disk Drive and when processing large files, this will be very advantageous.

C) Materials List

- Latest version of Sentinel-1 Toolbox (S1TBX)
- Pair of Sentinel-1 IW Ground Range Detected (GRD) products. Download the sample granules below or use the Vertex data portal to download your own GRD products.
    - **a.** **S1A_IW_GRDH_1SDV_20180518T093904_20180518T093929_021957_025F05_48E2**
    - **b.** **S1A_IW_GRDH_1SDV_20180518T093929_20180518T093954_021957_025F05_B913**

D) Steps to Generate a Mosaic and Subset

Step 1: Open the products in S1TBX



a) Open the Sentinel-1 Toolbox

b) Use the **Open Product** button in the top toolbar and browse to the location of the two GRD products

c) Press and hold the Ctrl button to select both zip files and press **Open**.

Note: if you unzipped the files, select the *manifest.safe* file from each Sentinel-1 product folder, instead.

Step 2: View the products

a) In the **Product Explorer** you will see the opened products

b) Double-click on the product to expand.

c) Expand the bands folder and you will find two bands: an *amplitude* band, which is actually the product, and a *virtual* intensity band, which is there to assist you in working with the GRD data.

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d) To view the data, double-click on the **Amplitude_VH** band.

e) Zoom in using the mouse wheel and pan by clicking and dragging the left mouse button

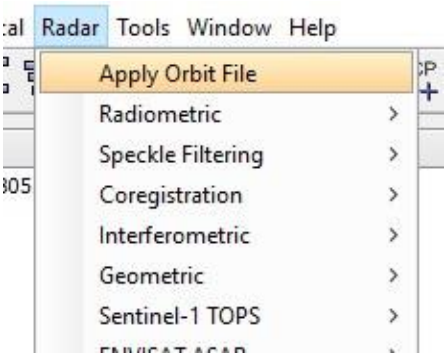
Step 3: Apply Orbit File

a) Select the first GRD product in the Product Explorer

b) From the top menu navigate to **Radar** > **Apply Orbit File**

c) In the **Apply-Orbit-File** window (Figure 2), specify the output folder and the target product name. The products will automatically be appended with the suffix "**_Orb**" if you choose the default name.

d) Click the **Processing Parameters** tab. If your product is less than 20 days old, a precise orbit file may not be available yet. You can either select **Sentinel Restituted** in the **Orbit State Vectors** dropdown, or if you are unsure whether the file has been updated yet, you can check the **Do not fail** box. Otherwise, if your products are more than 20 days old, leave this tab as is.



e) Click **Run** and allow the product to process

f) Repeat steps **a)** – **e)** for the second GRD product

g) When finished, close the **Apply Orbit File** window

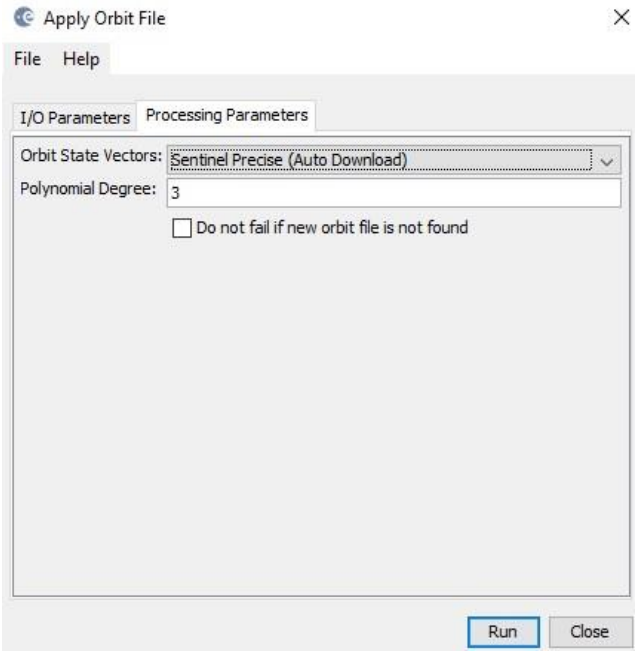


Figure 2. Apply Orbit File dialog.

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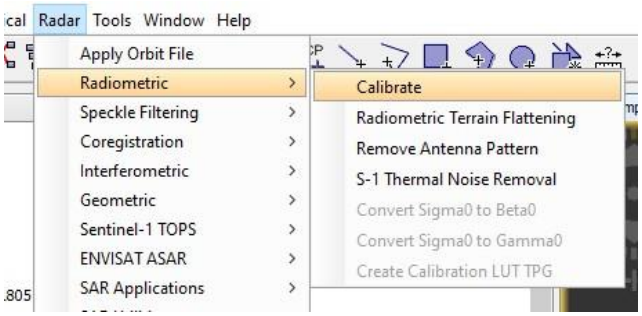
Step 4: Calibrate

a) Select the first **_Orb** product (created in **step 3**) in the **Product Explorer**

b) From the top menu navigate to **Radar** > **Radiometric** > **Calibrate**



c) In the **Calibration** window (Figure 3), specify the output folder and the target product name. The products will automatically be appended with the suffix "**_Cal**" if you choose the default name.

d) Leave all parameters as default and click **Run**

e) Repeat steps **a)** – **d)** for the second **_Orb** product

f) When finished, close the **Calibration** window

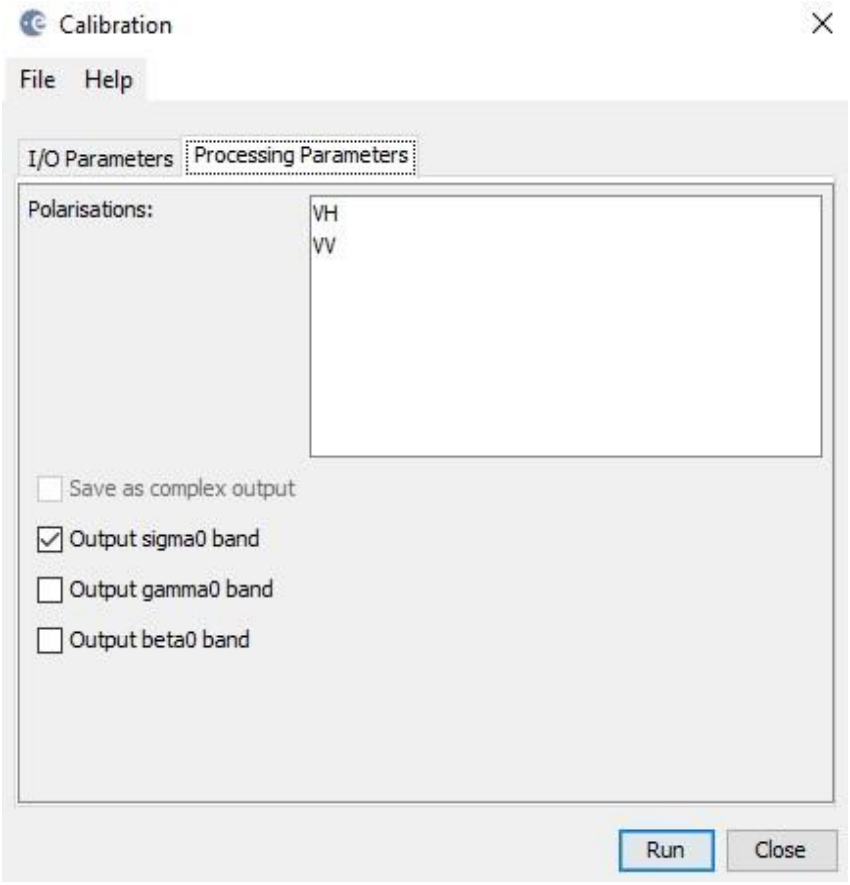


Figure 3. Calibration dialog.

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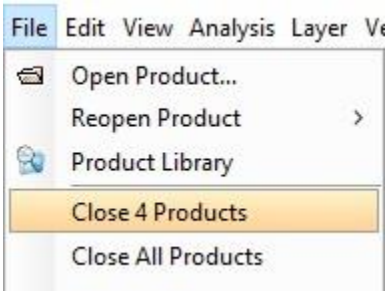
Step 5: Assemble Slices



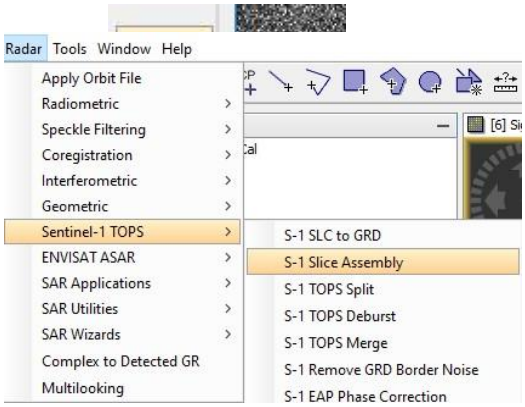
a) In the view window, close any old tabs opened before step 4. This will help free up RAM and increase performance.

b) In the Product Explorer, Ctrl-click every product except for the calibrated products you just made in **step 4**.

c) Click **File** > **Close # Products**.

d) From the top menu, navigate to **Radar** > **Sentinel-1 TOPS** > **S-1 Slice Assembly**

e) On the right side of the Slice Assembly window, click the **Add Opened** icon to select all of your open calibrated products.

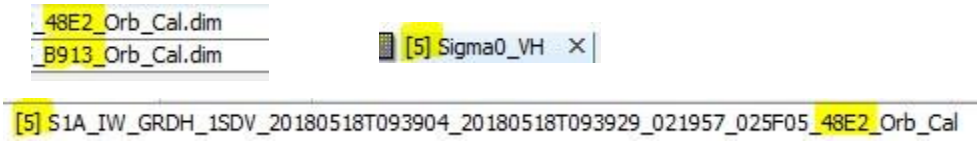


i) If the bottom of the window is displaying an error, you will need to update your toolbox. If the problem persists, it may help to restart your computer.

ii) Navigate to **Help** > **Check for Updates** and follow the instructions.

iii) Once the updates have been downloaded, restart your S1TBX

f) In the **Slice Assembly** window (Figure 4) verify that the products are in the order that they should be in the mosaic. Use the four character Product Unique Identifier and the product numbers shown in the **View Window tabs** and **Product Explorer** to reference the images. Use the green arrows to re-arrange the products



g) In the **Slice Assembly** tab, select the polarizations bands you wish to assemble. Unless you want to only specify a certain band, leave this tab as is.

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h) In the **Write** tab, specify the output folder and the target product name. The products will automatically be appended with the suffix "**_As**" if you choose the default name.

i) Click **Run** and allow the images to be processed.

j) Close the **S-1 Assembly** window.

k) The new product should appear in the **Product Explorer** and can be viewed (figure 5-C).

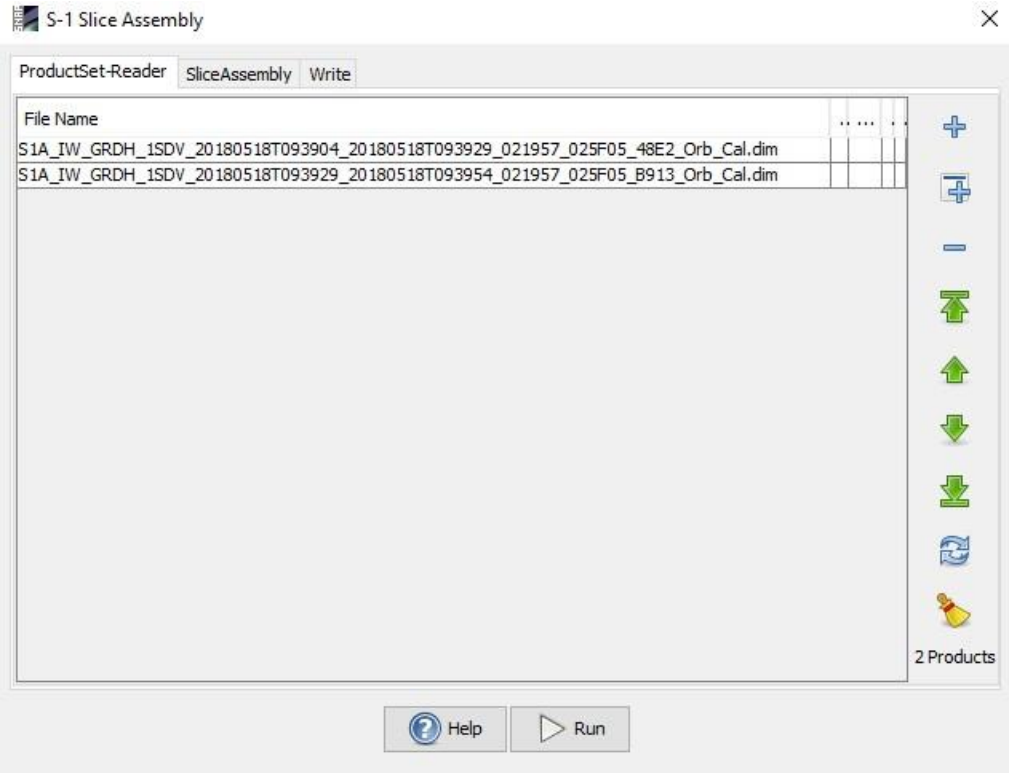

Figure 4. S-1 Slice Assembly dialog.

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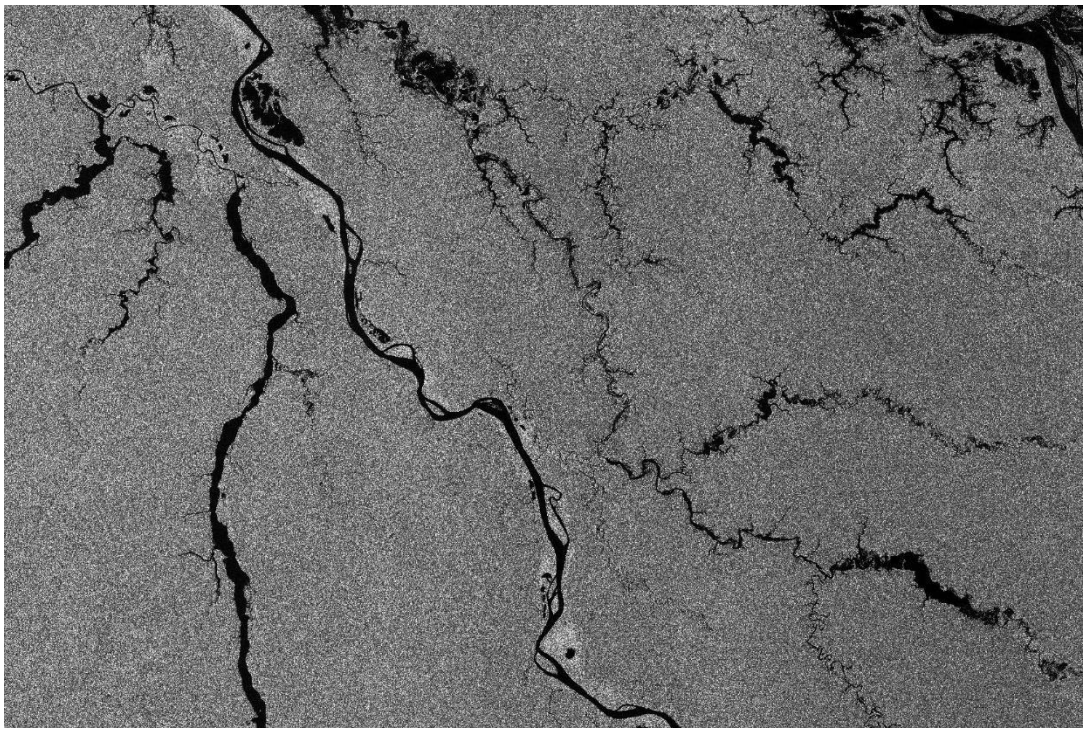

Figure 5-A. Northern calibrated product slice.

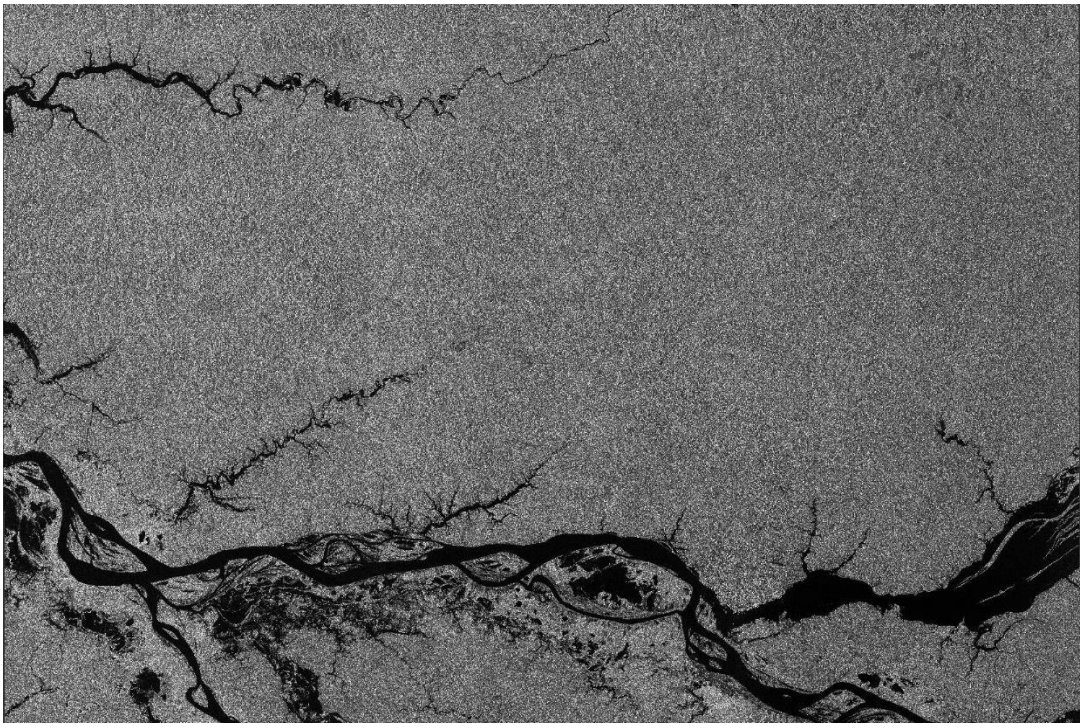

Figure 5-B. Southern calibrated product slice.

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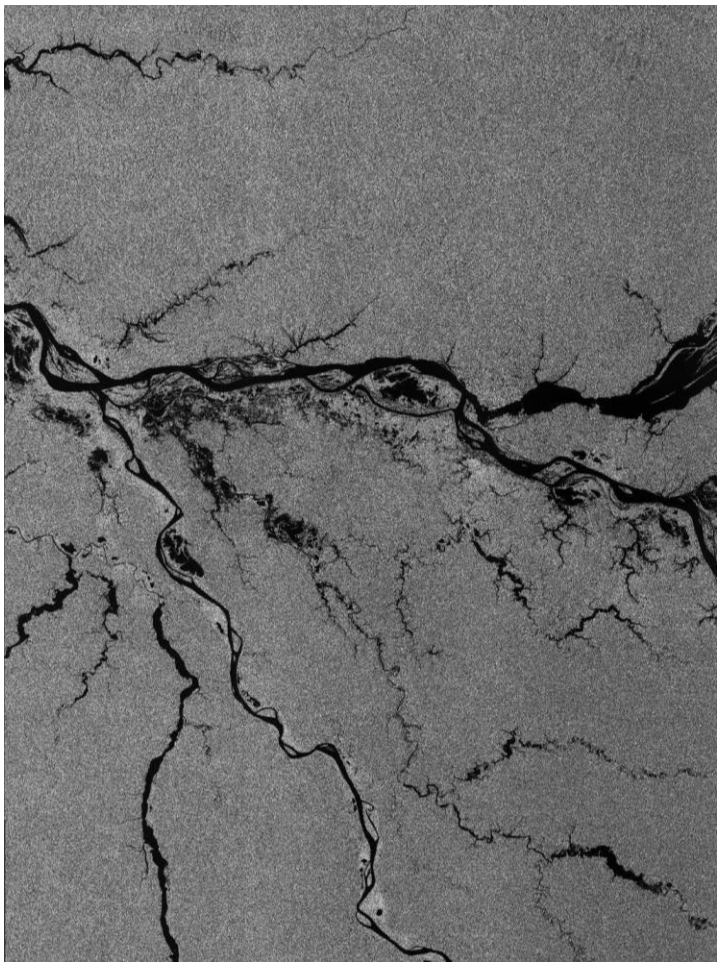

Figure 5-C. S-1 Assembled product mosaic.

Step 6: Create Subset

a) Open the new assembled product created in step 5, and close the products created in step 4.

b) Using your mouse-wheel to zoom and leftclick to drag (to do this, you must select the **panning tool** shown as a hand icon), center your view on the area you wish to study.

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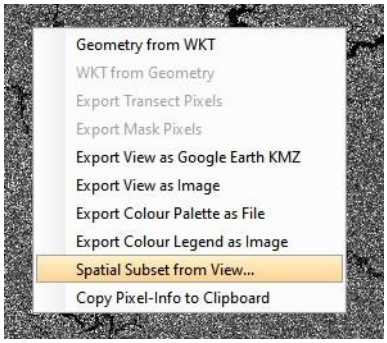
c) Right click in the view and select **Spatial Subset from View**.



d) In the **Product Subset** window (figure 6) view, further adjust your subset by moving the sides on the blue rectangle outline with your mouse.

e) Click **OK**.

f) Using the **Product Explorer**, view your new product.

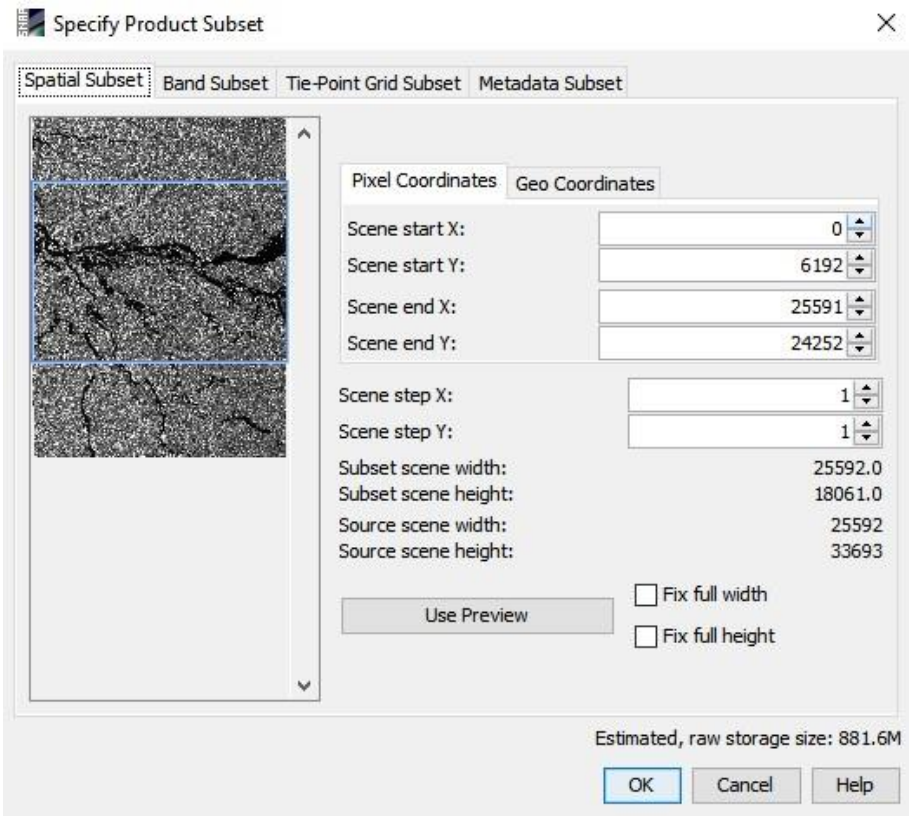


Figure 6. Product Subset Window.

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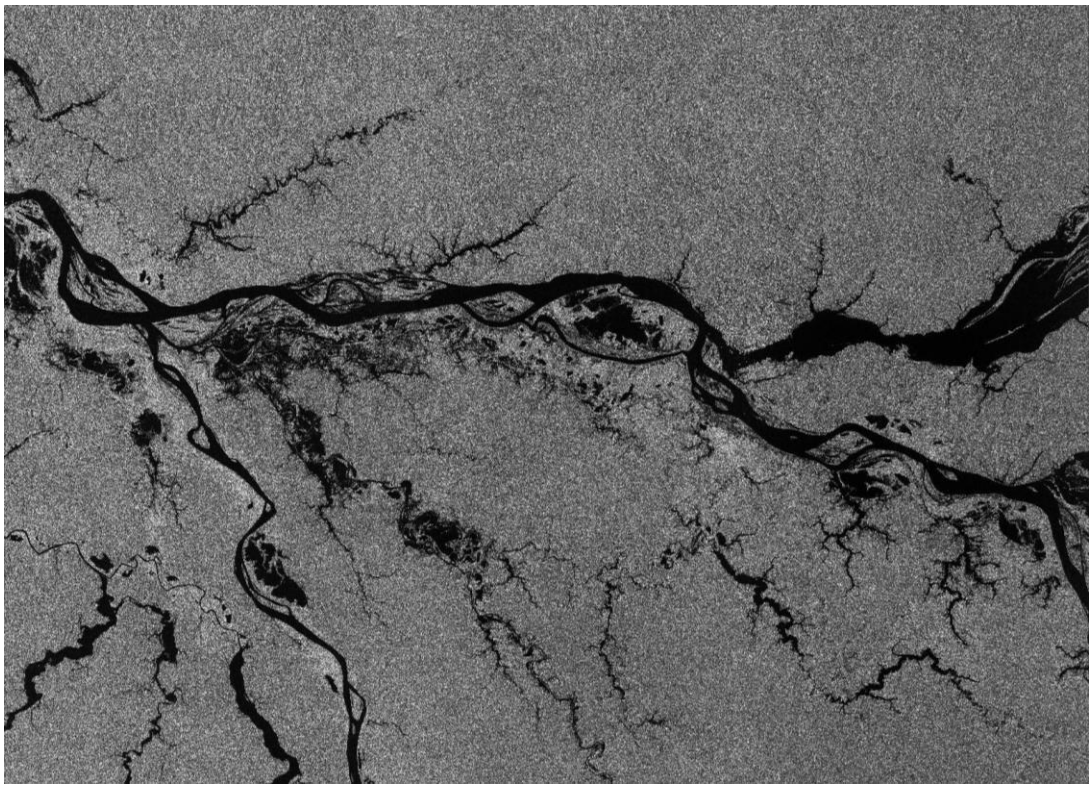
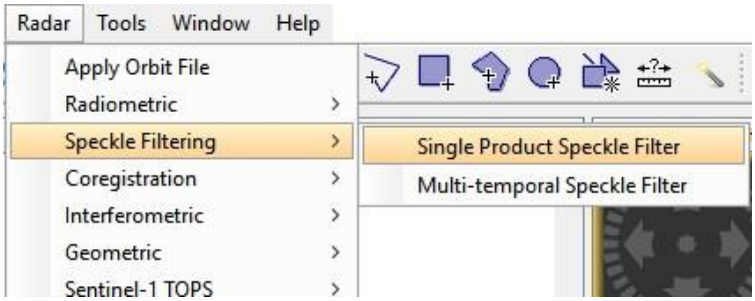


Figure 7. Product subset of the desired region.

Step 7: Speckle Filter (Optional)

g) Select your assembled subset GRD product in the Product Explorer

h) From the top menu navigate to **Radar** > **Speckle Filtering > Single Product Speckle Filter**



i) In the **Speckle Filter** window (figure 8) **I/O Parameters** tab, specify the output folder and the target product name. The products will automatically be appended with the suffix "**_Spk**" if you choose the default name.

j) In the **Processing Parameters** tab, leave all parameters as default and click **Run**

k) When finished, close the Calibration window

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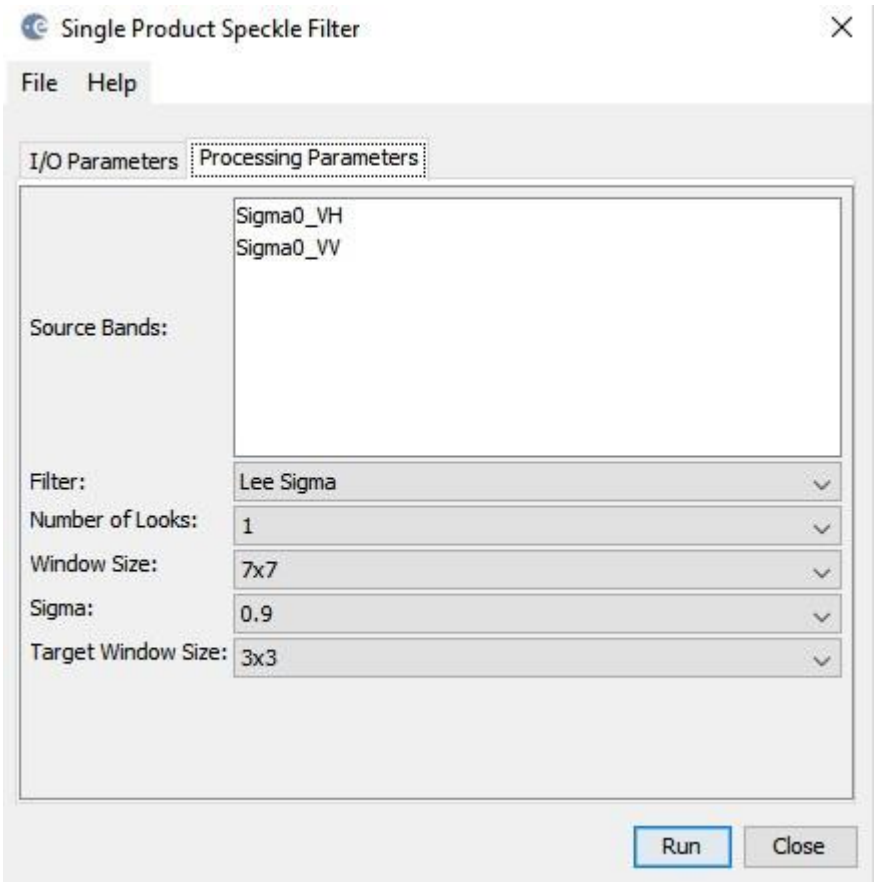

Figure 8. Speckle Filtering window.

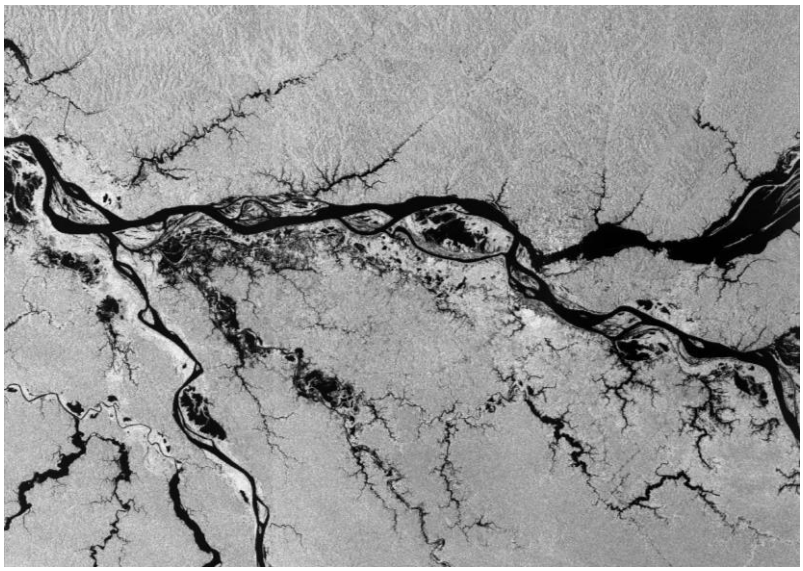

Figure 9. Speckle Filtered product.

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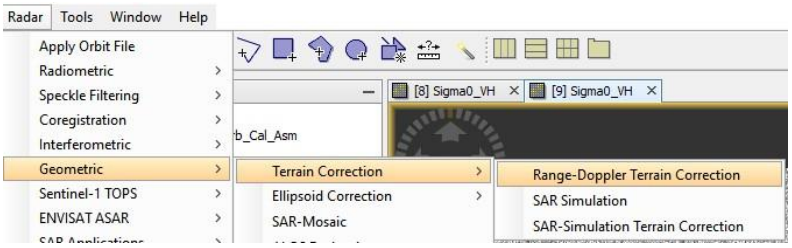
Step 8: Geocode (Optional)

l) Select your assembled subset GRD product in the Product Explorer

m) From the top menu navigate to **Radar** > **Geometric** > **Terrain Correction** > **Range-Doppler Terrain Correction**



n) In the **Range Doppler Terrain Correction** window (figure 10) **I/O Parameters** tab, specify the output folder and the target product name. The products will automatically be appended with the suffix "**_TC**" if you choose the default name.

o) In the Processing Parameters tab, leave all parameters as default and click **Run**

p) When finished, close the Calibration window and view the product (figure 11).

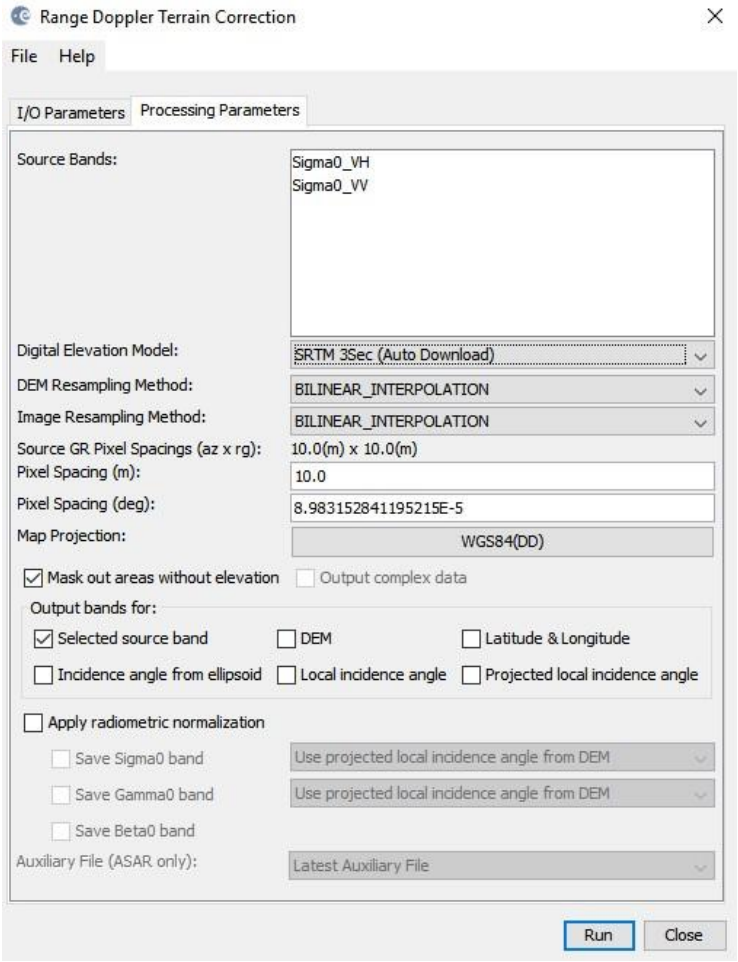


Figure 10.Terrain Correction window.

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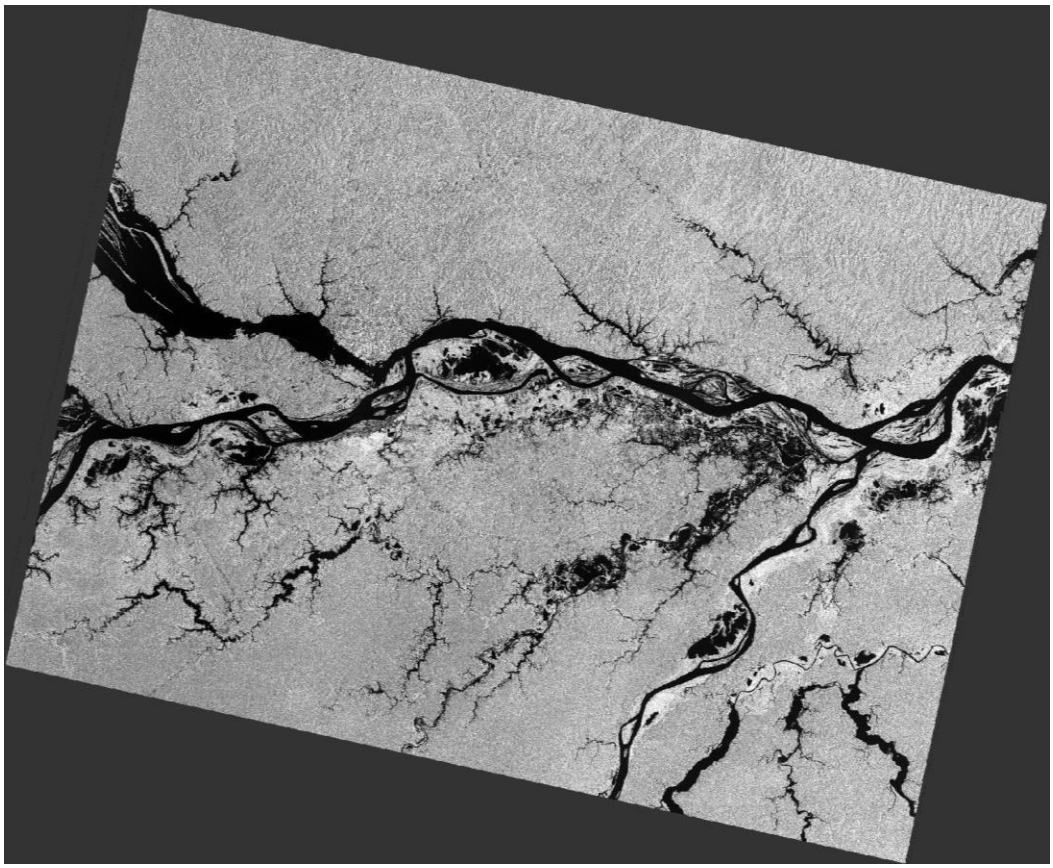

Figure 11. Terrain corrected and speckle filtered product.

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