

FORESTRY WITH SENTINEL-1: SINGLE IMAGE ANALYSIS

Data: The data used is high resolution Sentinel 1A Level 1 GRD data using dual polarization (VV/VH) acquired in interferometric wide swath mode

SINGLE IMAGE ANALYSIS:

1. Load S1 image into SNAP
 - File / Open Product...
2. Interpret the data
 - In the Product Explorer window, go to the image, click on +, open the Metadata folder and double click on Abstracted Metadata.
 - If you open one of the bands of the image by double clicking the band name, you can see information on the pixels in the scene by opening the tab Pixel Info (next to Product Explorer) and sliding the mouse over the pixels of interest. If Pixel Info does not show, go to View>Tool Windows>Pixel Info.
 - The Navigation and World View tabs above the preview window can help you to locate the scene.
3. Take subset
 - Select the image in the Product Explorer, then go to Raster>Subset. You can define the subset area by either zooming into the region of interest or by defining pixel or geographic coordinates. In this exercise we use the following geographic coordinates, that you can enter manually:
 - o North latitude bound: 47.962
 - o West longitude bound: 16.945
 - o South latitude bound: 48.453
 - o East longitude bound: 17.512
 - Click OK. The new subset will appear in your Product Explorer window
 - Right click on the subset > Save Product As, and adjust name and output folder
4. Apply orbit file
 - Go to Radar>Apply Orbit File
 - Adjust Target Product name and output
 - Run with pre-defined processing parameters (Sentinel Precise and polynomial of third degree)
5. Apply radiometric correction
 - Go to Radar>Radiometric>Calibrate and select the result image from step 3
 - Under the Processing Parameters tab select both polarizations and select the **Output beta0 band** option. The radiometric correction is necessary to remove any image-dependent radiometric bias.
6. Flatten Terrain
 - Go to Radar>Radiometric>Radiometric Terrain Flattening.

- Under Processing Parameters select **SRTM 1sec HGT (Auto Download)**
 - For DEM Resampling Method, use Bicubic_interpolation
 - Check the Re-grid method box
 - This process transforms Beta0 into Gamma0!!!
- 7.** Multilook the image by a factor 5x5
- Go to Radar>Multilooking. In “Processing Parameters” change “Number of Range Looks” and “Number of Azimuth Looks” both to 5. If the GR Square pixel option is activated, the same number of looks will be applied in both azimuth and range.
- 8.** Create elevation band and run SAR Simulation
- Go to Raster>DEM Tools>Add Elevation Band. Here you can select the appropriate elevation band to add to the image (we will select SRTM 3 sec (AutoDownload)).
 - After having added the elevation band, go to Radar>Geometric>Terrain Correction>SAR Simulation and run the SAR simulation.
- 9.** Terrain correct the Multi-looked images
- Go to Radar>Geometric>Terrain Correction>Range-Doppler Terrain Correction
 - Digital Elevation Model: SRTM 3Sec (Auto Download)
 - DEM Resampling Method: Bilinear Interpolation
 - Check the “Mask out areas without elevation” and the “Apply radiometric normalisation”boxes
- 10.** Convert gamma0 images to dB
- In the Product Explorer select first the Gamma0_VH band, then go to Raster>Data Conversion>Linear to/from dB and repeat with the Gamma0_VV band.
 - This will create two Virtual bands (with a V icon). Right click on each > Convert Band to transform them
 - Right click on the Step9 product > Save Product As, and adjust the output name and folder. This will save the product
- 11.** Compute difference image from gamma0 [dB]: VV-VH
- Open Raster> Band Maths. Name it “Gamma0-VV_VH”. Click on ‘Edit Expression’ and enter the expression $\text{Gamma0_VV_dB} - \text{Gamma0_VH_dB}$
- 12.** Display data as RGB view
- Go to Window>Open RGB Image Window and select the difference band for the red channel, the Gamma0_VH band as green and Gamma0_VV as blue.
- 13.** Statistical analysis – scatterplots, histogram analysis, profile plot.
- Open Analysis> Scatter Plot and in the right panel select the Gamma0_VH_dB as X-axis input and Gamma0_VV_dB as Y-axis input, then click the Refresh View button.

- Select the Gamma0_VH_dB band and open Analysis> Histogram. Click the Refresh View button. This operation can be done for any of the other bands.
- To draw a polygon, you may need to activate the Tools toolbar via View>Toolbars>Tools. Select the Gamma0_VV_VH band. In the toolbar select the Polygon or the Line tool and draw a shape on your region of interest. Open Analysis> Profile Plot. This operation can be done for any of the other bands.