



Radar Training : Pre-processing using SNAP

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The purpose of this training is to estimate floods dynamic using several Sentinel-1 radar images. You will first pre-process the data, then perform a classification, at last, you will use 4 to 5 floods map of different date in a GIS software to estimate the temporal floods dynamic.

General schedule for each acquisition



I. Downloading the data

The Sentinel-1 data can be freely downloaded from the Data Hub platform of the Copernicus program <https://scihub.copernicus.eu/> or the CNES Peps platform <https://peps.cnes.fr/rocket/#/search>. A video detailing the download process is available for [ESA](#) and [CNES](#) platforms.

To avoid Internet connexion problem, an extract of the 2 Sentinel-1 images acquired the 6th and the 18th of January 2016 is available in the folder Radar_Data/.

II. Radar pre-processing

All pre-processing functions are available in the SNAP software. The SNAP software can be freely downloaded from the ESA platform - <http://step.esa.int/main/download/> , a forum for help is also available <http://forum.step.esa.int/> . You do not have to unzip the data to process it in SNAP.

Memory management by the software is not optimal, to avoid problems, close all other applications and keep an eye on the use of RAM from the "Processes" of the Windows Task Manager.

a. Opening and visualization

Open the image Radar_Data/S1A_20160106.dim and visualize it by double-click on **Bands** → **Intensity HV** in the tab **Explore Product**. The image is in gray level and is not in the usual geometry (North South reversed, top of the picture not exactly to the North etc ...). After, double-click on the Intensity VV image. Using the menu **Window** → **Tile Horizontally**, navigate through the two image and find some differences between both polarizations. According to your radar knowledges, how can we recognize water surfaces ? Why ?

b. Calibration

This step transforms the pixels values from the digital count recorded by the sensor into a physical quantity: the backscatter coefficient (σ^0), this is necessary to compare different acquisitions. **Radar** → **Radiometric** → **Calibrate**. Set the output directory to Radar_Data and run the process.

c. Filtering

Radar images are affected by the speckle : it is a noise that deter the image analysis. In order to reduce its impact, a filtering step is necessary. Many filters exist, I recommend the use of the Lee filter with a window size of 5x5 pixels. Within a sliding window of 5 pixels high by 5 pixels wide, a pixel part will be averaged depending on the local variance. This degrades the spatial resolution but improves the radiometric resolution. **Radar** → **Speckle Filtering** → **Single Product Speckle Filtering** and set the **Processing Parameter** to **Lee** filter and set the **X and Y filter size** to 5 and then run the process. Use different filter and different windows size, visualize them using **Window** → **Tile Horizontally** and chose the best filtering result.

d. Géocodage

The image is in the acquisition geometry of the sensor, the pixels do not have geographical coordinates. The geocoding operation will allow to project the image in the geometry of our choice. In the example proposed, the image will be geocoded in UTM 30N. **Radar** → **Geometric** → **Terrain Correction** → **Range Doppler Terrain Correction**. With an Internet connexion, the Digital Elevation Model SRTM is downloaded automatically, as we do not have Internet, set **External DEM** to DEM_SRTM_UTM30.tif from the menu **Digital Elevation Model**. Change the **Map projection** to UTM / WGS84 (automatic) and unabled the parameter **Mask out areas without elevation**, then run the process.

Then the image is ready for the classification process and can be visualized into a GIS software.

e. Color Composed

To visualize the data, a color composed can be performed. Right-click on the image and select **Open RGB image Windows**. Change manually Intensity_VV/Intensity_VH to Intensity_VH/Intensity_VV. Then extract the image using **Raster** → **Data Convert** → **Convert Data Type**, change the output format and select the virtual bands R G B.

Caution : this product is a visualization product, the calibration is not preserved.

You can process the other image in the same way.

f. Interpretation

Open the two color composed and the optical Sentinel-2 data in Qgis. What is the land cover affected by floods ?

3 flood maps derived from Sentinel-1 data are available in the folder Floods_Extractions, open them and try to estimate the flood dynamic in this wetland area.

g. Graph builder

From this part, an other area will be performed. In order to save time, the pre-processing step can be gathered into a graph builder. Open the image ????. From the menu **Tools** → **Graph Builder** add the steps by right-clicking on the white area and connect the graph. Set all parameters following the steps above (Calibration, filtering and geocoding) and the output directory. Save the graph and run the process.

h. Batch processing

All images can be processed automatically using the batch processing function available in **Tools** → **Batch Processing**. Add images using the “+” button, load the graph previously saved and run the process.

A video of the training is available on the channel Gisway SIG form [Youtube](#).