

Instructions for practical exercises

## Pre-processing and multi-temporal analysis of SAR time series

### Multitemporal Analysis of SAR Backscatter Intensity

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#### Objectives

- Familiarize with SNAP toolbox
- Familiarize with Sentinel-1 GRD products
- Calculating backscatter intensity from Sentinel-1 detected products
- Analysing of temporal backscatter signatures for various land cover types
- Change detection over AOI (Beijing Daxing International Airport)

#### Dataset

Time series of Sentinel-1 GRDH images over China

*S1A\_IW\_GRDH\_1SDV\_20151003T222044\_20151003T222111\_007994\_00B2F6\_9374*  
*S1A\_IW\_GRDH\_1SDV\_20160611T222046\_20160611T222112\_011669\_011DDC\_7FBO*  
*S1B\_IW\_GRDH\_1SDV\_20171115T222014\_20171115T222041\_008298\_00EAE8\_2415*  
*S1B\_IW\_GRDH\_1SDV\_20181110T222021\_20181110T222048\_013548\_019131\_A556*  
*S1B\_IW\_GRDH\_1SDV\_20190930T222028\_20190930T222054\_018273\_022698\_C498*

#### Data preparation

The subset of the dataset has been prepared in advance. In order to prepare the subset the following steps shall be followed

## *File/Open Products*

Visualise one of the bands

## *Raster/Subset/Spatial Subset*

Select 'Pixel Coordinates', 'Geo Coordinates' or select AOI from the preview

Confirm 'OK'

# **1. Manual Data pre-processing (for single data product)**

## **1.1 Updating orbits**

### *Radar/Apply orbit file*

Input: Subset of S1 GRD

eg. 2\_Subsets\_GRD/Subset\_S1A\_IW\_GRDH\_1SDV\_20151003T222044...

Output: Subset\_S1A\_IW\_GRDH\_1SDV\_20151003T222044...\_Orb

Parameters:

Sentinel Precise

## **1.2 Radiometric Calibration**

### *Radar/Radiometric/Calibrate*

Input: Subset\_S1A\_IW\_GRDH\_1SDV\_20151003T222044...\_Orb

Output: Subset\_S1A\_IW\_GRDH\_1SDV\_20151003T222044...\_Orb\_Cal

Parameters:

Polarisations VV,VH

Output sigma0 band

## **1.3 Terrain Correction**

Radar/Geometric/Terrain Correction/Range Doppler Terrain Correction

Input: Subset\_S1A\_IW\_GRDH\_1SDV\_20151003T222044...\_Orb\_Cal

Output: Subset\_S1A\_IW\_GRDH\_1SDV\_20151003T222044...\_Orb\_Cal\_TC

Parameters:

Digital Elevation Model SRTM3sec

Pixel spacing 10m

Map projection WGS84

Mask areas without elevation

## **2. Automatic pre-processing using graph processing tool and batch processing (for all files)**

*Tools/Graph Builder*

Input: Subset\_S1A\_IW\_GRDH\_1SDV\_20160611T222046\_...\_

Output: Subset\_S1A\_IW\_GRDH\_1SDV\_20160611T222046\_...\_Orb\_Cal\_TC

Parameters:

Build processing chain with functions presented in steps 1.1-1.3

Save the graph as GRD\_Cal\_TC.xml

*Tools/Batch Processing*

Input: all GRD subset files

Output: GRD subset files processed as in steps 1.1-1.3

Parameters: Load GRD\_Cal\_TC.xml

## **3. Further processing**

### **3.1 Multitemporal stack**

*Radr/Coregistration/Stack Tools/Create Stack*

Input: all GRD subset files processed in section 2

Output: backscatter\_Stack.dim

Parameters:

Create Stack-Initial offset method 'Product Geolocation'

### 3.2 Specke Filtering

*Radar/Speckle Filtering/Multi-temporal Speckle Filter*

Input: backscatter\_Stack.dim

Output: backscatter\_Stack\_Spk.dim

Parameters:

Source bands – all

Filter – Gamma Map

Filter Size – 3x3

### 3.3 Linear to db conversion

*Raster/Data Conversion/Converts bands to\from dB*

Input: backscatter\_Stack\_Spk.dim

Output: backscatter\_Stack\_Spk\_dB.dim

Parameters: all bands

### 3.4 Creating RGB

Right click on the name of the product created in 3.3 (in Product Explorer)

Open RGB Image Window

R: Sigma0\_VH\_3\_Oct\_2015

G: Sigma0\_VH\_30\_Sep\_2019

B: Sigma0\_VH\_30\_Sep\_2019

### 3.5 Stack Averaging

*Radar/Coregistration/Stack Tools/Stack Averaging*

Input: backscatter\_Stack\_Spk\_dB.dim

Output: backscatter\_Stack\_Spk\_dB\_avg.dim

Parameters: Mean Average

RGB - Right Click on the name of the product 'backscatter\_Stack\_Spk\_dB\_avg.dim'

R: Sigma0\_VV

G: Sigma0\_VH

B: Sigma0\_VV/Sigma0\_VH