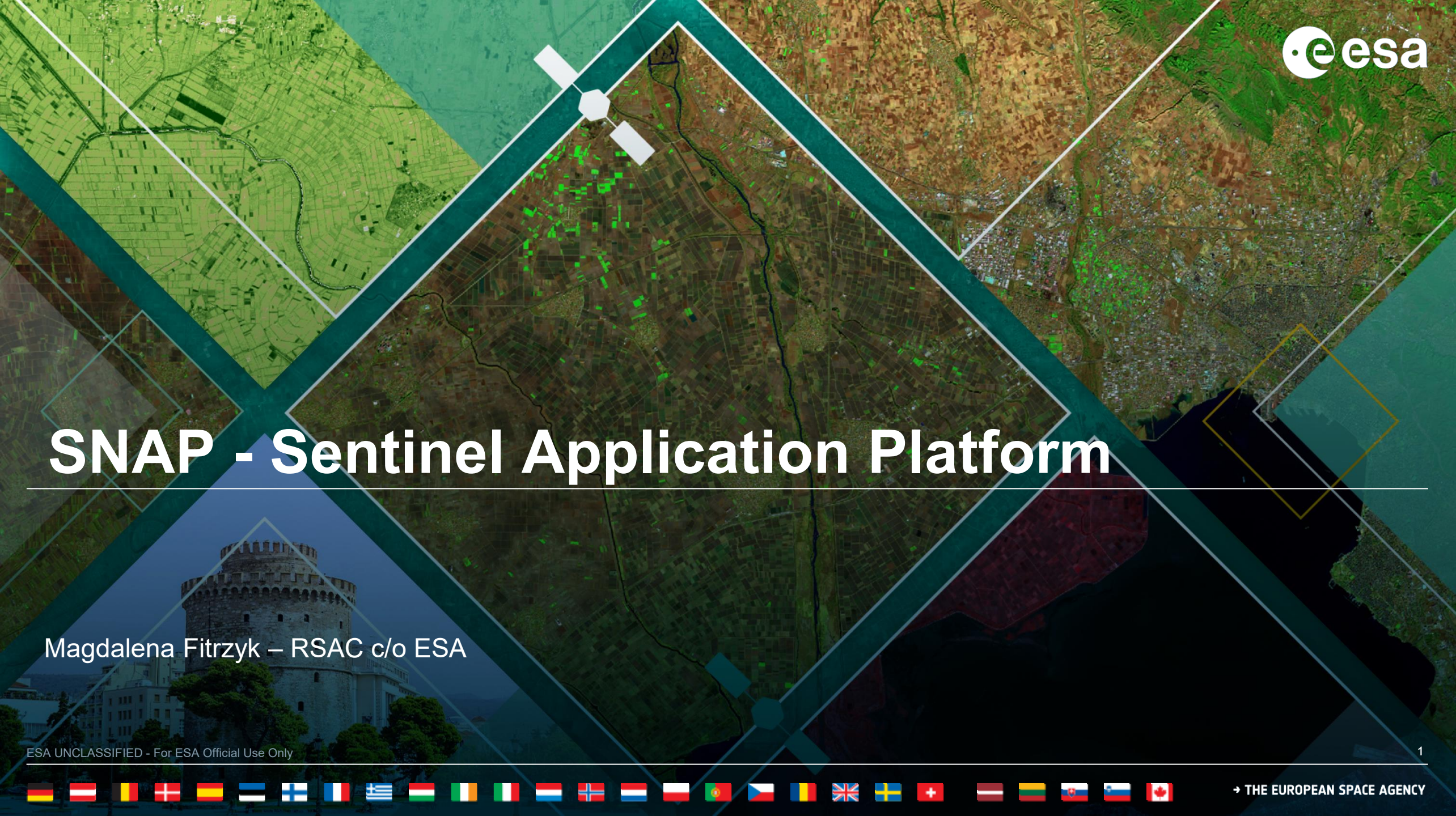


SNAP - Sentinel Application Platform

Magdalena Fitrzyk – RSAC c/o ESA

SNAP – Sentinel Application Platform

Download it at

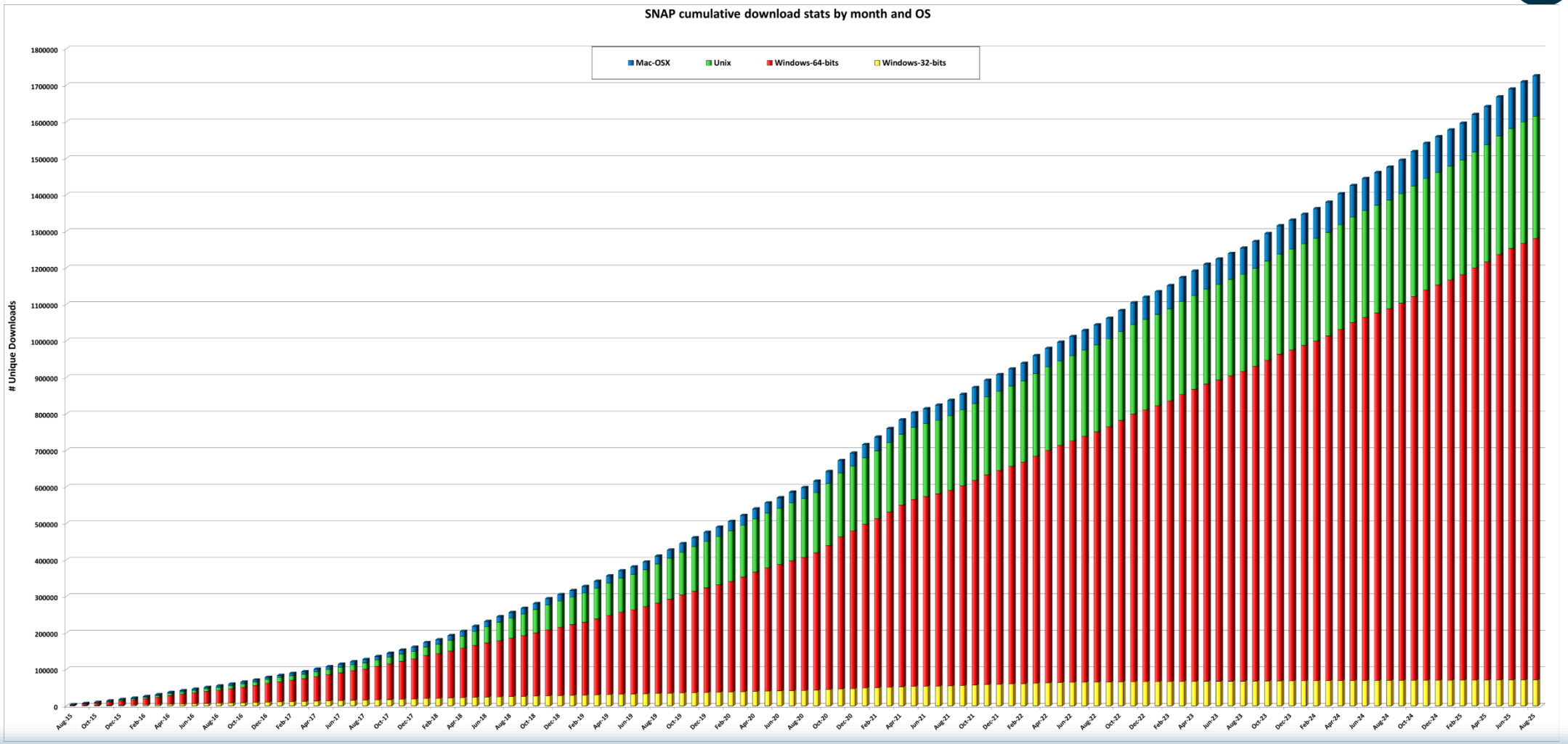
step.esa.int

- ✓ Free and open source software
- ✓ Common Java core framework
- ✓ Joint development of SNAP platform for Sentinels and other satellite data
- ✓ Interchangeable Java/Python plugins
- ✓ Portable engine to Cloud infrastructure
- ✓ User friendly: single installation, intuitive GUI, online help, tutorials, active user forum

SNAP
SeNtinel **A**pplication **P**latform

- **Sentinel-1 Toolbox**
- **Sentinel-2 Toolbox**
- **Sentinel-3 Toolbox**
- **SMOS Toolbox**

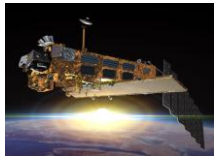
SNAP downloads

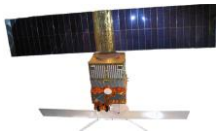


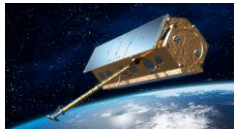
SNAP downloads exceeded 1˙725˙000 from June 2015 until today

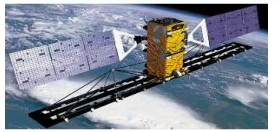
SNAP Microwave Toolbox


Sentinel-1


ENVISAT


ERS-1

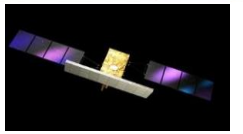

TerraSAR-X


RADARSAT


KOMPSAT-5


ALOS 1&2


ICEYE


COSMO-SkyMed

Main features:

- Data calibration, Multilooking, Speckle filtering, Precise orbits handling (auto download)
- Coregistration of detected and complex products
- Full support of Sentinel-1 TOPS interferometry, debursting, slice assembly
- ETAD correction (Extended Timing Annotation Dataset)
- Terrain Correction
- SAR simulation and Layover and shadow masks
- Applications: offset tracking, oil spill detection, ship detection, wind field estimation etc.
- Compatibility with PolSARpro Toolbox (Polarimetric tool)
- Integrated Export to SNAPHU (interferometric phase unwrapping) and STAMPS (PS InSAR)

Coming soon in SNAP 13

Sentinel-1 characteristics

Radar imaging mission, constellation of two polar-orbiting satellites providing continuous all-weather, day and night imagery for Land and Maritime Monitoring

Main features:

→ C-band (5.4 GHz) SAR
→ Daily coverage of high priority areas;
→ Bi-weekly global coverage;
→ 12 days repeat cycle (6 days with both Sentinels 1A and 1C operational);Sentinel 1B ended operations in 2022
→ 7 years design life time (consumables for 12 years).

Applications:

→ Land, Ice and marine monitoring
→ Mapping in support of humanitarian aid in crisis situations

Sentinel-1 A & C Data

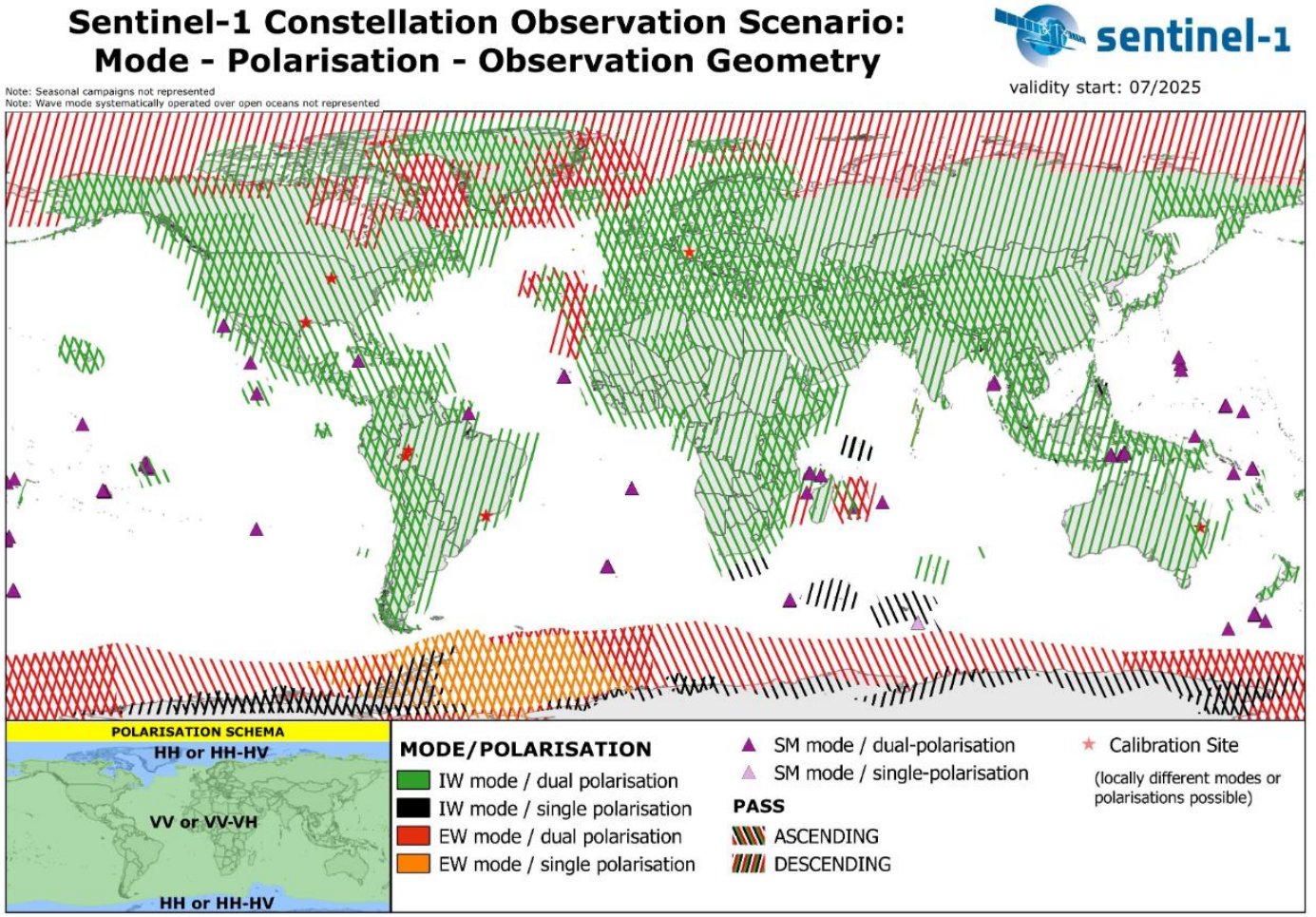
Sentinel-1 products available for users

Level 1

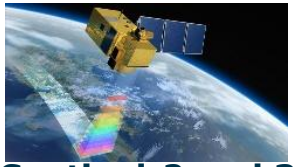
- Ground Range Detected (GRD) SAR data that has been detected, multi-looked and projected to ground range
- Single Look Complex (SLC) images in the slant range by azimuth imaging plane, in the image plane of satellite data acquisition. Each image pixel is represented by a complex number

Level 2

- The OCN (Ocean) products are specifically processed radar data products for oceanographic applications.

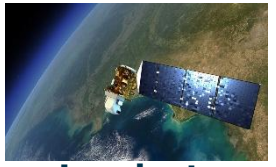


SNAP Optical Toolbox


Sentinel-2 and 3


SPOT


Pleiades


Landsat


ALOS AVNIR


RapidEye


Kompsat


Ikonos


Worldview

.....

Main features:

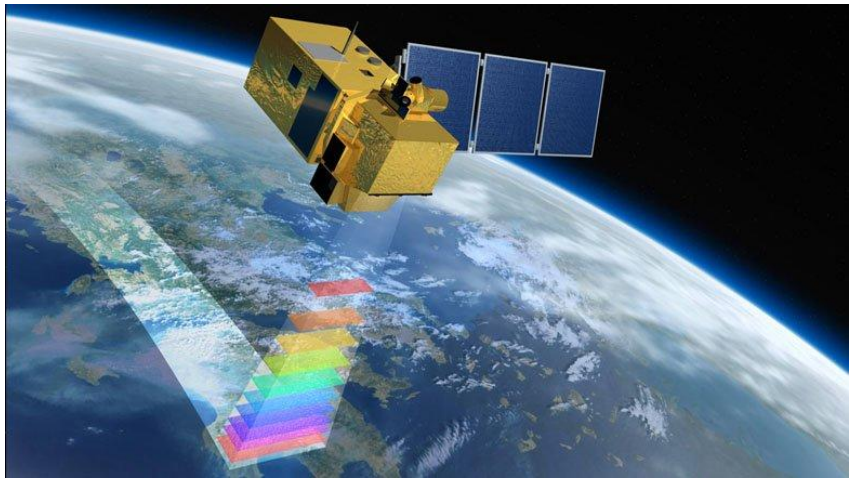
- Tools for manipulation and processing of raster data
- Reflectance to Radiance Processor
- L2B **biophysical processor** (LAI, fAPAR, …)
- **Radiometric Indices**
  - ***Vegetation indices:*** *DVI, RVI, PVI, IPVI, WDVI, TNDVI, GNDVI, GEMI, ARVI, NDI45, MTCI, MCARI, REIP, S2REP, IRECI, PSSRa*
  - ***Soil indices:*** *SAVI, TSAVI, MSAVI, MSAVI2, BI, BI2, RI, CI*
  - ***Water indices:*** *NDWI, NDWI2, MNDWI, NDPI, NDTI*
- **Sen2Cor** and **i-Cor** for Atmospheric Correction
- **IdePix Processor:** pixel classification
- Processors specific for S3 OLCI products: Optical water type classification based on atmospherically corrected reflectances, FU (Forel-Ule) Classification and many more

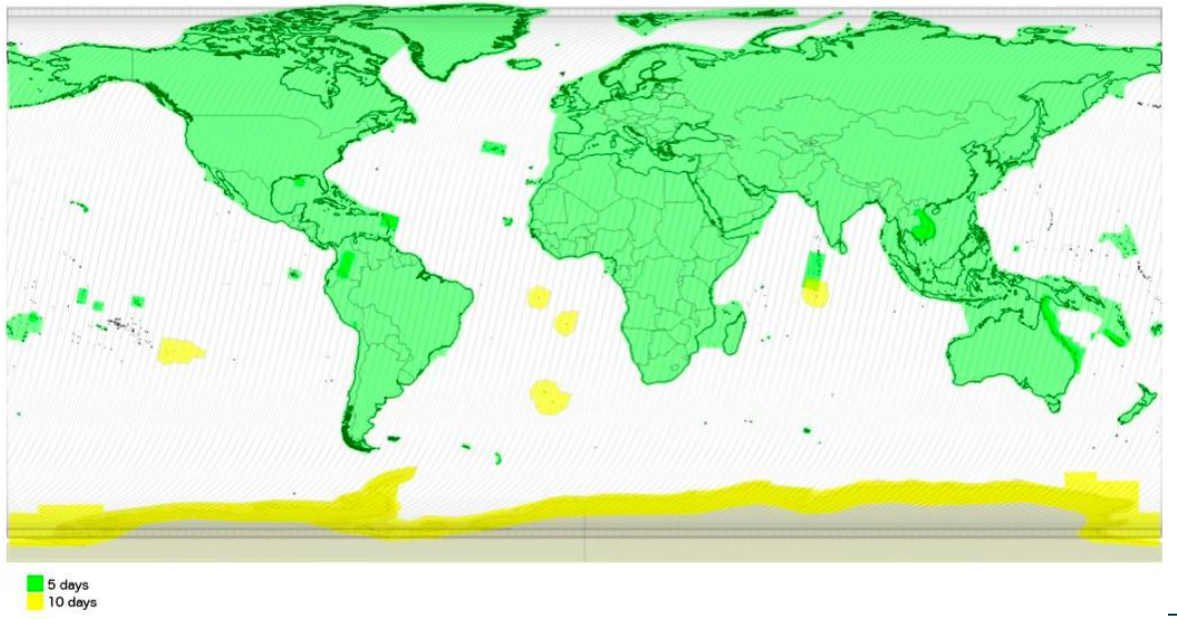
Sentinel-2 characteristics

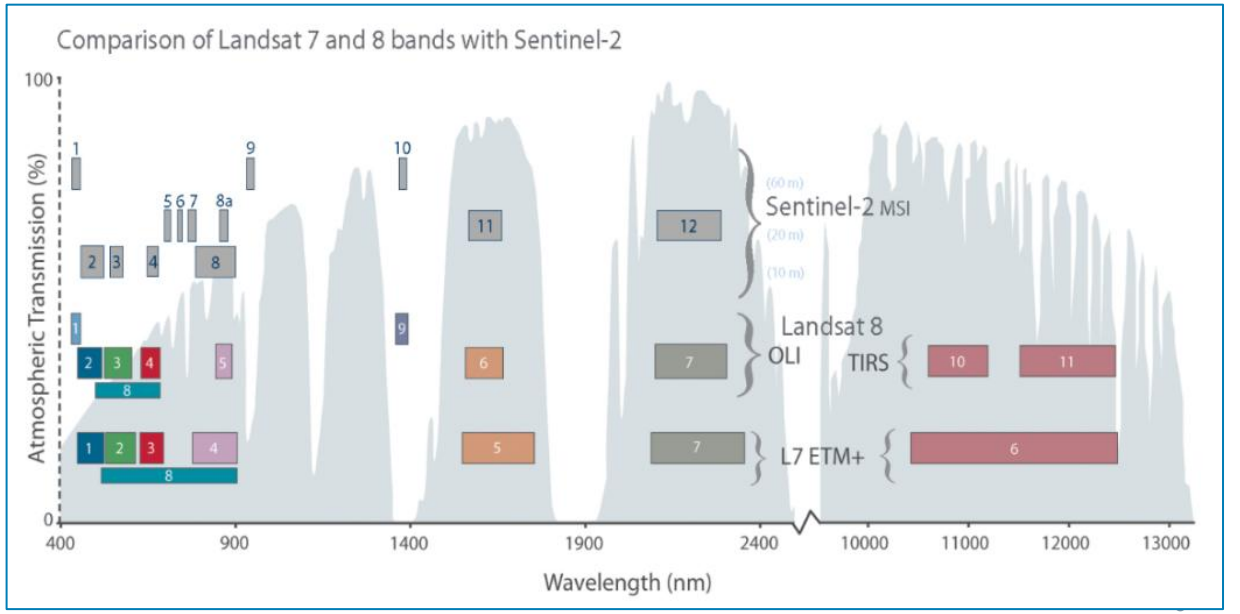
Optical mission for the monitoring of land and coastal regions

Main features:

- → Constellation of two identical satellites
- → Each satellite carries an innovative wide swath high-resolution multispectral imager with 13 spectral bands
- → 10 days repeat cycle (5 days with both Sentinels 2B and 2C; Sentinel 2C replaced Sentinel 2A in January 2025)
- → Swath of 290km







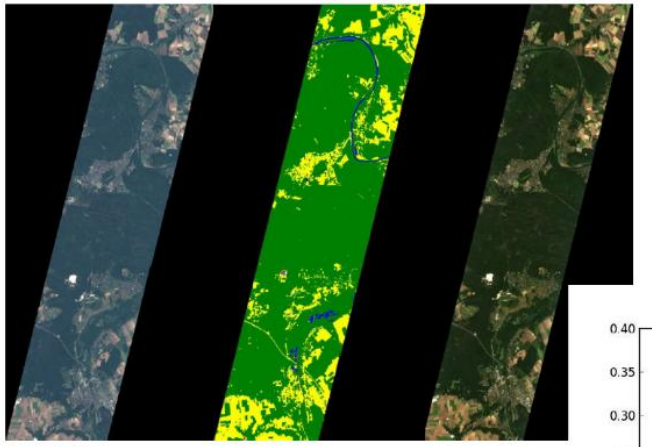
Sentinel-2 products

SENTINEL-2 products available for users are:

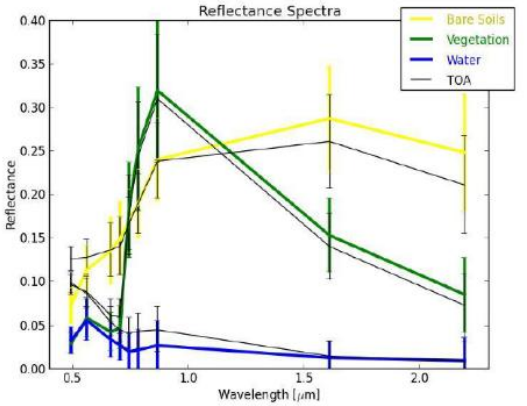
Level-1B
- Radiometrically corrected Top-Of-Atmosphere (TOA) radiance in sensor geometry
- Includes refined geometric model used to generate Level 1C products

Level-1C
- Top-Of-Atmosphere reflectances in cartographic geometry
- Systematic generation and online distribution

Level-2A
- Botton-Of-Atmosphere reflectances in cartographic geometry
- Systematic and on-User side (using SNAP)



Site: Fontainebleau, France



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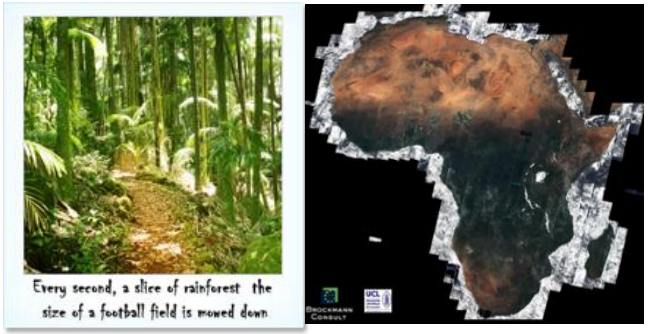
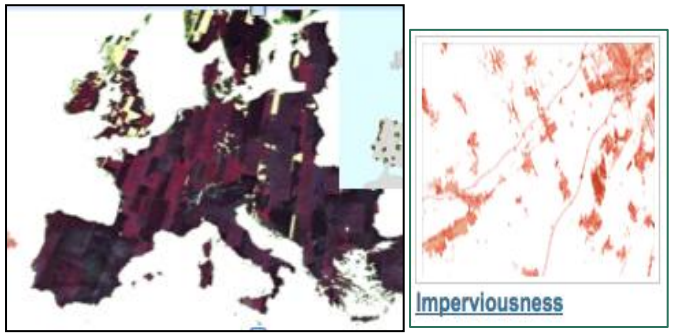
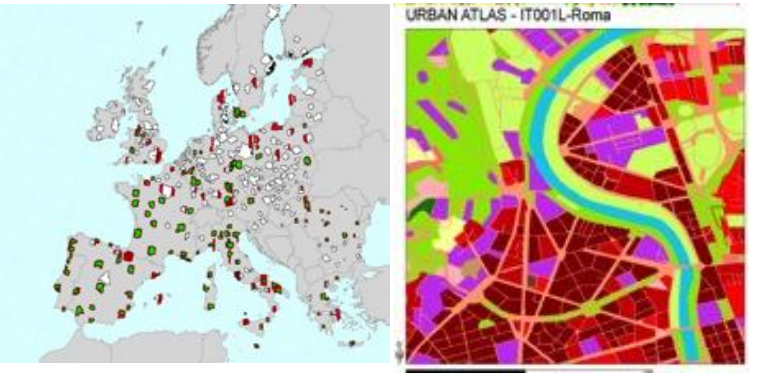
Sentinel-2 applications



Agriculture, Forests & Carbon, Vegetation monitoring

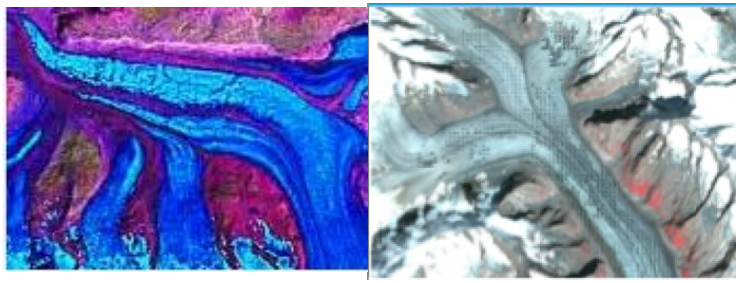


Land cover classification, high resolution layers & change.



Regional to Urban Applications

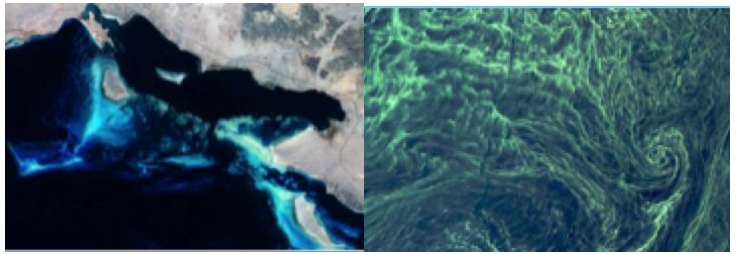
Emergency management



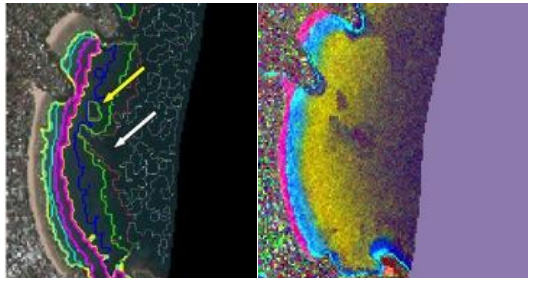
Glaciers & Ice

Global Land use & change

Geology



Water quality



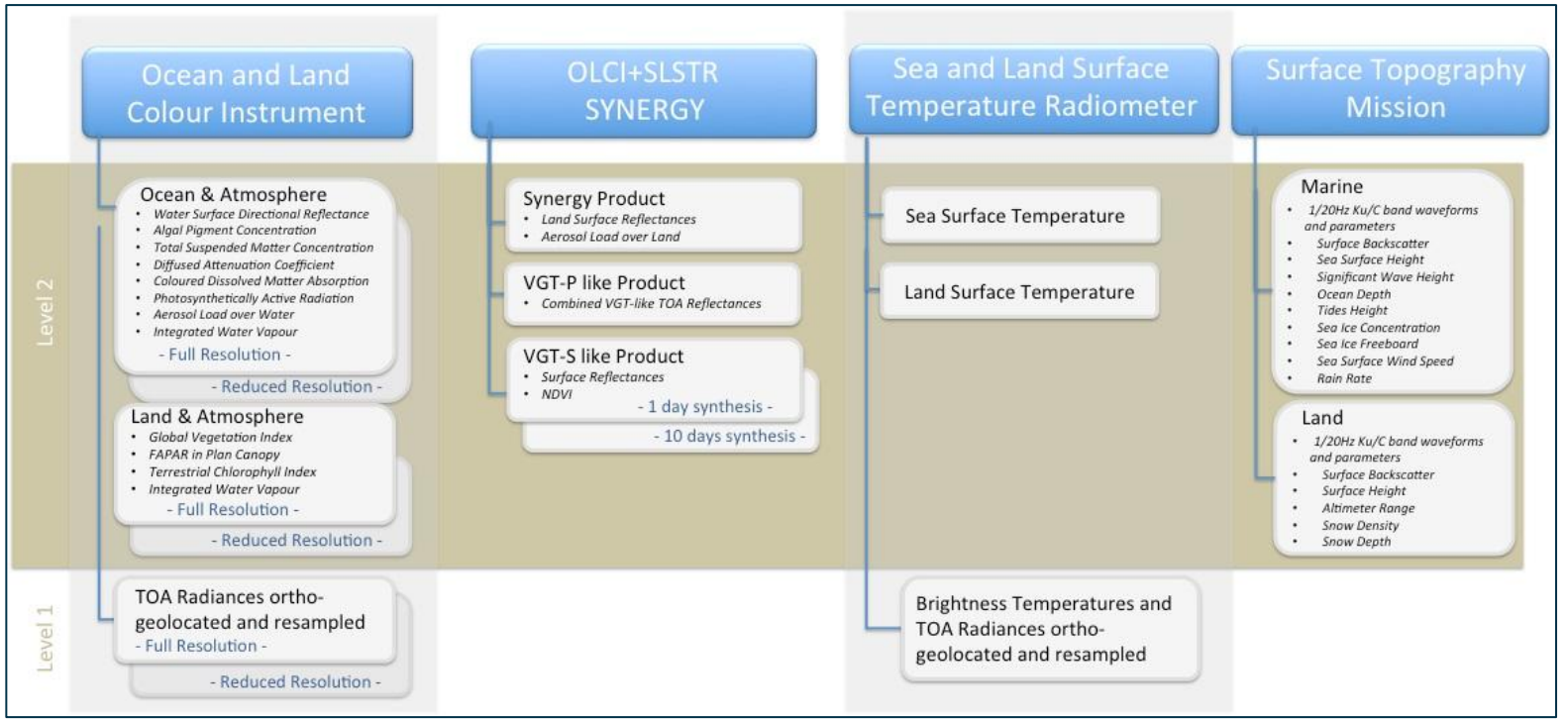
Coastal zones/bathymetry

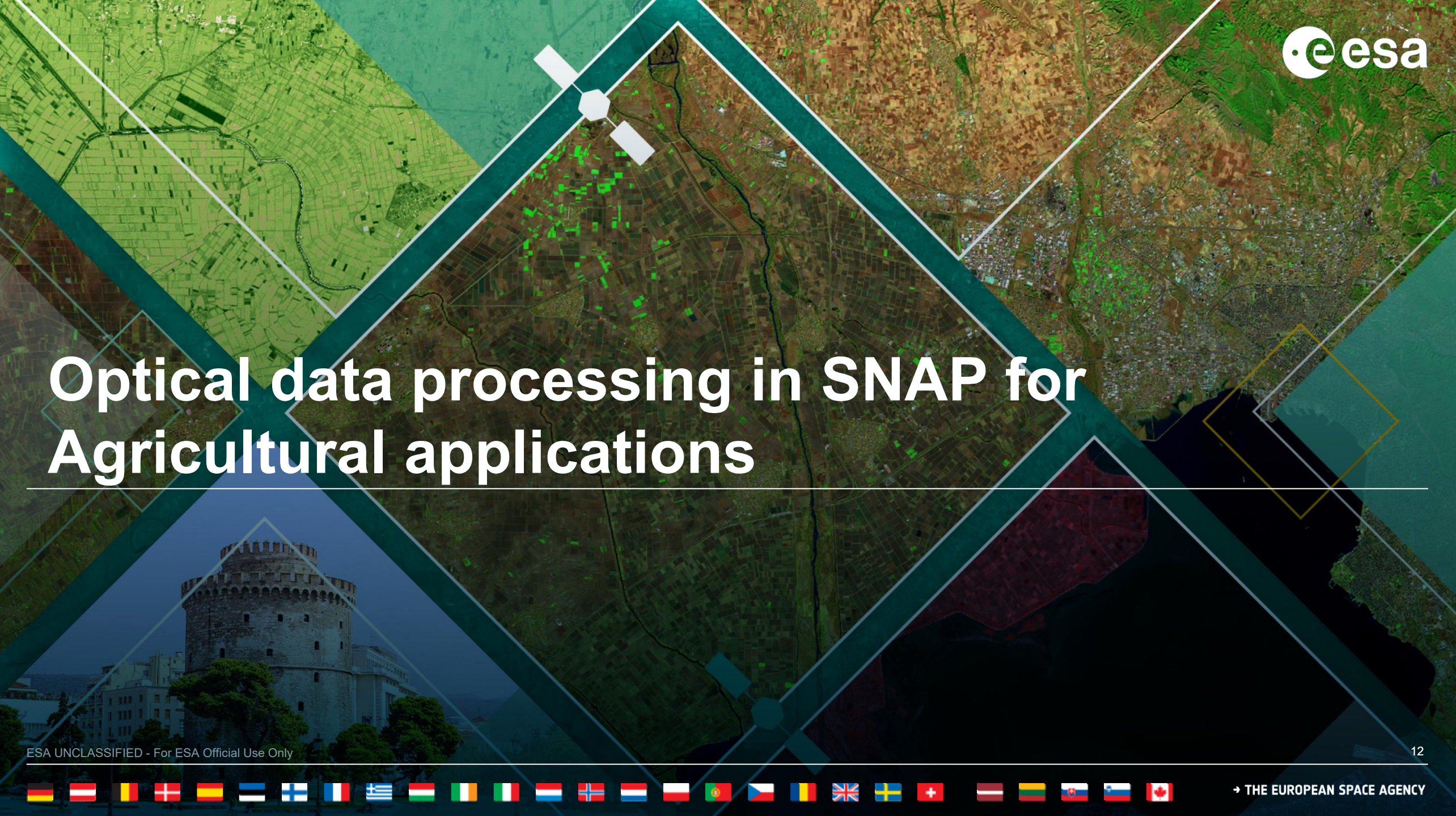
Sentinel-3 products

Sentinel-3 is an ocean and land mission and provides data continuity for the ERS, ENVISAT and SPOT-VGT satellites.

SENTINEL-3 makes use of multiple sensing instruments to accomplish its objectives:

- ***SLSTR*** *(Sea and Land Surface Temperature Radiometer)*
- ***OLCI*** *(Ocean and Land Colour Instrument)*
- ***SRAL*** *(SAR Altimeter)*
- ***DORIS*** *(Doppler Orbitography and Radiopositioning Integrated by Satellite)*
- ***MWR*** *(Microwave Radiometer)*





Optical data processing in SNAP for Agricultural applications

Sentinel-2 pre-processing

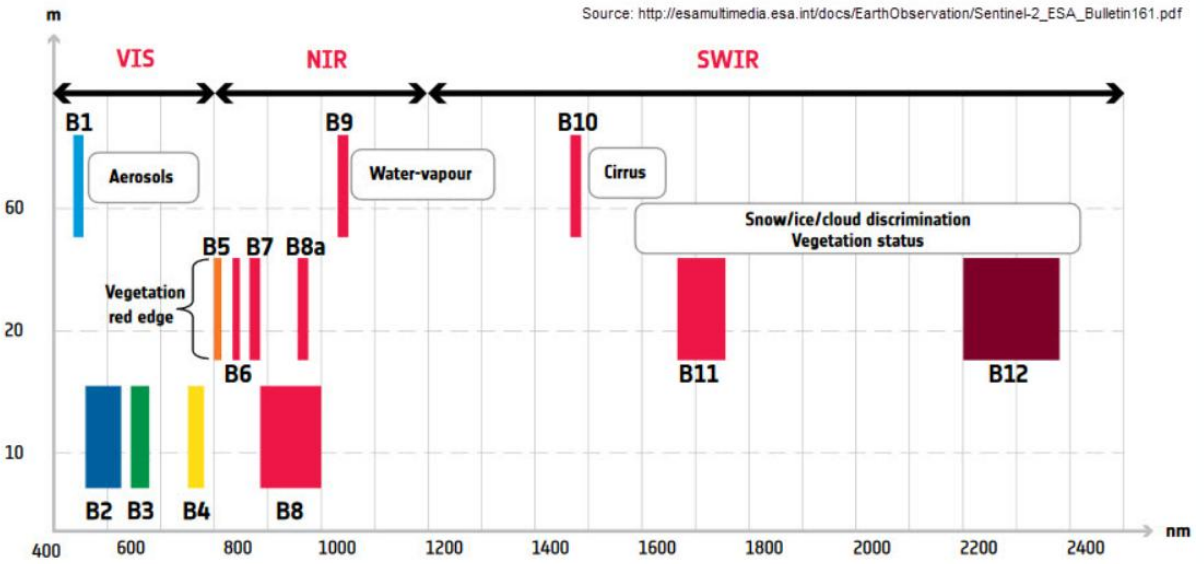
Essential pre-processing steps:

Resampling

The S2 products are multi-size

- *B2, B3, B4 and B8 @ 10m*
- *B5, B6, B7, B8A, B11 and B12 @ 20m*
- *B1, B9 and B10 @ 60m*

Needed if the user wants to combine bands with different spatial resolution



Subset (spatially/spectrally)

The S2 data are distributed in tiles 100x100 km^2 ortho-images in UTM/WGS84 projection.

Needed if the AOI covers a portion of the S2 scene or if only a subset of bands are useful in the next step (this will reduce the computation time)

Re-projection

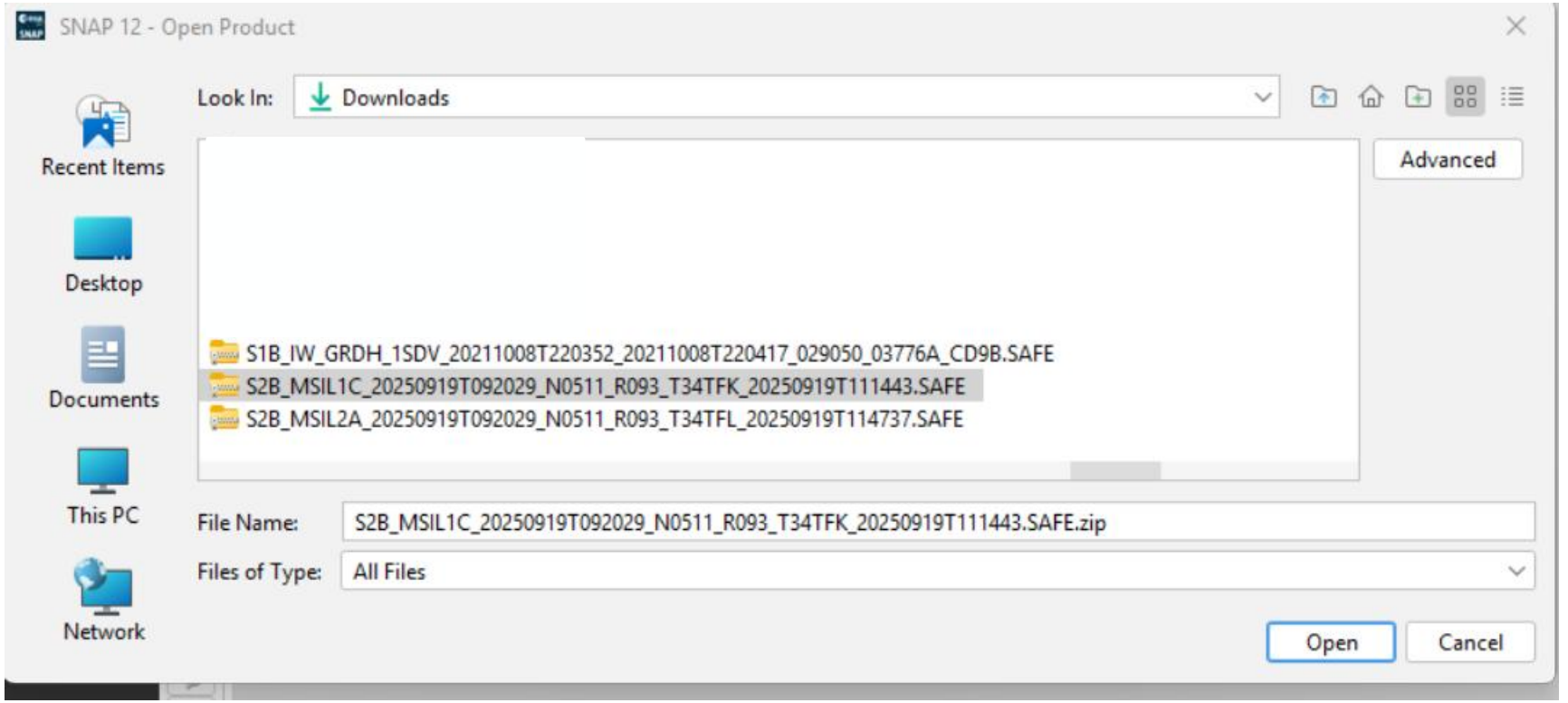
If the AOI covers more than one S2 tile in different UTM zones the user needs to re-project in a common CRS before to mosaic them.

If the user wants to merge different data sources projected in different CRS.

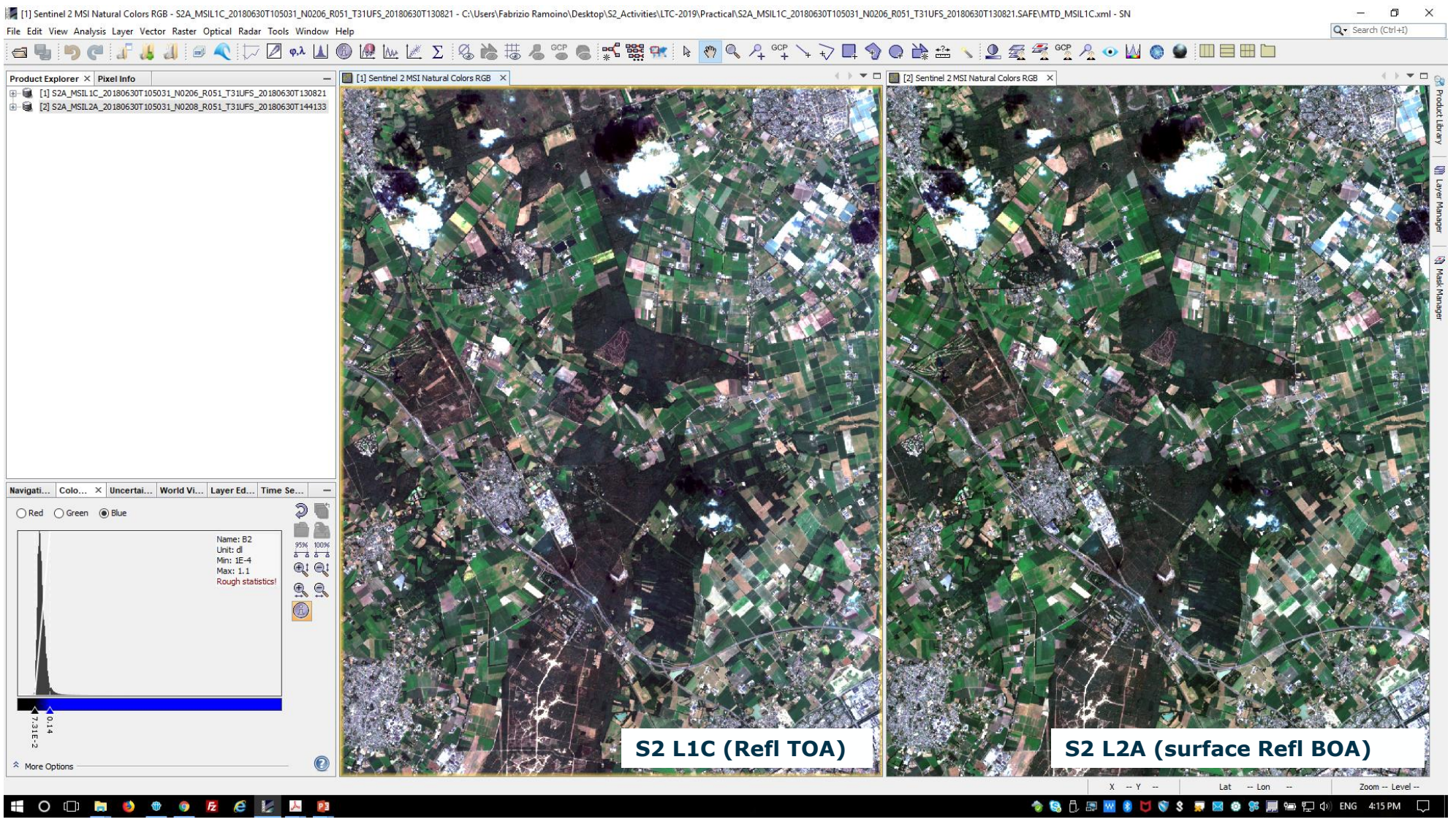
To export the view in KMZ and visualise your output in Google Earth.

Open a Sentinel-2 data

Click on ‘File’ → ‘Open Product…’ → select the *.SAFE file*



Visualize Sentinel-2 data

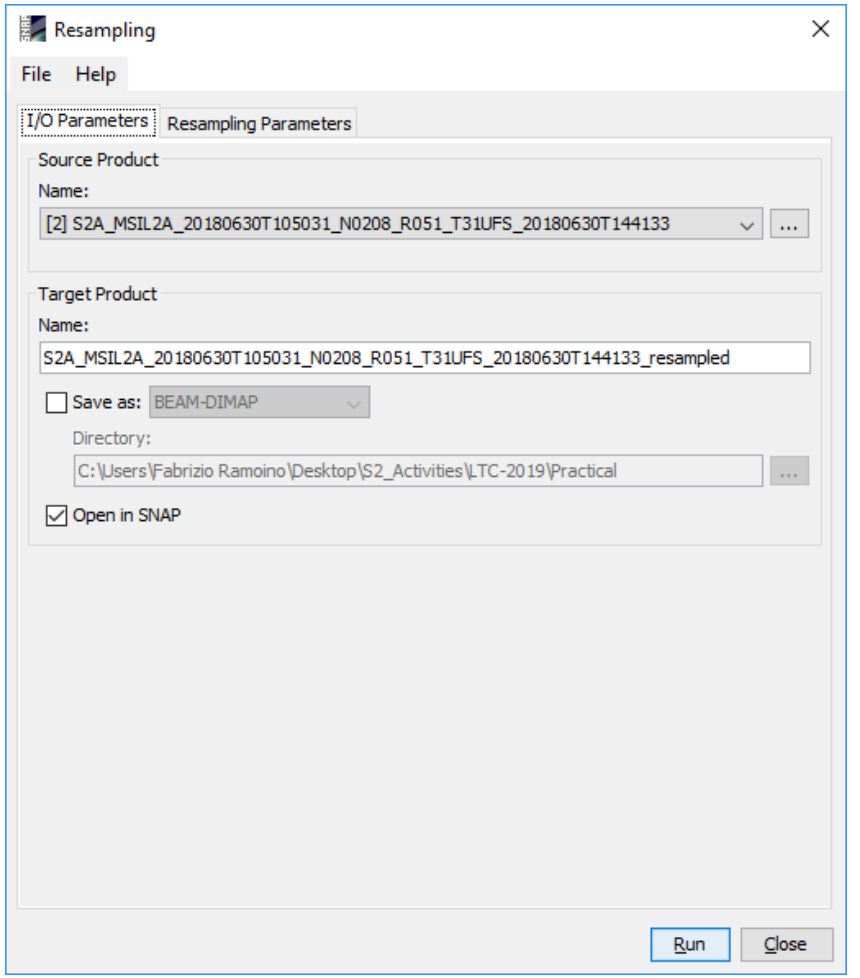


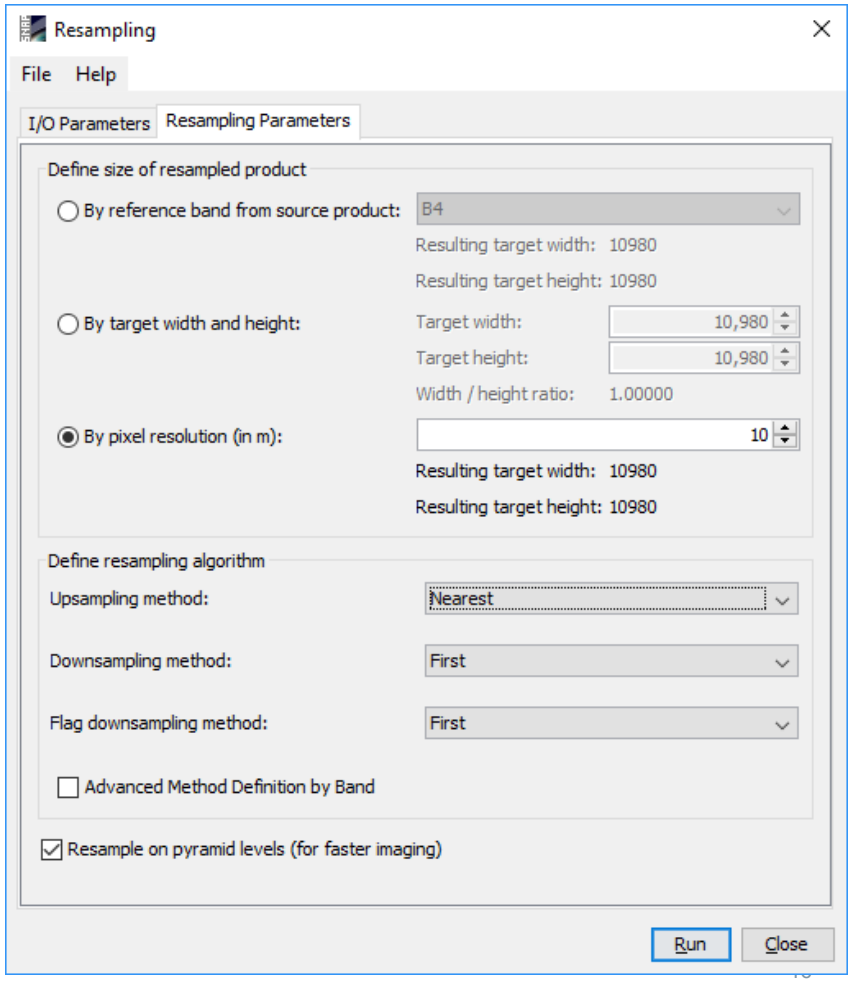
Resampling

1) Select the product in the Product Explorer window.
2) Click on ‘Raster’ → ‘Geometric Operations’ → ‘Resampling’

In the pop-up window set up the parameters as shown in the Figures:

- ✓ Unselect ‘Save as:’
- ✓ ‘10m’ as pixel resolution
- ✓ ‘Nearest’ as Upsampling method
- ✓ Click on ‘Run’



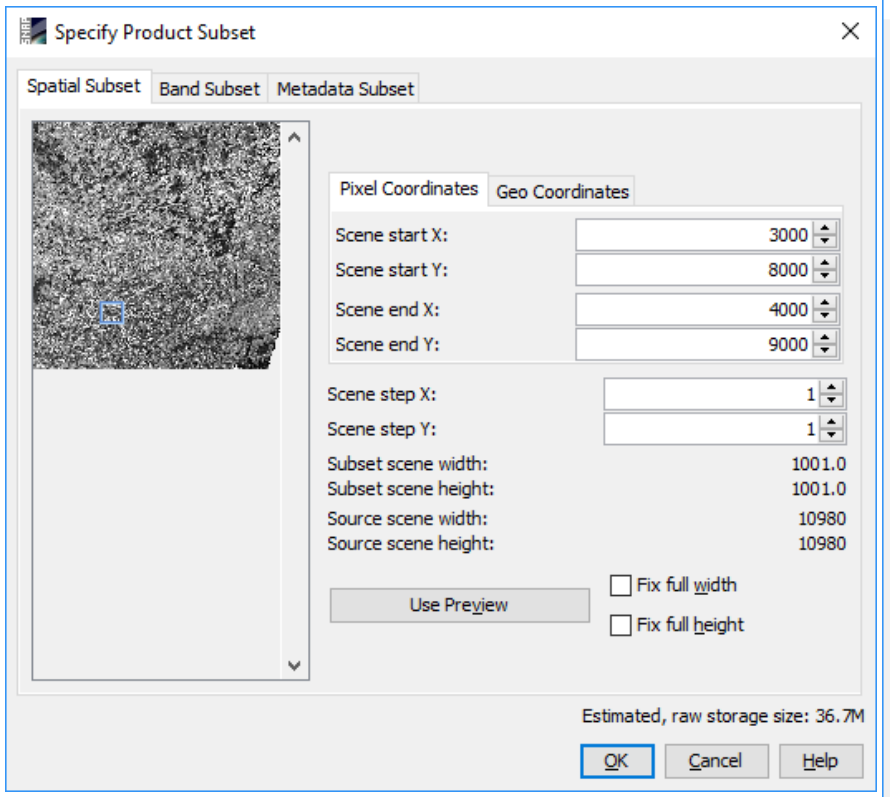


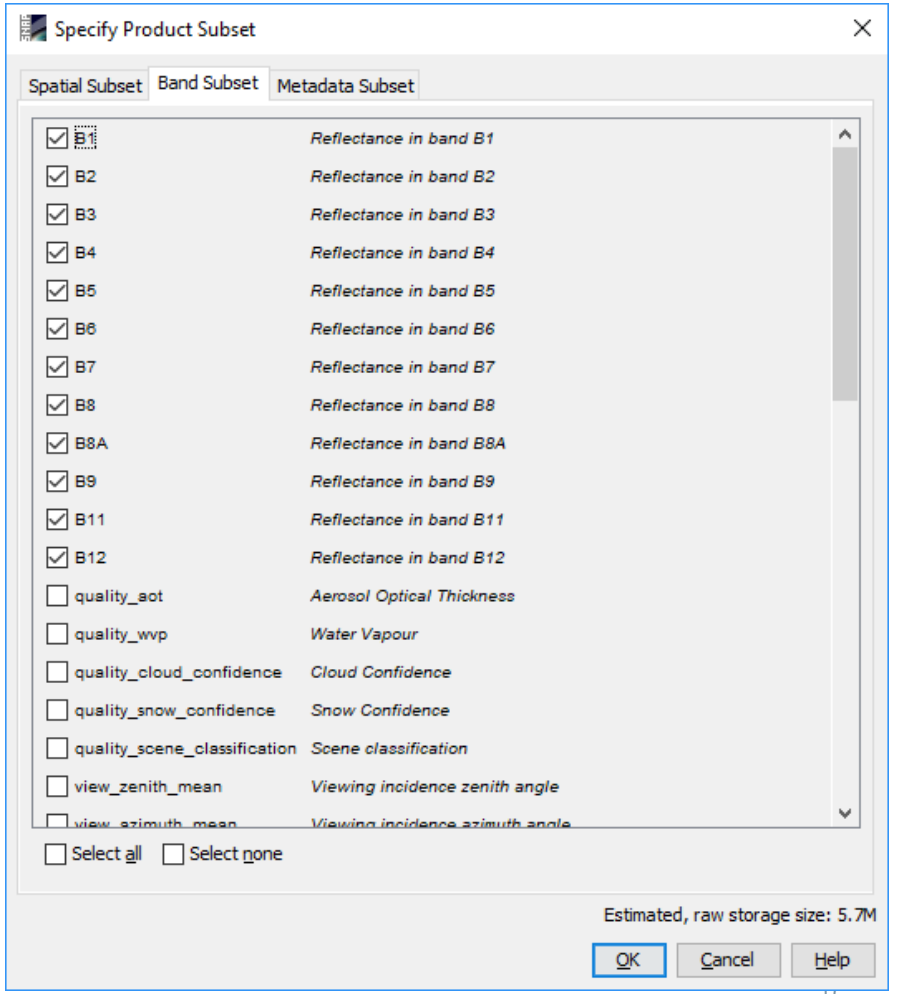
Subset (spatially/spectrally)

1) Select the new product in the Product Explorer window.
2) Click on 'Raster' → 'Subset…'

In the pop-up window set up the parameters as shown in the Figures:

- ✓ Define the X and Y pixels range or the X and Y geo-coordinates to crop the input product
- ✓ Define which bands you want to export
- ✓ Click on 'Run'



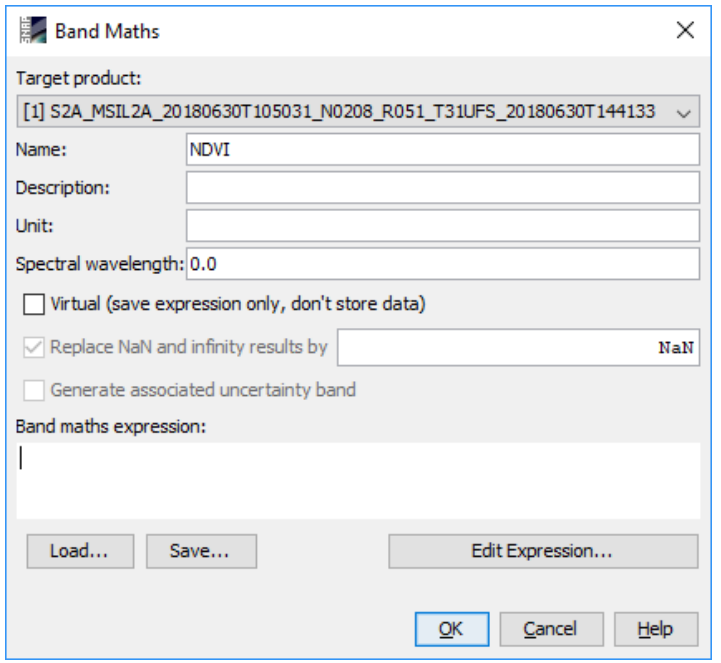


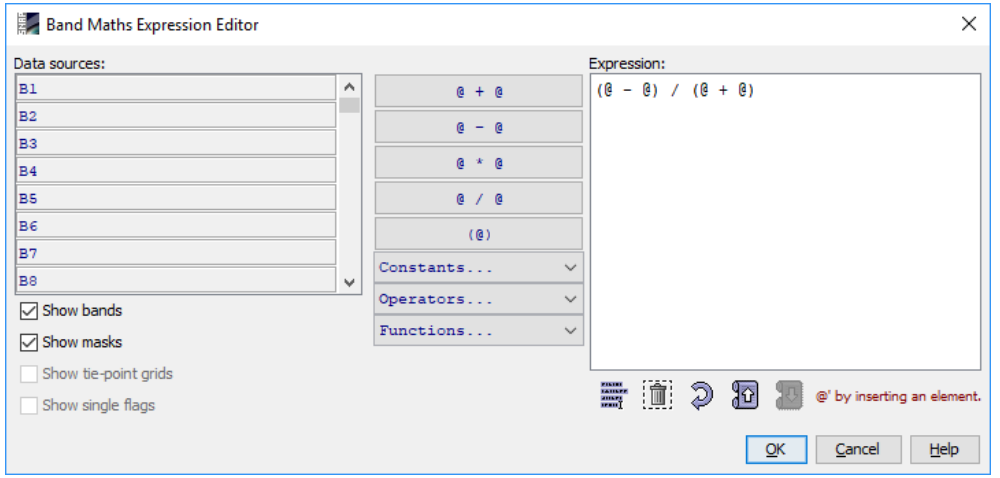
Band Maths (e.g. NDVI)

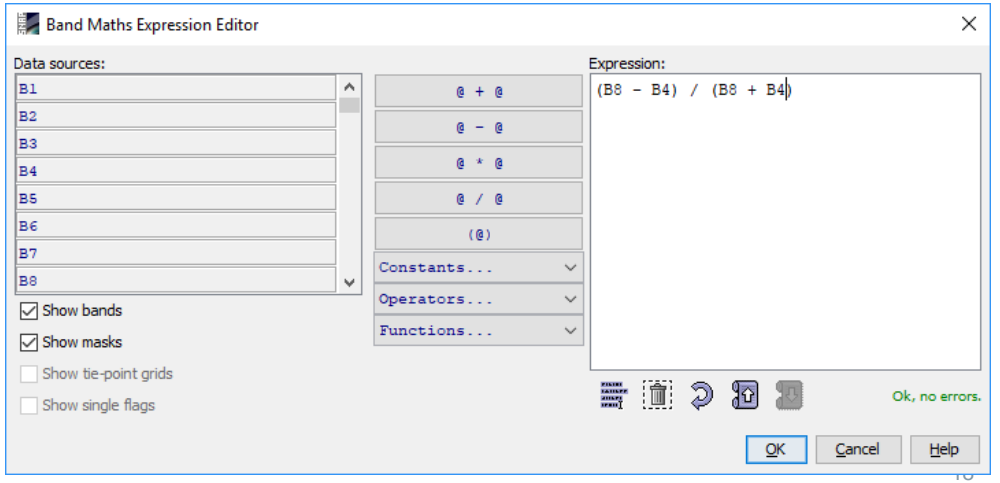
1) Select the product in the Product Explorer window.
2) Click on 'Raster' → 'Band Maths…'

In the pop-up window set up the parameters as shown in the Figures:

- ✓ Change the Name: 'NDVI'
- ✓ Unselect 'Virtual' box
- ✓ Click on 'Edit Expression…'
- ✓ Create your expression using '@' and after replace them with the bands
  - ✓ *(@ - @) / (@ + @)*
  - ✓ *(B8 – B4) / (B8 + B4)*
- ✓ Click on 'Run'



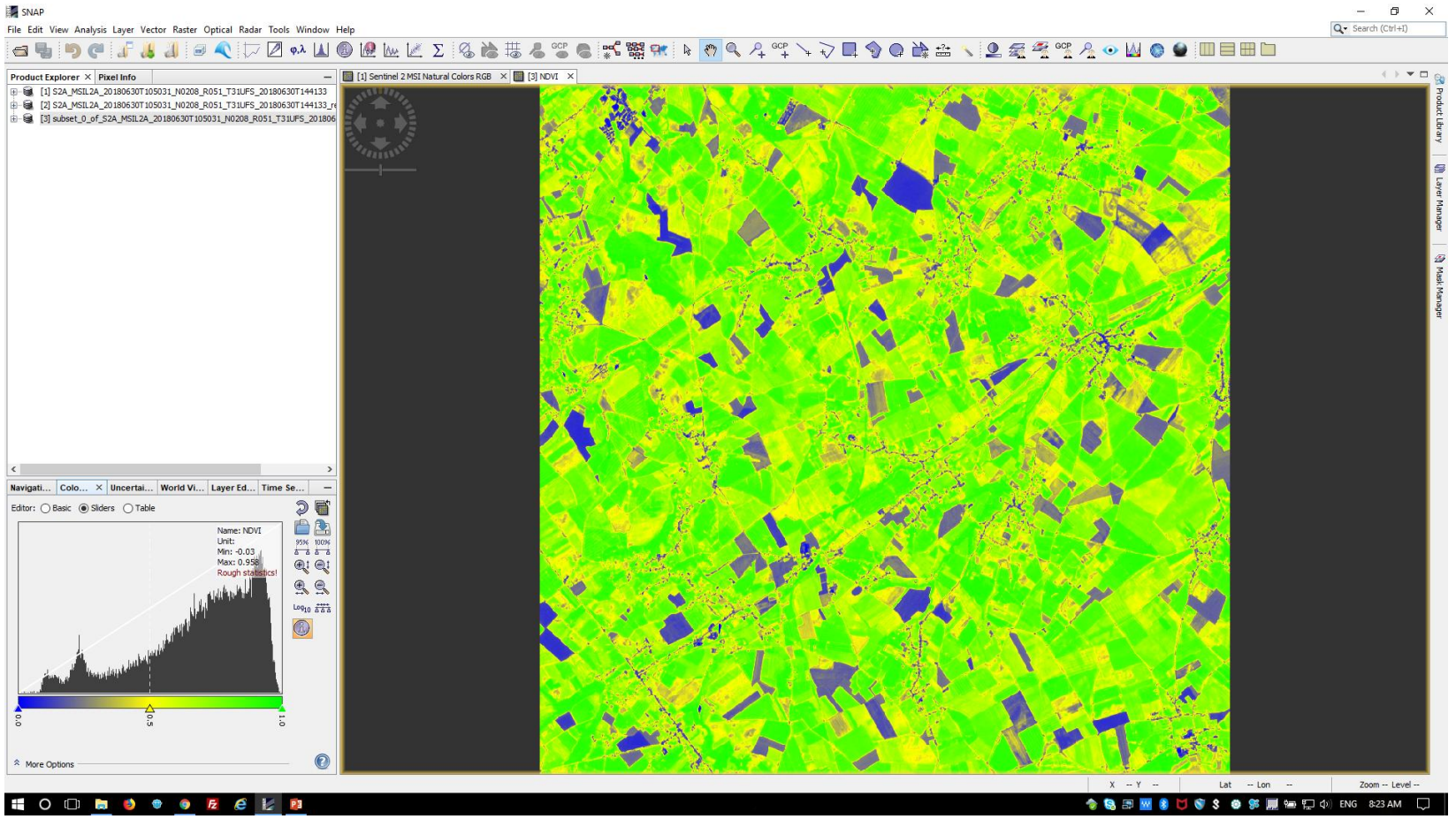




Output Visualization

When the processing is finished the output will be automatically opened in the ‘Product Explorer’ of SNAP Select the product in the Product Explorer window.

Using the Colour Manipulation (bottom left) you can modify the colour palette.



Radiometric Indices

Radiometric indices are quantitative measures of features that are obtained by combining several spectral bands

Vegetation indices

- DVI, RVI, PVI
- NDVI, WDVI, TNDVI, GNDVI
- SAVI, TSAVI, MSAVI, MSAVI2
- GEMI
- ARVI
- NDI45
- MTCI, MCARI, PSSRa
- S2REP, REIP, IRECI

Soil indices

- BI
- BI2
- RI
- GEMI

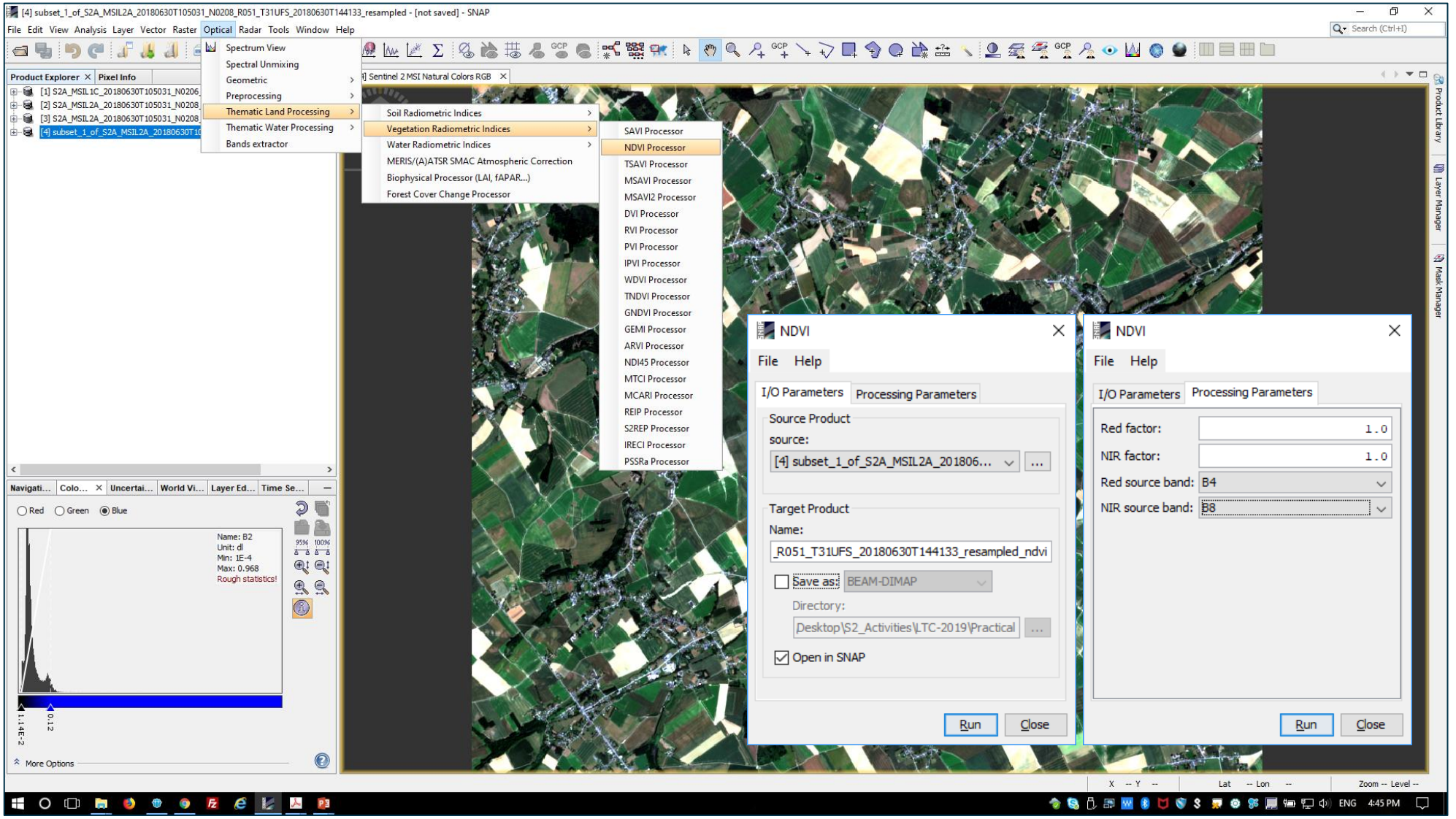
Water indices

- NDWI
- NDWI2
- MNDWI
- NDPI
- NDTI

Radiometric Indices (e.g. NDVI)

$$\frac{(NIR - Red)}{(NIR + Red)}$$

$$\frac{(B8 - B4)}{(B8 + B4)}$$



Biophysical processor (L2B)

1) Select the new product in the Product Explorer window.
2) Click on 'Optical' → 'Thematic Land Processing' → 'Biophysical processor (LAI, fAPAR, …)'

In the pop-up window set up the parameters as shown in the Figures:

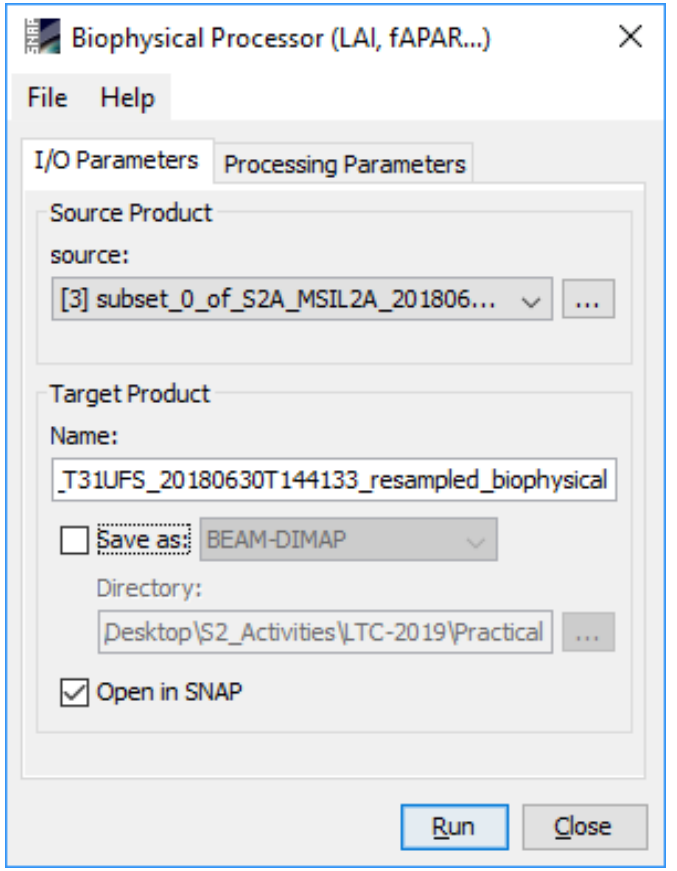
✓ Unselect 'Save as:'

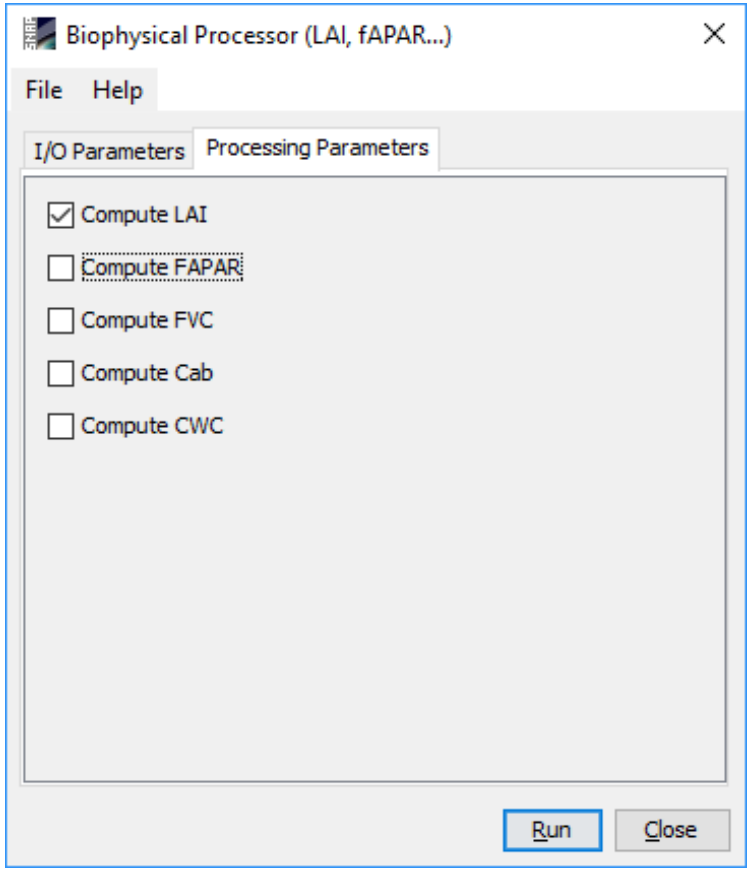
✓ Select only 'LAI'

✓ Click on 'Run'

Top-of-canopy normalized reflectance data -> set of biophysical variables

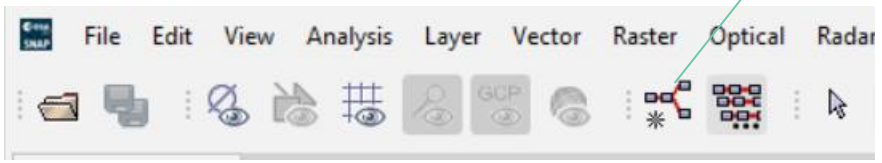
- LAI: Leaf Area Index
- fAPAR: Fraction of Absorbed Photosynthetically Active Radiation
- FVC: Fraction of vegetation cover
- Cab: Chlorophyll content in the leaf
- CWC: Canopy Water Content

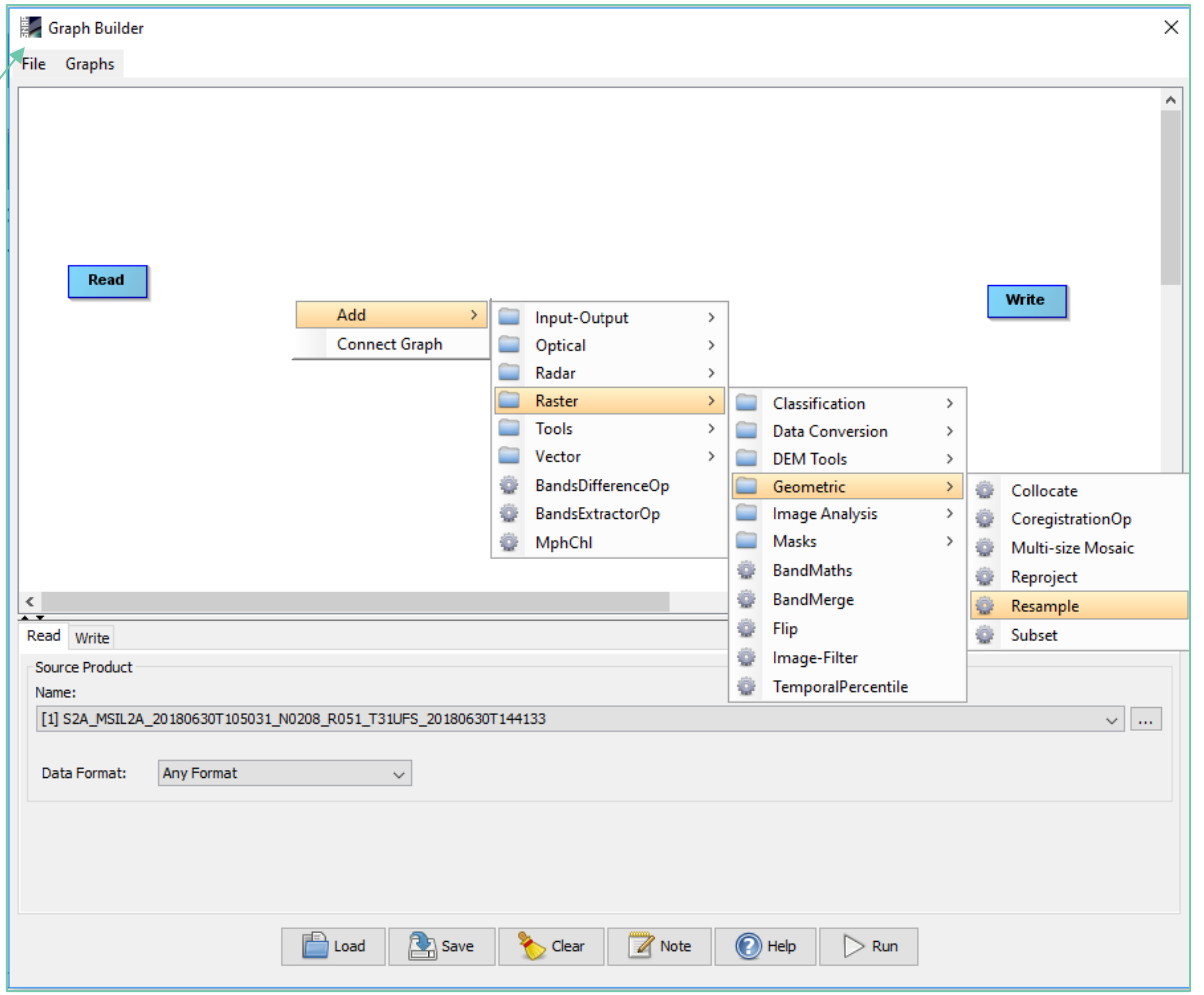




GraphBuilder

The Graph Builder allows the user to assemble graphs from a list of available operators and connect operator nodes to their sources. Right click on the top panel to add an Operator.





GraphBuilder

We can create our processing chain adding to the default blocks 'Read' and 'Write':

'Rempling'
'Raster' → 'Geometric' → 'Resample'

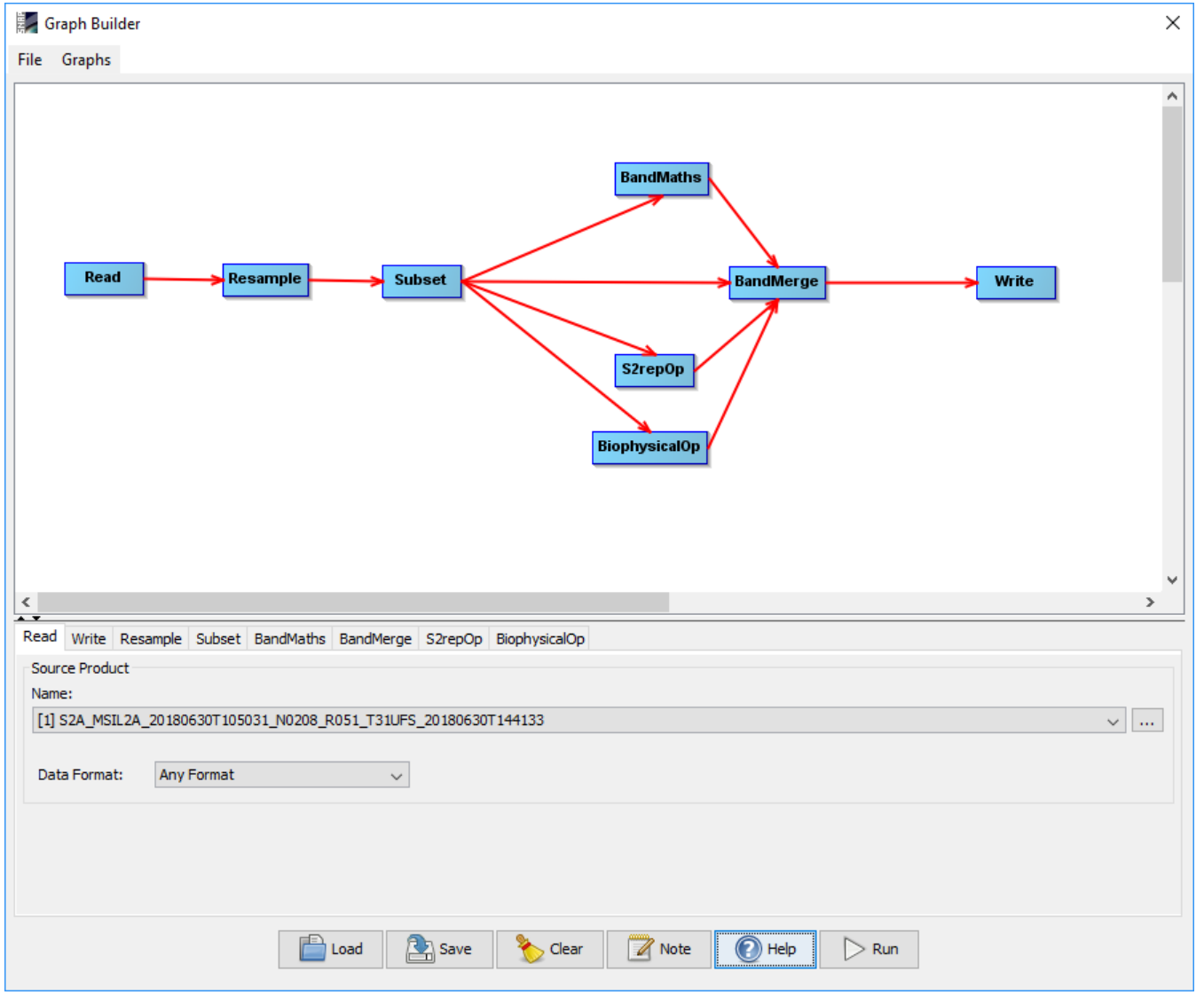
'Subset'
'Raster' → 'Geometric' → 'Subset'

'Band Maths'
'Raster' → 'BandMaths'

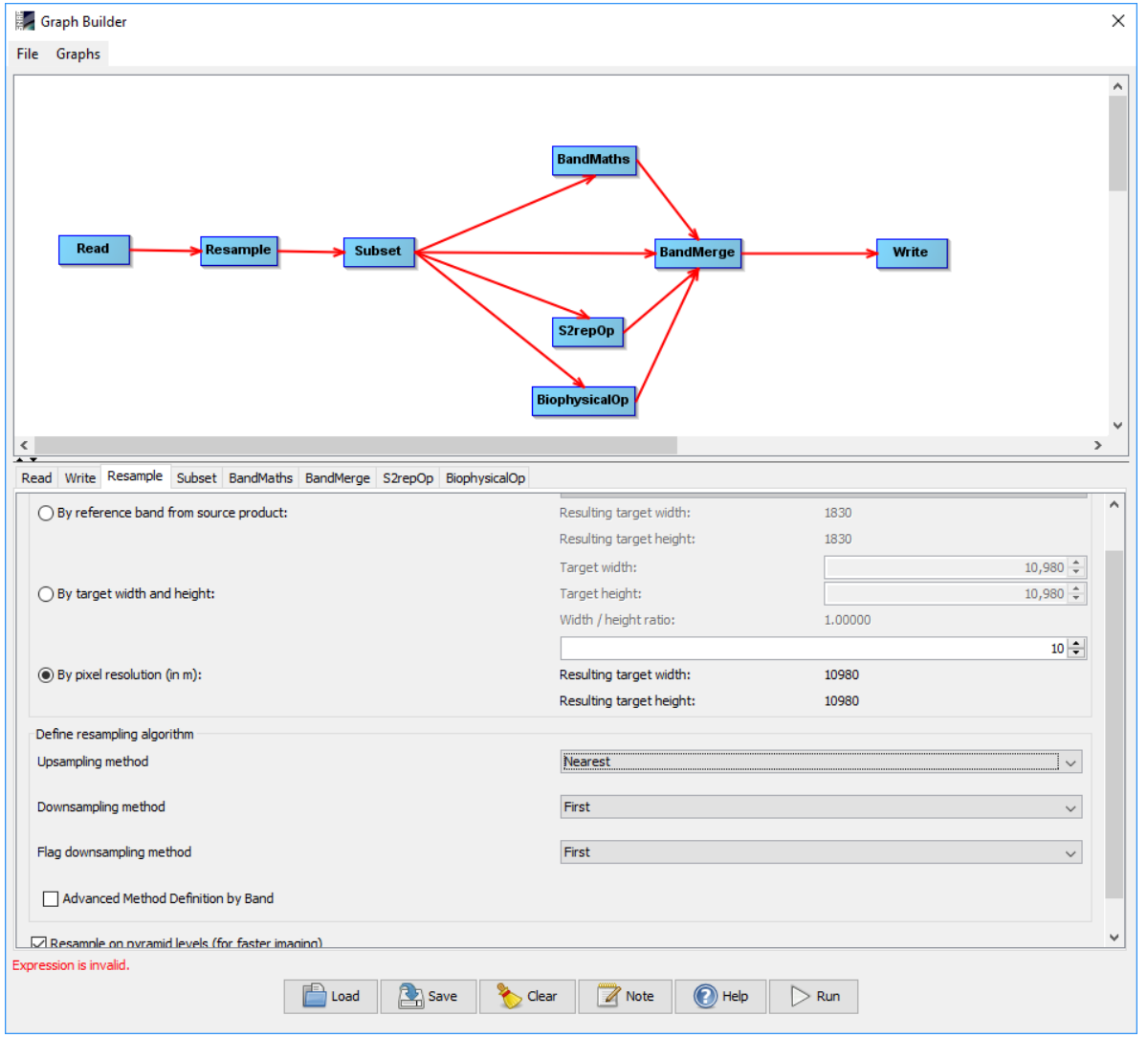
'S2rep' (S2 Red-Edge Position Index)
'Optical' → 'Them. Land Proc.' → 'Veg. Rad. Ind.' → 'S2repOp'

'Biophysical Processor'
'Optical' → 'Thematic Land Processing' → 'BiophysicalOp'

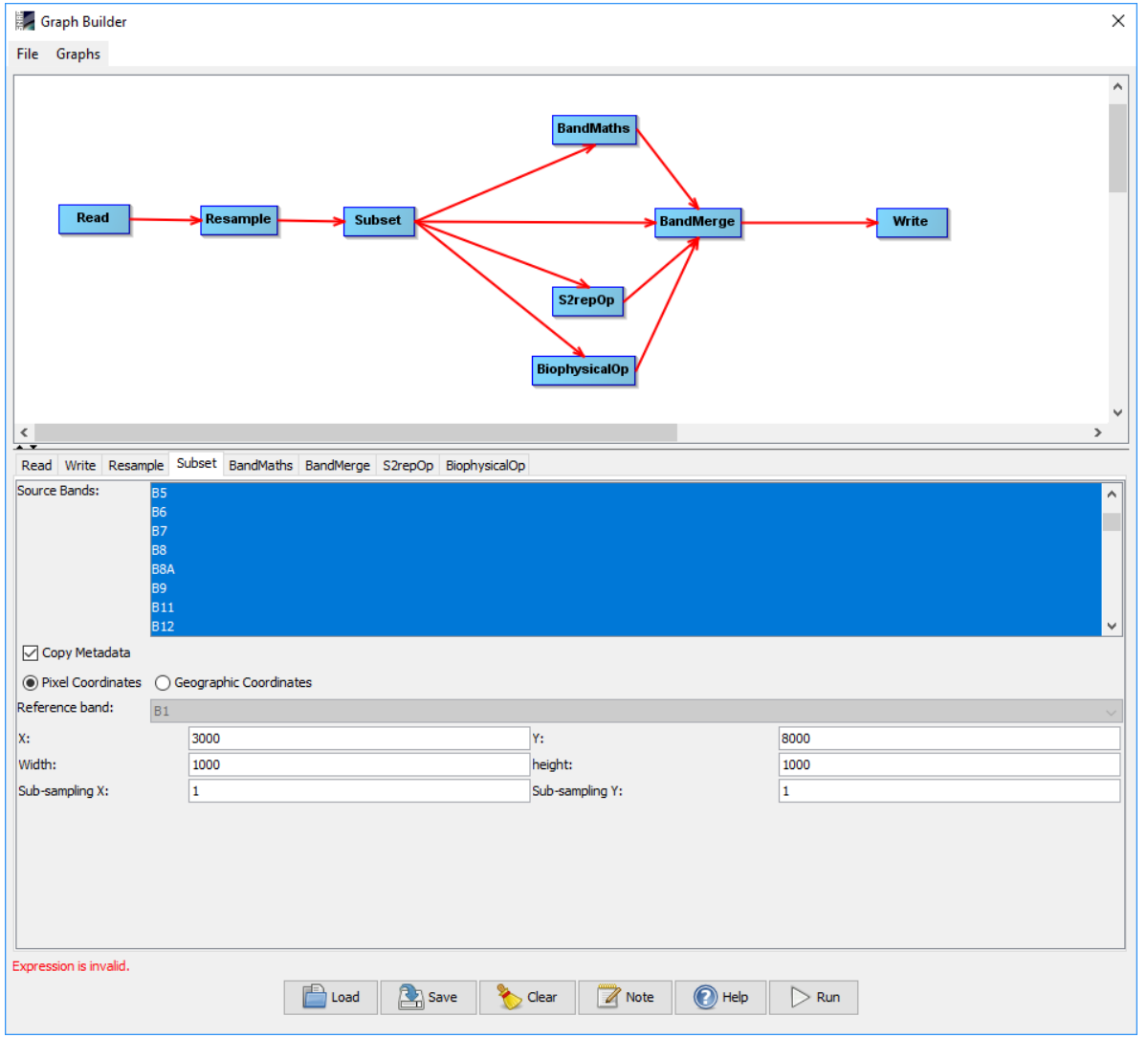
'Band Merge'
'Raster' → 'BandMerge'



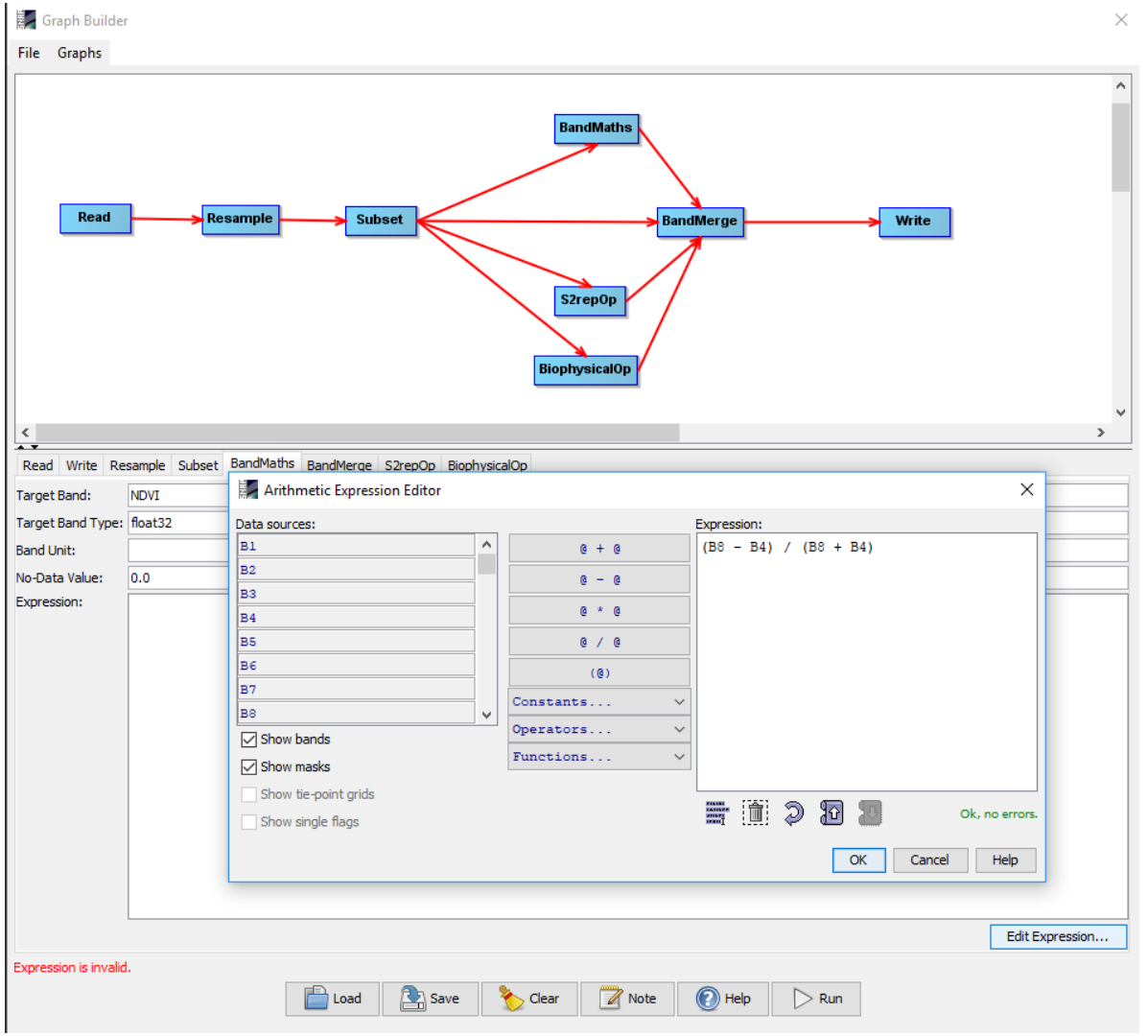
GraphBuilder (Resample module)



GraphBuilder (Subset module)



GraphBuilder (BandMaths module)

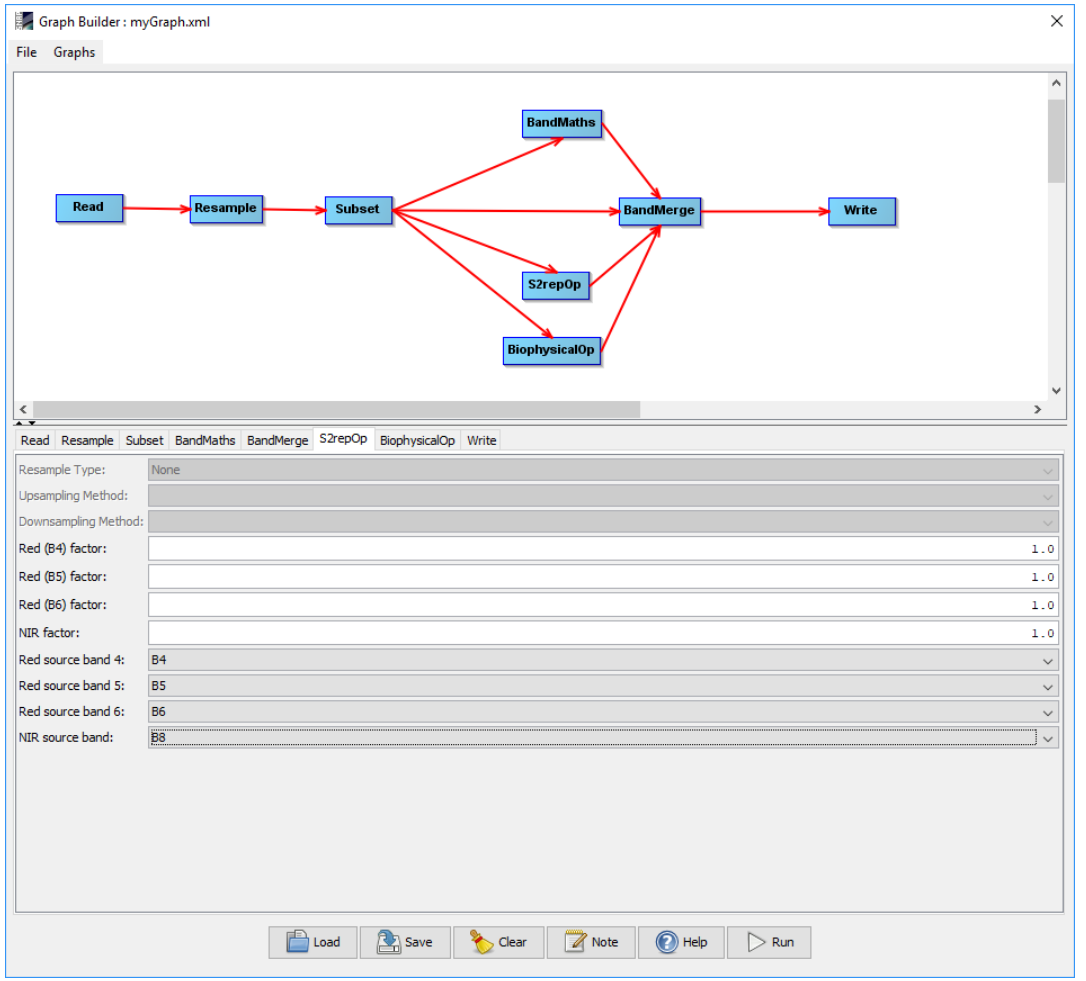


GraphBuilder (S2repOp module)

The Sentinel-2 Red-Edge Position Index algorithm is based on linear interpolation, as presented by Guyot and Baret (1988).
Red edge, as the inflection point of the strong red absorption to near infrared reflectance, includes the information of both crop (chlorophyll content) N and growth status.

$$705 + 35 \times \frac{\frac{(Red + NIR)}{2} - Red_2}{(Red_3 - Red_2)}$$

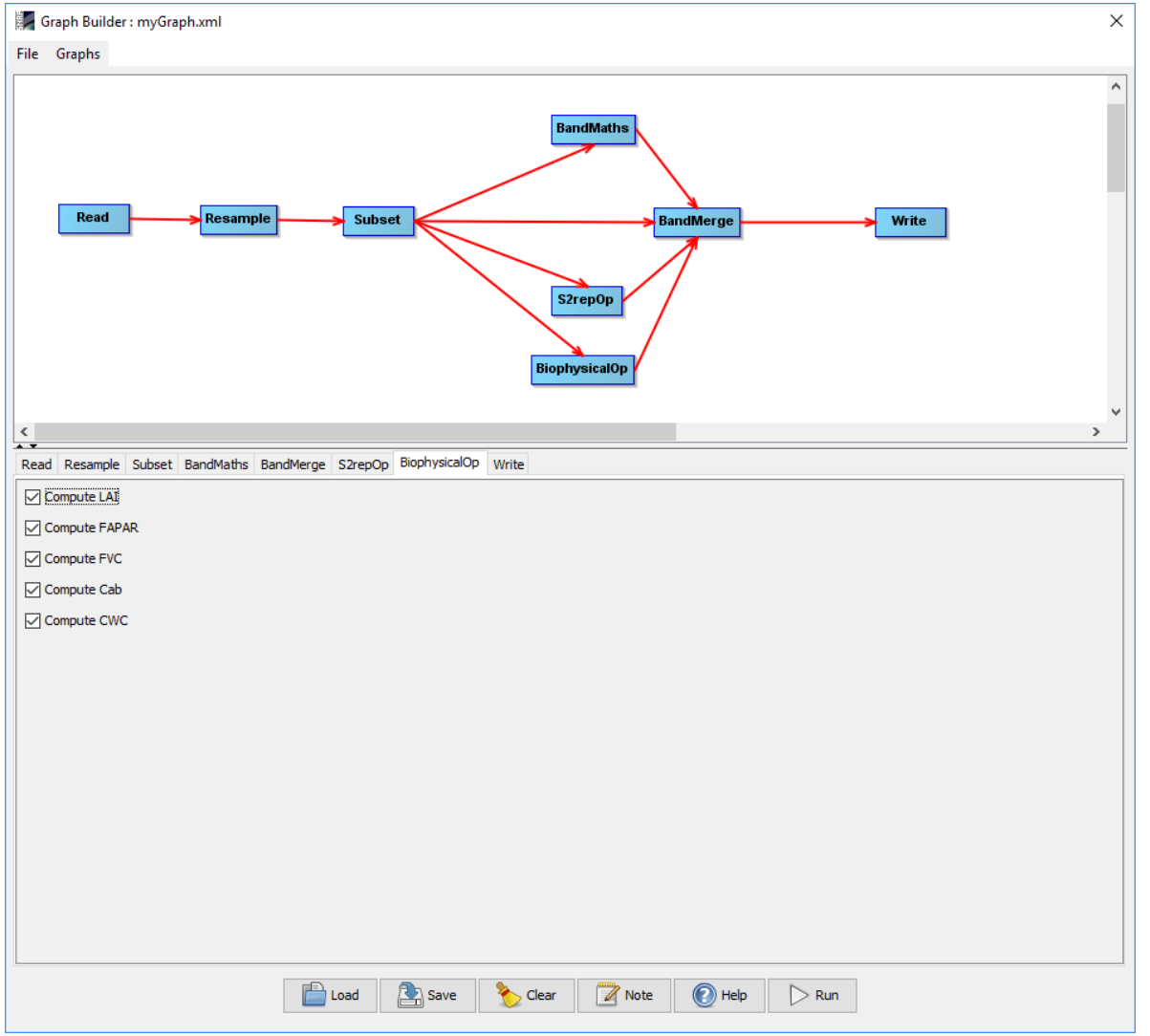
$$705 + 35 \times \frac{\frac{(B4 + B7)}{2} - B5}{(B6 - B5)}$$



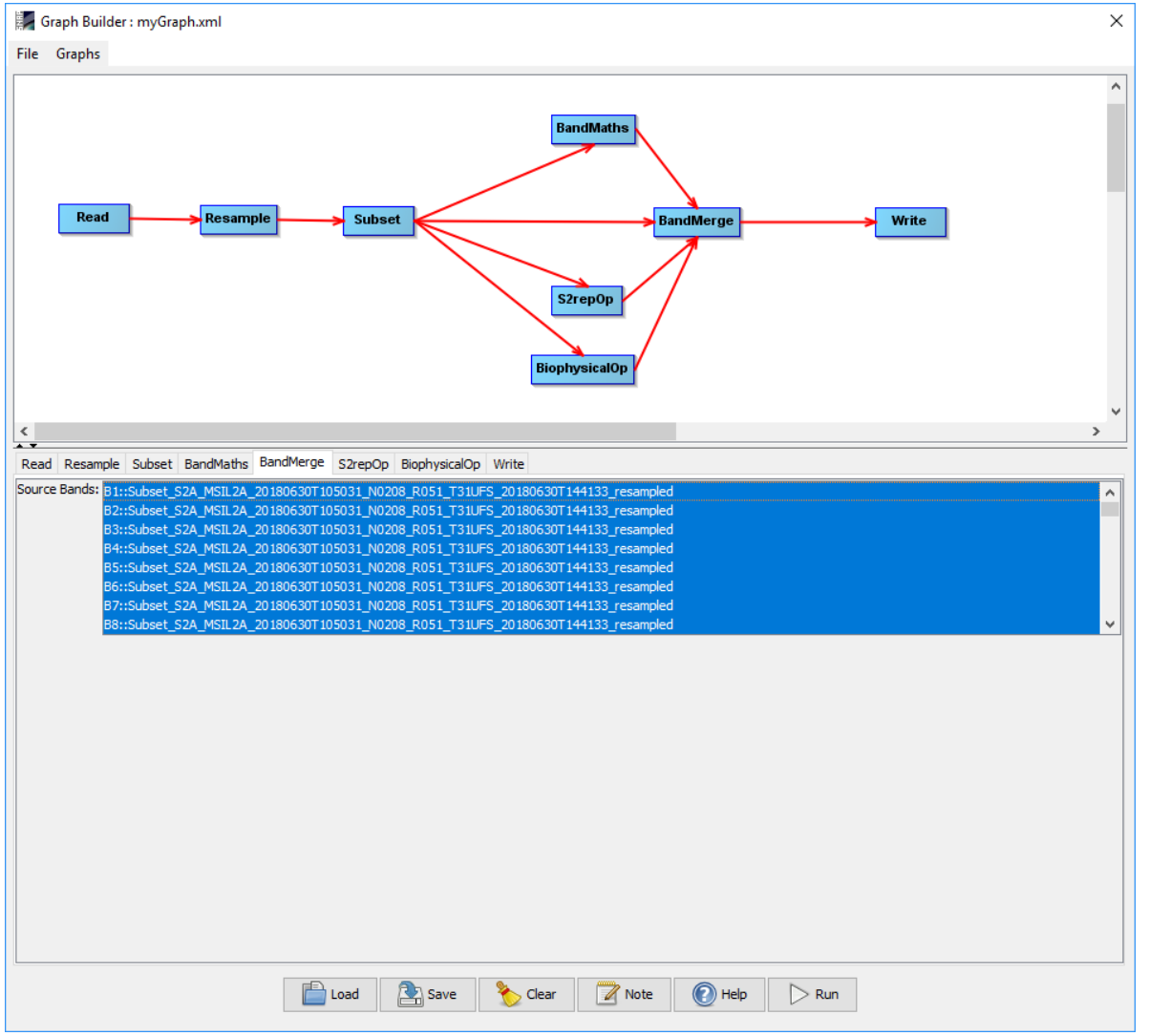
GraphBuilder (BiophysicalOp module)

The Biophysical Processor computes Level-2B Biophysical products from Sentinel-2 reflectances.
From Bottom Of Atmosphere normalized reflectance data, it derives a set of biophysical variables, namely:

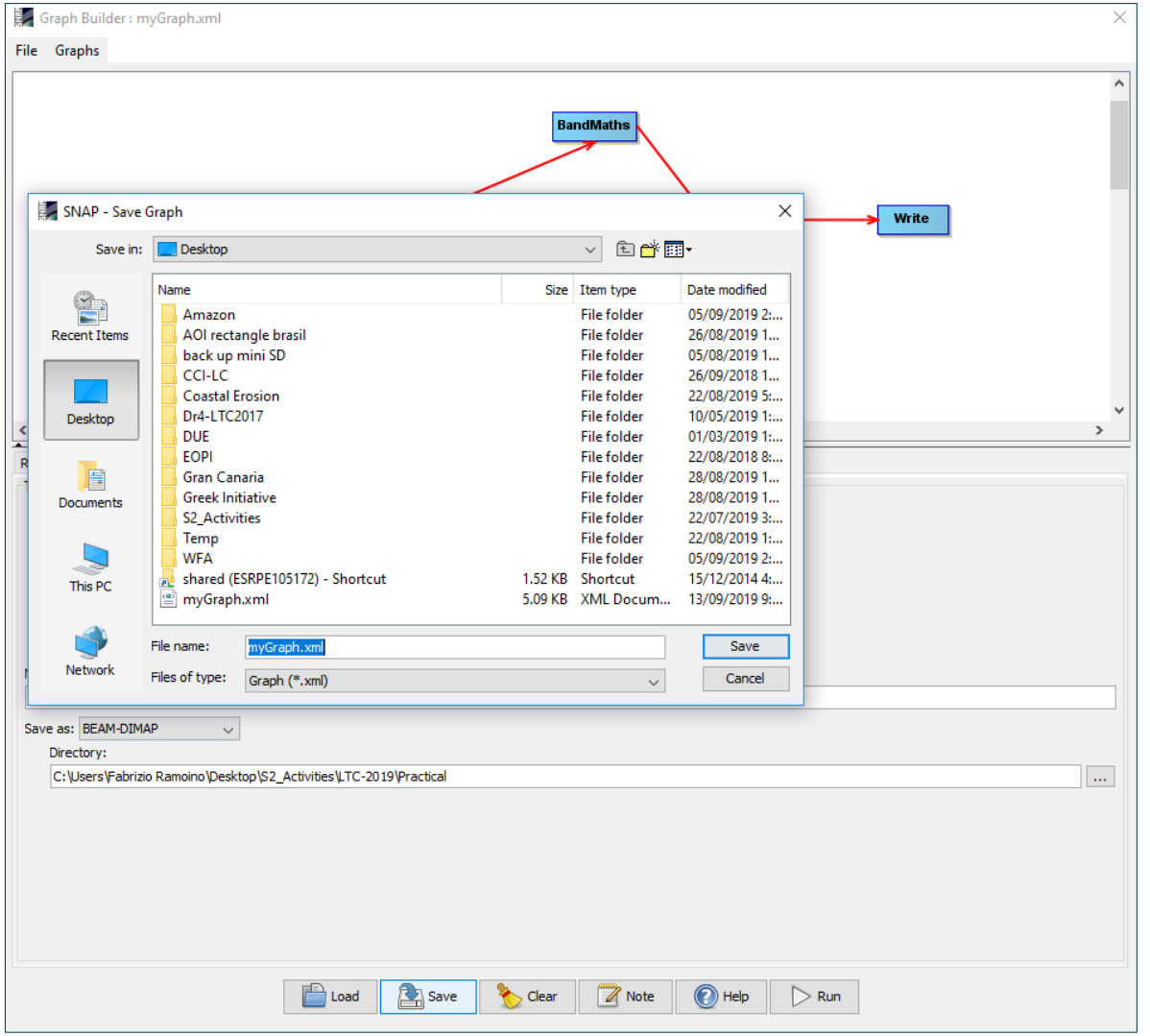
- ✓ LAI: Leaf Area Index
- ✓ fAPAR: Fraction of Absorbed Photosynthetically Active Radiation
- ✓ FVC: Fraction of vegetation cover
- ✓ Cab: Chlorophyll content in the leaf
- ✓ CWC: Canopy Water Content



GraphBuilder (Band Merge module)

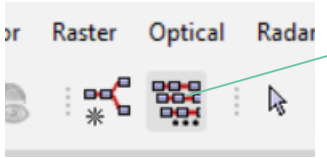


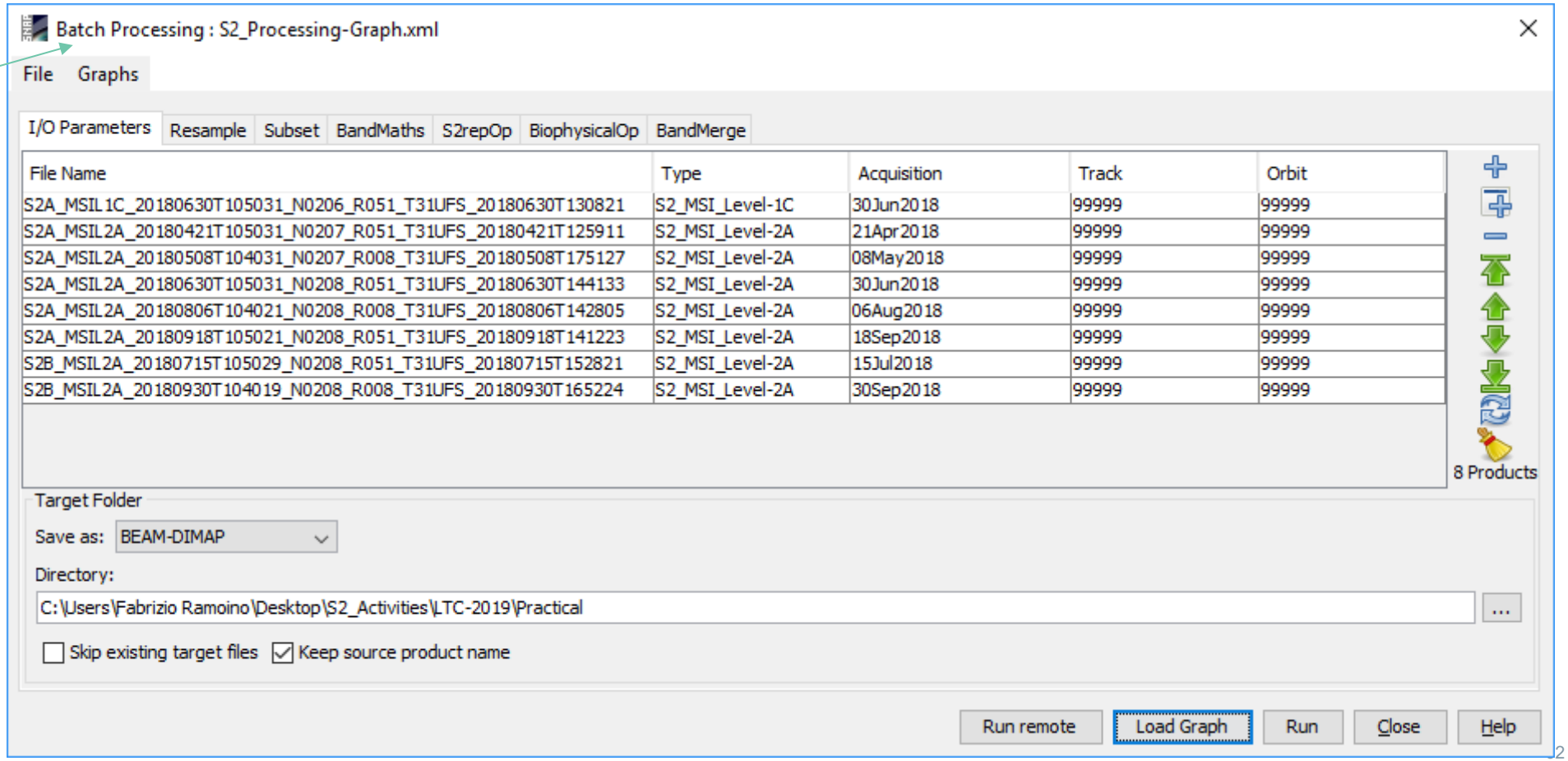
GraphBuilder (Save the graph)



Batch Processing

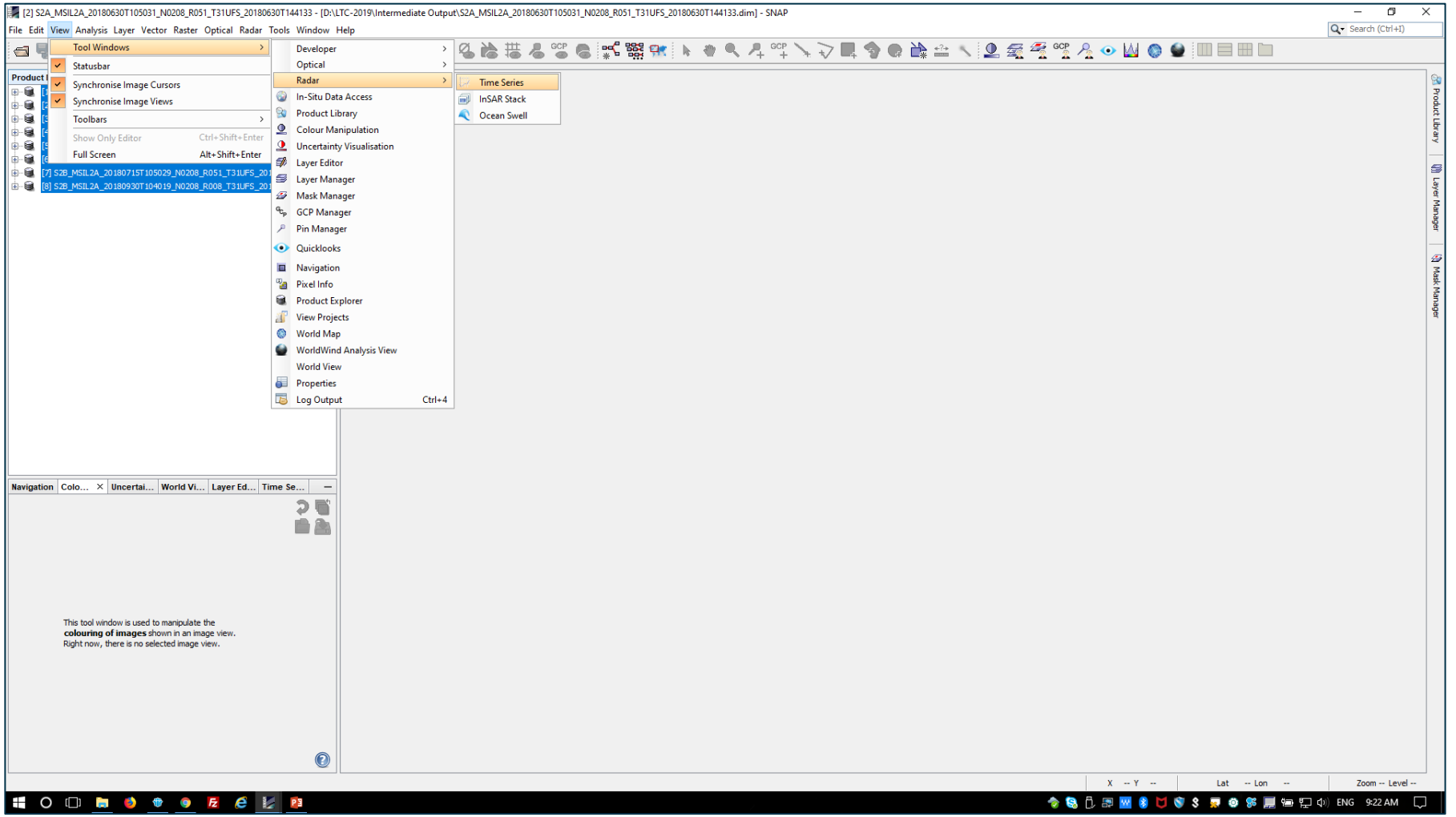
The Batch Processing tool allows you to execute a single reader/writer graph for a set of products. Select the Batch Processing tool from the Graphs menu and then press the "Load" button to browse for a previously saved graph. Next, add products in the I/O tab by pressing the "Add" button. Set the target folder where the output will be written to and then press "Run".





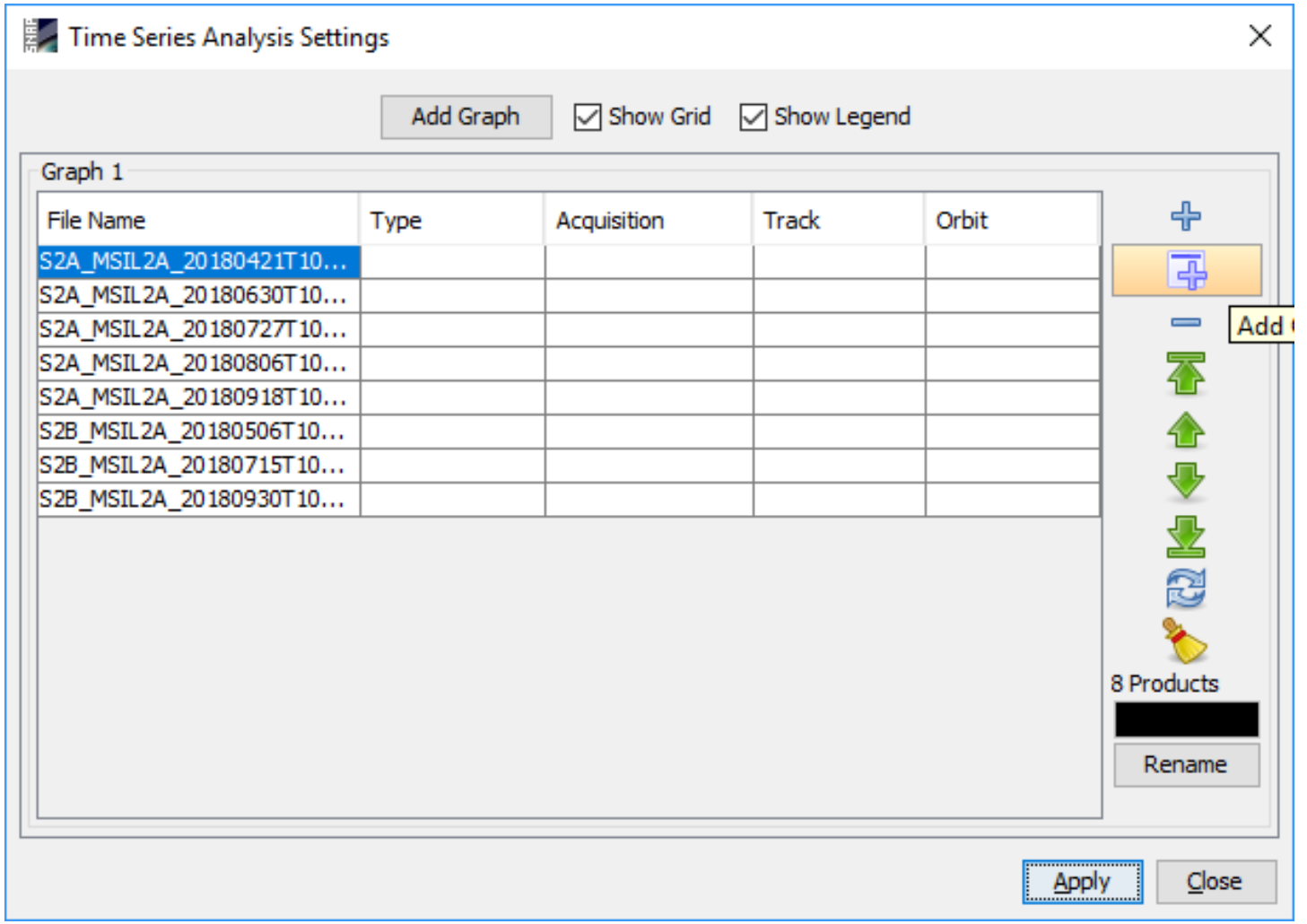
Time Series

Open them in SNAP and then open the Time Series Window. ‘View’ → ‘Tool Windows’ → ‘Radar’ → ‘Time Series’

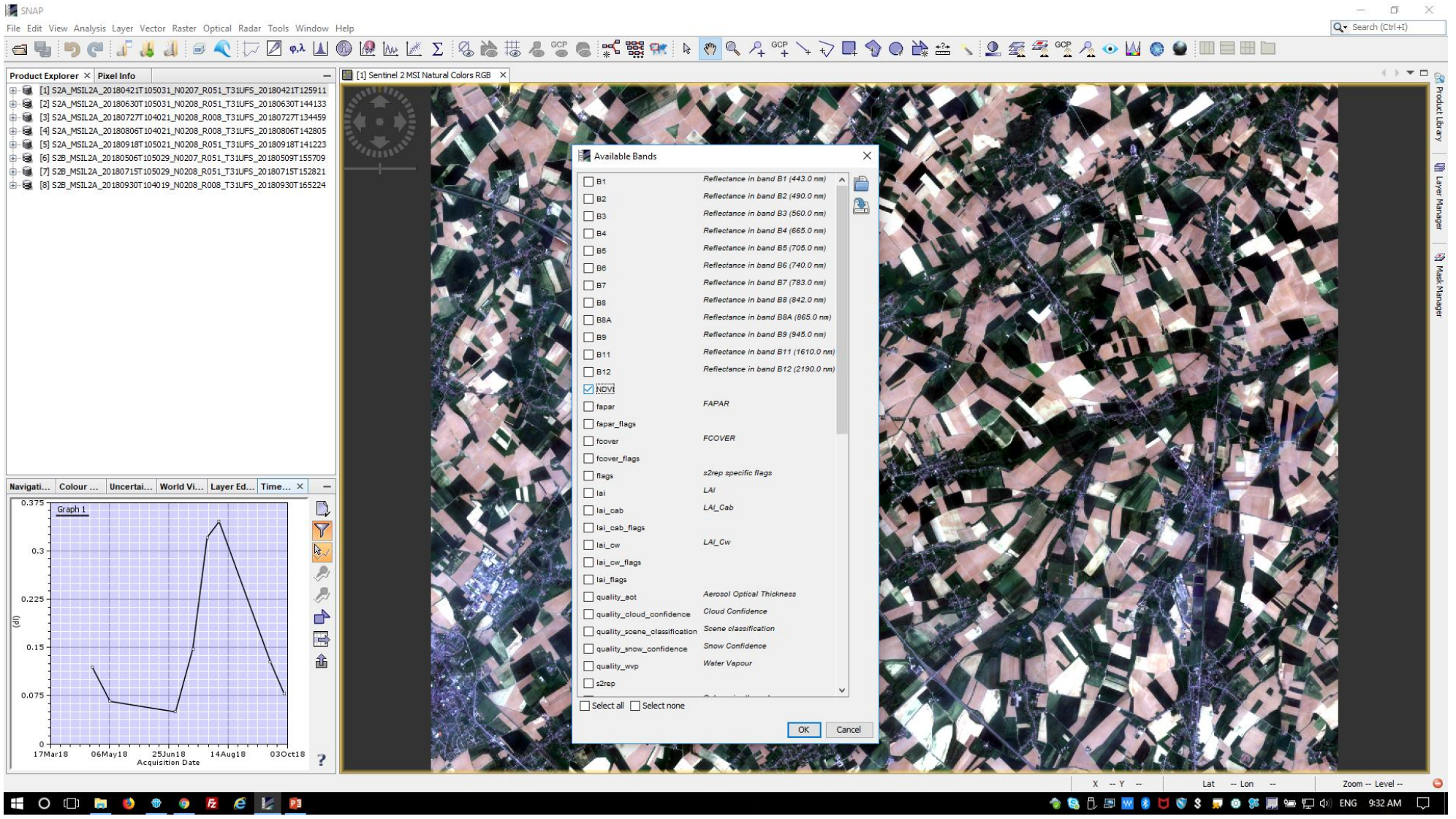


Time Series

To populate the time series you can add all the products opened in SNAP or browsing from your disk.



Time Series


SNAP
File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help
Product Explorer
Pixel Info
[1] S2A_MSIL2A_20180421T105031_N0207_R051_T31UFS_20180421T125911
[2] S2A_MSIL2A_20180630T105031_N0208_R051_T31UFS_20180630T144133
[3] S2A_MSIL2A_20180727T104021_N0208_R008_T31UFS_20180727T134459
[4] S2A_MSIL2A_20180806T104021_N0208_R008_T31UFS_20180806T142805
[5] S2A_MSIL2A_20180918T105021_N0208_R051_T31UFS_20180918T141223
[6] S2B_MSIL2A_20180506T105029_N0207_R051_T31UFS_20180509T155709
[7] S2B_MSIL2A_20180715T105029_N0208_R051_T31UFS_20180715T152821
[8] S2B_MSIL2A_20180930T104019_N0208_R008_T31UFS_20180930T165224
[1] Sentinel 2 MSI Natural Colors RGB
Available Bands
B1 Reflectance in band B1 (443.0 nm)
B2 Reflectance in band B2 (490.0 nm)
B3 Reflectance in band B3 (560.0 nm)
B4 Reflectance in band B4 (665.0 nm)
B5 Reflectance in band B5 (705.0 nm)
B6 Reflectance in band B6 (740.0 nm)
B7 Reflectance in band B7 (783.0 nm)
B8 Reflectance in band B8 (842.0 nm)
B8A Reflectance in band B8A (865.0 nm)
B9 Reflectance in band B9 (945.0 nm)
B11 Reflectance in band B11 (1610.0 nm)
B12 Reflectance in band B12 (2190.0 nm)
NDVI
fapar FAPAR
fapar_flags
fcover FCOVER
fcover_flags
flags s2rep specific flags
lai LAI
lai_cab LAI_Cab
lai_cab_flags
lai_cw LAI_Cw
lai_cw_flags
lai_flags
quality_aot Aerosol Optical Thickness
quality_cloud_confidence Cloud Confidence
quality_scene_classification Scene classification
quality_snow_confidence Snow Confidence
quality_wvp Water Vapour
s2rep
Select all Select none
OK Cancel
Graph 1
0.375
0.3
0.225
0.15
0.075
0
(dl)
17Mar18 06May18 25Jun18 14Aug18 03Oct18
Acquisition Date
Product Library
Layer Manager
Mask Manager
X -- Y --
Lat -- Lon --
Zoom -- Level --
ENG 9:32 AM

Radar data processing in SNAP for Agricultural applications

Introduction

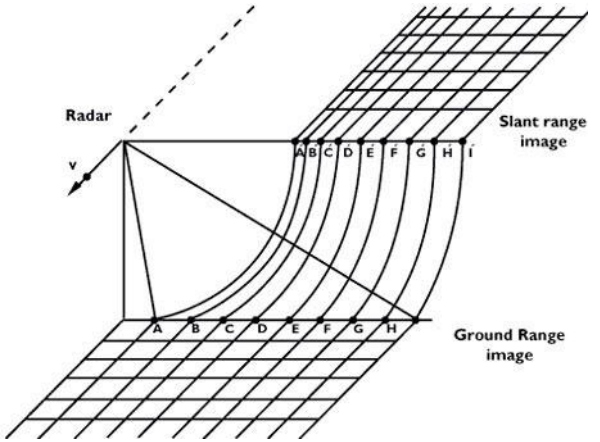
Input data: time series of Sentinel-1 GRDH images

Output: temporal backscatter signatures for various crops

Sentinel-1 level 1 GRDH – what's that?

Available products

- Level 0 (L0-RAW)
- Level 1 Ground Range Detected, Multi-Looked, projected to ground range using Earth ellipsoid model WGS84- Medium Resolution (L1-GRDM) and High Resolution (L1-GRDH)
- Level 1 Single-Look Complex (L1-SLC)
- Level 2 Ocean (L2-OCN)

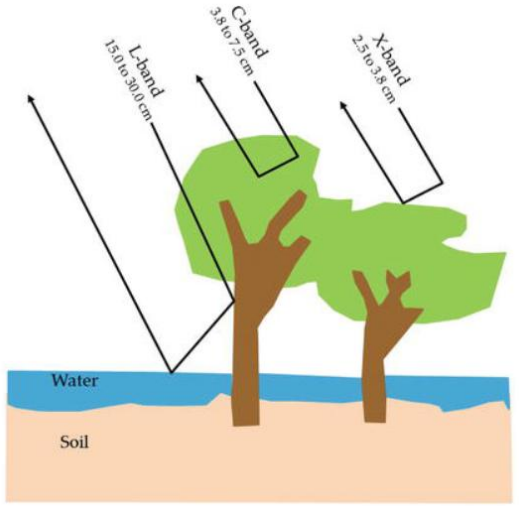


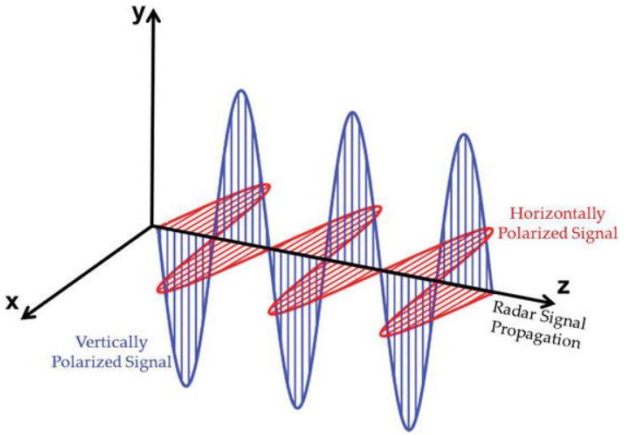
REMEMBER

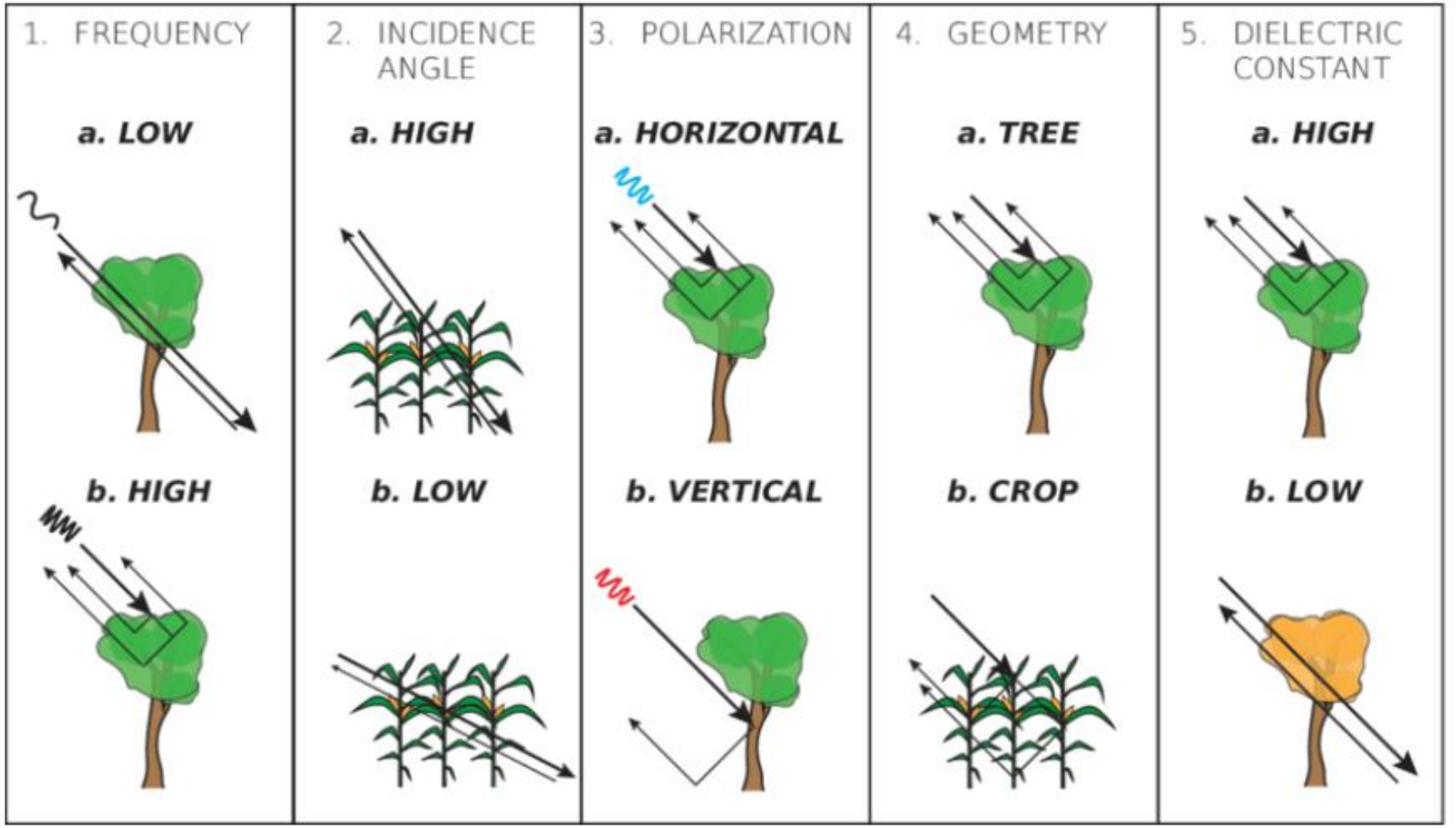
In GRD data

- Ground range coordinates are the slant range coordinates projected onto the ellipsoid of the Earth.
- Pixel values represent detected amplitude – the power of reflected signal which depends on the surface scattering characteristics
- Phase information is lost.
- The resulting product has approximately square resolution pixels and square pixel spacing with reduced speckle at a cost of reduced spatial resolution.

Scattering mechanisms





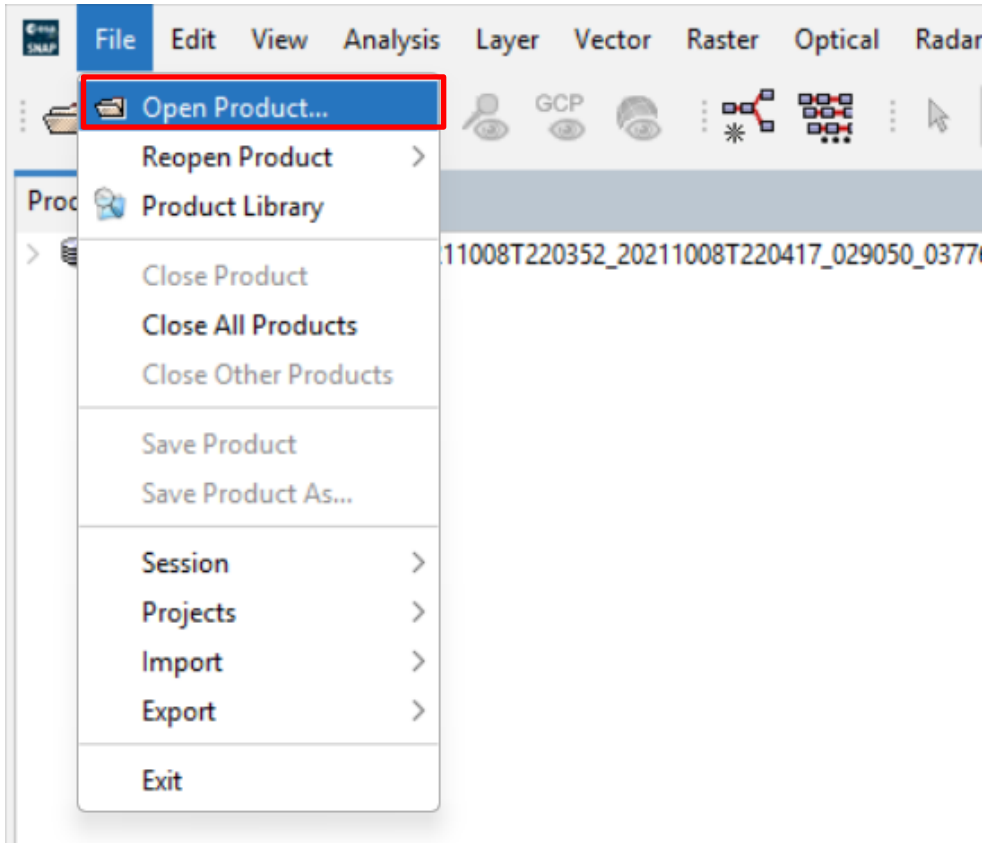


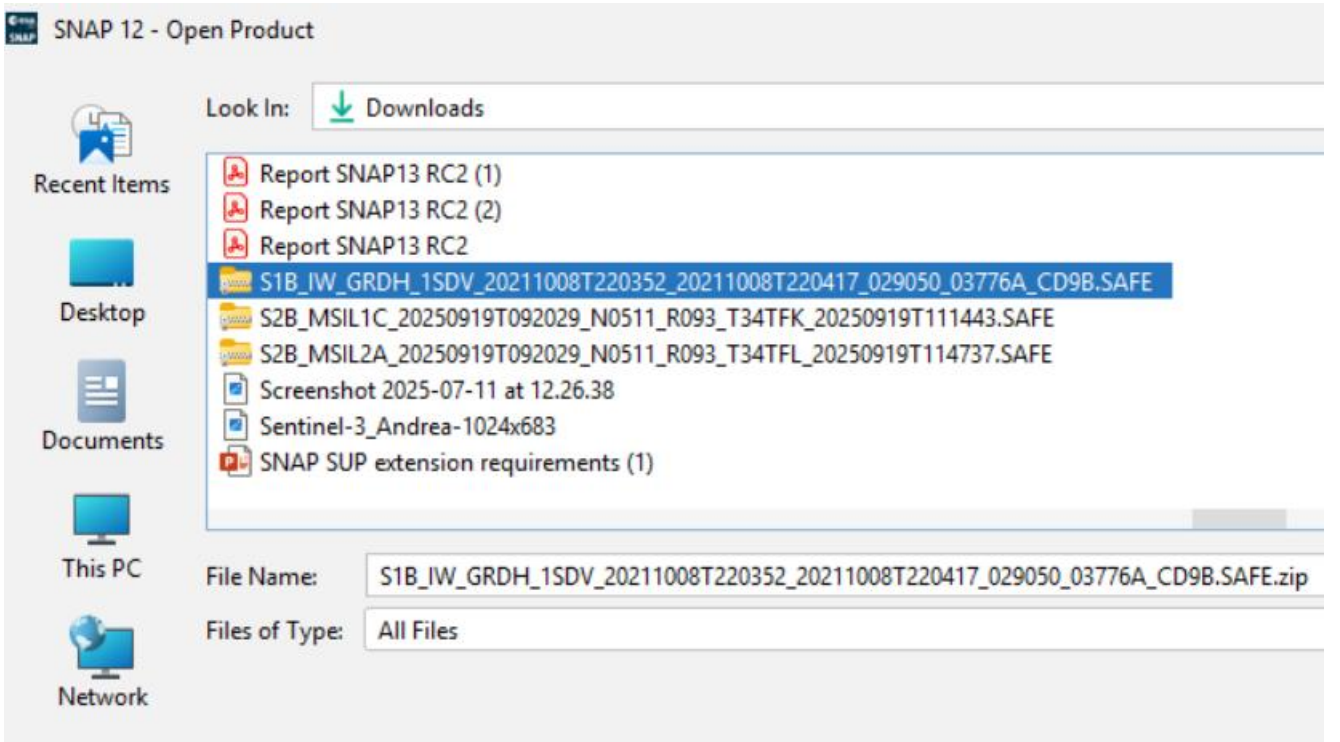
Data processing

- Creating a subset of S1 GRDH images
  Spatial subset depending on the AOI
- Radiometric calibration
  Conversion of image intensity to sigma0 providing the radar backscatter
- Terrain correction
  Compensate for geometric distortions caused by topographical variations of a scene and the tilt of satellite sensor
- Creating a multitemporal stack
  Collocation spatially overlapping products (based on geolocation)
- Speckle filtering
  Filtering the inherent salt and pepper like texturing called speckles
- Linear to dB conversion
  Compensate for very high dynamic range in visualisation
- Stack statistics
  Analysis of temporal backscatter signatures

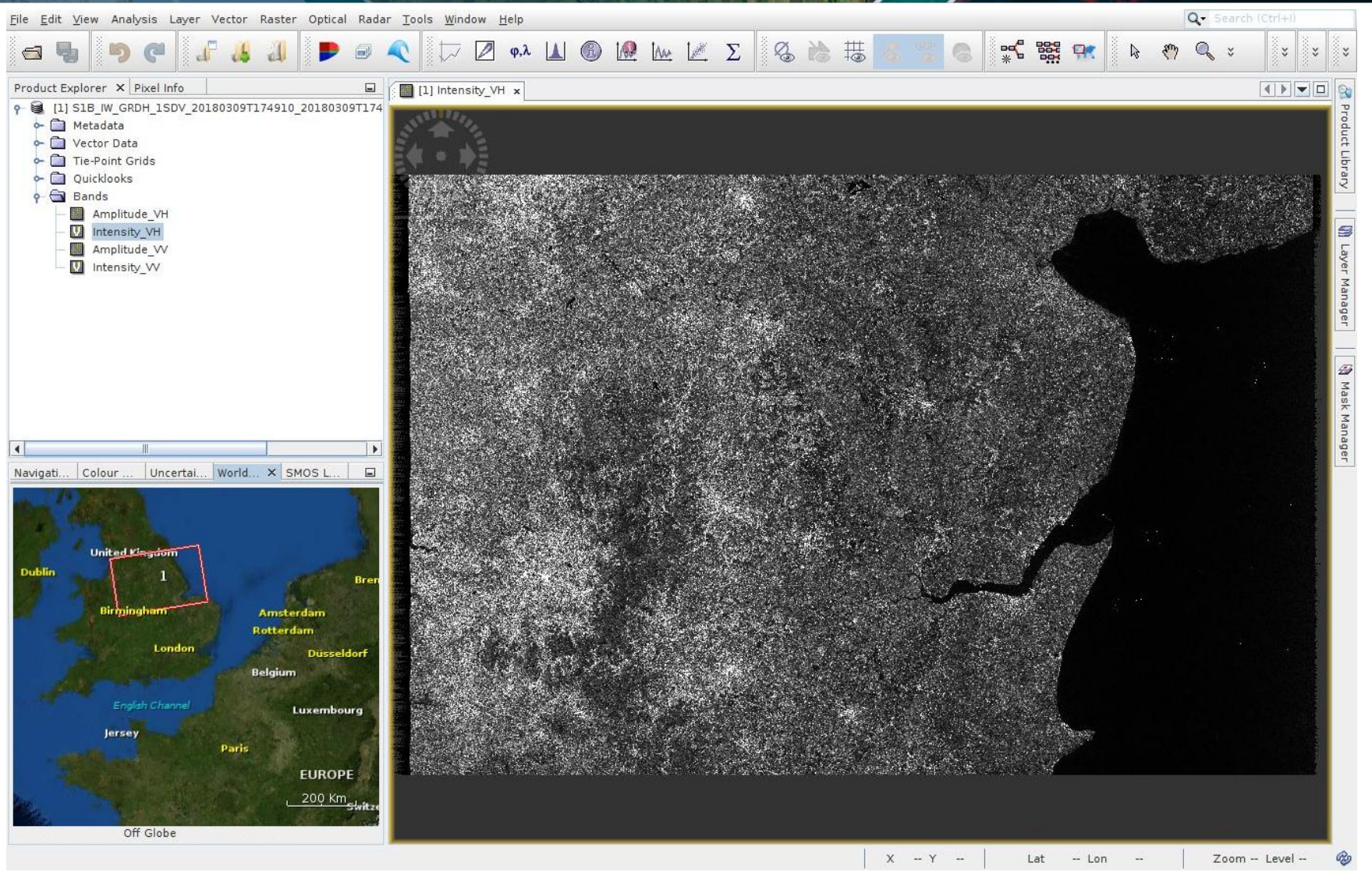
Data preparation

Opening the S1 data

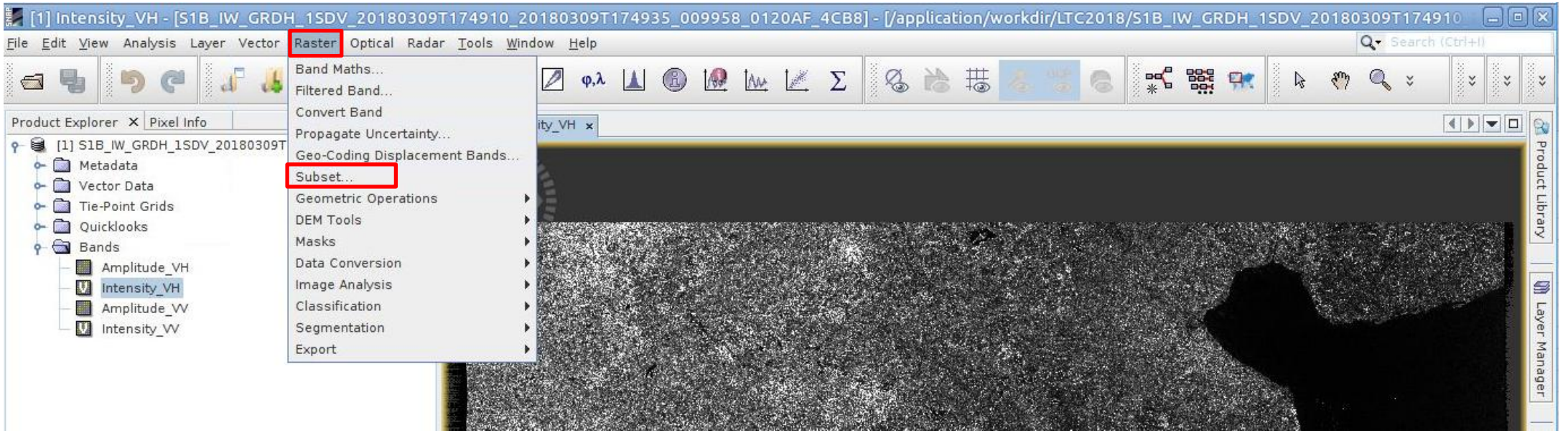




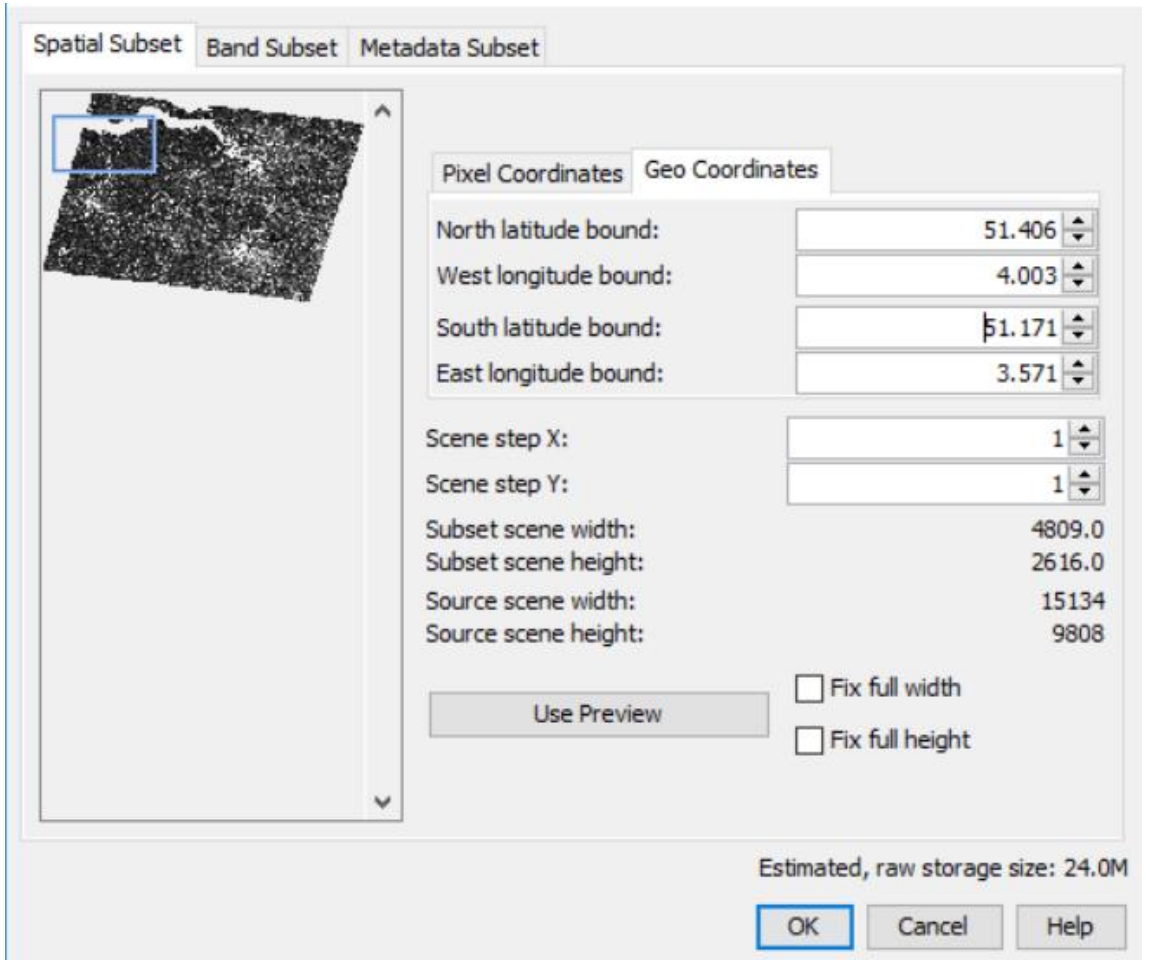
Data preparation

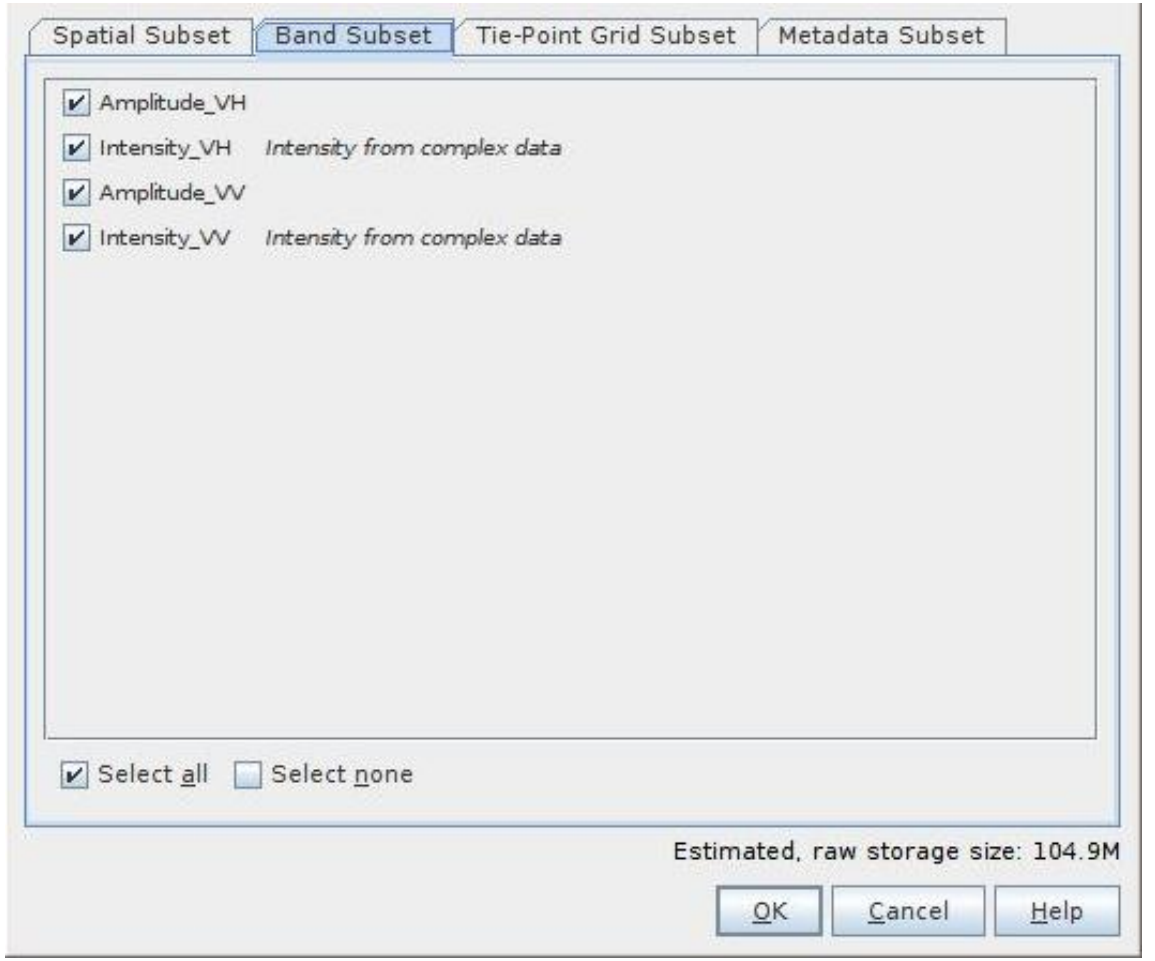


Spatial subset

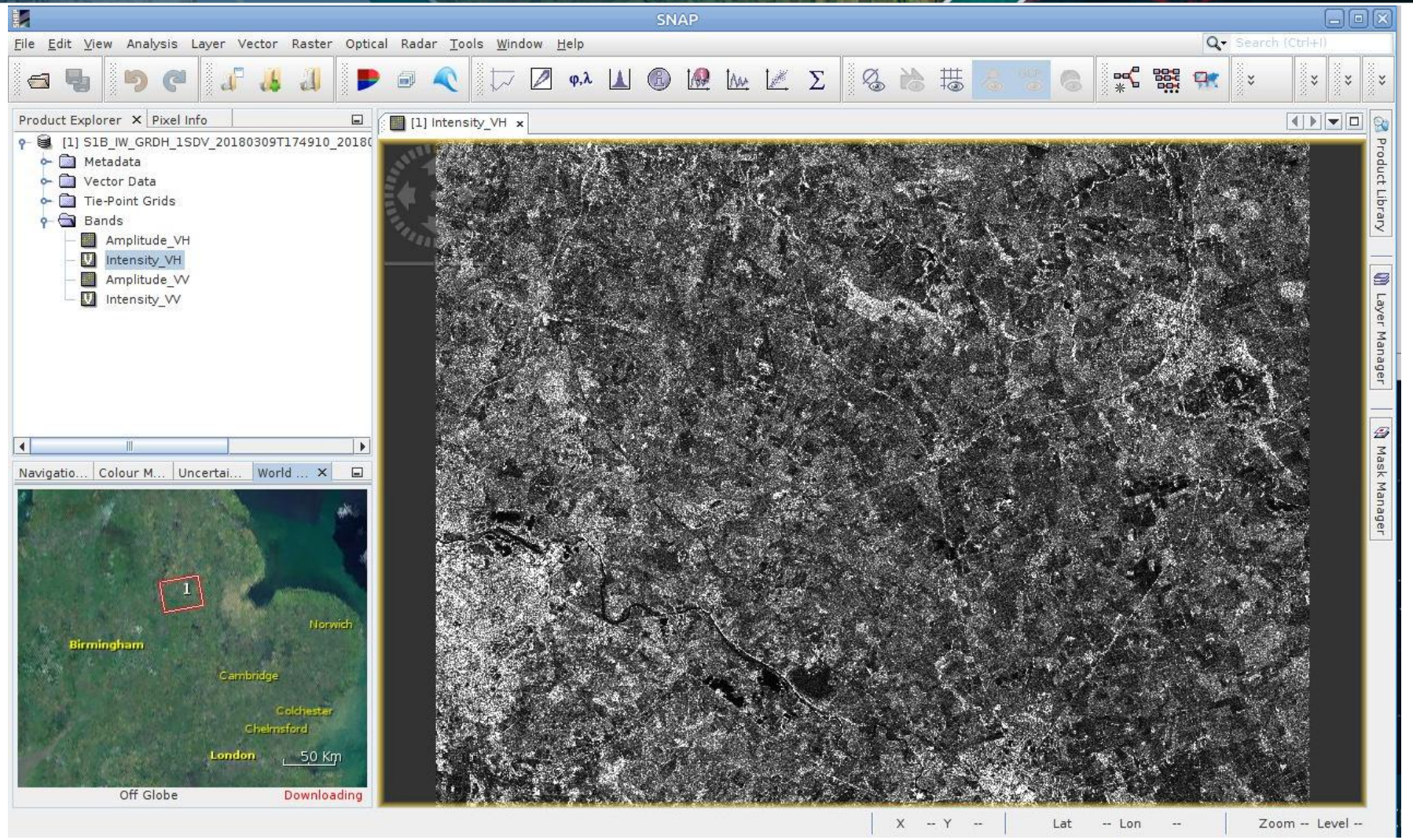


Spatial subset - parameters





Data check


SNAP
File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help
Search (Ctrl+I)
Product Explorer
Pixel Info
[1] S1B_IW_GRDH_1SDV_20180309T174910_2018
Metadata
Vector Data
Tie-Point Grids
Bands
Amplitude_VH
Intensity_VH
Amplitude_VV
Intensity_VV
[1] Intensity_VH
Navigatio...
Colour M...
Uncertai...
World ...
Norwich
Birmingham
Cambridge
Colchester
Chelmsford
London
50 Km
Off Globe
Downloading
Product Library
Layer Manager
Mask Manager
X -- Y --
Lat -- Lon --
Zoom -- Level --

Data processing

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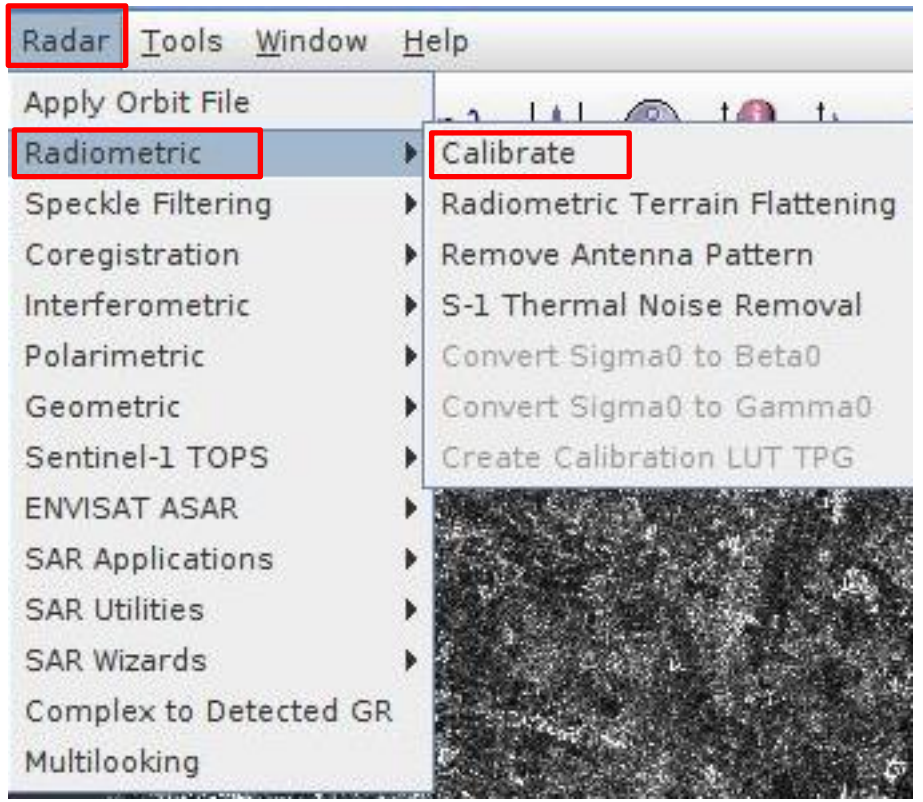
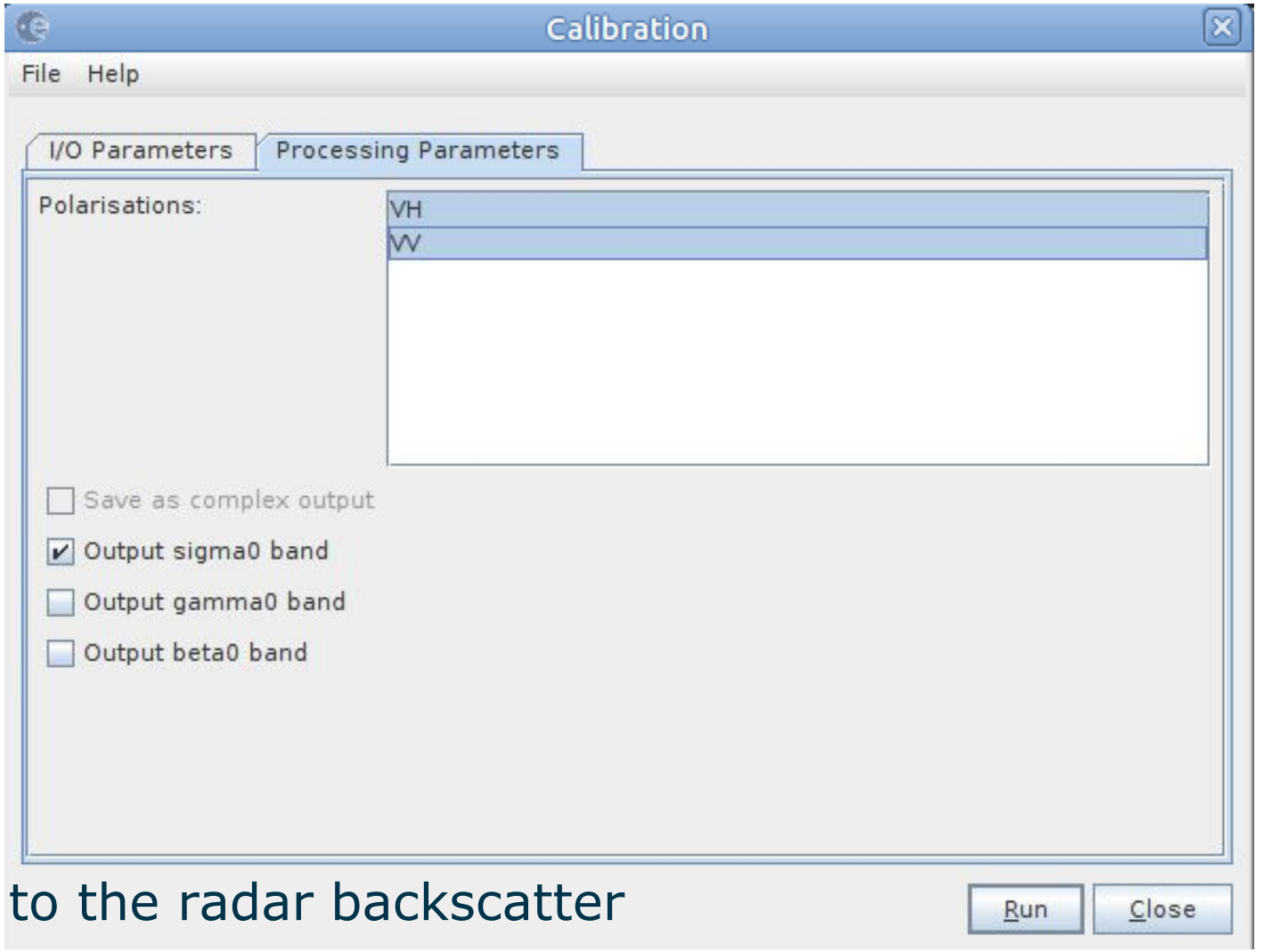
Radiometric Calibration





Pixel values can be directly related to the radar backscatter

Data processing

- Creating a subset of S1 GRDH images
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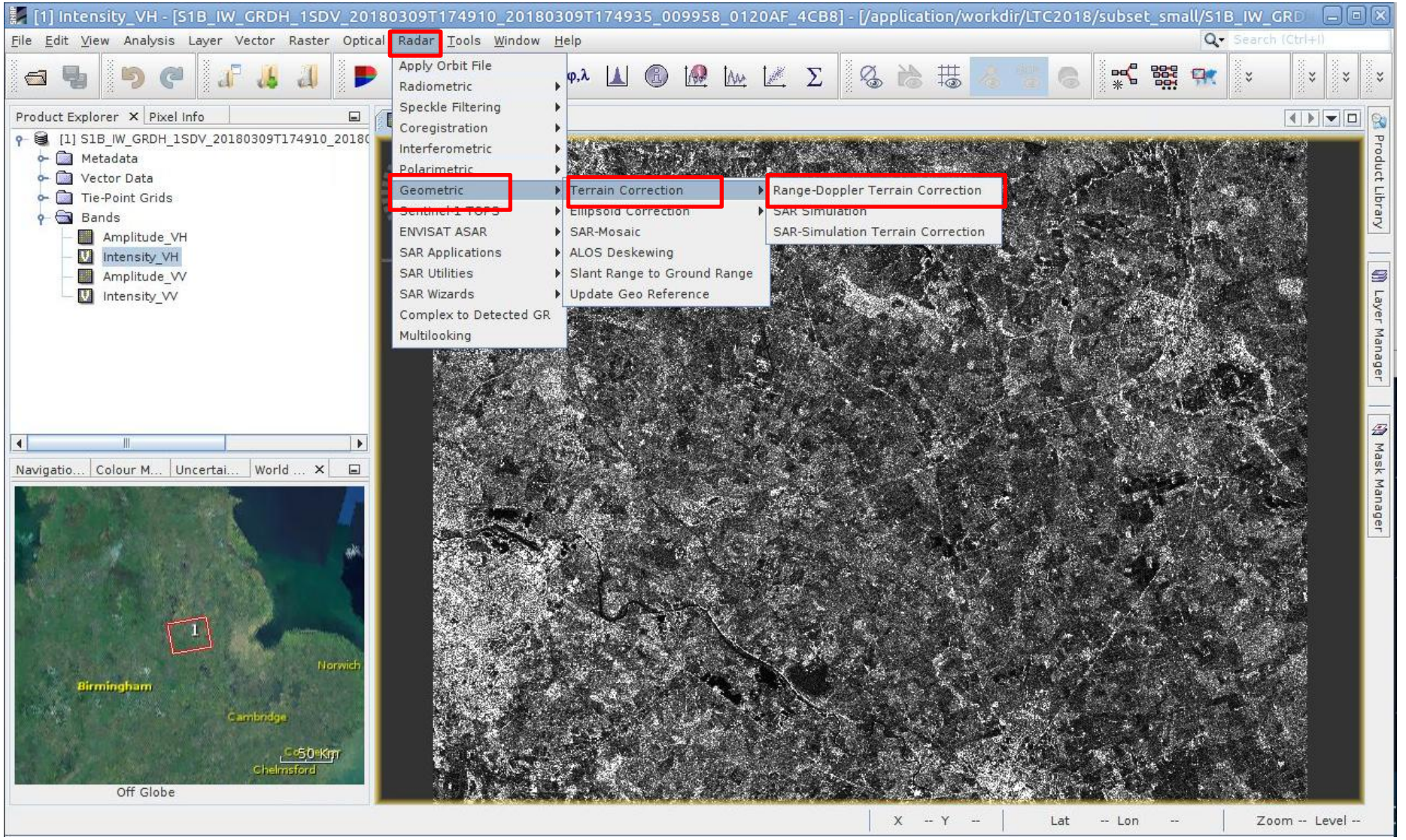
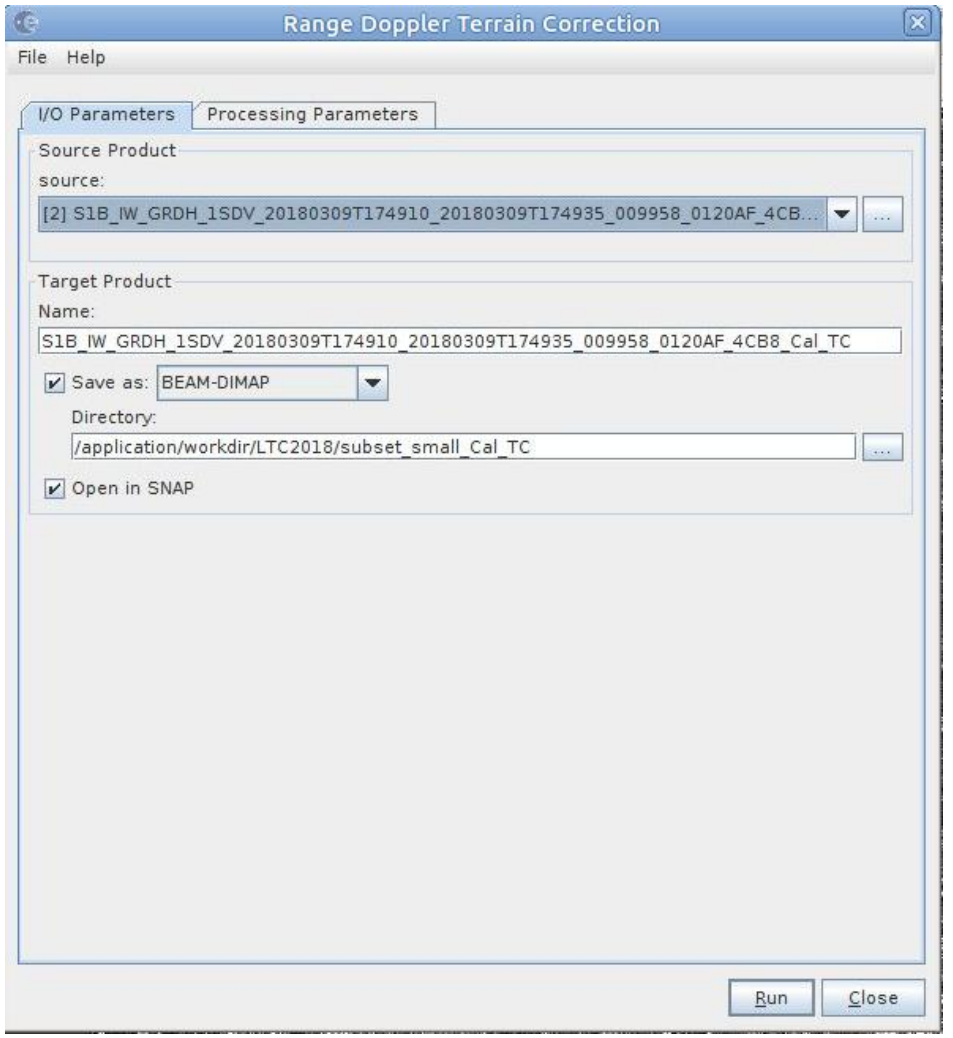
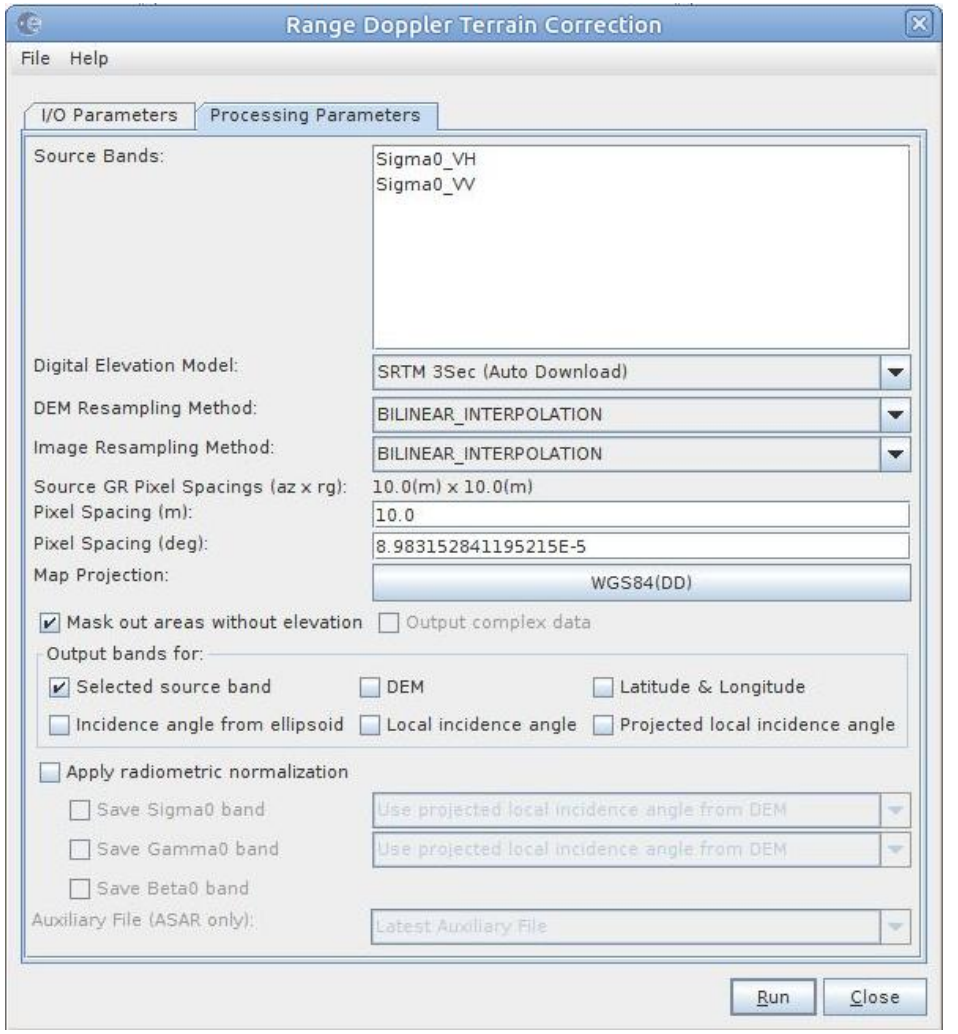
Geocoding

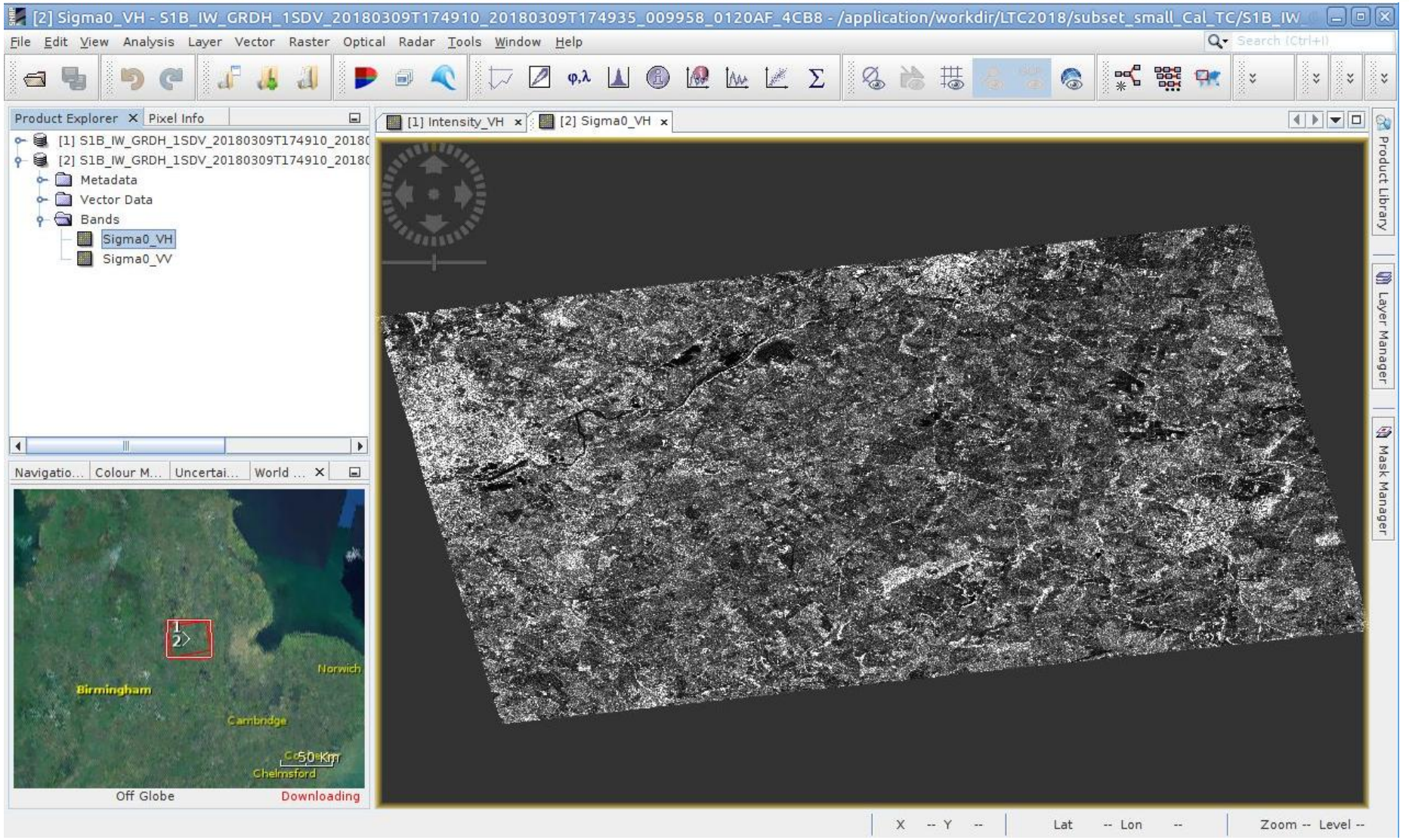

[1] Intensity_VH - [S1B_IW_GRDH_1SDV_20180309T174910_20180309T174935_009958_0120AF_4CB8] - [/application/workdir/LTC2018/subset_small/S1B_IW_GRD
File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help
Search (Ctrl+I)
Apply Orbit File
Radiometric
Speckle Filtering
Coregistration
Interferometric
Polarimetric
Geometric
Sentinel-1 TOPS
ENVISAT ASAR
SAR Applications
SAR Utilities
SAR Wizards
Complex to Detected GR
Multilooking
Terrain Correction
Ellipsoid Correction
SAR-Mosaic
ALOS Deskewing
Slant Range to Ground Range
Update Geo Reference
Range-Doppler Terrain Correction
SAR Simulation
SAR-Simulation Terrain Correction
Product Explorer
Pixel Info
[1] S1B_IW_GRDH_1SDV_20180309T174910_2018
Metadata
Vector Data
Tie-Point Grids
Bands
Amplitude_VH
Intensity_VH
Amplitude_VV
Intensity_VV
Navigatio...
Colour M...
Uncertai...
World ...
Norwich
Birmingham
Cambridge
Chelmsford
50 Km
Off Globe
Product Library
Layer Manager
Mask Manager
X -- Y --
Lat -- Lon --
Zoom -- Level --

Geocoding

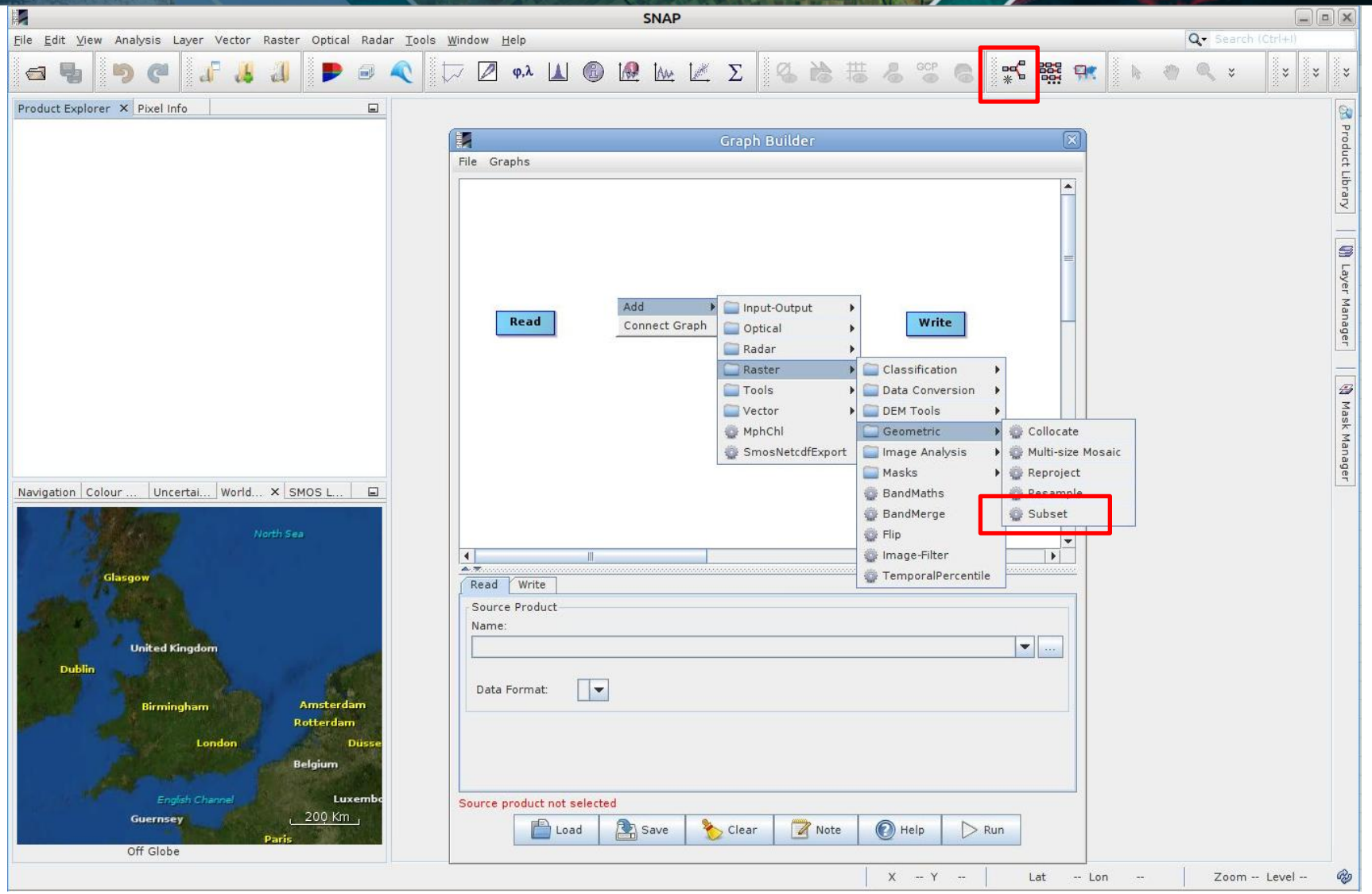

Range Doppler Terrain Correction
File Help
I/O Parameters
Processing Parameters
Source Product
source:
[2] S1B_IW_GRDH_1SDV_20180309T174910_20180309T174935_009958_0120AF_4CB...
Target Product
Name:
S1B_IW_GRDH_1SDV_20180309T174910_20180309T174935_009958_0120AF_4CB8_Cal_TC
Save as:
BEAM-DIMAP
Directory:
/application/workdir/LTC2018/subset_small_Cal_TC
Open in SNAP
Run
Close


Range Doppler Terrain Correction
File Help
I/O Parameters
Processing Parameters
Source Bands:
Sigma0_VH
Sigma0_VV
Digital Elevation Model:
SRTM 3Sec (Auto Download)
DEM Resampling Method:
BILINEAR_INTERPOLATION
Image Resampling Method:
BILINEAR_INTERPOLATION
Source GR Pixel Spacings (az x rg):
10.0(m) x 10.0(m)
Pixel Spacing (m):
10.0
Pixel Spacing (deg):
8.983152841195215E-5
Map Projection:
WGS84(DD)
Mask out areas without elevation
Output complex data
Output bands for:
Selected source band
DEM
Latitude & Longitude
Incidence angle from ellipsoid
Local incidence angle
Projected local incidence angle
Apply radiometric normalization
Save Sigma0 band
Save Gamma0 band
Save Beta0 band
Auxiliary File (ASAR only):
Latest Auxiliary File
Run
Close

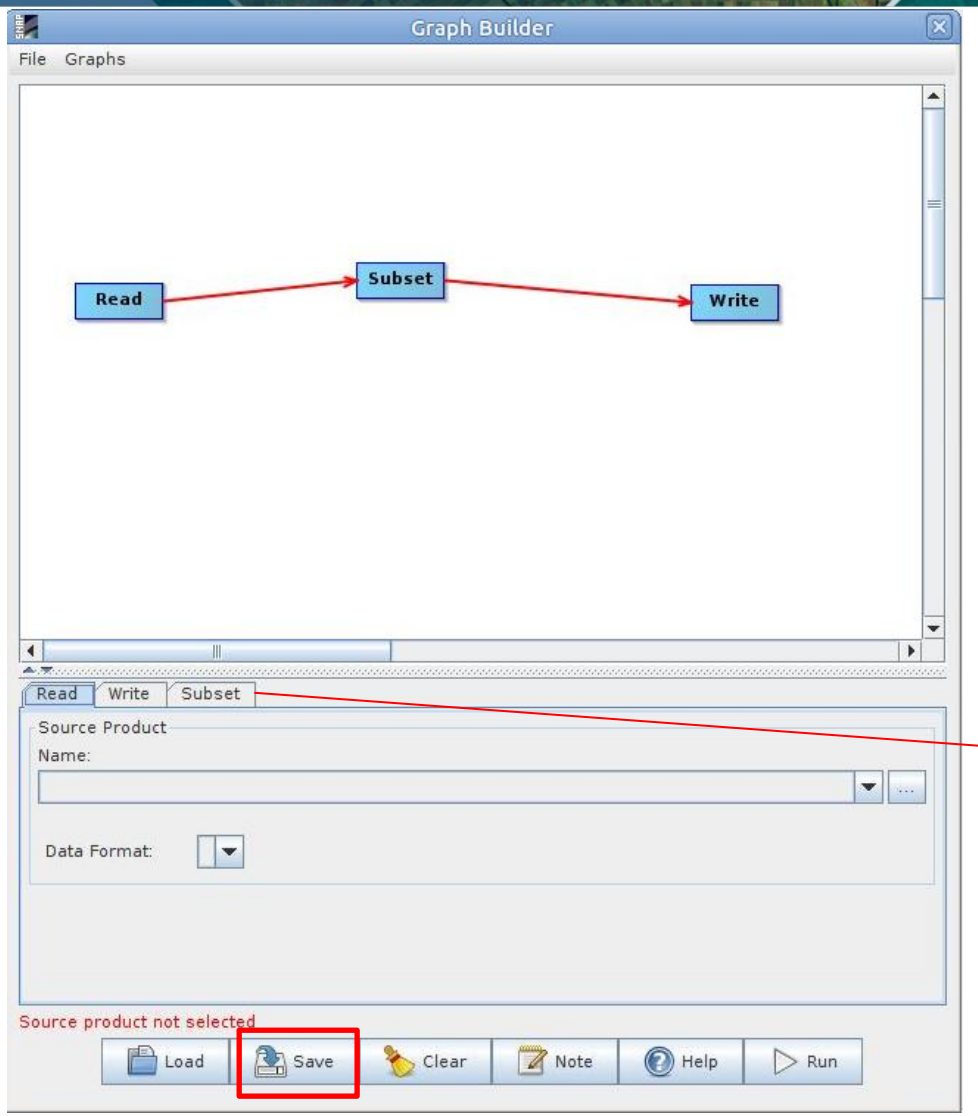
Data check


[2] Sigma0_VH - S1B_IW_GRDH_1SDV_20180309T174910_20180309T174935_009958_0120AF_4CB8 - /application/workdir/LTC2018/subset_small_Cal_TC/S1B_IW
File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help
Search (Ctrl+I)
Product Explorer
Pixel Info
[1] S1B_IW_GRDH_1SDV_20180309T174910_2018(
[2] S1B_IW_GRDH_1SDV_20180309T174910_2018(
Metadata
Vector Data
Bands
Sigma0_VH
Sigma0_VV
Navigatio...
Colour M...
Uncertai...
World ...
Norwich
Birmingham
Cambridge
50 Km
Chelmsford
Off Globe
Downloading
[1] Intensity_VH
[2] Sigma0_VH
Product Library
Layer Manager
Mask Manager
X -- Y --
Lat -- Lon --
Zoom -- Level --

Spatial subset – batch processing with automatic processing graph

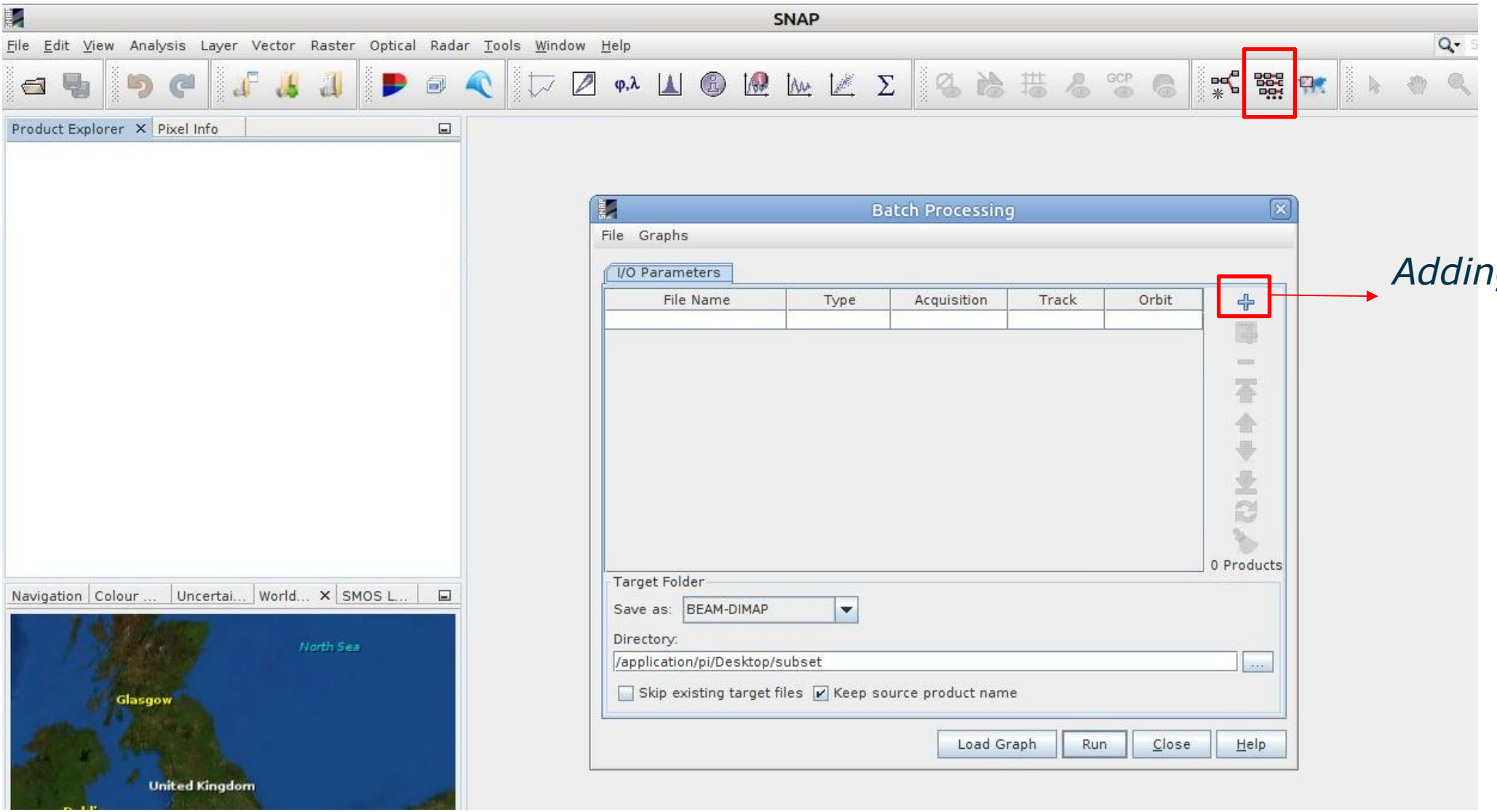


Spatial subset - automatic processing graph



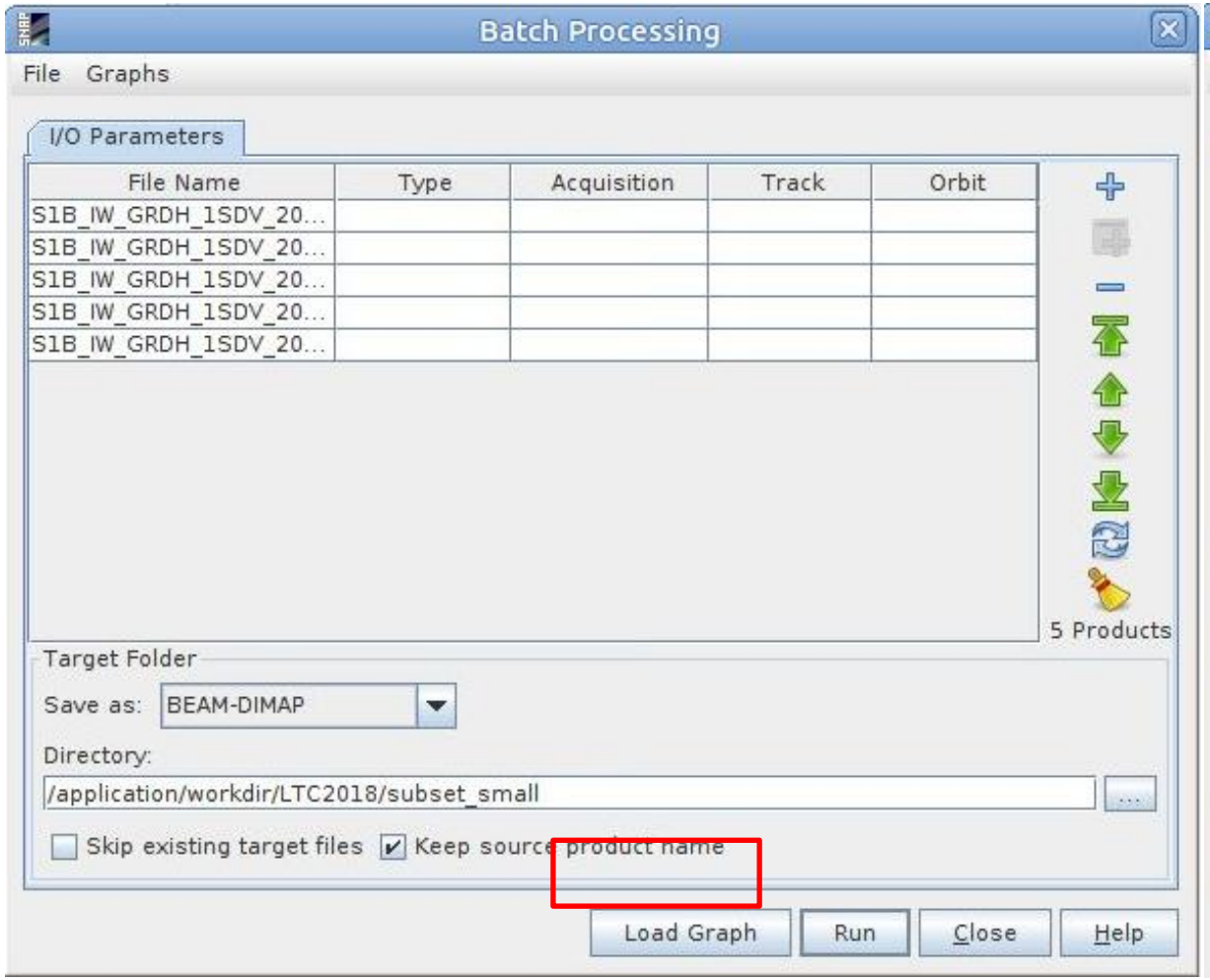
Parameters of the subset (e.g. spatial extent)

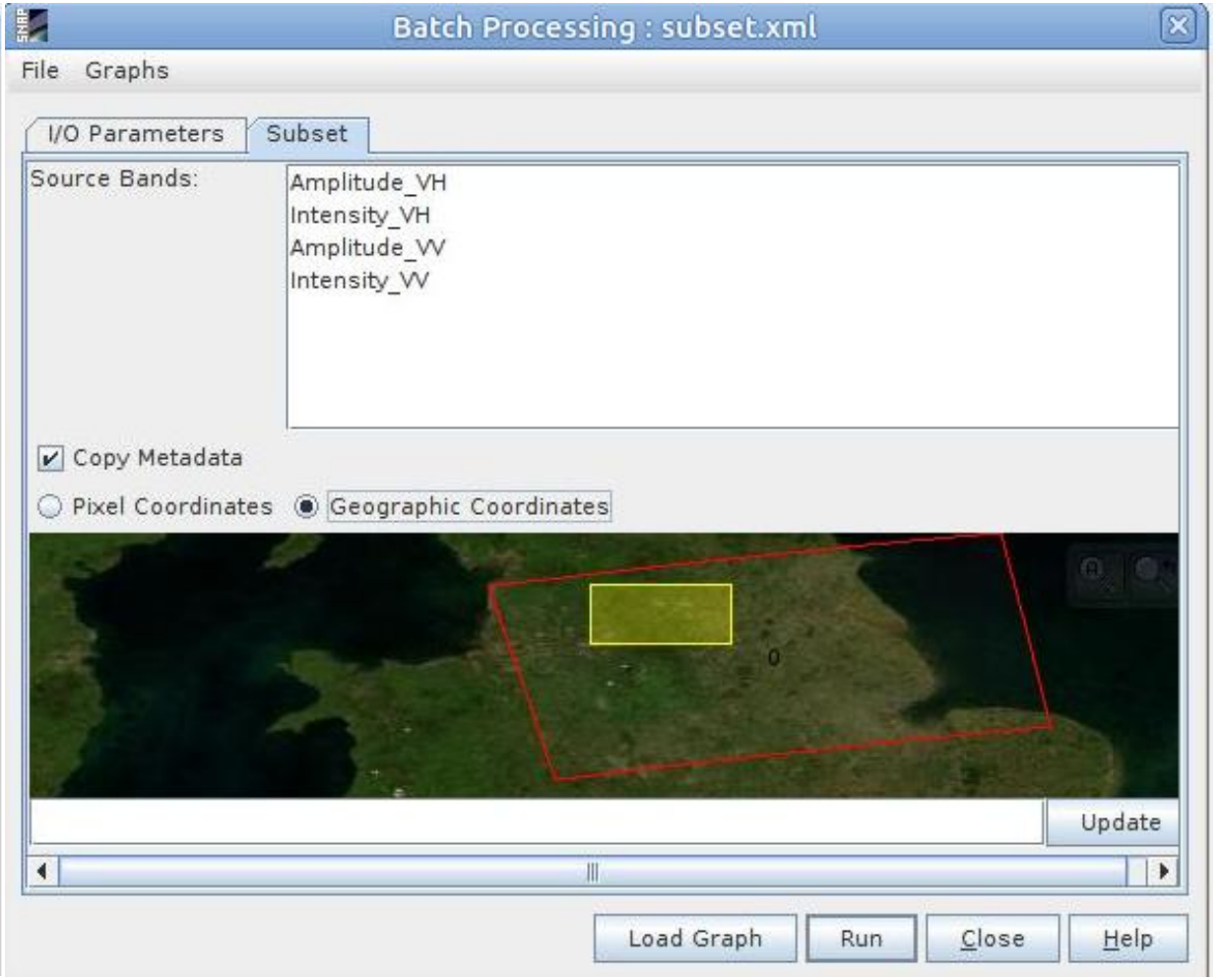
Spatial subset – batch processing



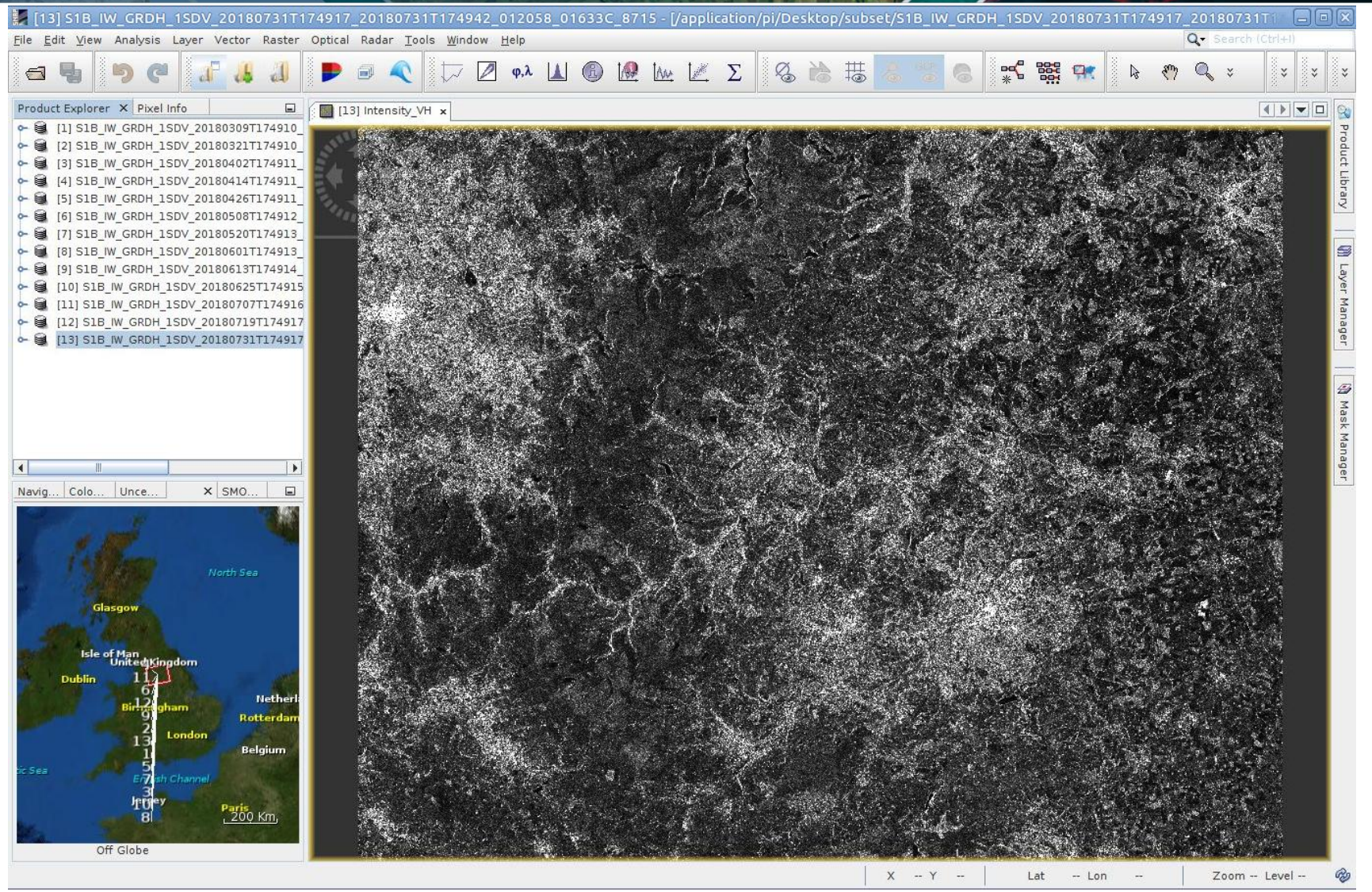
Adding data products

Spatial subset – batch processing





Data check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File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help
Search (Ctrl+I)
Product Explorer
Pixel Info
[1] S1B_IW_GRDH_1SDV_20180309T174910_
[2] S1B_IW_GRDH_1SDV_20180321T174910_
[3] S1B_IW_GRDH_1SDV_20180402T174911_
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[6] S1B_IW_GRDH_1SDV_20180508T174912_
[7] S1B_IW_GRDH_1SDV_20180520T174913_
[8] S1B_IW_GRDH_1SDV_20180601T174913_
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[10] S1B_IW_GRDH_1SDV_20180625T174915
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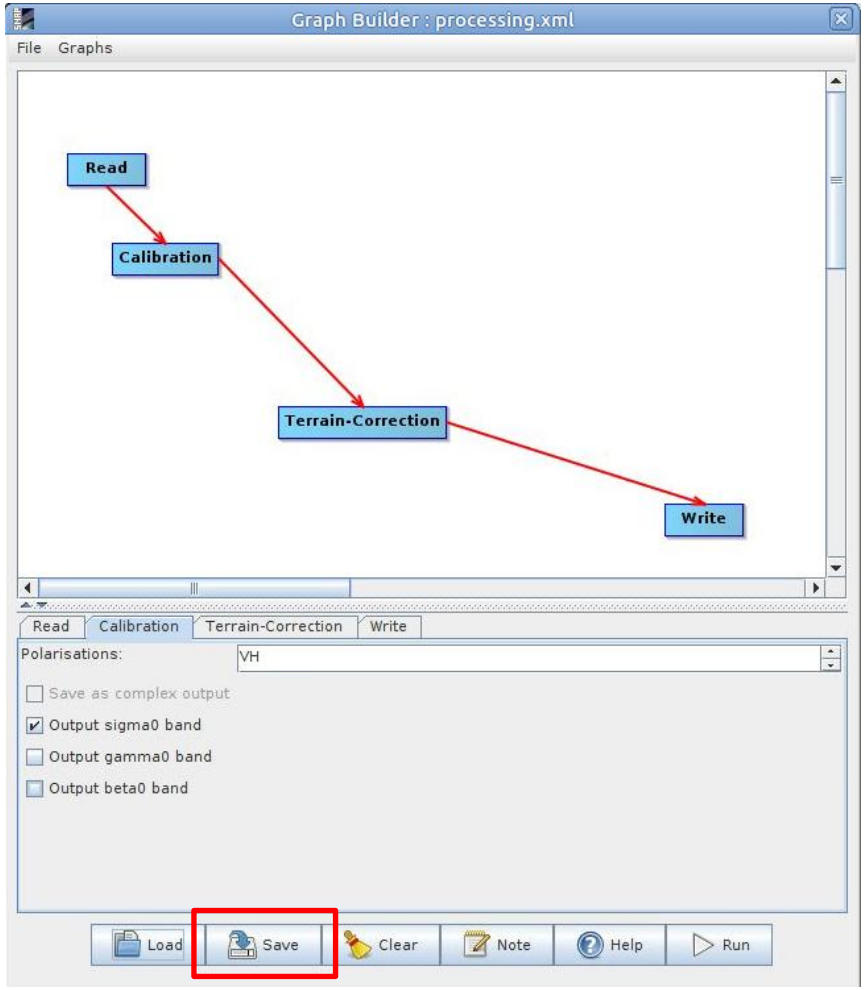
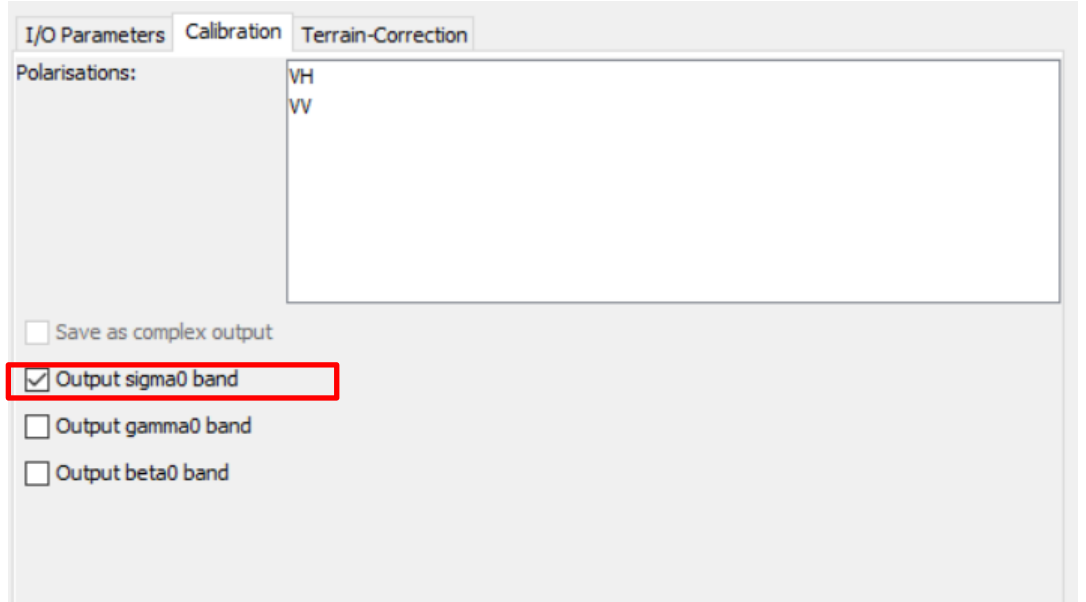
[13] S1B_IW_GRDH_1SDV_20180731T174917
Navig... Colo... Unce... SMO...
North Sea
Glasgow
Isle of Man
United Kingdom
Dublin
Netherl
Rotterdam
London
Belgium
Paris
200 Km
Off Globe
[13] Intensity_VH
Product Library
Layer Manager
Mask Manager
X -- Y --
Lat -- Lon --
Zoom -- Level --

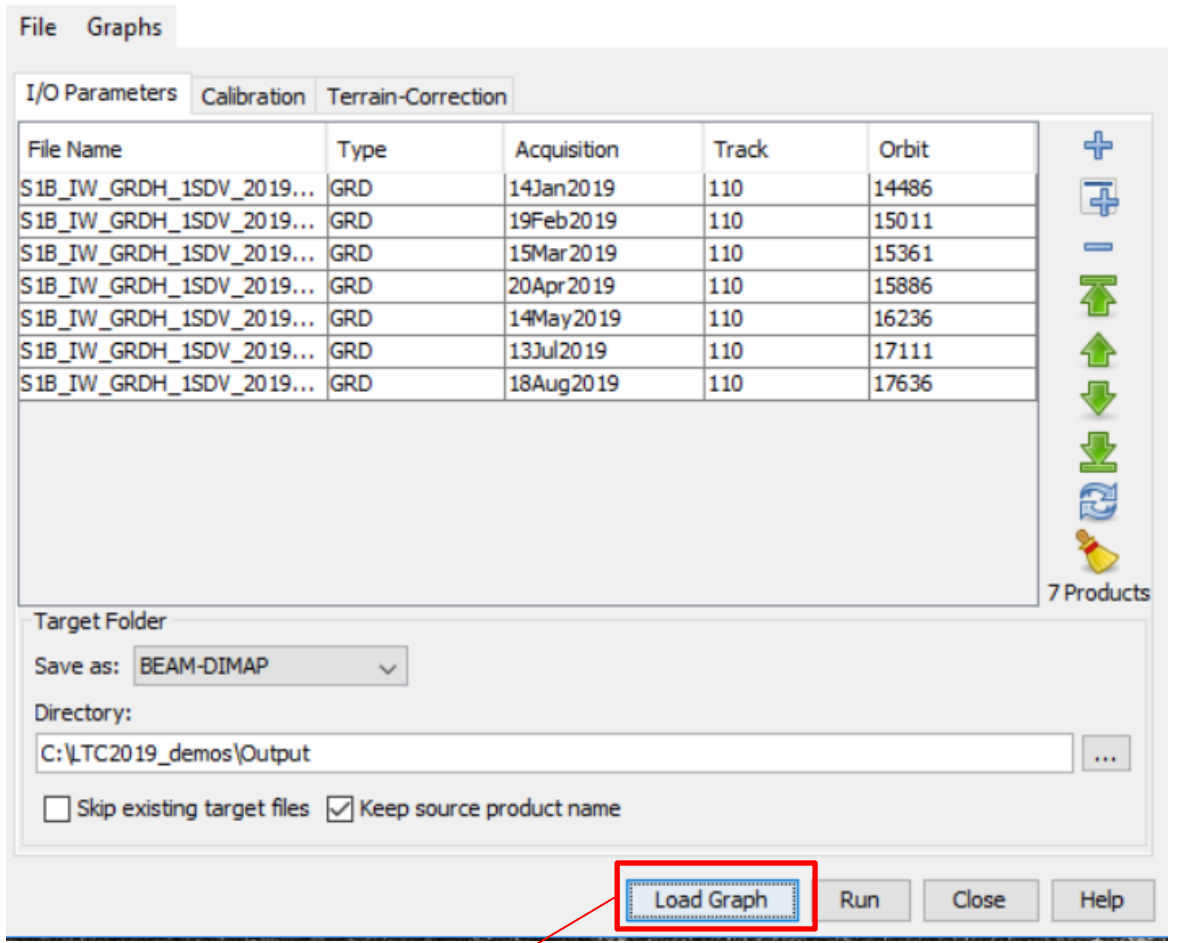
Automatic Processing Graph – Calibration, Terrain Correction

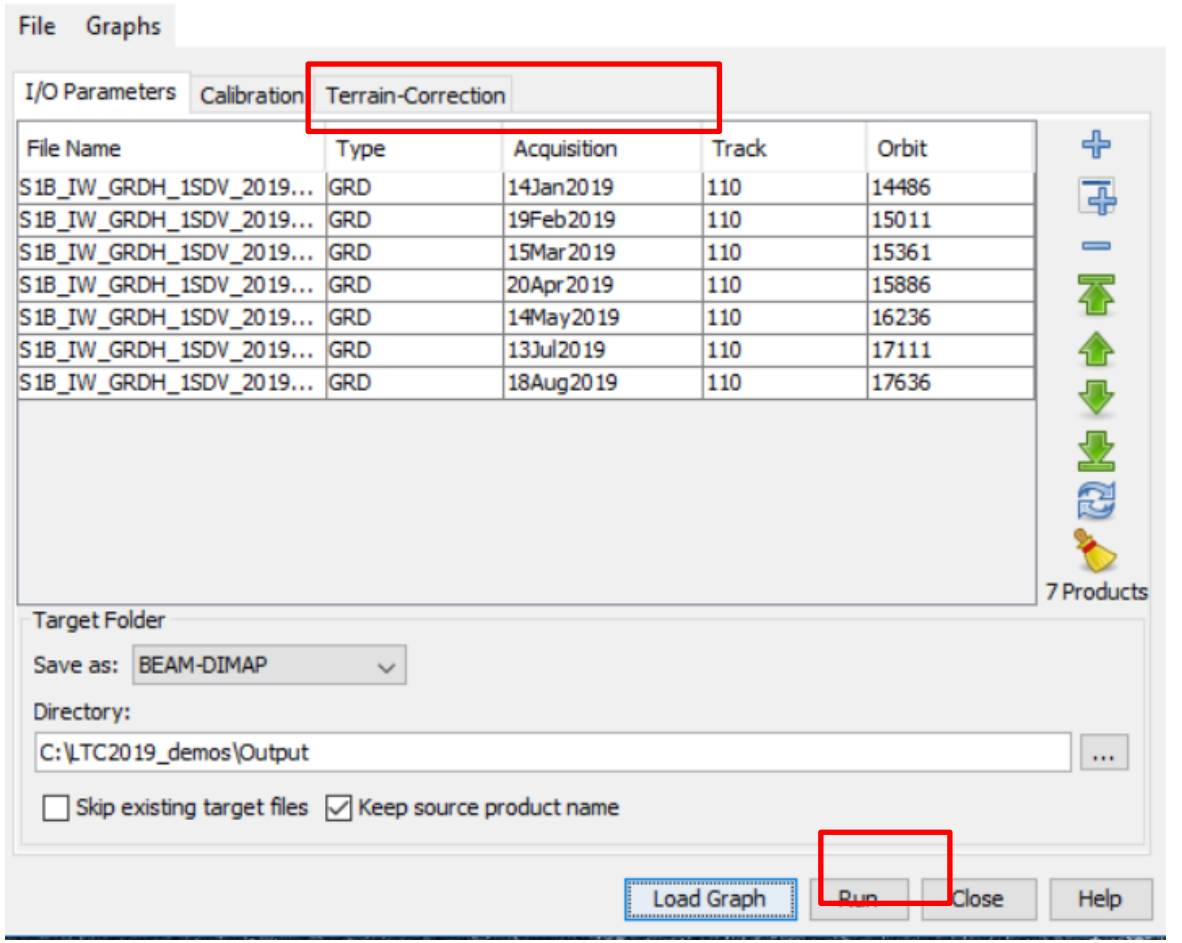




save as e.g. Cal_TC.xml

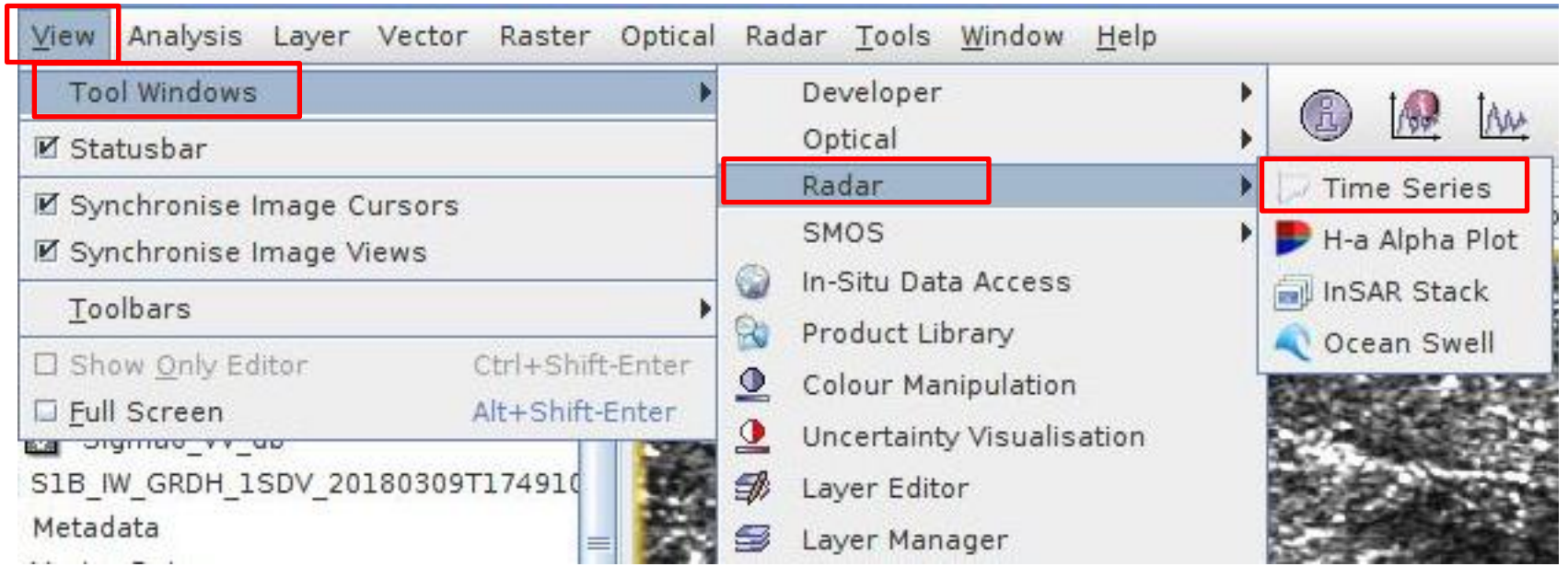
Batch processing

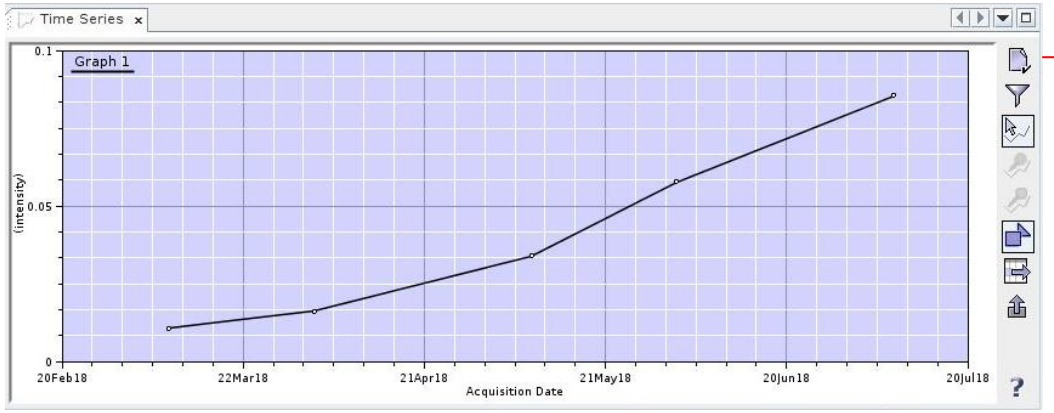




Open previously saved graph Cal_TC.xml

Time series analysis

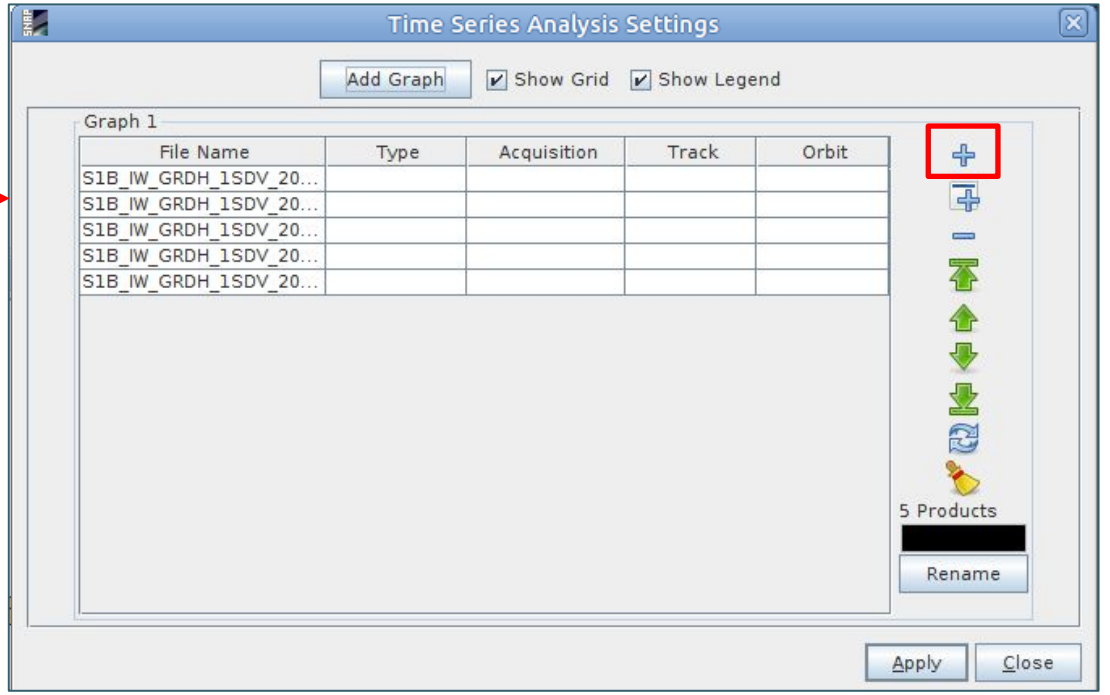


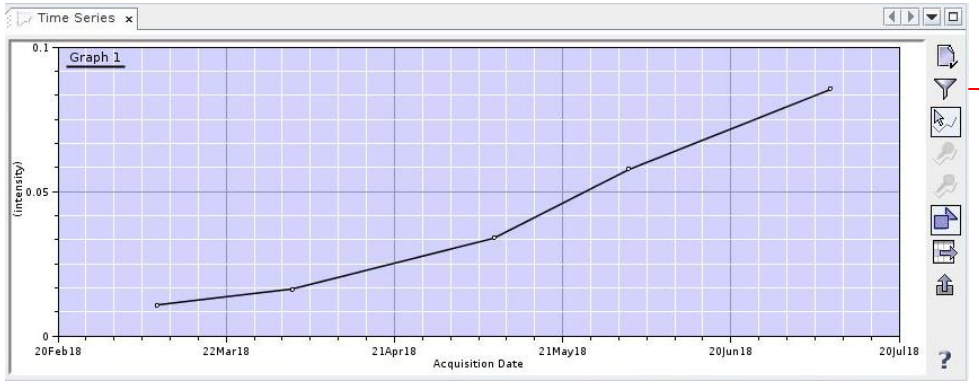


→ *Add your data products*

Time series analysis

Choose your processed data products

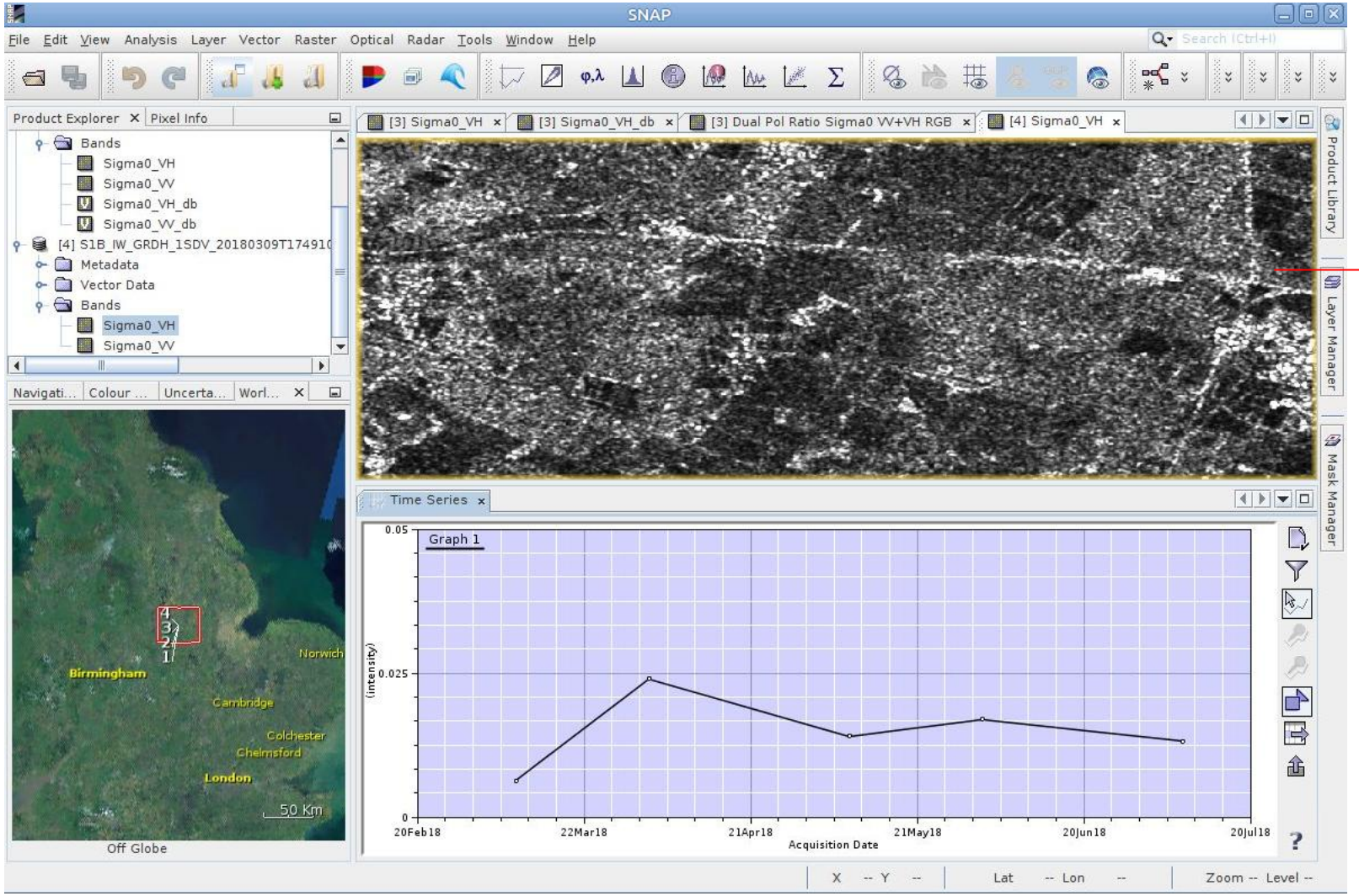




Bands filter

Show plot at cursor position

Time series analysis

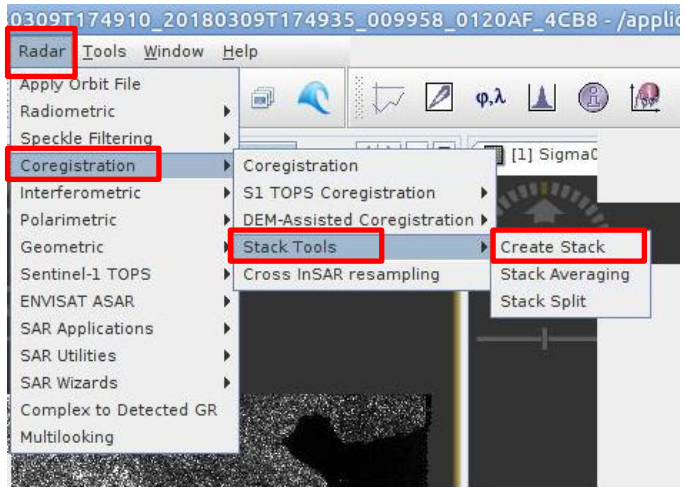


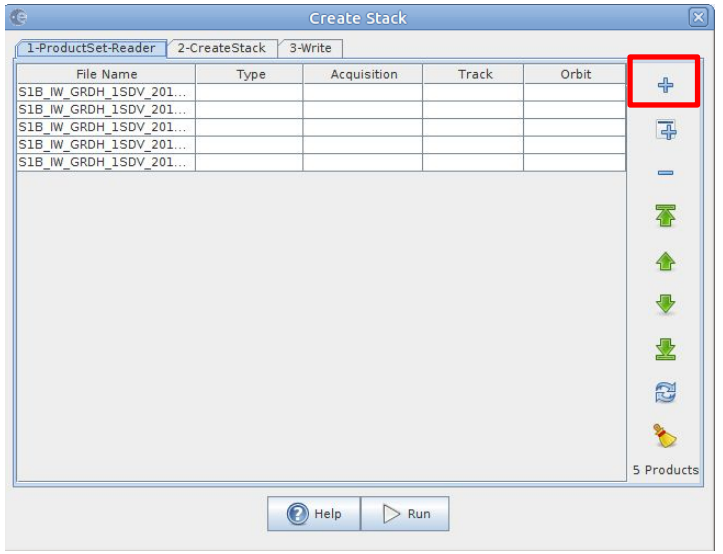
One of the plottet bands has to be opened

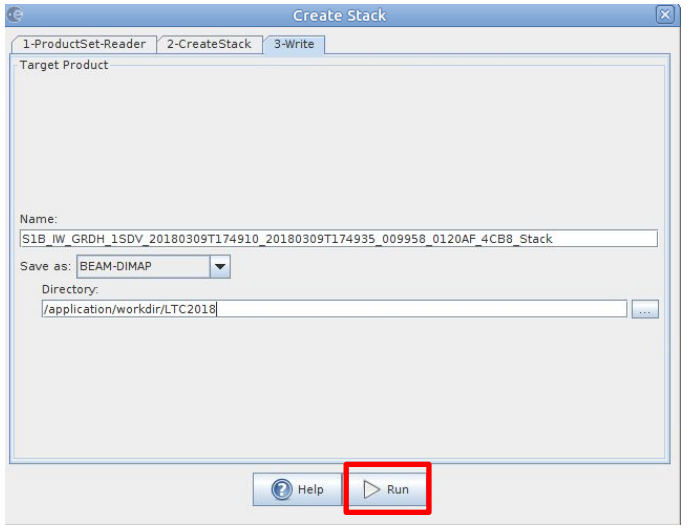
Data processing

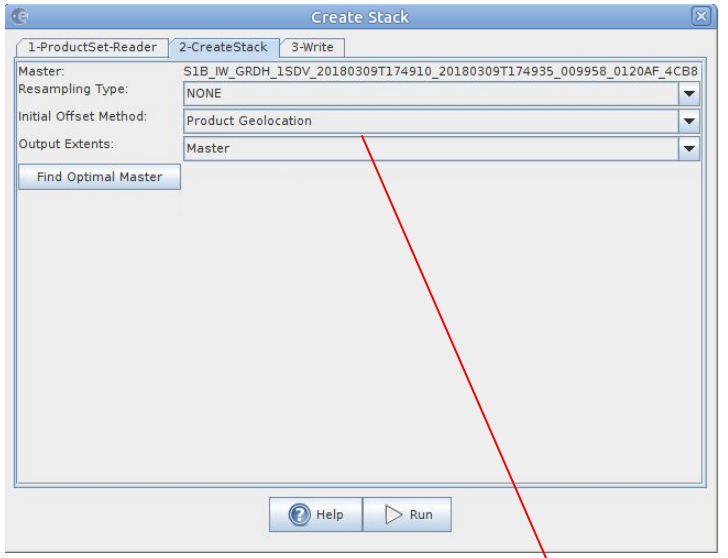
- Creating a subset of S1 GRDH images
  Spatial subset depending on the AOI
- Radiometric calibration
  Conversion of image intensity to sigma0 providing the radar backscatter
- Terrain correction
  Compensate for geometric distortions caused by topographical variations of a scene and the tilt of satellite sensor
- Creating a multitemporal stack
  Collocation spatially overlapping products (based on geolocation)
- Speckle filtering
  Filtering the inherent salt and pepper like texturing called speckles
- Linear to dB conversion
  Compensate for very high dynamic range in visualisation
- Stack statistics
  Analysis of temporal backscatter signatures

Creating multitemporal stack









Collocating spatially overlapping images

- *Product geolocation (if terrain corrected)*
- *Orbits (if not terrain corrected)*

Data processing

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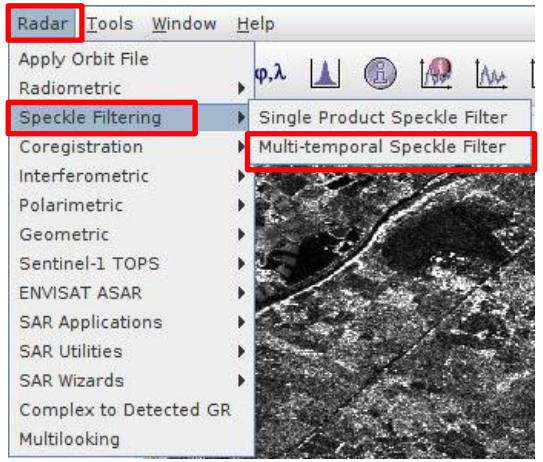
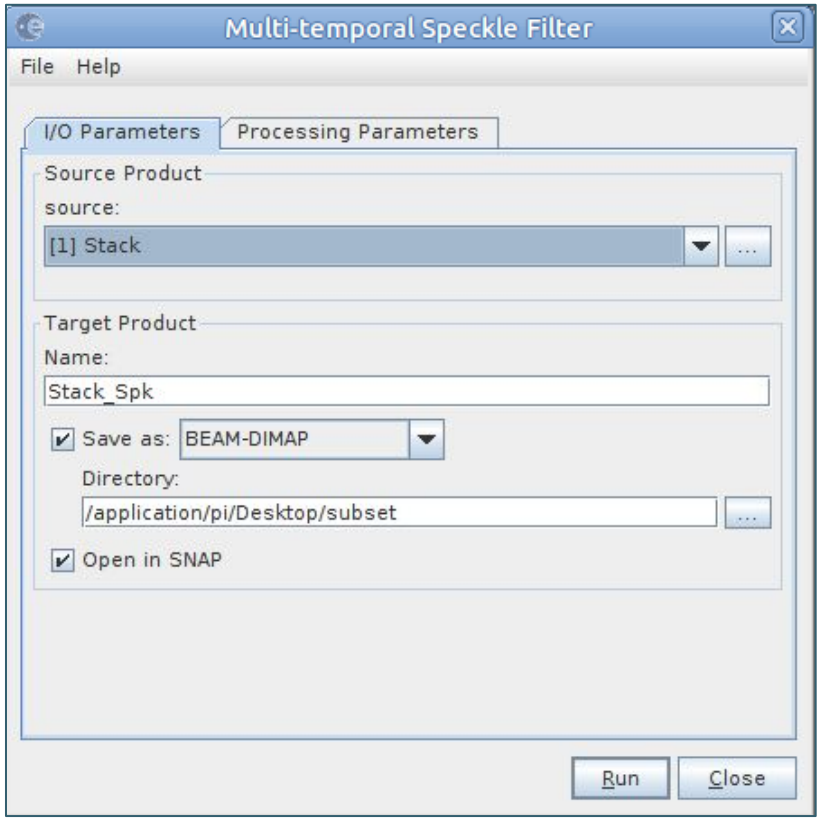
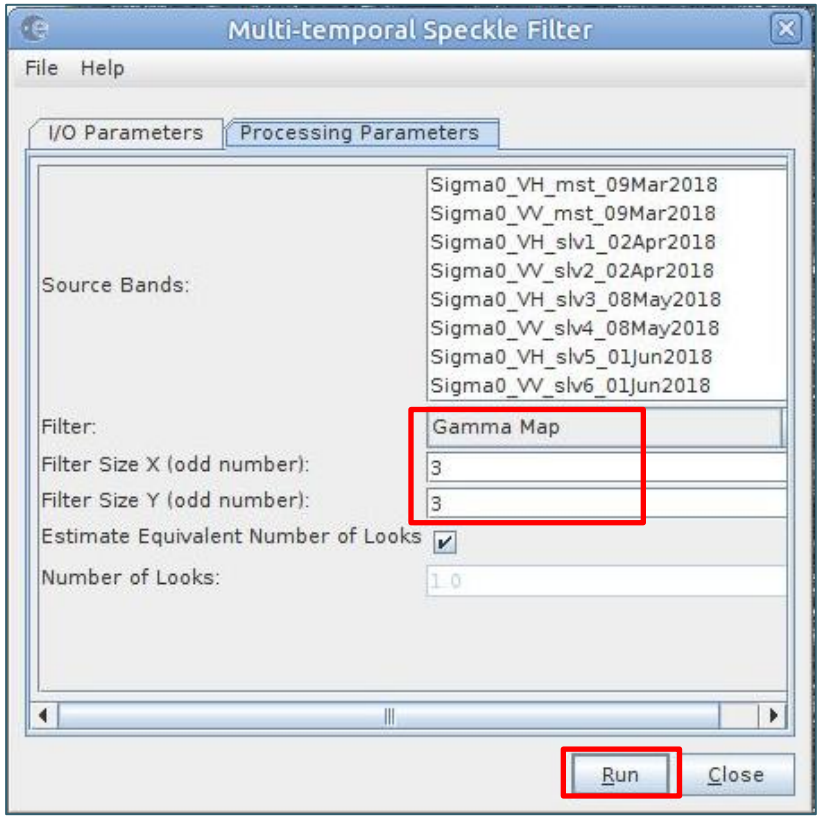
Multitemporal speckle filtering

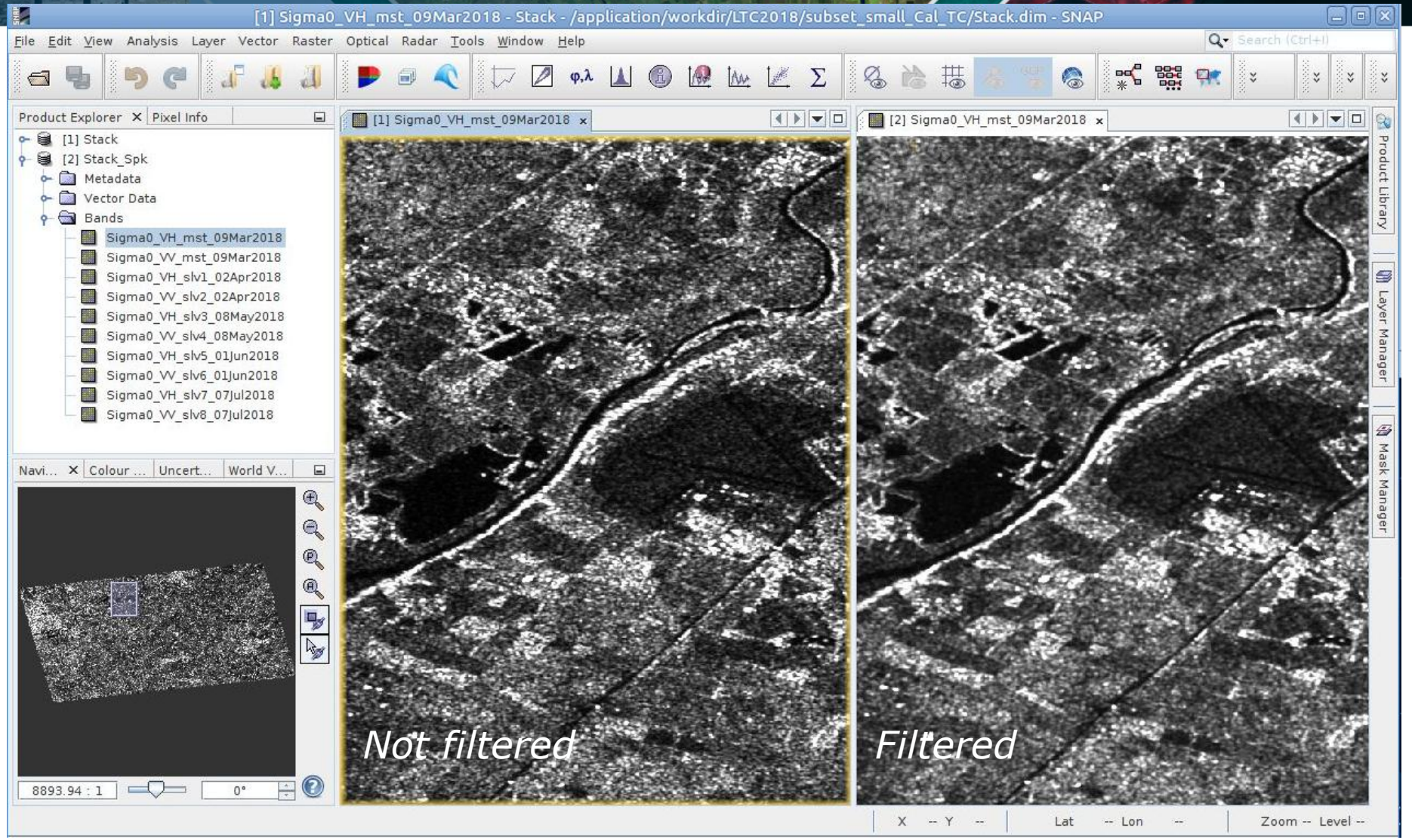






Spatial filtering with weighted average of selected filter across the images of the time series

Multitemporal speckle filtering



Data processing

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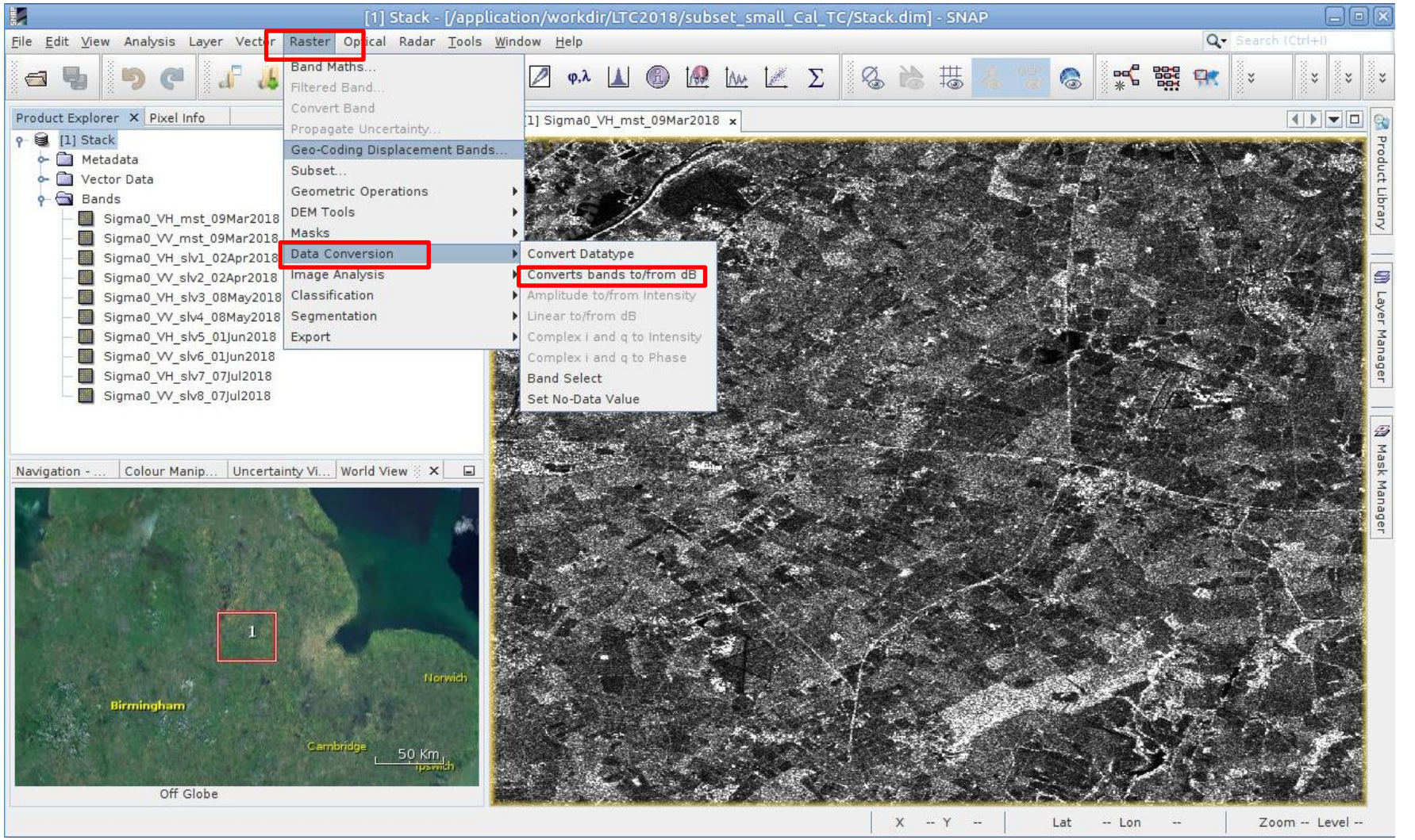
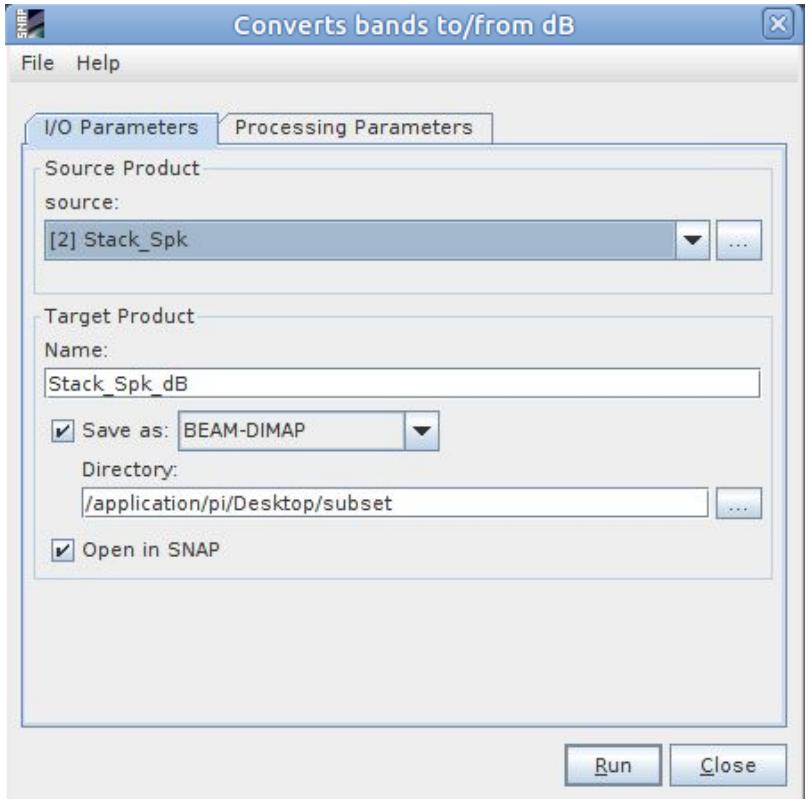
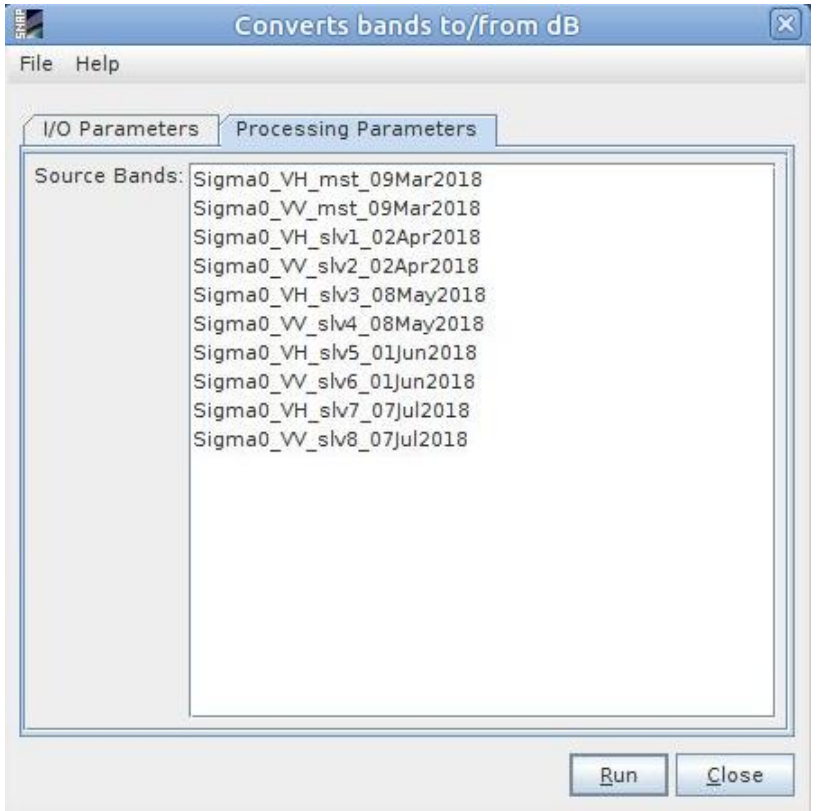
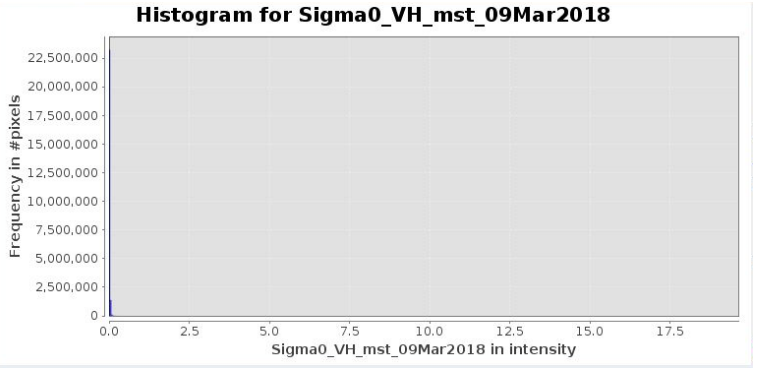
Conversion from linear to dB

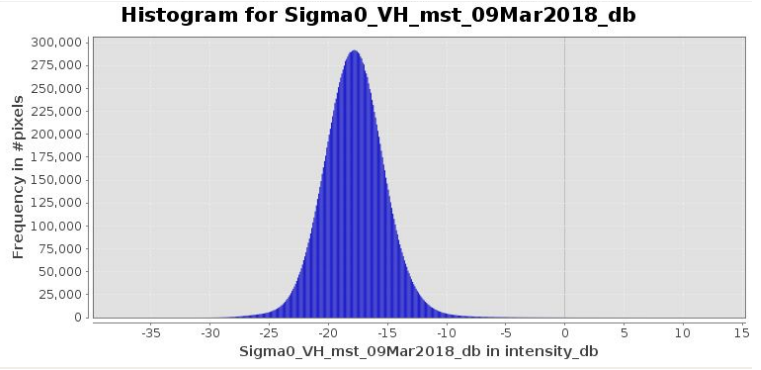


Conversion from linear to dB

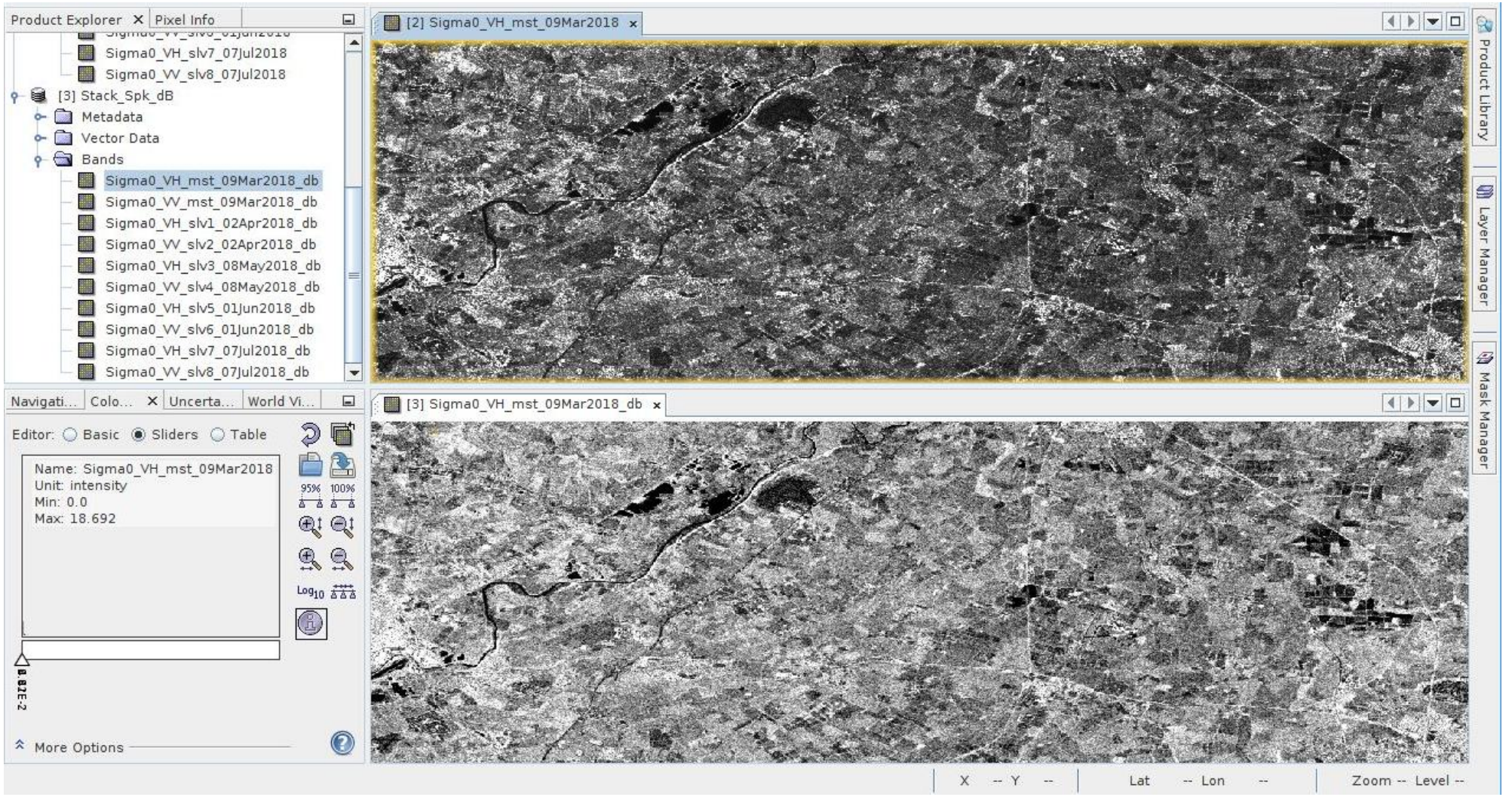




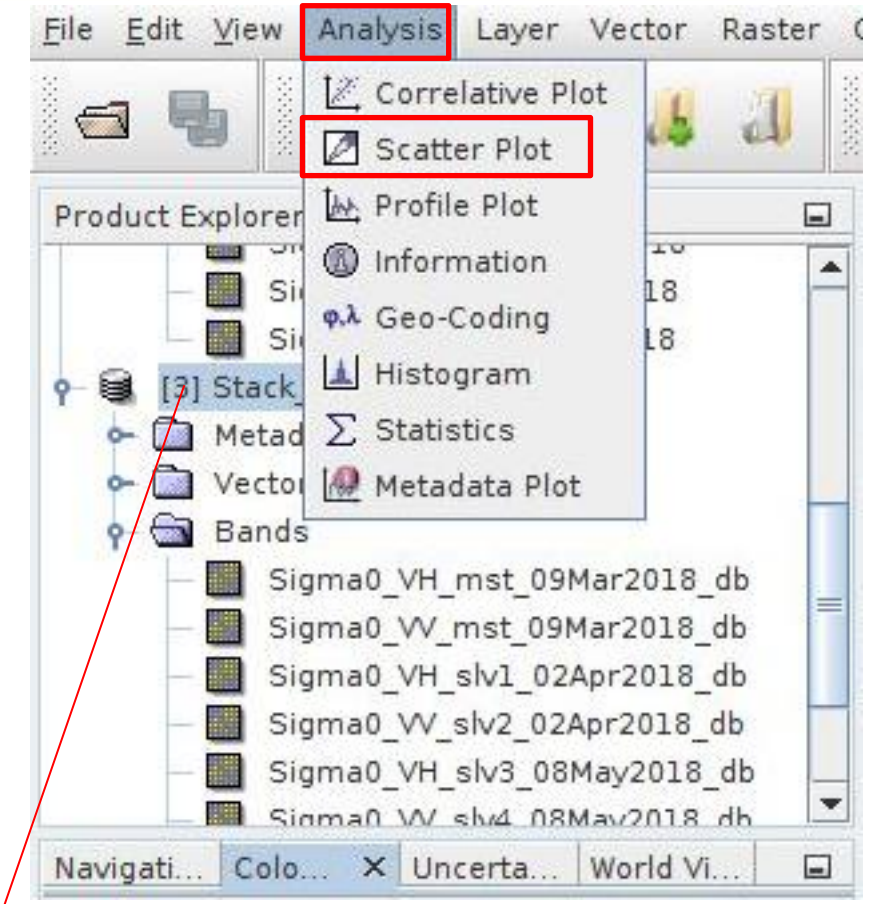




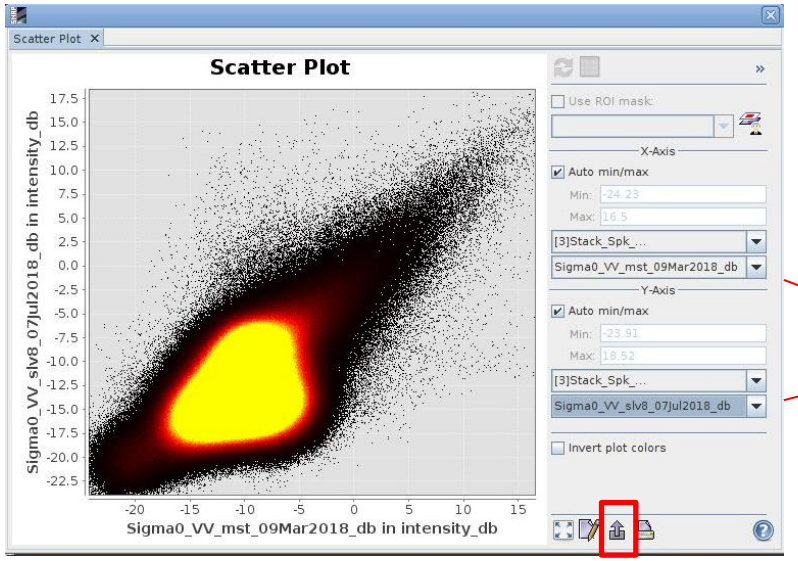
Linear vs dB comparison

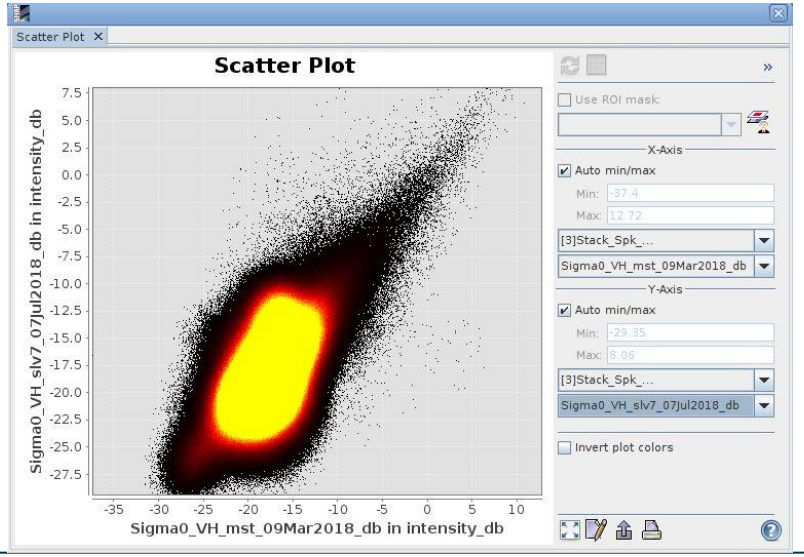


Scatterplots



Select your data stack





Select bands that you want to plot

Data processing

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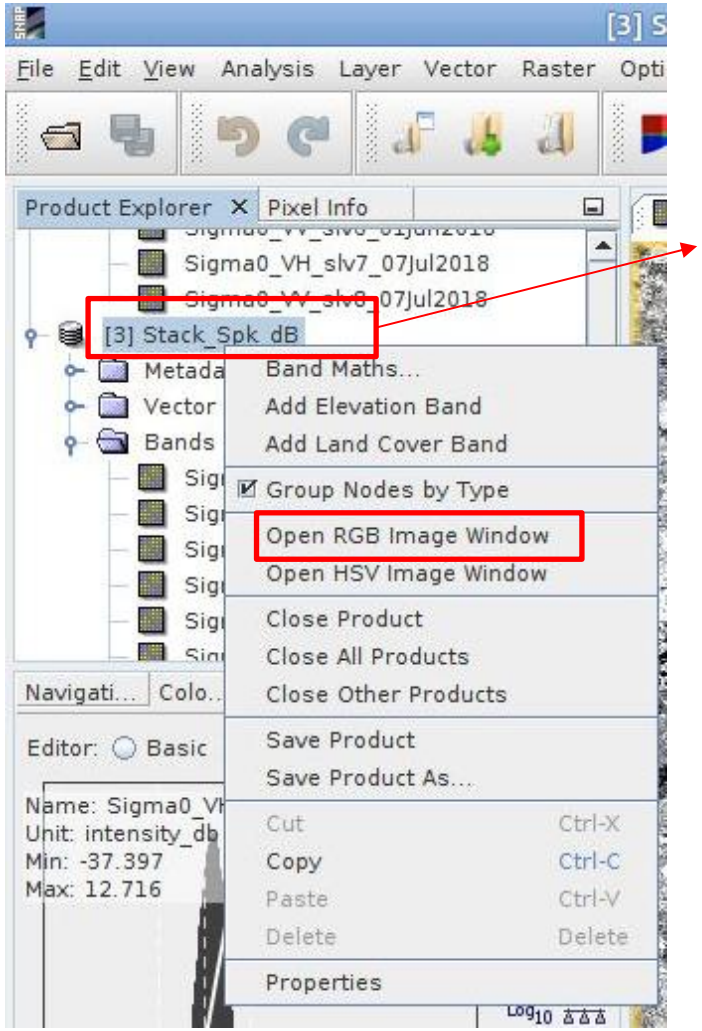
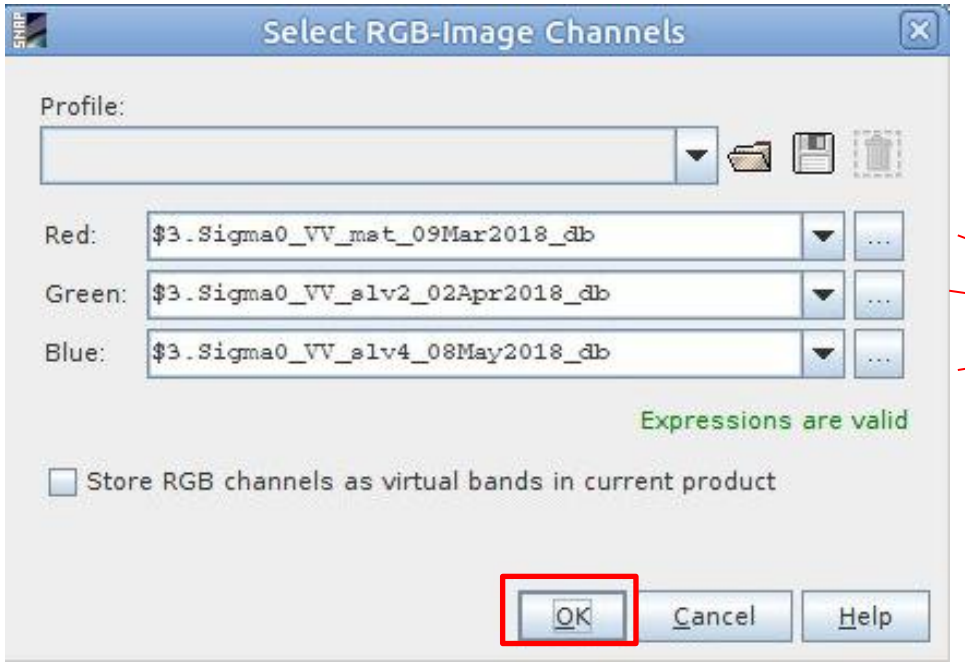
RGB Composite

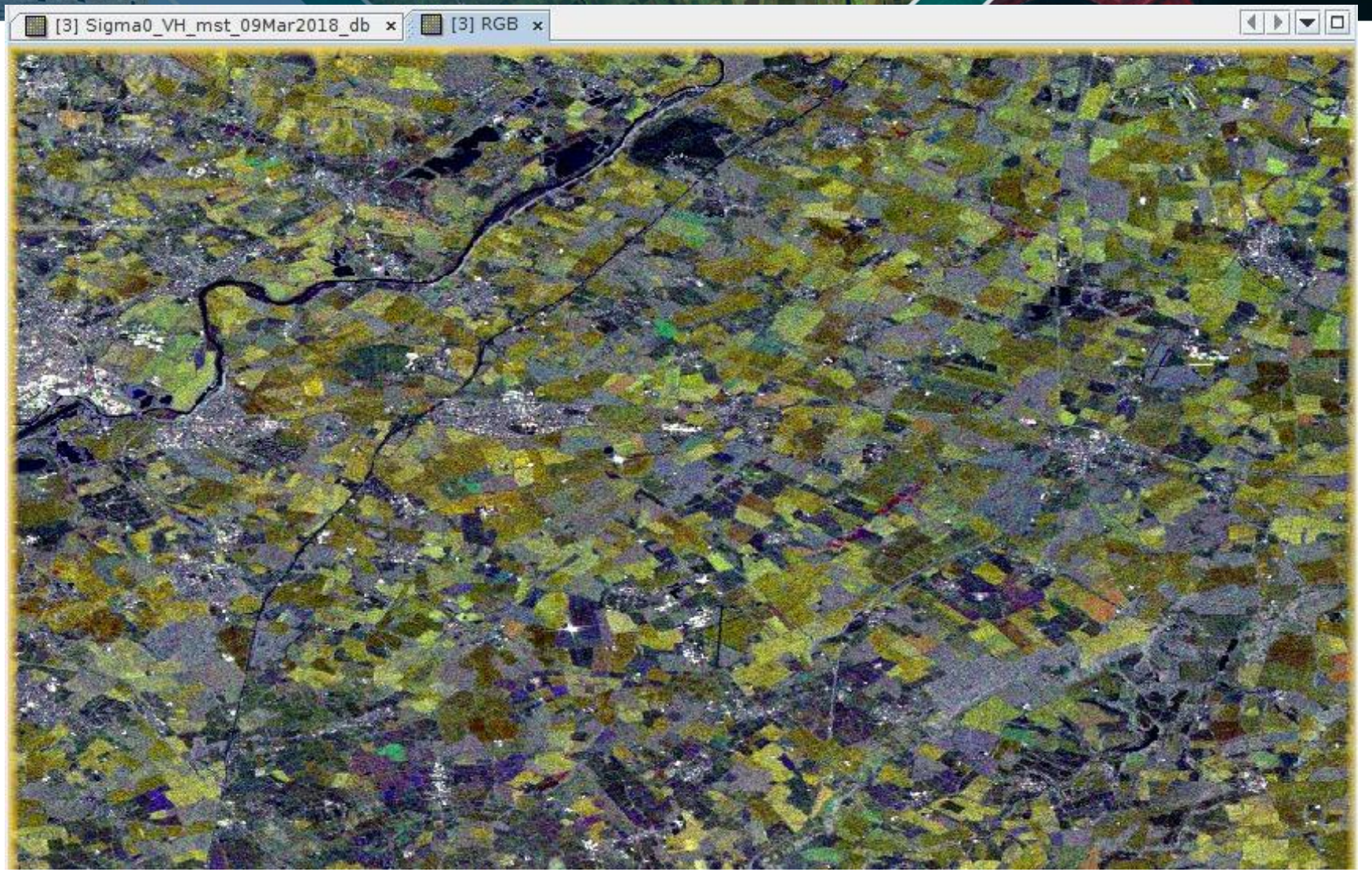


Right click on the product

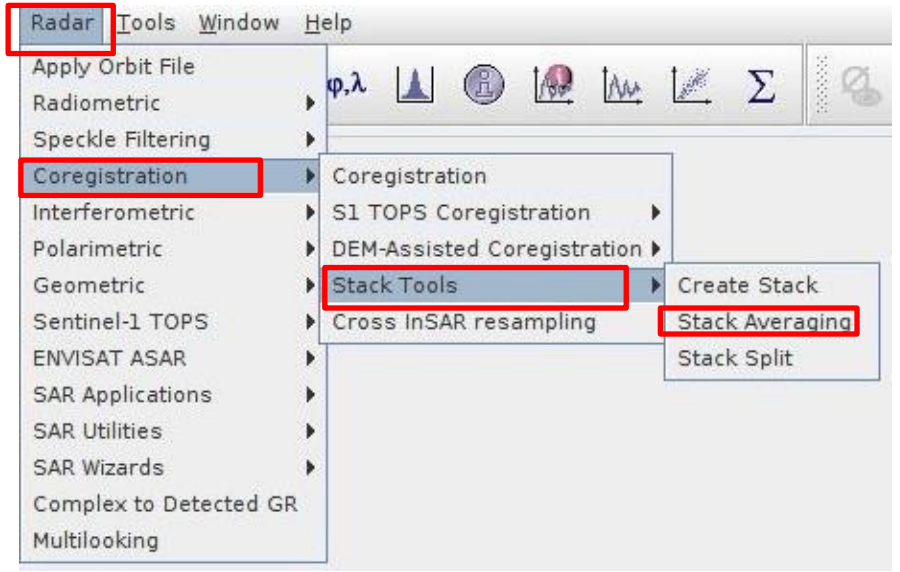


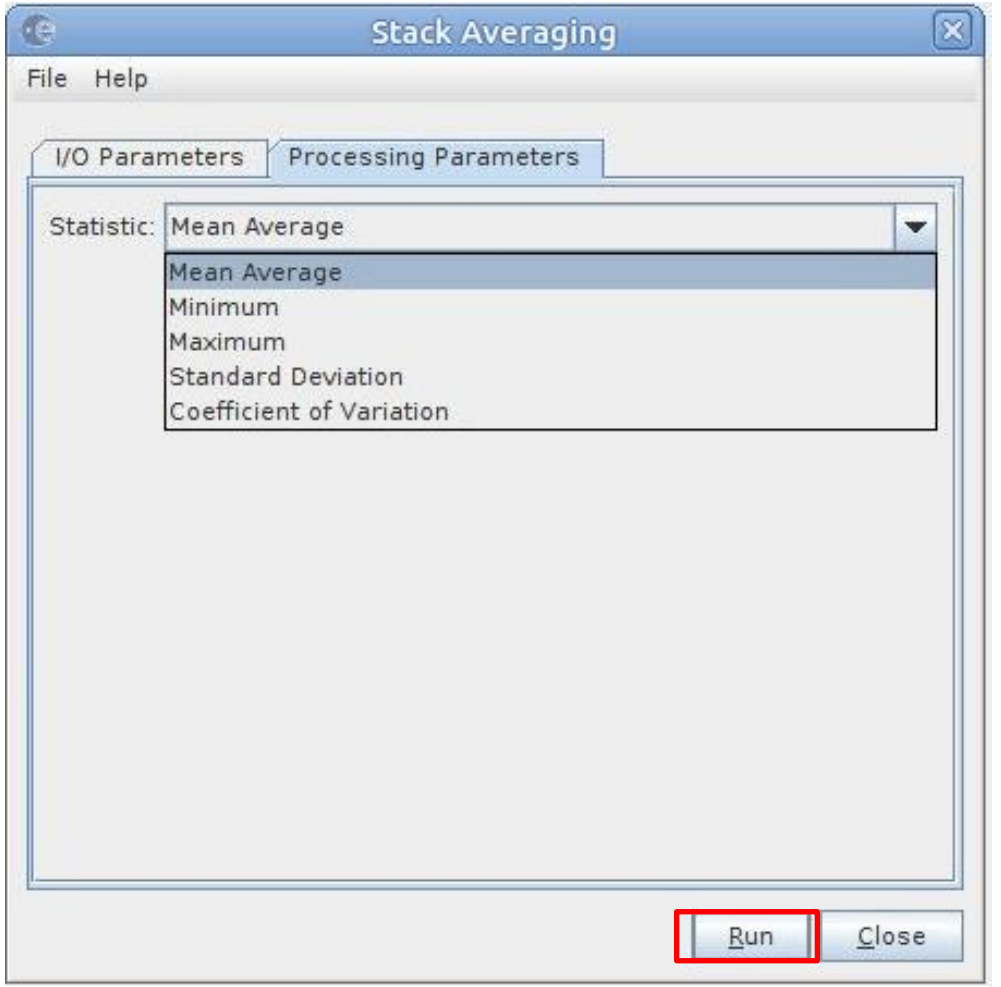
Band selection

RGB Composite



Stack averaging





Stack averaging – RGB Composite

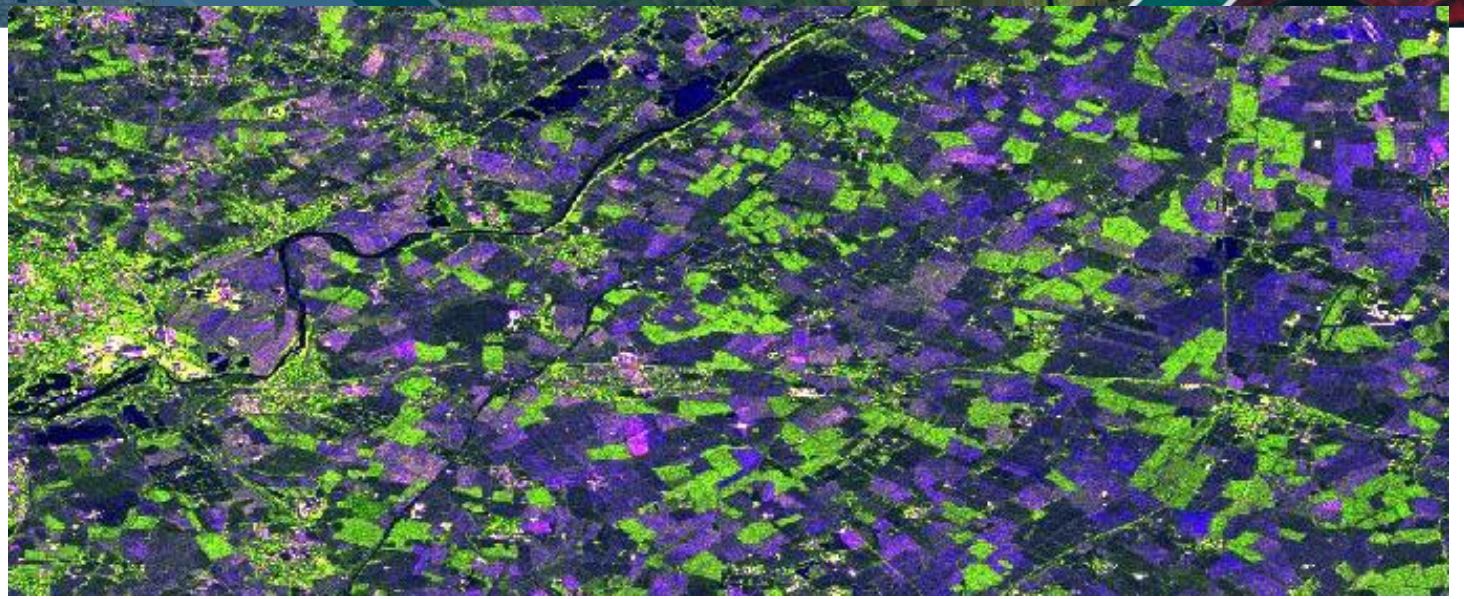
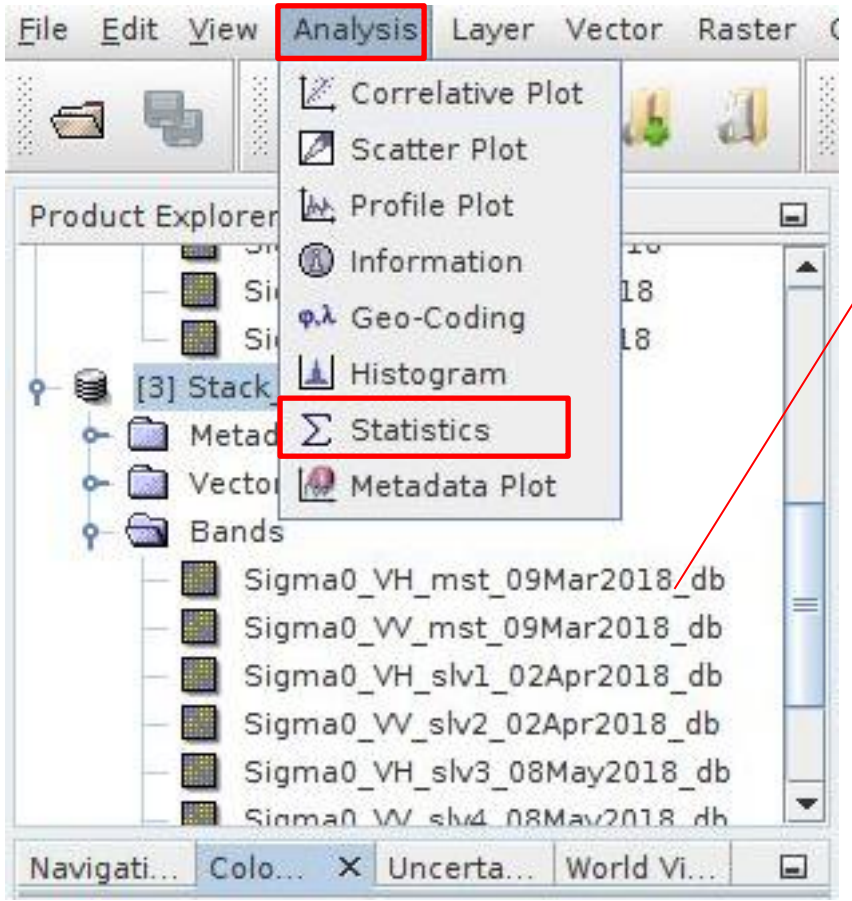


Image statistics



Choose your band

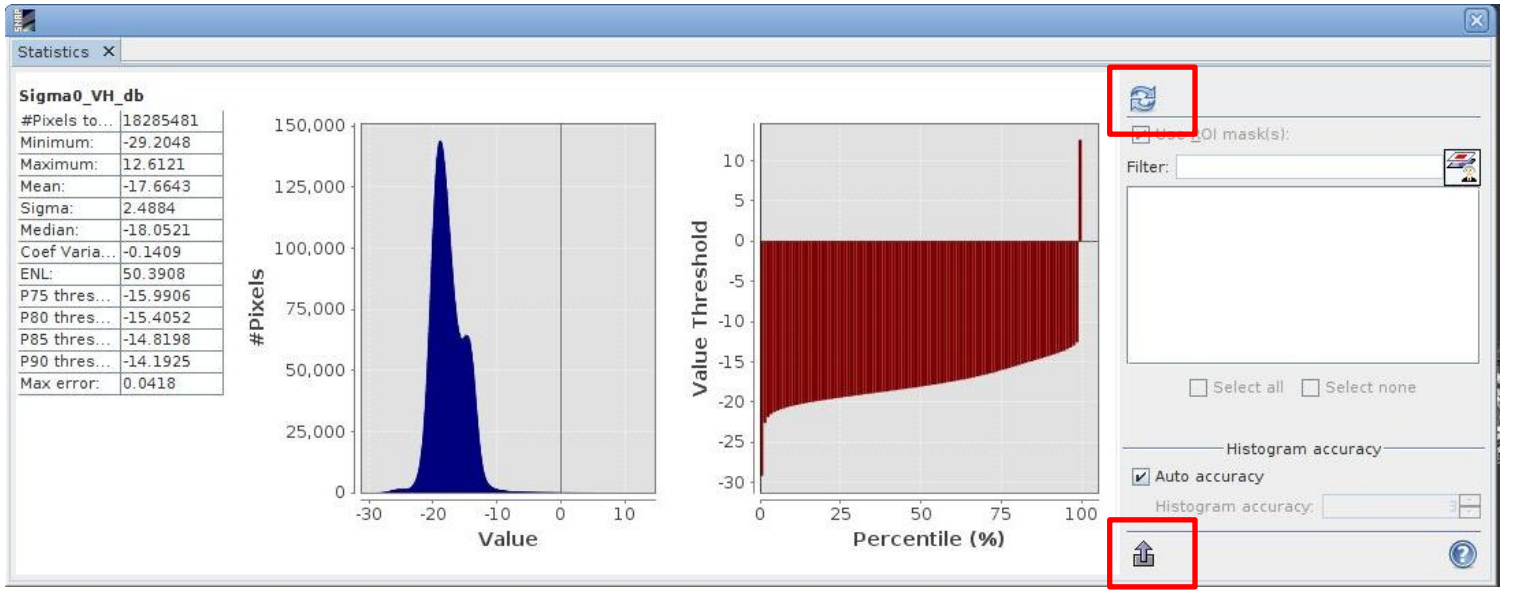
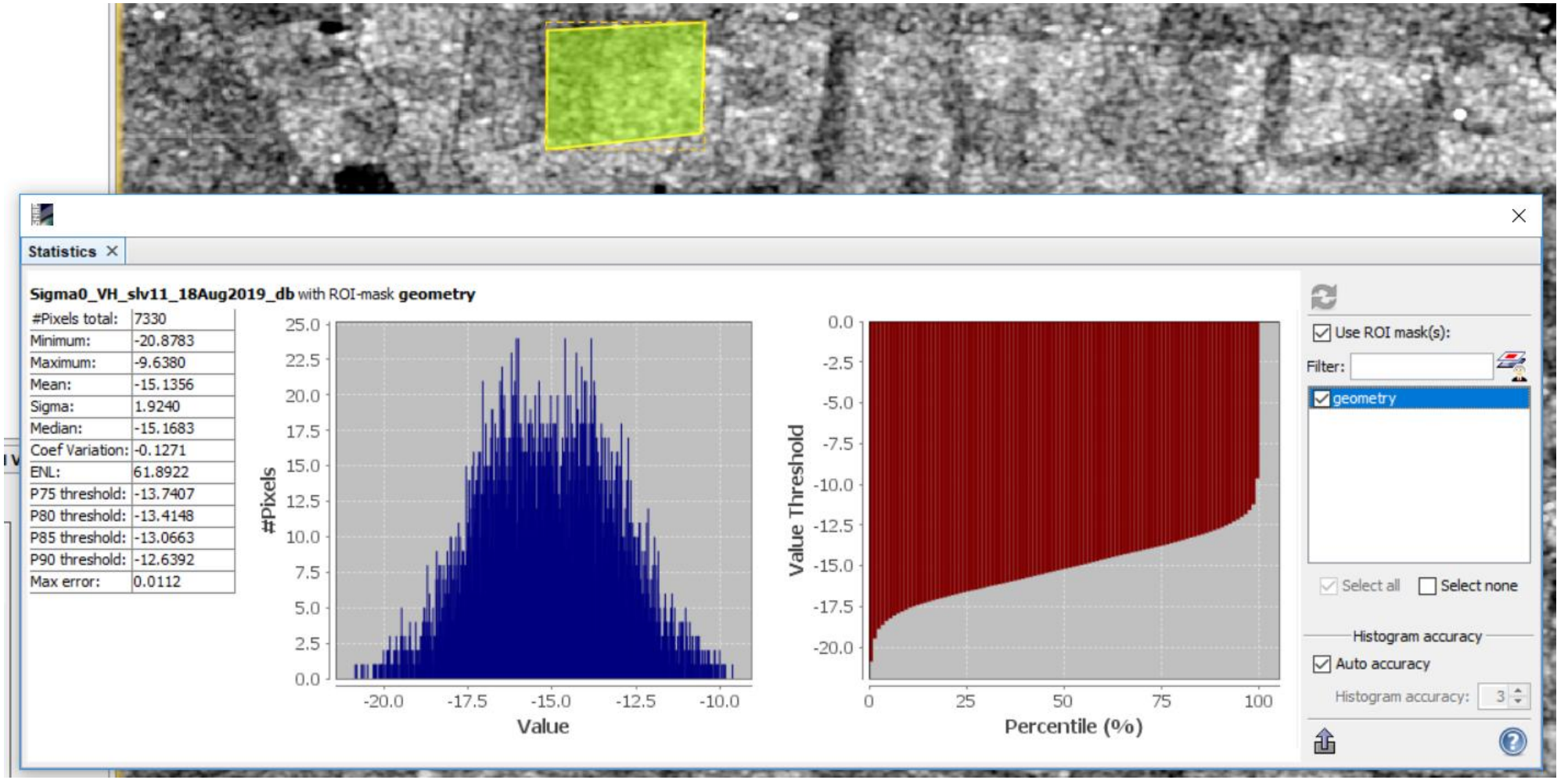
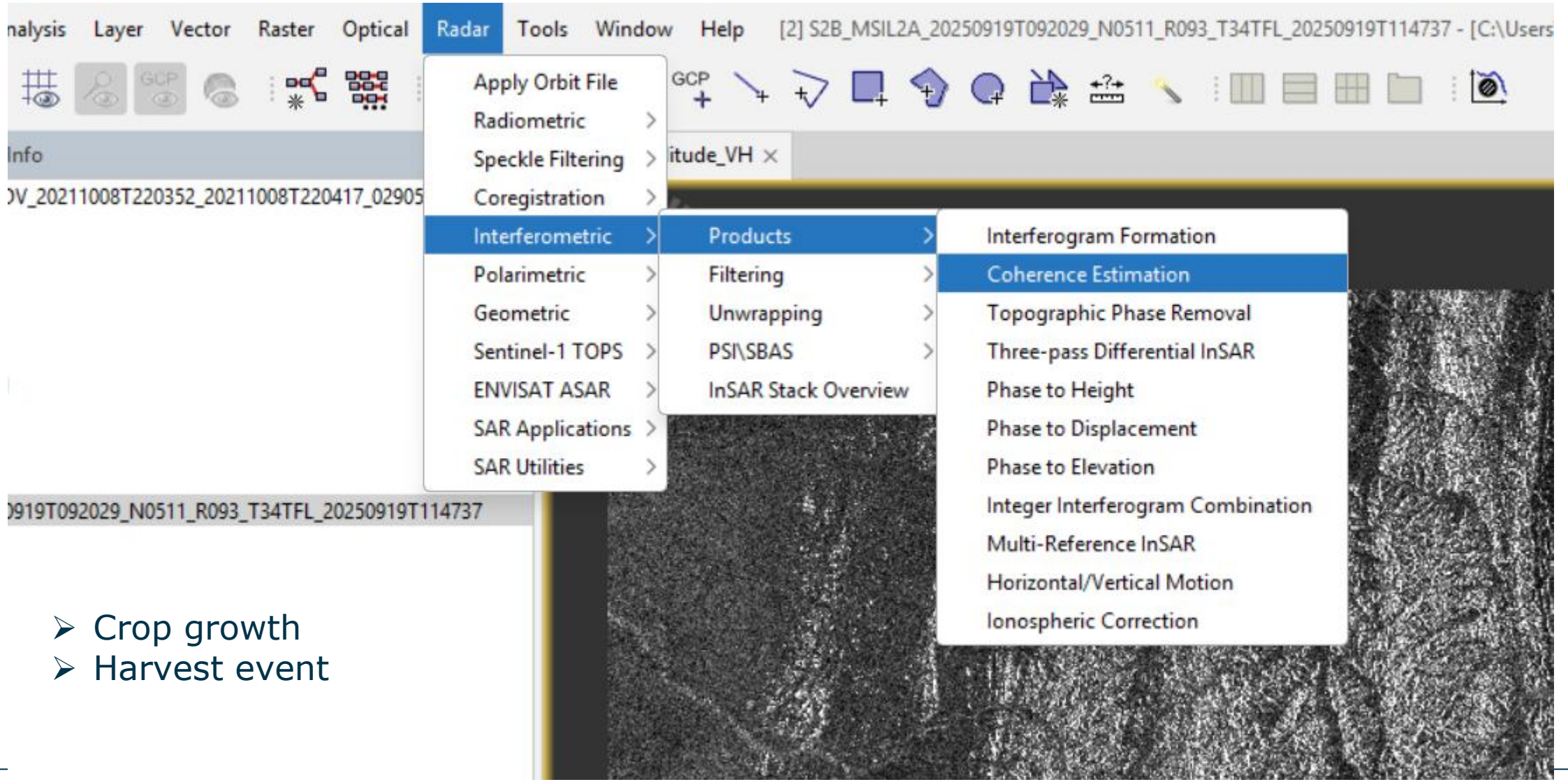


Image statistics - polygon

Draw the polygon

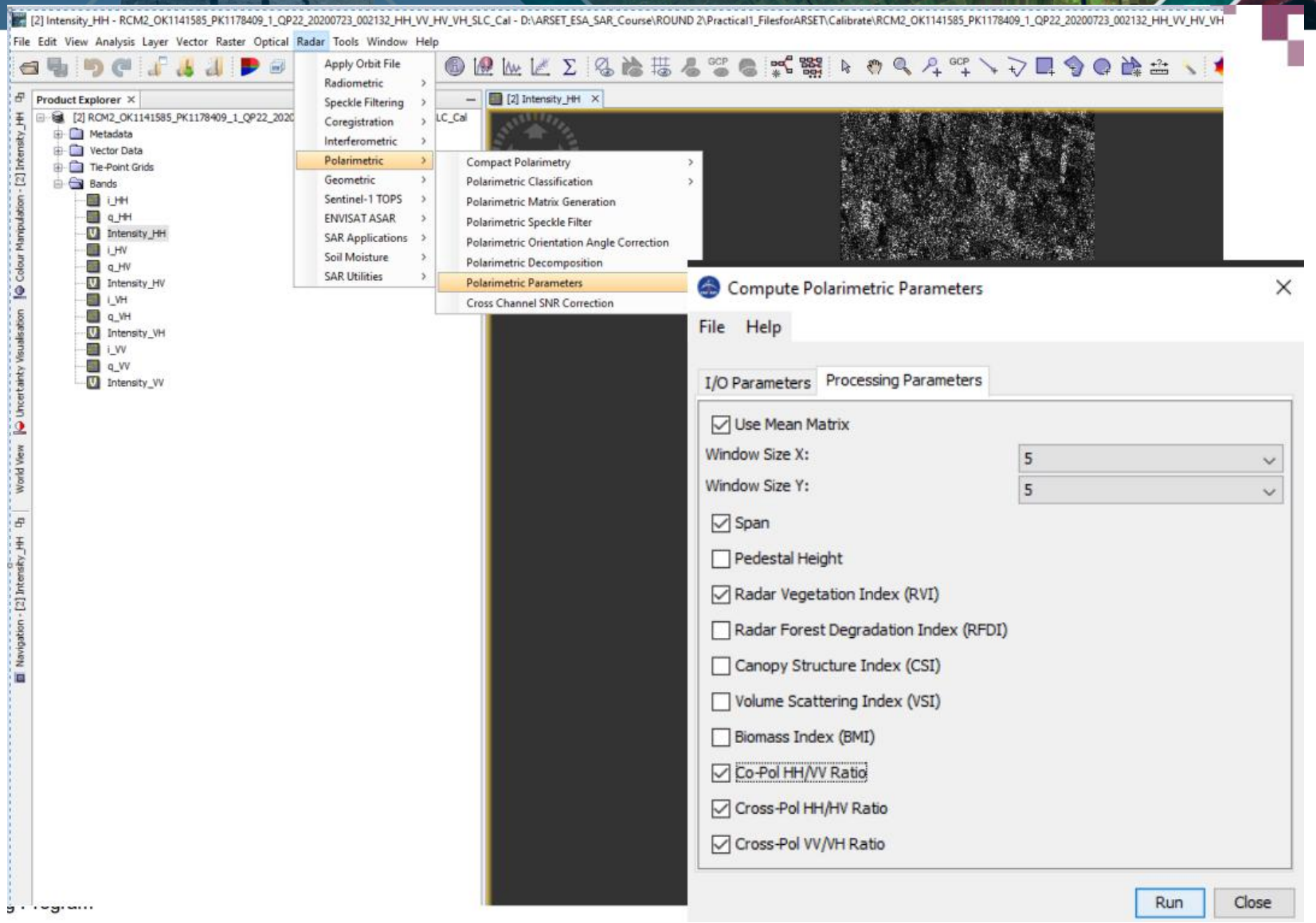


Looking for more advanced applications?



- Crop growth
- Harvest event

Looking for more advanced applications?



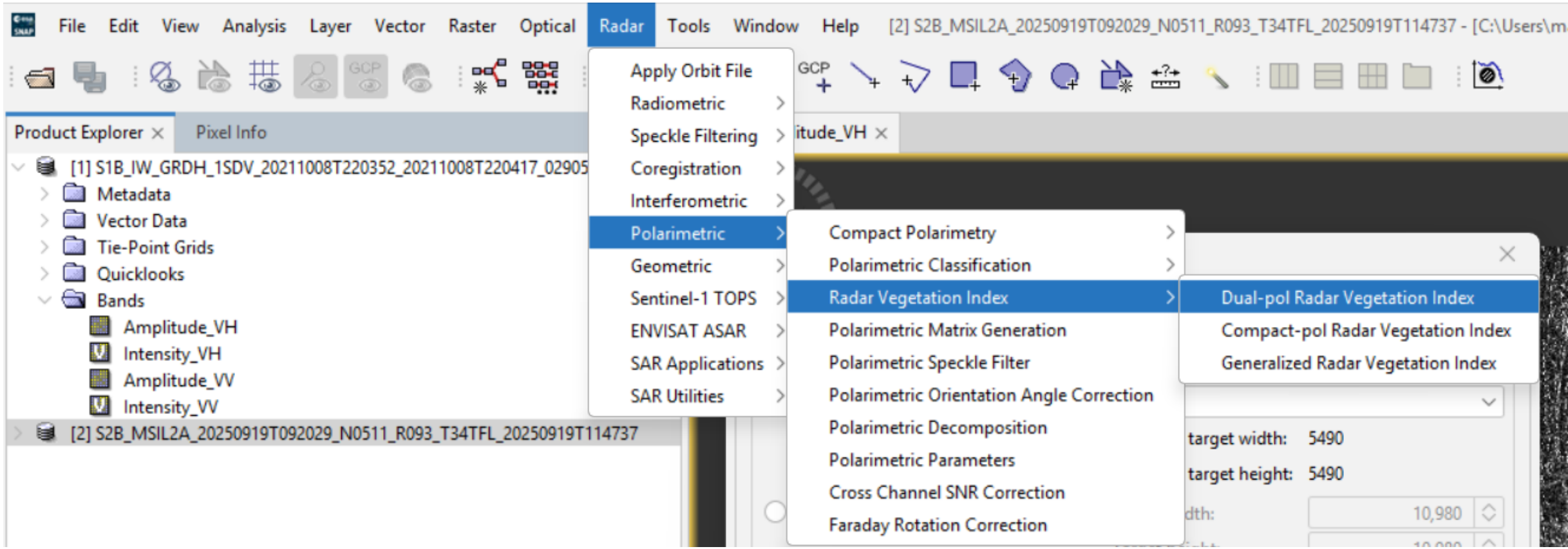
The Radar Vegetation Index (RVI) is used to estimate vegetation conditions, similar to NDVI

July 19, 2020 August 16, 2020 September 17, 2020

Declining RVI values as the growing season winds down.

Value
High :1
Low : 0

Looking for more advanced applications?



- Vegetation growth through different phenological phases . The DpRVI follows the advancement of plant growth until full canopy development with the accumulation of the Plant Area Index (PAI) and biomass (vegetation water content (VWC) and dry biomass (DB))