Hands-on Exercise on Estimation of Damaged Buildings post earthquake by ALOS 2 Coherence Image

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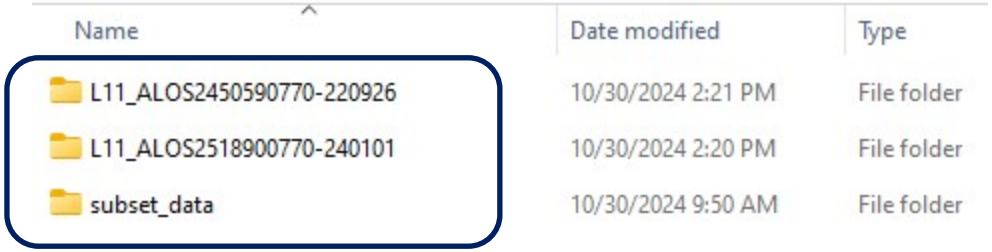
Step-1 copy the data to your local drive

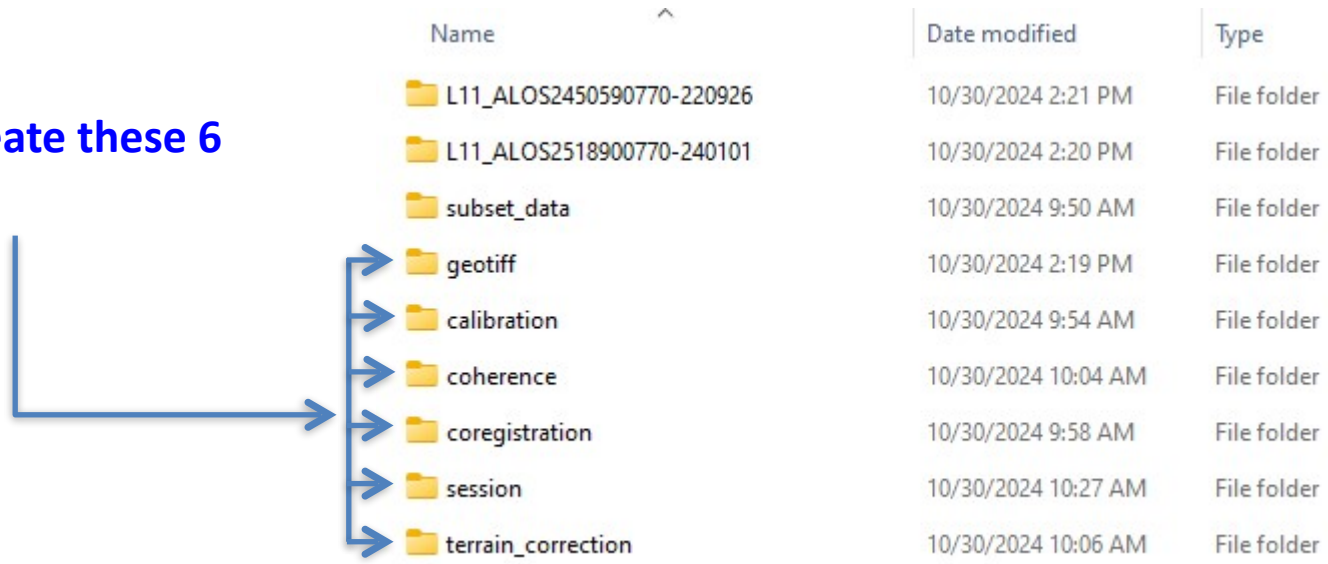


Pre Earthquake image: L11_ALOS2450590770-220926

Post Earthquake image: L11_ALOS2518900770-240101

Original data : ALOS-2 / PALSAR-2 Observation Products|ALOS@EORC Home Page

Step-2 Create these 6 folders



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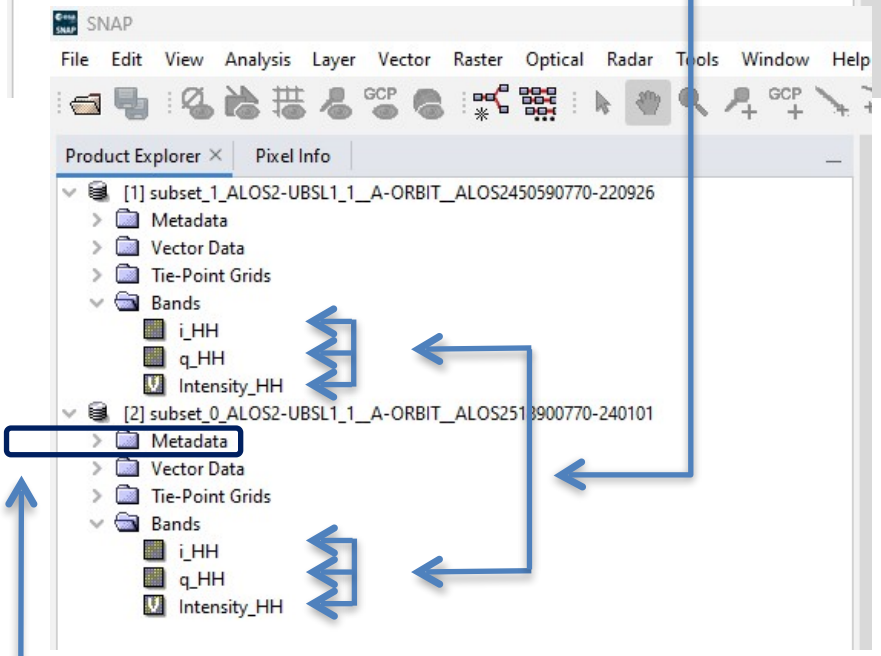
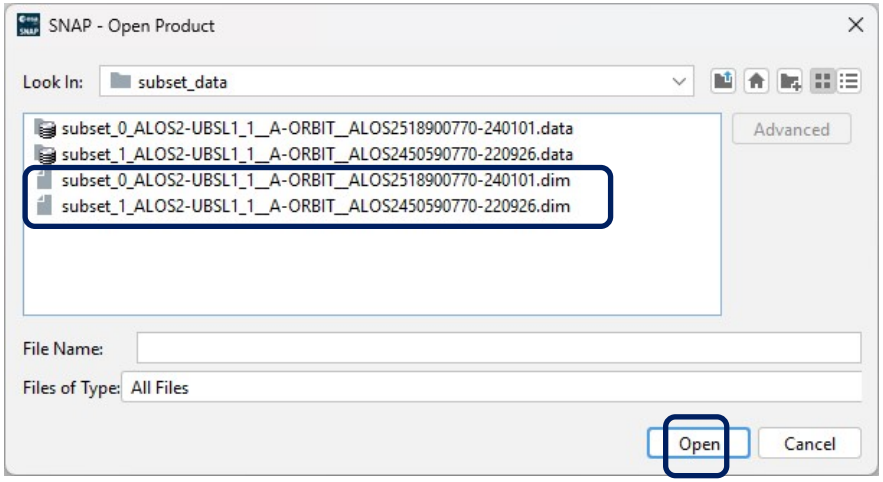
Step-3 start SNAP

Step-4 Open the images

Step-6 go to Bands and double click on the bands to display them



Step-5 Go to your folder of images , select them and click open



Check the metdata of the images

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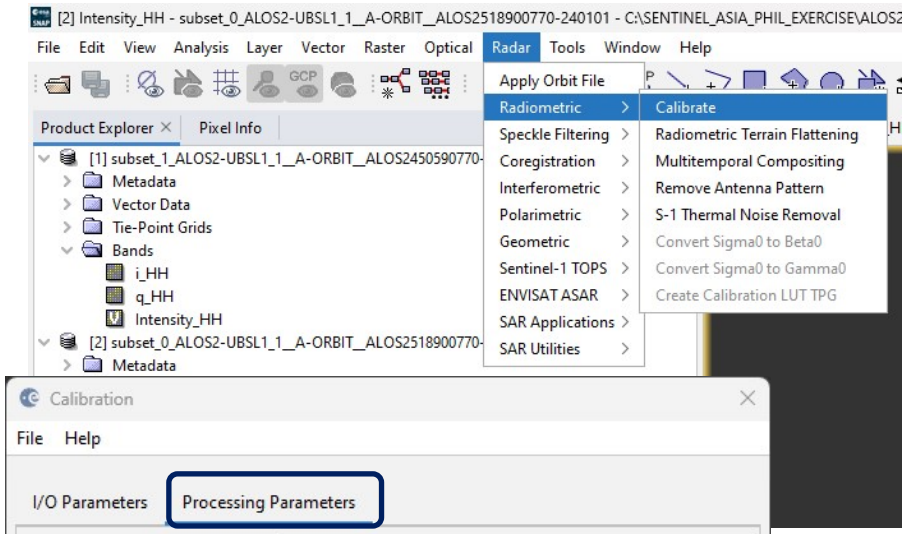
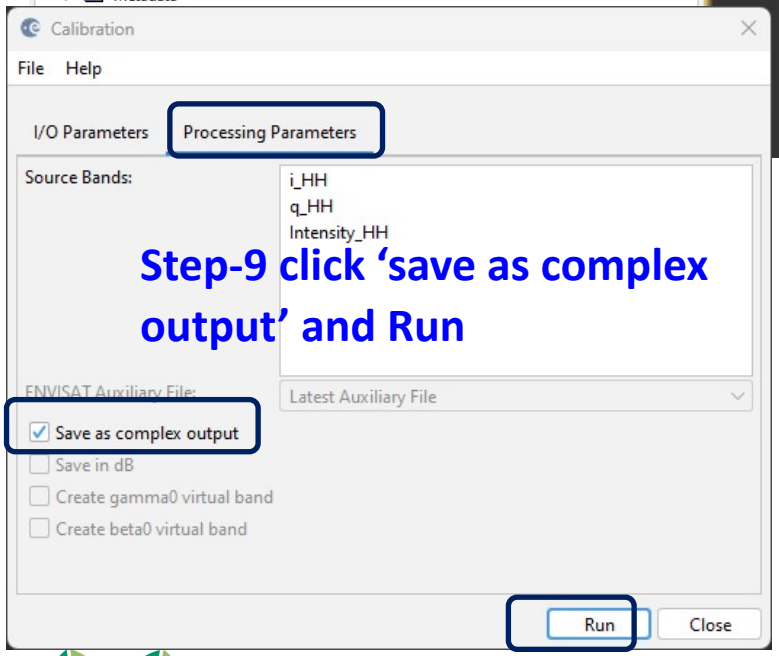
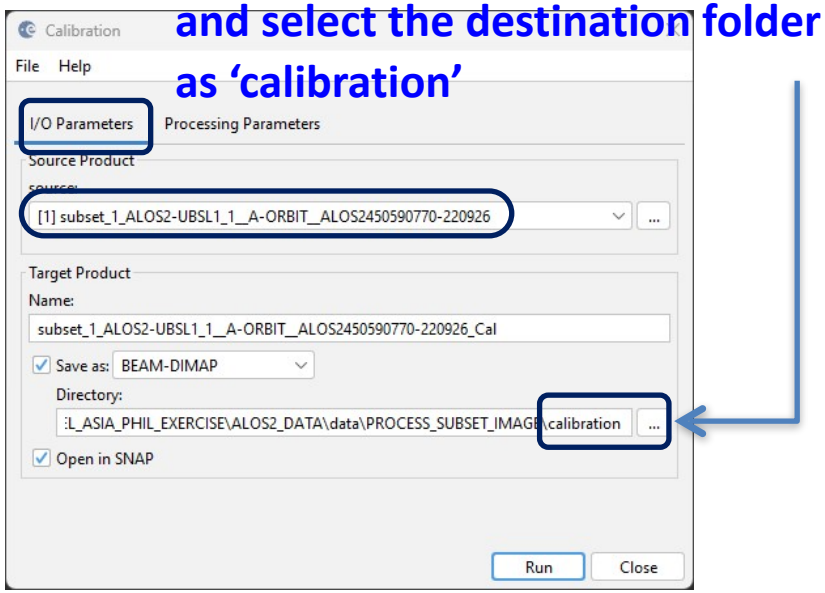
Step-7 Radar>Radiometric>Calibrate



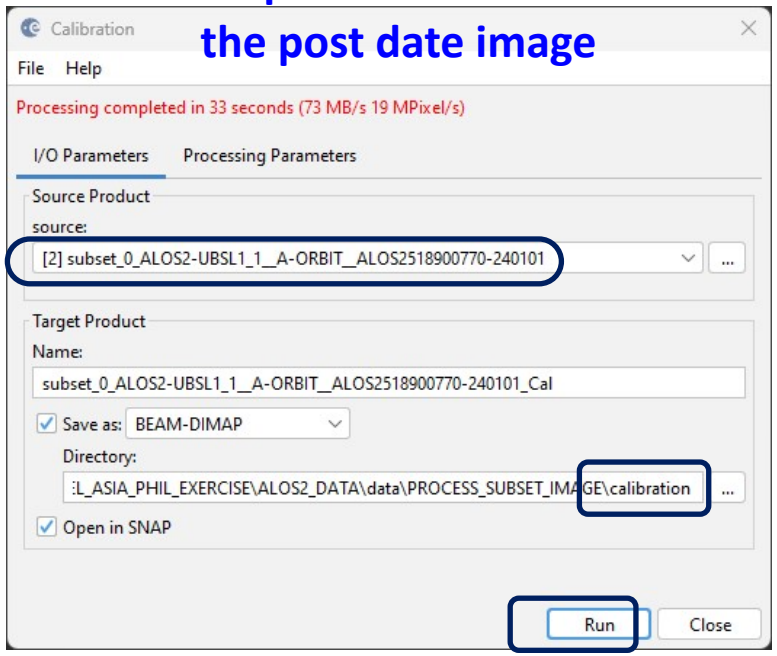


Step-8 select the pre image and select the destination folder as 'calibration'



Step-9 click 'save as complex output' and Run

Step-10 Perform the same on the post date image



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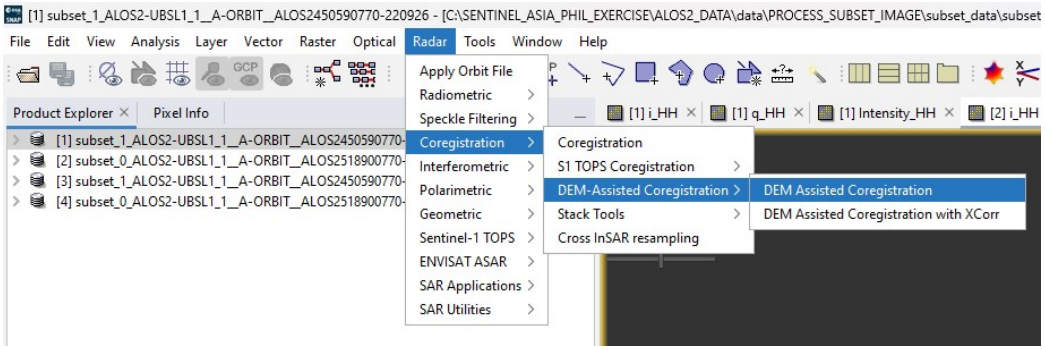
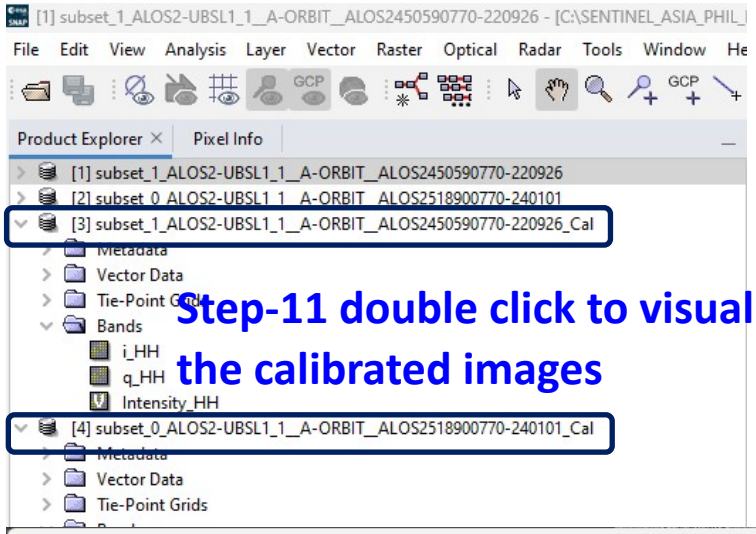
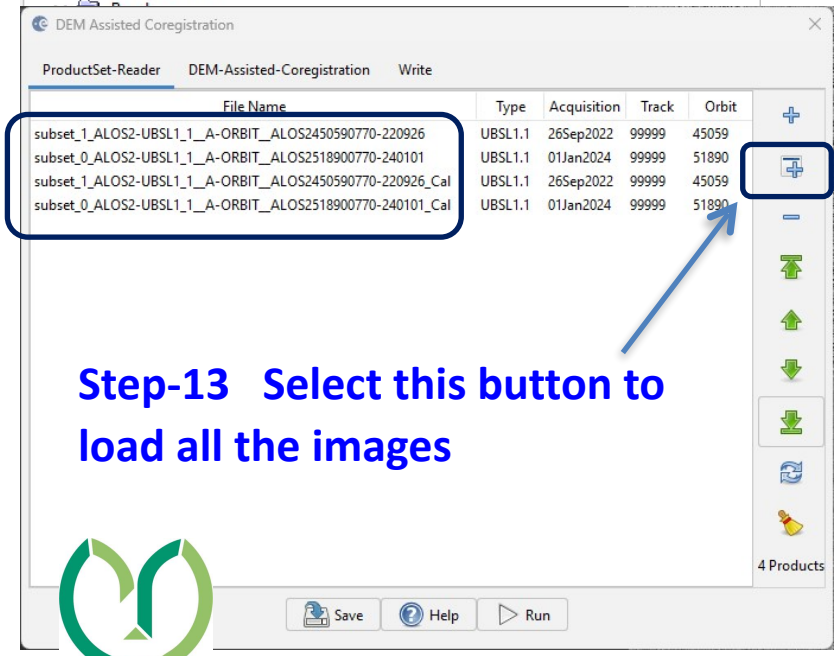
Step-12 Radar> Coregistration> DEM assisted Coregistration

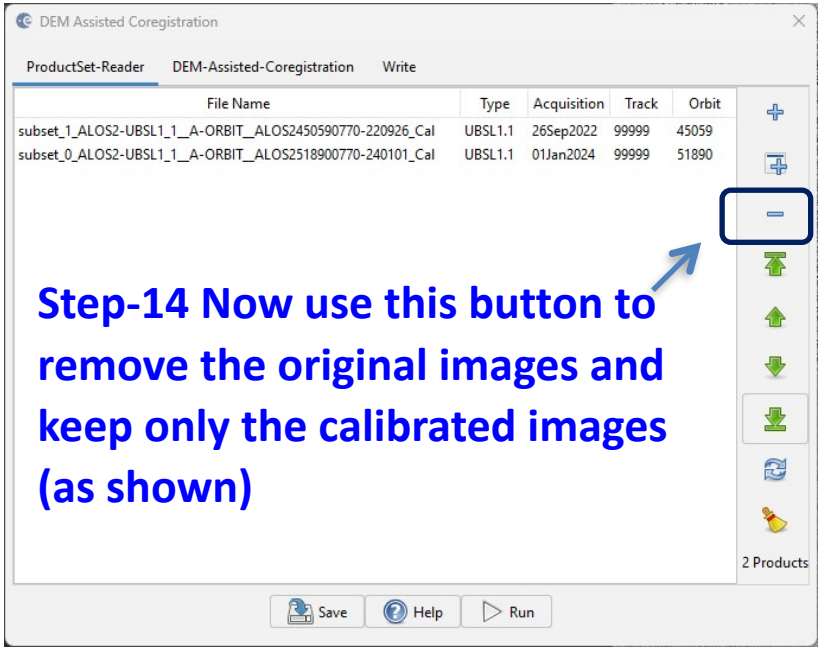




Step-11 double click to visualize the calibrated images



Step-13 Select this button to load all the images



Step-14 Now use this button to remove the original images and keep only the calibrated images (as shown)

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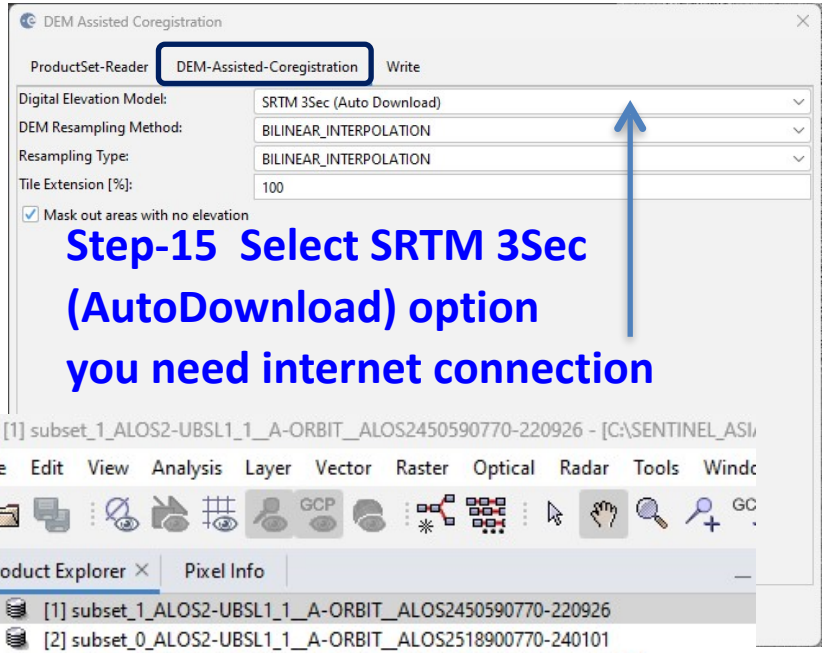
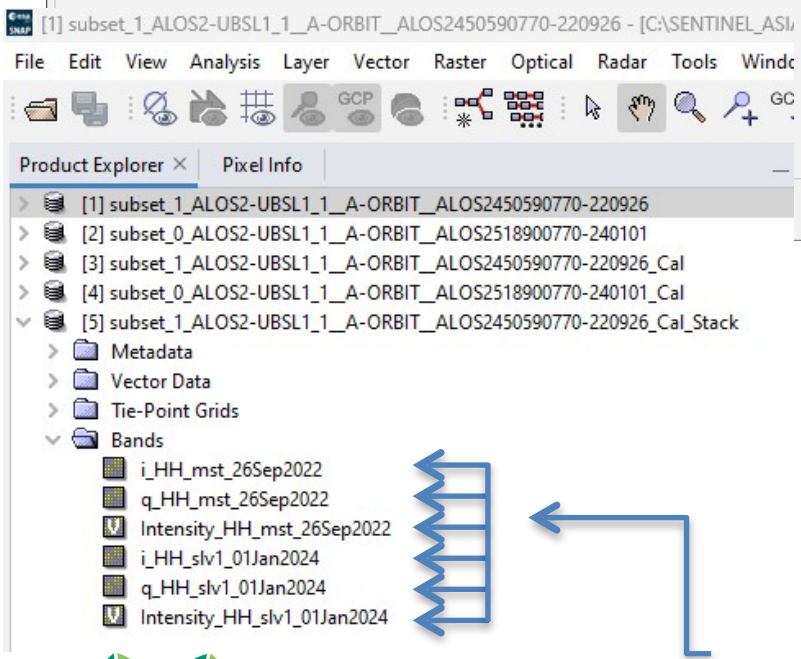
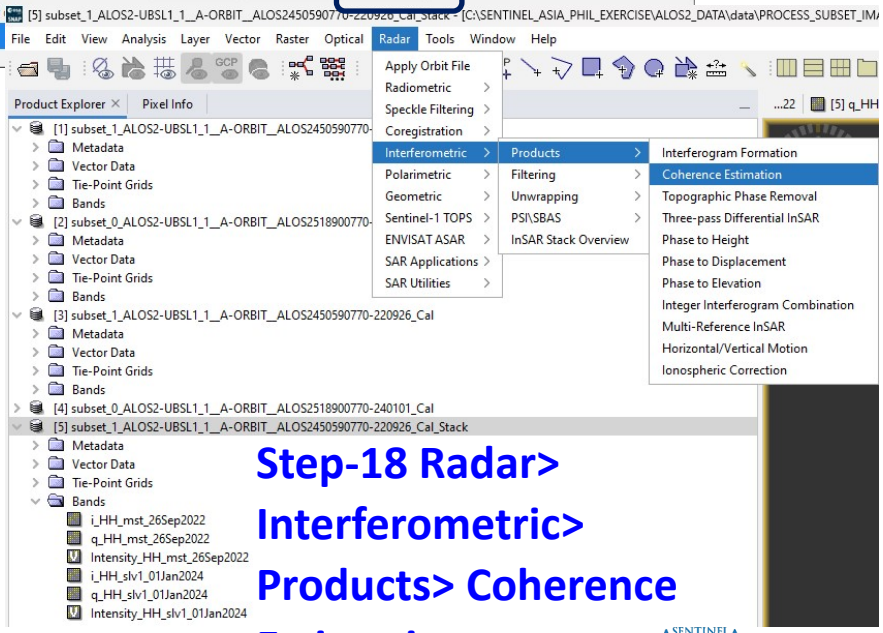


Step-15 Select SRTM 3Sec (AutoDownload) option
you need internet connection

Step-16 select the destination folder as 'coregistration' and Run



Step-17 Once processed, you will see these 6 bands 'double click to visualize'



Step-18 Radar> Interferometric> Products> Coherence Estimation

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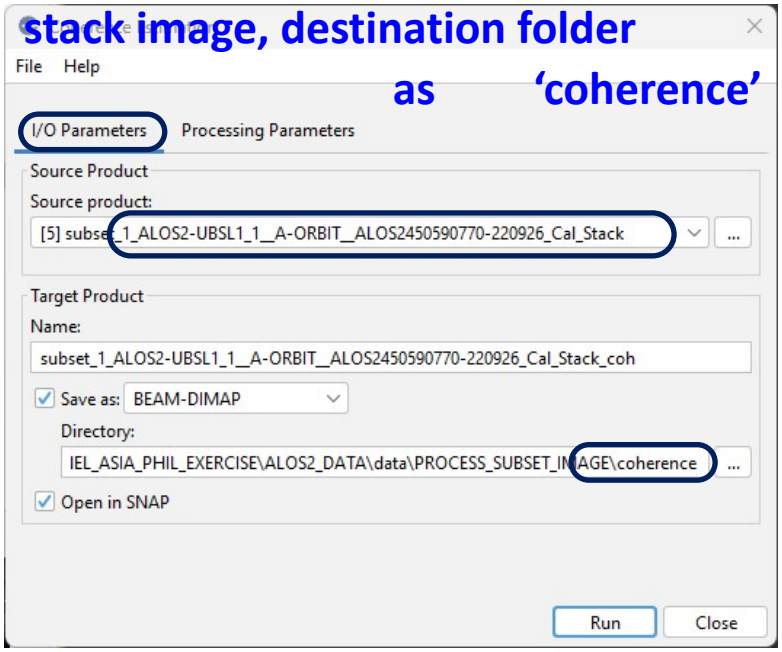
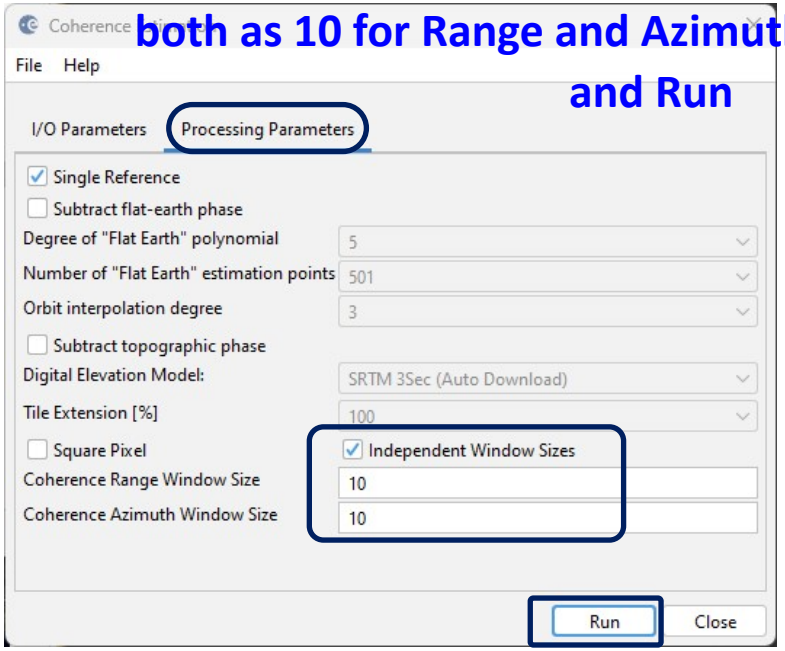
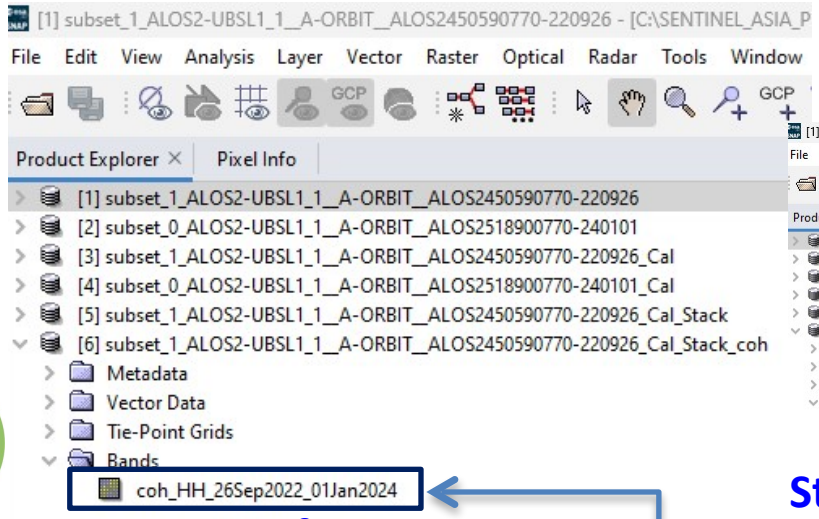
Step-19 Select the calibrated stack image, destination folder as 'coherence'

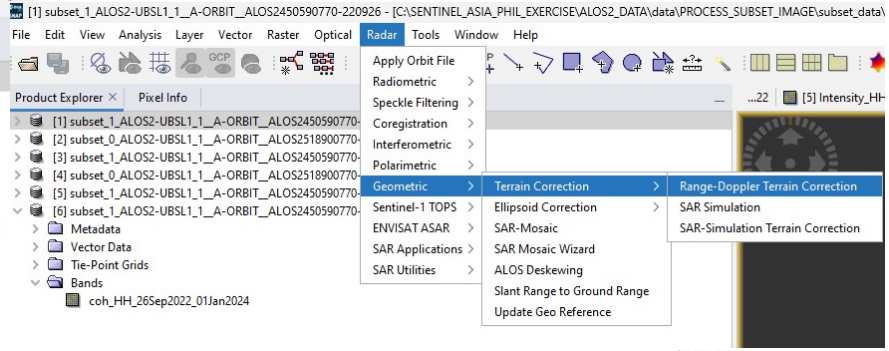


Step-20 Select 'independent window sizes' both as 10 for Range and Azimuth and Run





Step-21 after process cohernce band will be created, double click to visualize



Step-22 Radar> Geometric> Terrain Correction > Range Doppler Terrain Correction

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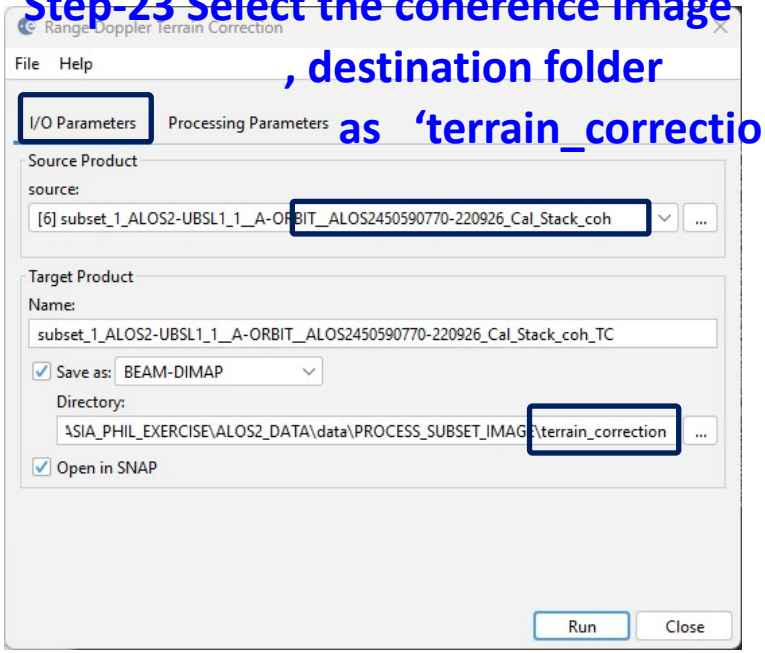
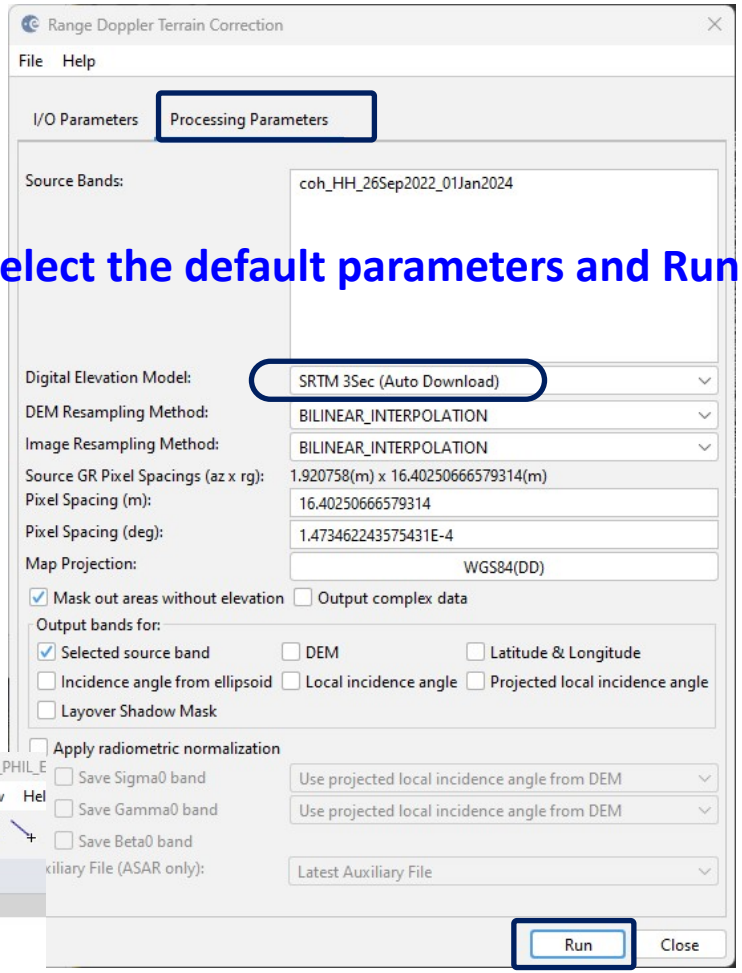
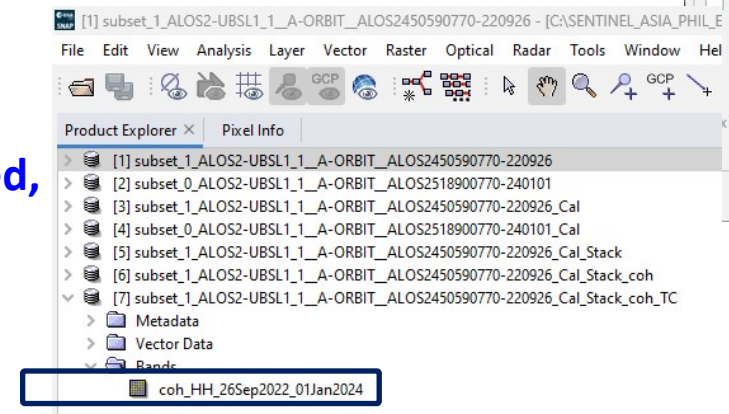
Step-23 Select the coherence image, destination folder as ‘terrain_correction’



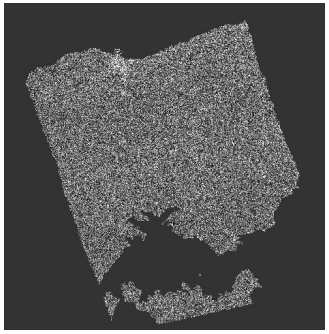
Step-24 Select the default parameters and Run



Step-25 after process coherence band will be Terrain corrected, double click to visualize



Step-26 The terrain corrected coherence image



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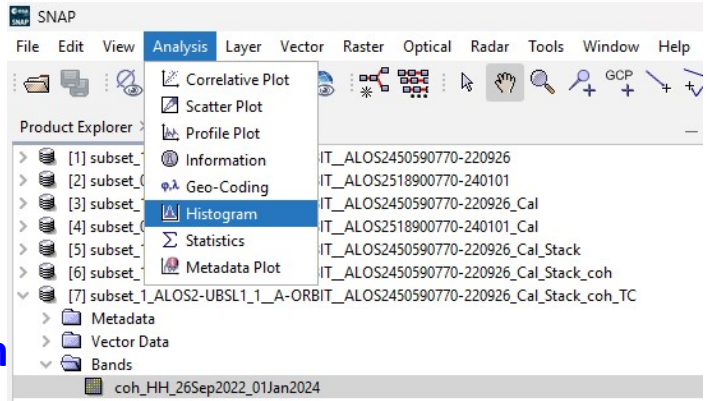
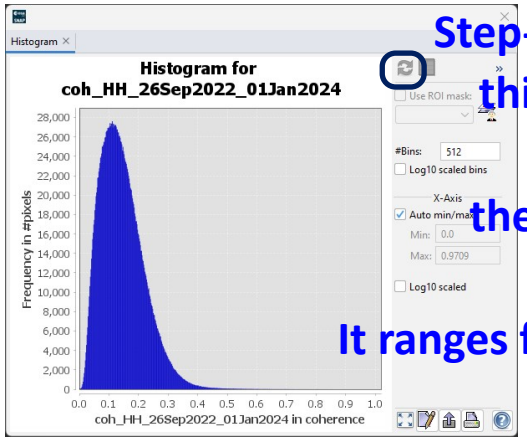
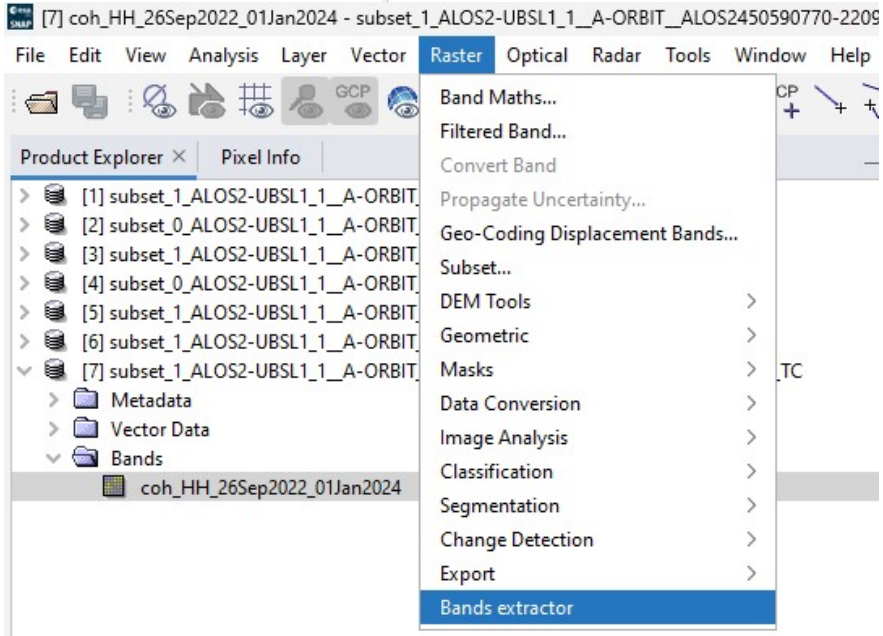
Step-27
Check the histogrm of the 'Terrain corrected' Coherence Image
Analysis> Histogram

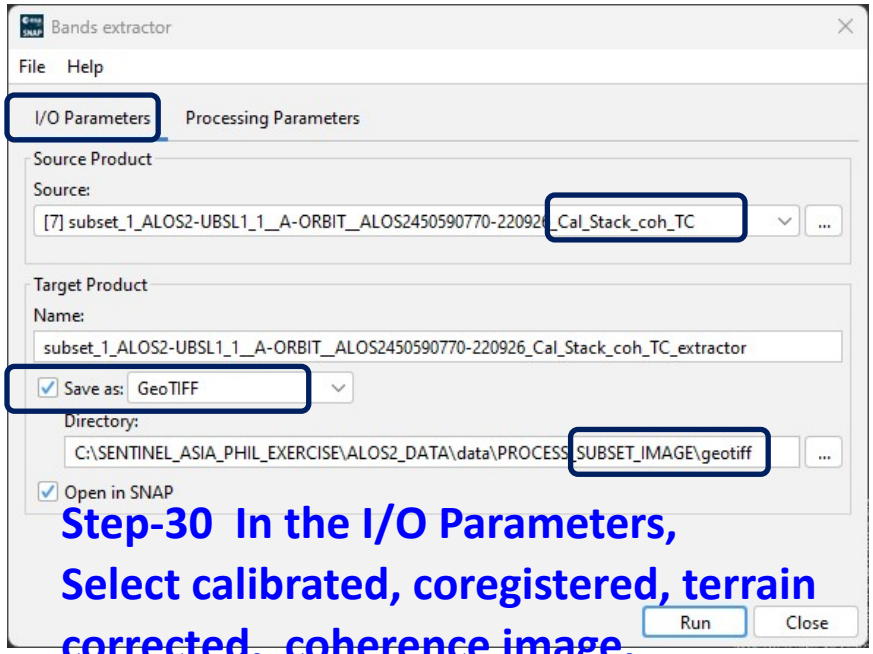


Step-28 Click on this button to compute the Histogram



It ranges from (0 ~ 1)





Step-30 In the I/O Parameters, Select calibrated, coregistered, terrain corrected, coherence image, Save it as 'GeoTiff', select the destination folder 'geotiff'

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Step-29 Extract the terrain corrcted Coherence image in Geotiff format (for further analysis).
Raster> Band Extractor

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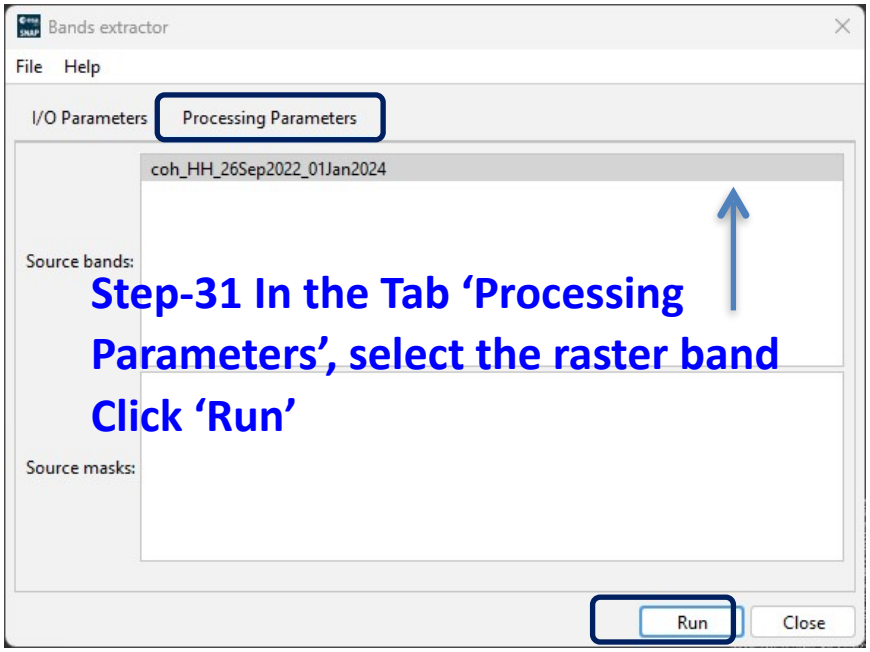
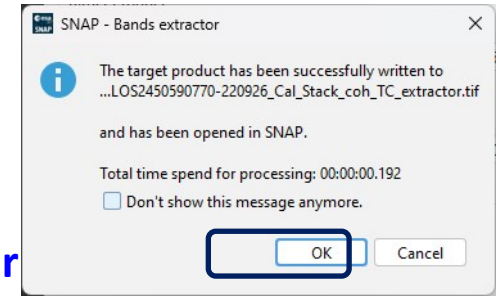
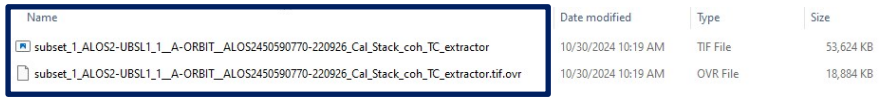


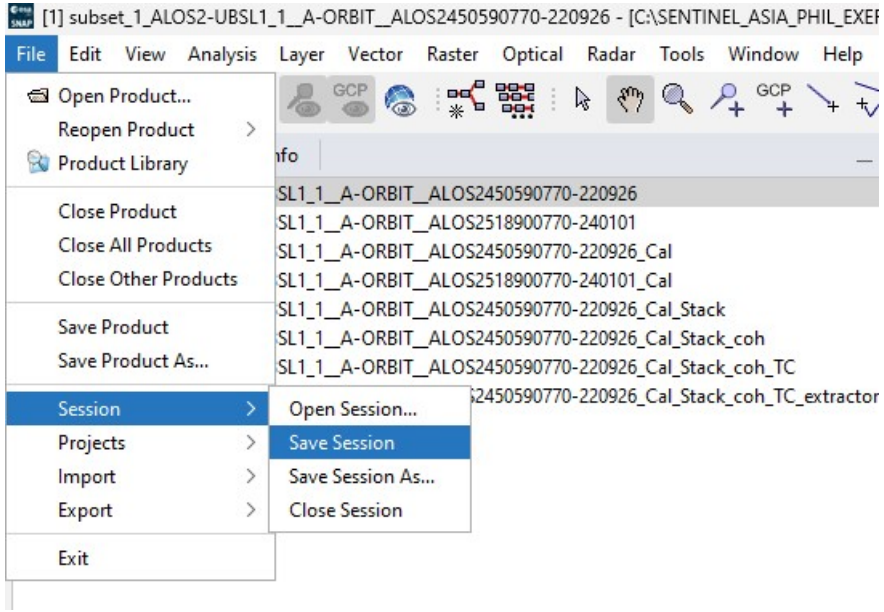
Step-31 In the Tab 'Processing Parameters', select the raster band Click 'Run'

Step-32
The product is written to the destination folder click 'ok'



Step-33 Check the Raster in the 'Geotiff' Folder





Step-34 File> Session> Save Session (necessary to reopen the project later in SNAP)

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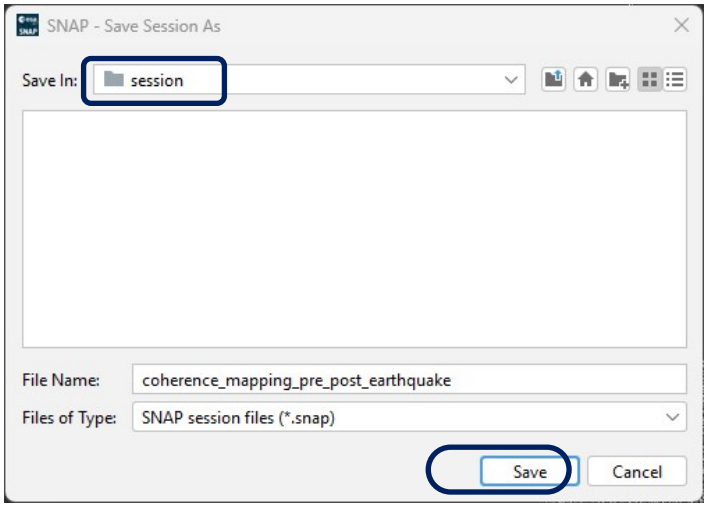
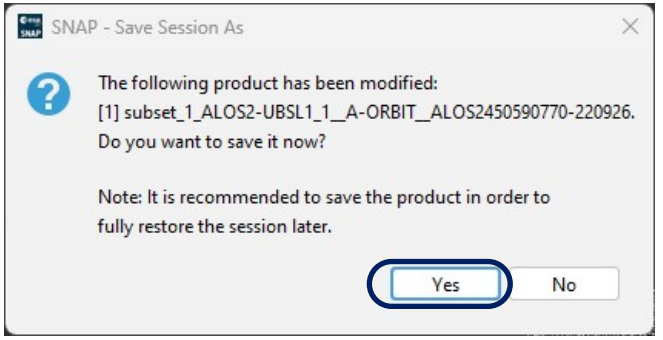
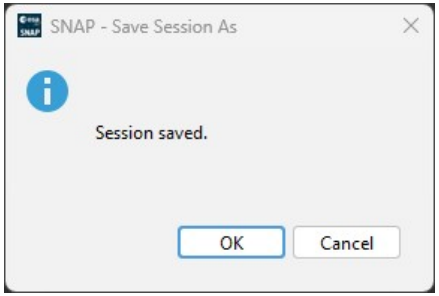
Step-35 Select the folder ‘Session’ and save the project as coherence_mapping_pre_post_earthquake



Step-36 Click ‘Yes’





Step-37 Session Saved (you can reopen the project by File> Session> Open Session)

Step-38 Now launch QGIS

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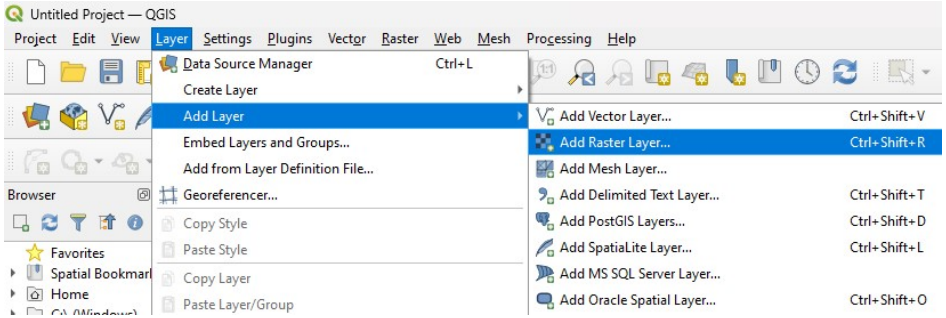
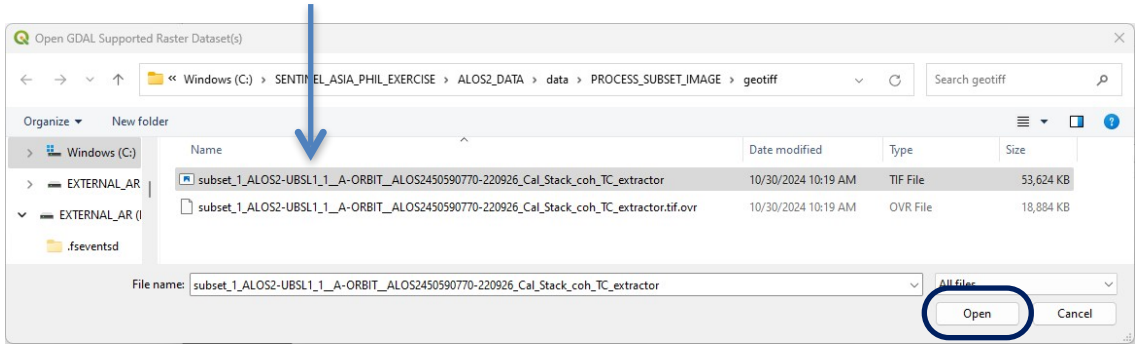
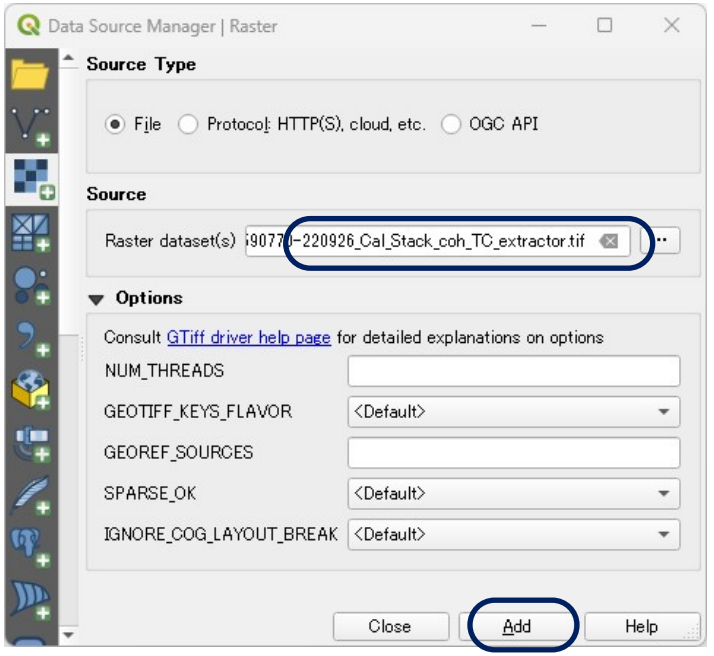
Step-39 Open an new empty Project

Step-40 In QGIS, Layer> Add Layer > Add Raster Layer



Step-41 Select the TIFF file that you exported from SNAP, select it and click 'Open'





Step-42 Add the raster file

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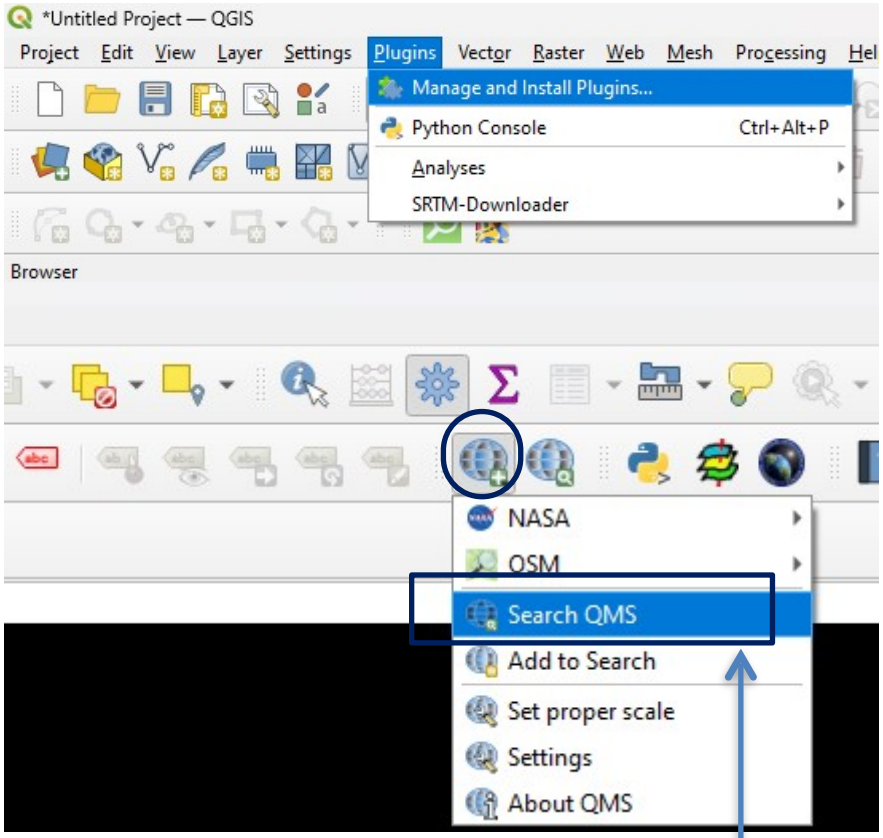
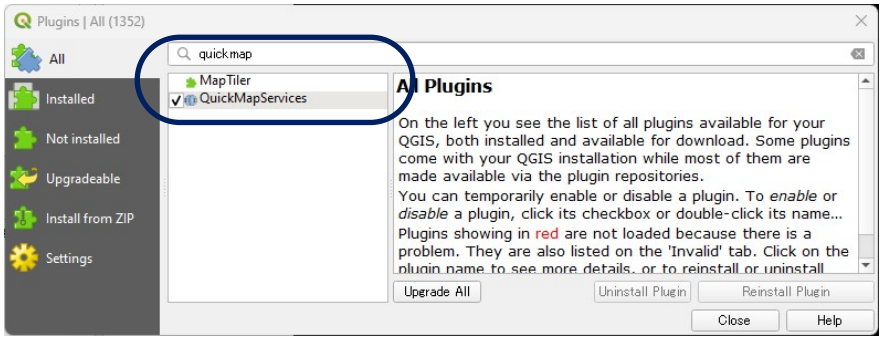
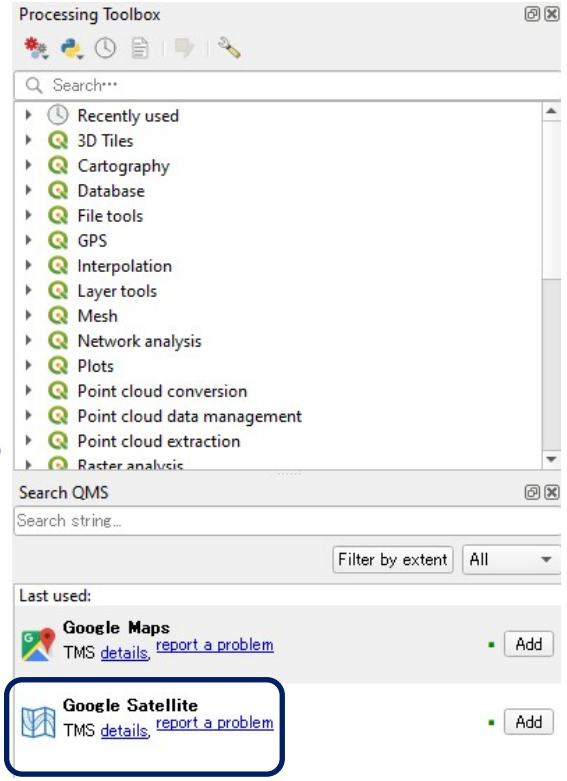
Step-43 In QGIS , you need to install a plugin
Go to Plugins>Manage and Install Plugins



Step-44 Install the plugin 'Quick Map Services'



Step-46 We will use the Google Satellite images as background image



double click (here)

Step-45 Once installed, Click on the icon and go to Search QMS

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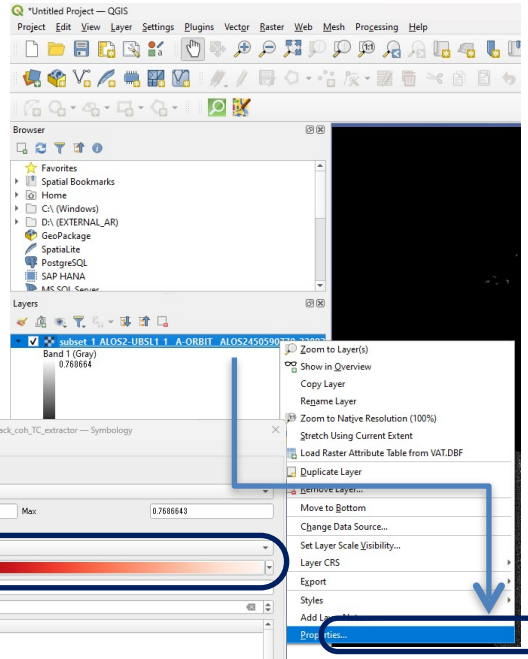
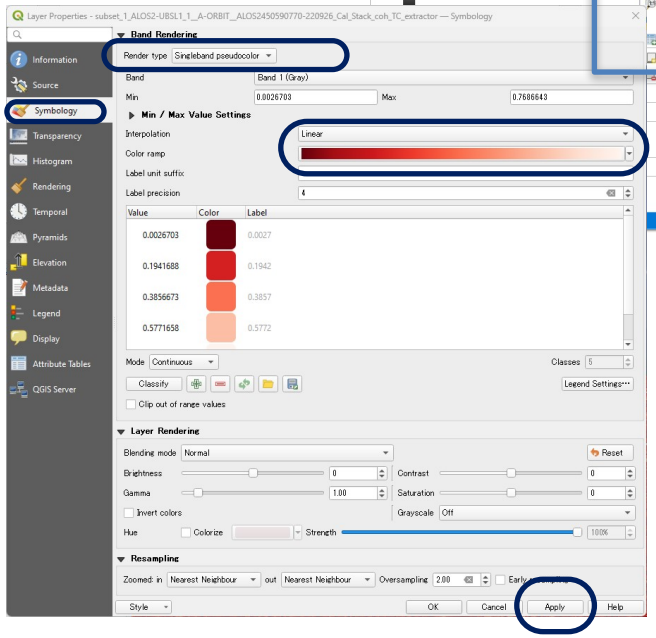
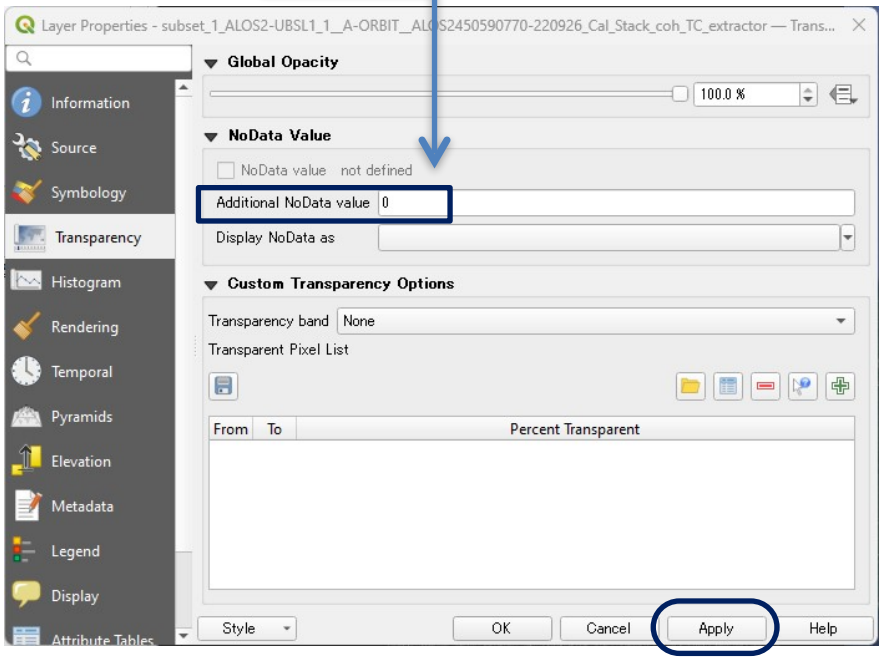
Step-47 Over the Raster, right click > Properties

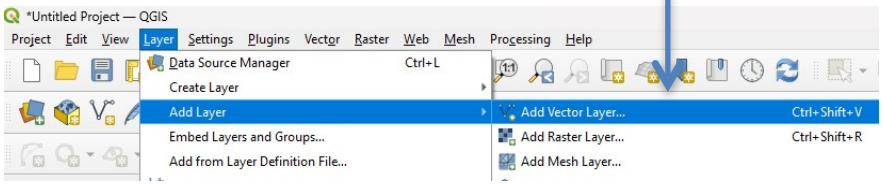




Step-48 Go to Transparency > Put no data value as '0' click> Apply



Step-50 Again Go to Layer > Add Layer> add Vector Layer



Step-49 Click on symbology> render type: singleband pseudocolor> Interpolation: Linear> colour map: Red > Apply

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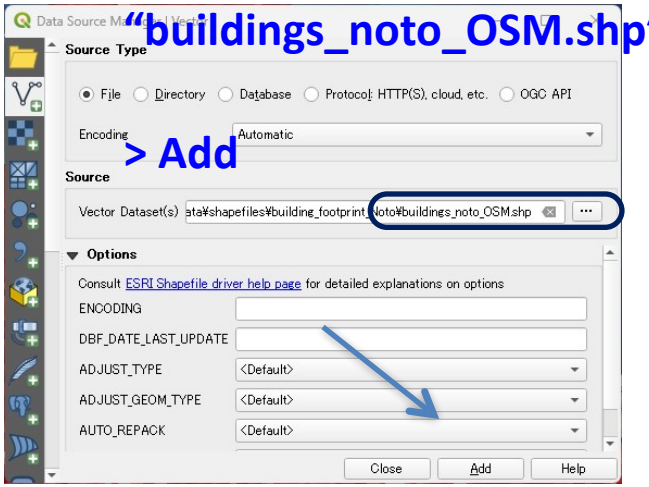
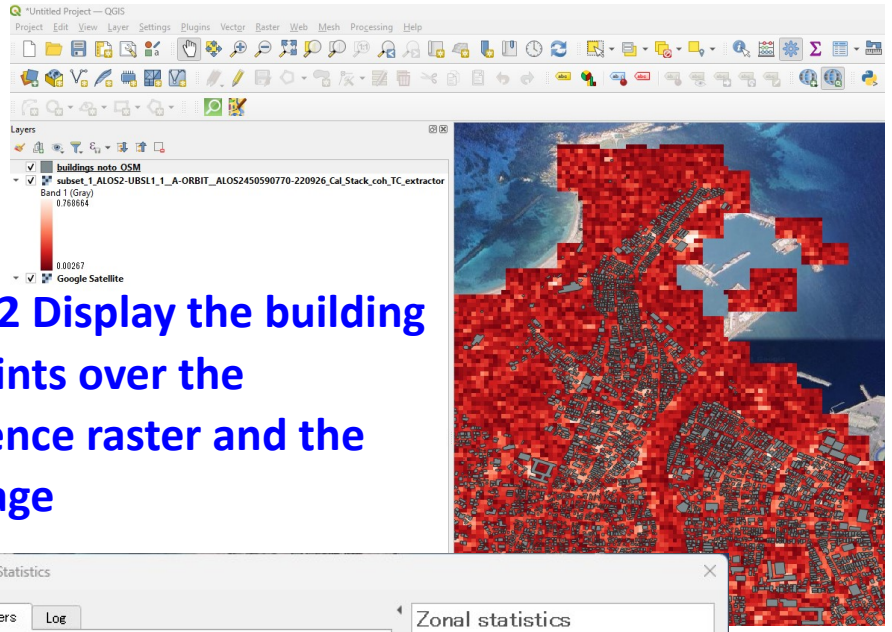
Step-51 select the building shapefile “buildings_noto_OSM.shp”

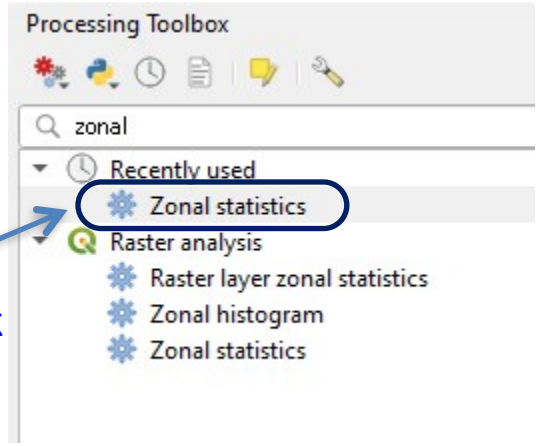


> Add

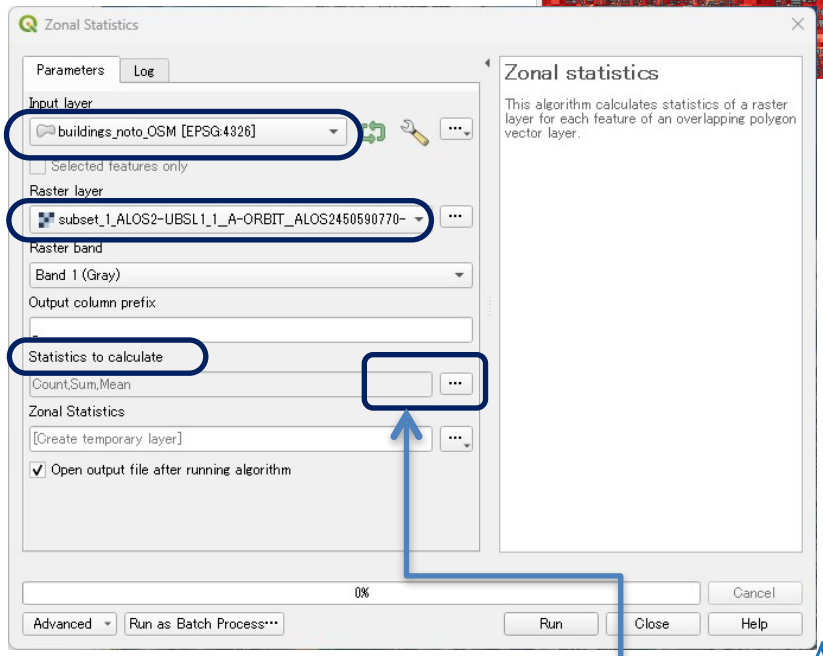


Step-52 Display the building footprints over the coherence raster and the GE image

Step-53 Go to the ‘Processing Toolbox’ in QGIS and search for ‘zonal statistics’



double click



Step-54 Select the Building shapefile in ‘Input Layer’ and ‘coherence_raster’ in ‘Raster Layer’ and click on (...) on ‘Statistics to calculate’

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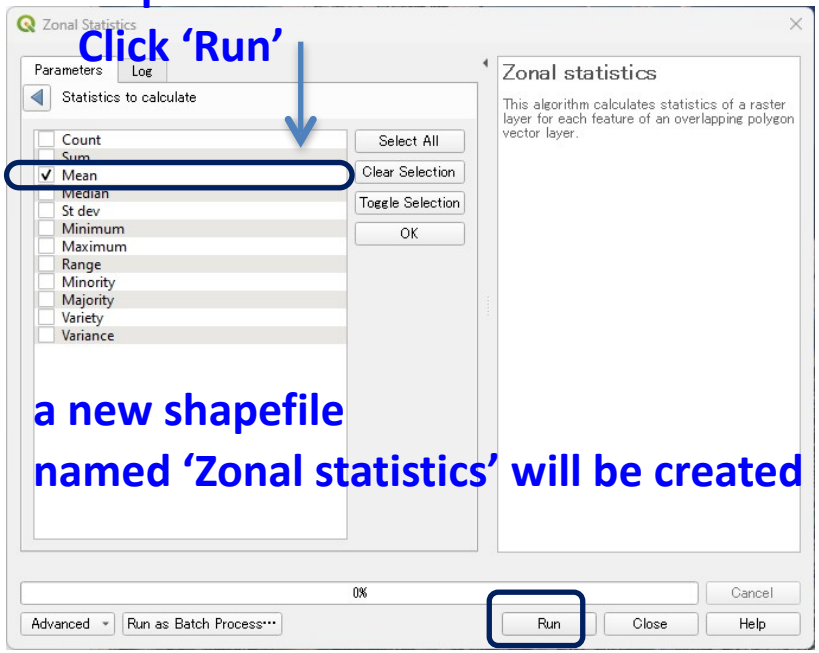
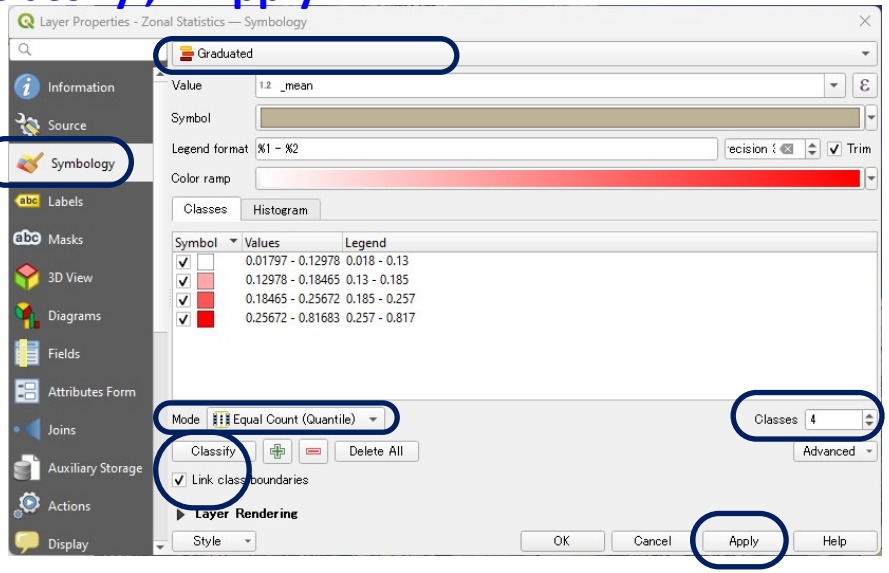
Step-55 Select the ‘Mean’ and Click ‘Run’

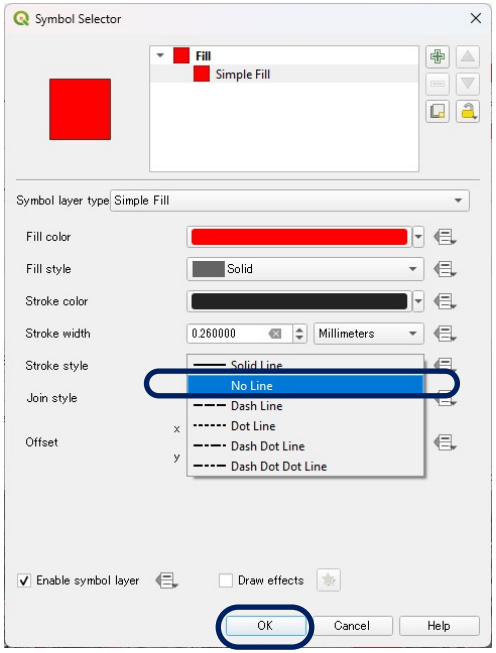


a new shapefile named ‘Zonal statistics’ will be created

Step-56 Right Click on the Zonal Statistics> Properties> Symbology. Select Graduated, Value : _mean , Colour ramp: Red, classes: 4 , Mode: Equal Count, Classify , > Apply



Step-57 You can make the boundaries of the buildings transparent (optional)



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Step-58 Display Building footprints with different coherence values (4 classes)

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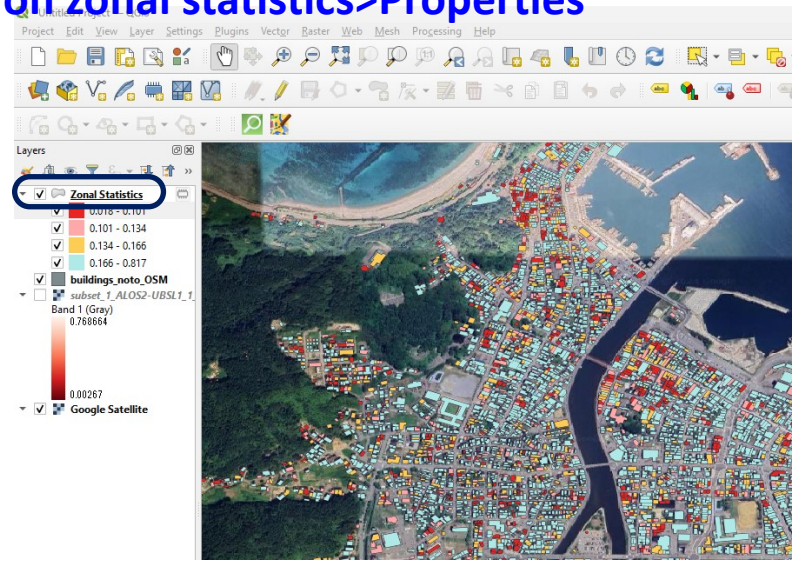
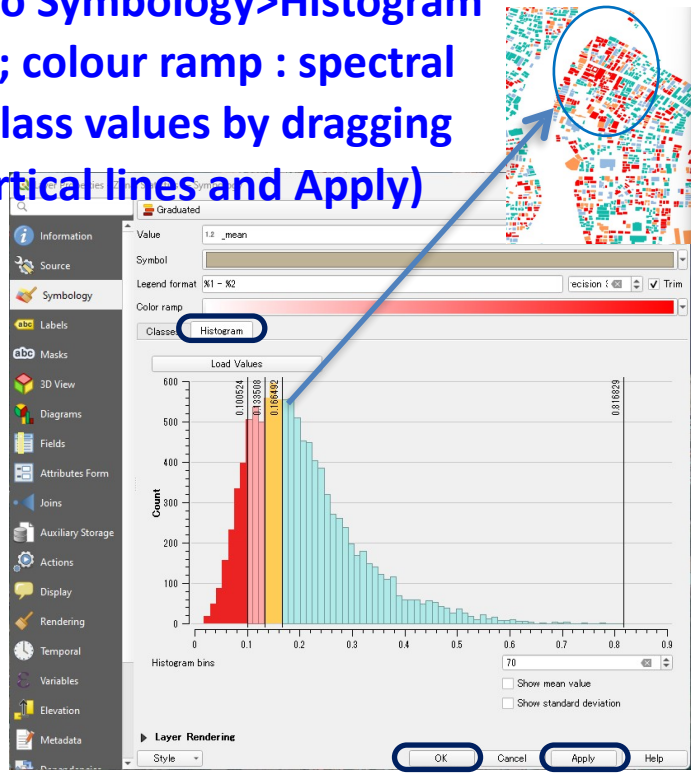
Step-59 Now we will refer a high resolution image where there is clear damage to buildings seen after the earthquake (image on the right). These buildings will have low coherence in the shapefile "zonal statistics"

Step-60 Adjust the class values so that the buildings in damaged areas are seen in red colours in our shapefile 'zonal statistics'

Right click on zonal statistics>Properties



Step-61 Go to Symbology>Histogram Load values ; colour ramp : spectral (adjust the class values by dragging the black vertical lines and Apply)



once verified, click ok (remember the class breaks)

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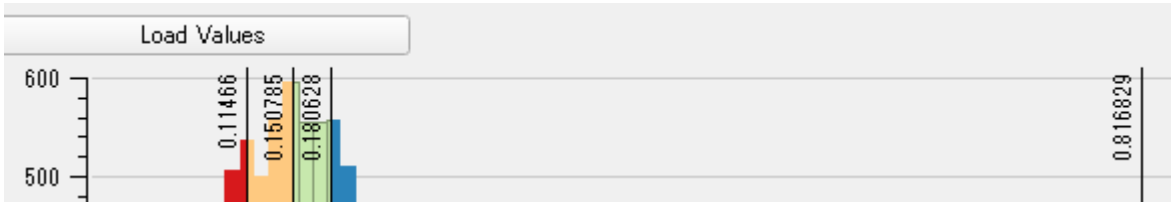
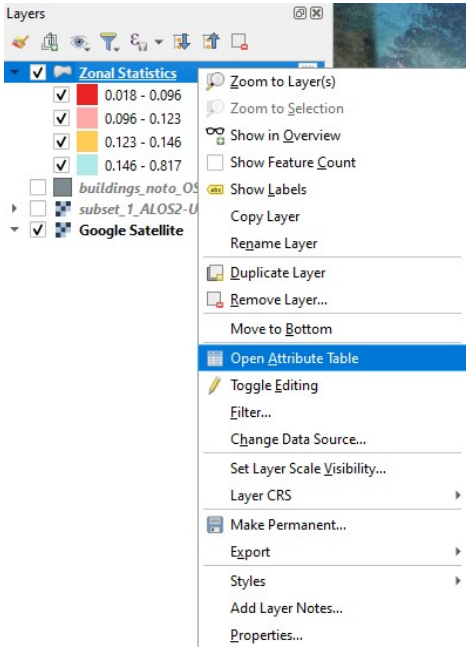
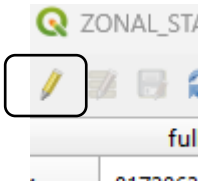
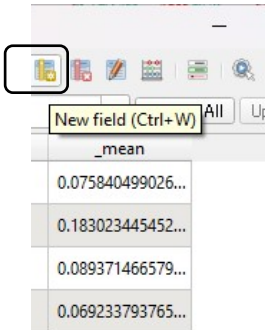


the class breaks, here are :
0.11 , 0.15 , 0.18 (you may decide on slightly different values)

Step-62 Right Click on 'Zonal Statistics' >
Open attribute table > 'toggle editing mode'
> new field







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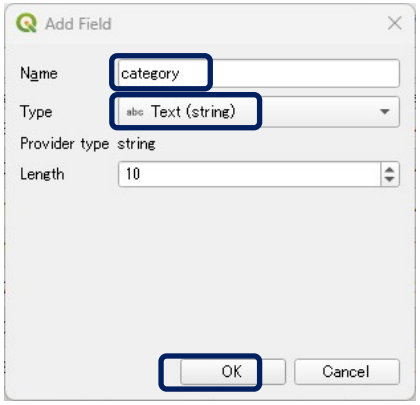
Step-63 Create a new field named ‘category’ , Type: Text (String) > ok

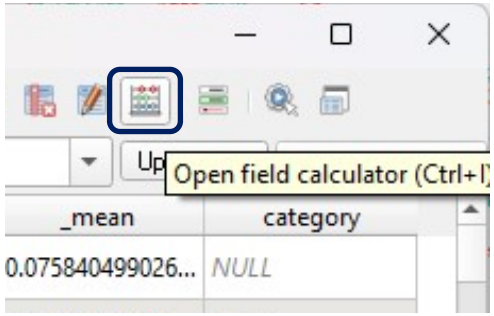


class values

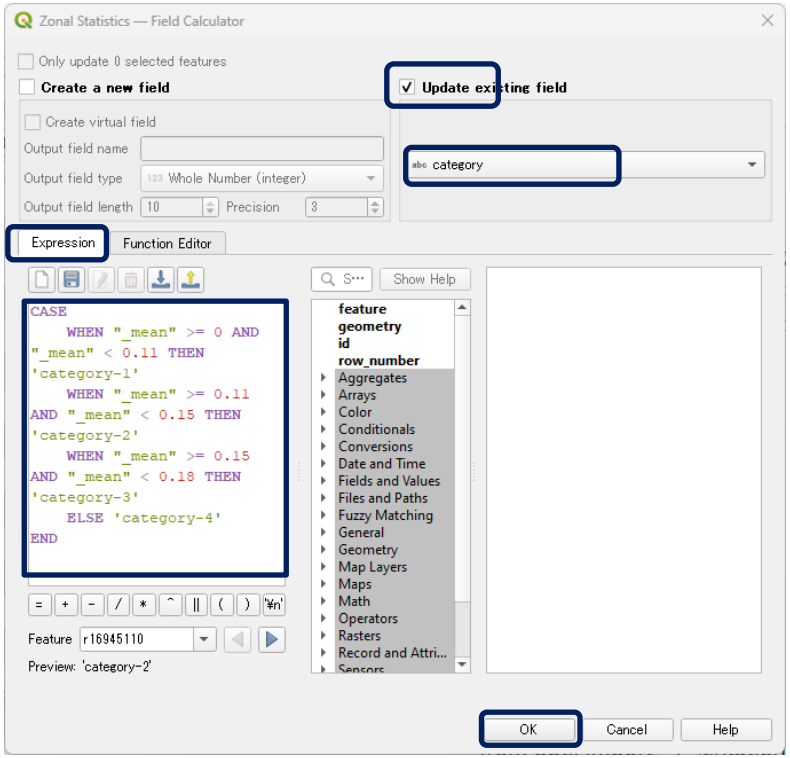
Expression

```
CASE
   WHEN "_mean" >= 0 AND "_mean" <= 0.11 THEN 'category-1'
   WHEN "_mean" > 0.11 AND "_mean" <= 0.15 THEN 'category-2'
   WHEN "_mean" > 0.15 AND "_mean" <= 0.18 THEN 'category-3'
   ELSE 'category-4'
END
```

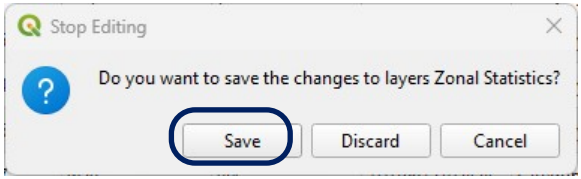
Step-64 Open Field Calculator



Step-65 Use the expression as shown while click ‘update existing field’ , chose ‘category’ > ok use your own class values you think is appropriate



Step-66 Toggle Editing Mode > Save



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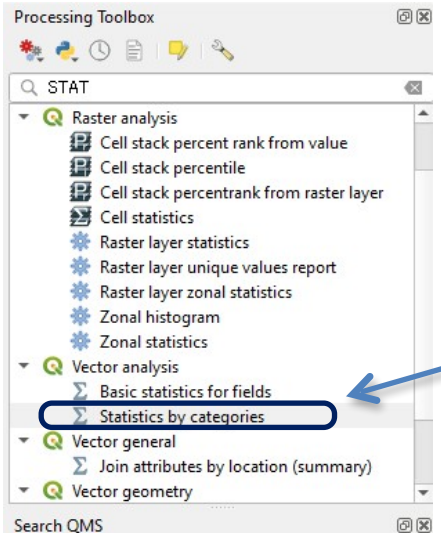
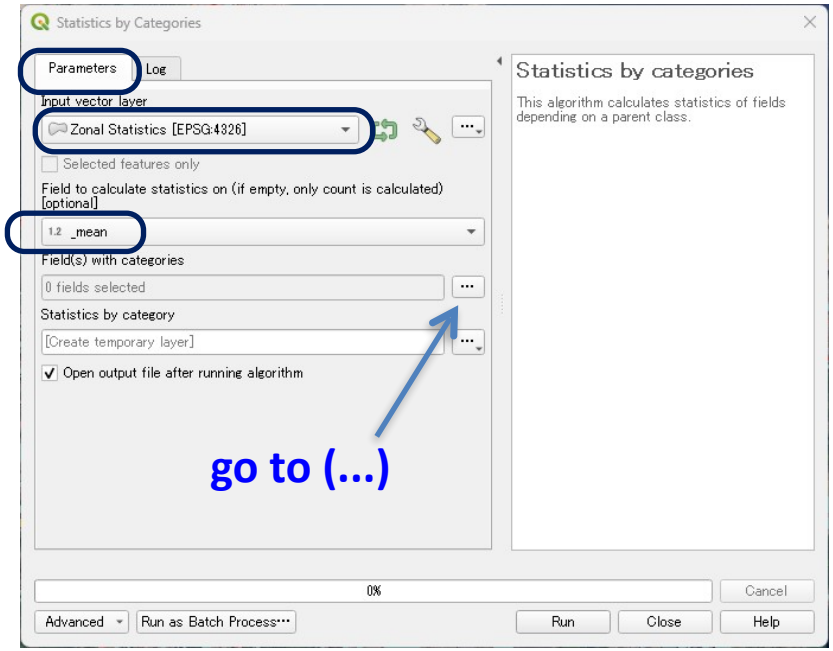
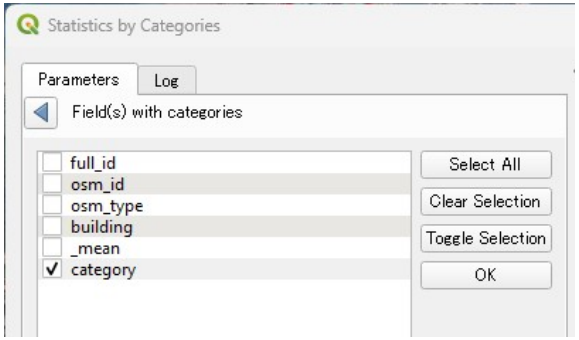
Step-67 Go to Processing Toolbox > search : statistics by categories



Step-68 Select Zonal Statistics and _mean under 'Parameters' Tab



Step-69 Select 'category' and 'Run'



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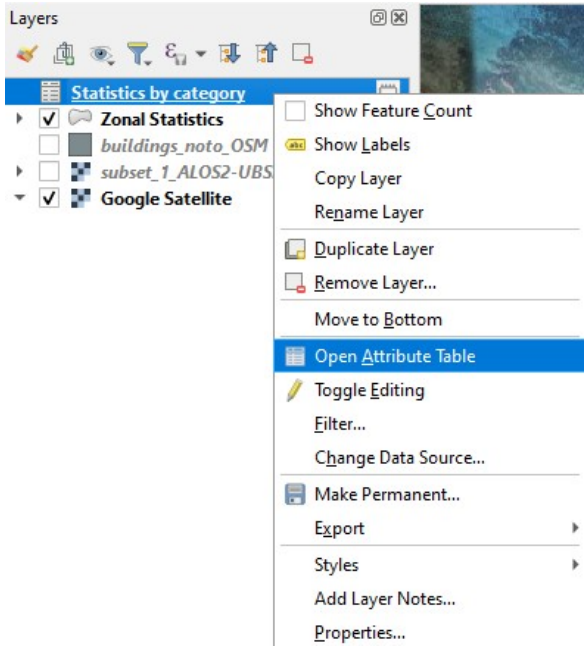
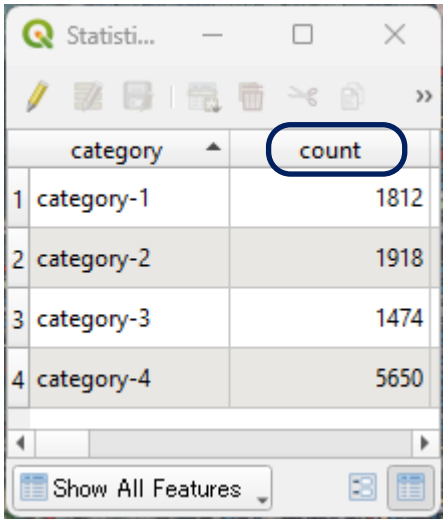
Step-74 You will see a file named ‘Statistics by category’
Right Click > Open Attribute Table



Step-75 You will see the number of Buildings damaged under each category



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Thank you

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