Flood Extraction Using ALOS 2 PALSAR 2 Data

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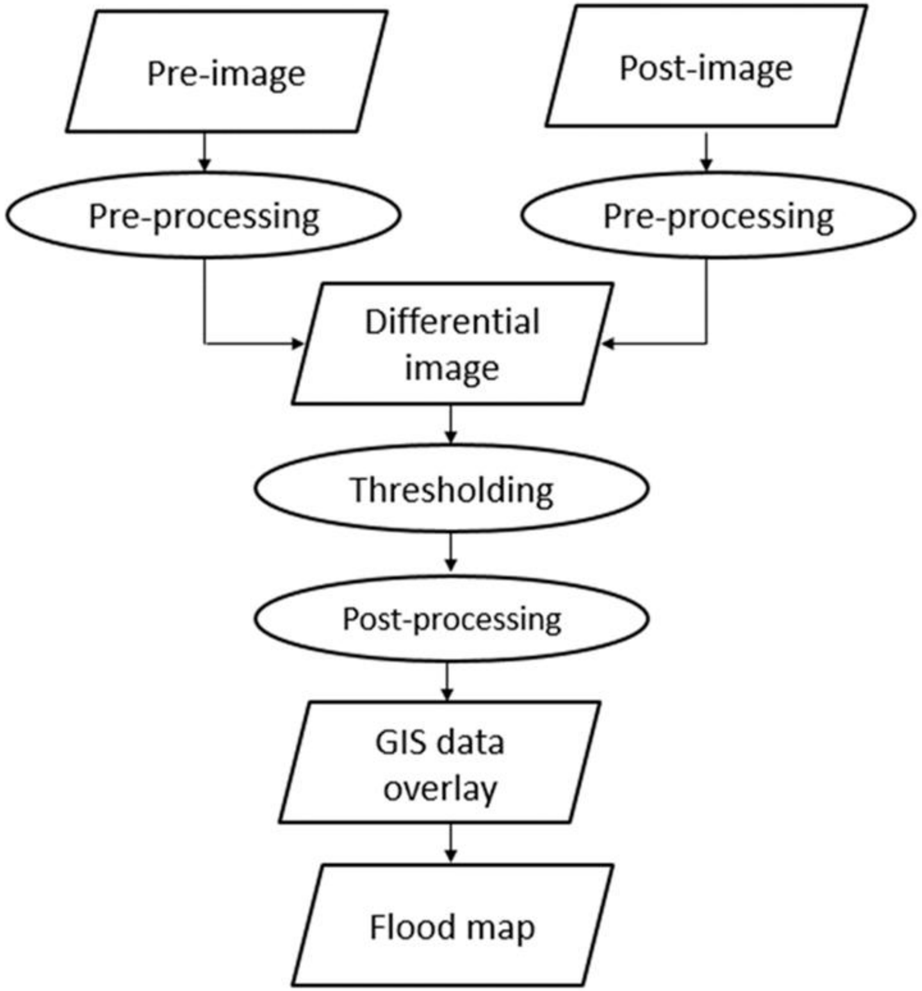
Methodology behind the Flood extraction



ALOS 2 PALSAR 2 Data Calibration

$$\sigma^0[\mathrm{d}B] = 10\log_{10}(DN)^2 + CF$$

$\boldsymbol{\sigma^0}$ – Radar Backscatter

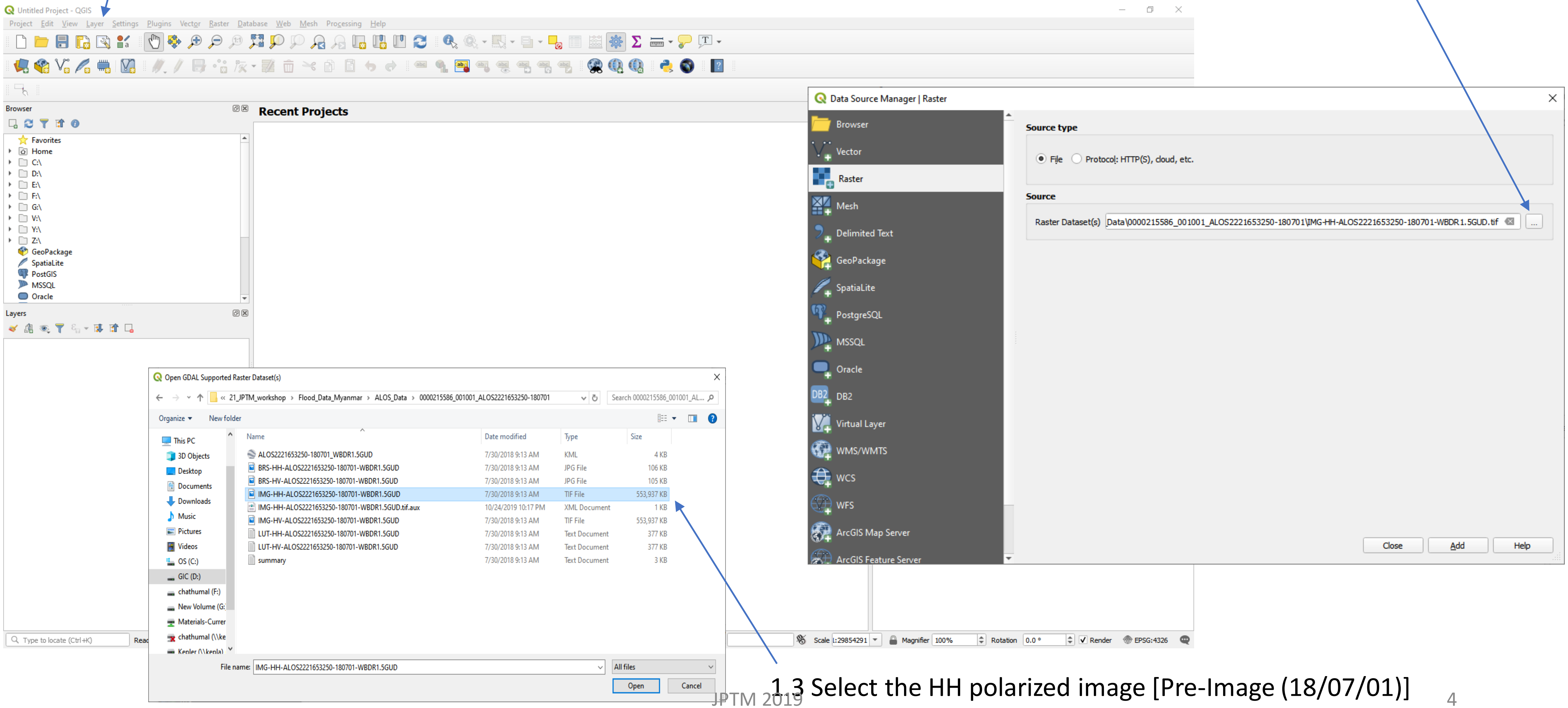
DN – Pixel DN values

CF - Calibration Factor

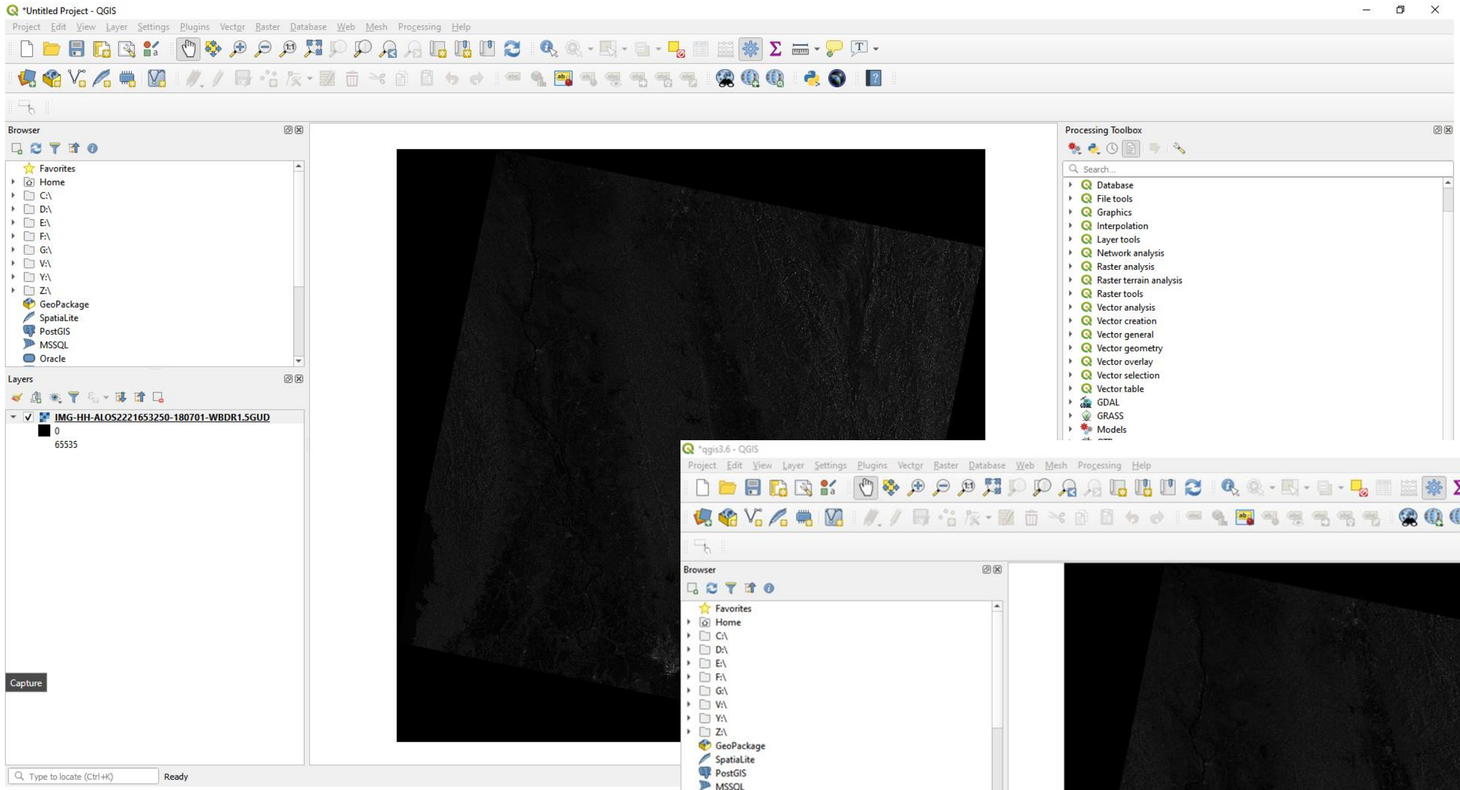
1 Open **QGIS** installed on your computer

1.1 Goto **Layer > Add Layer > Add Raster Layer**

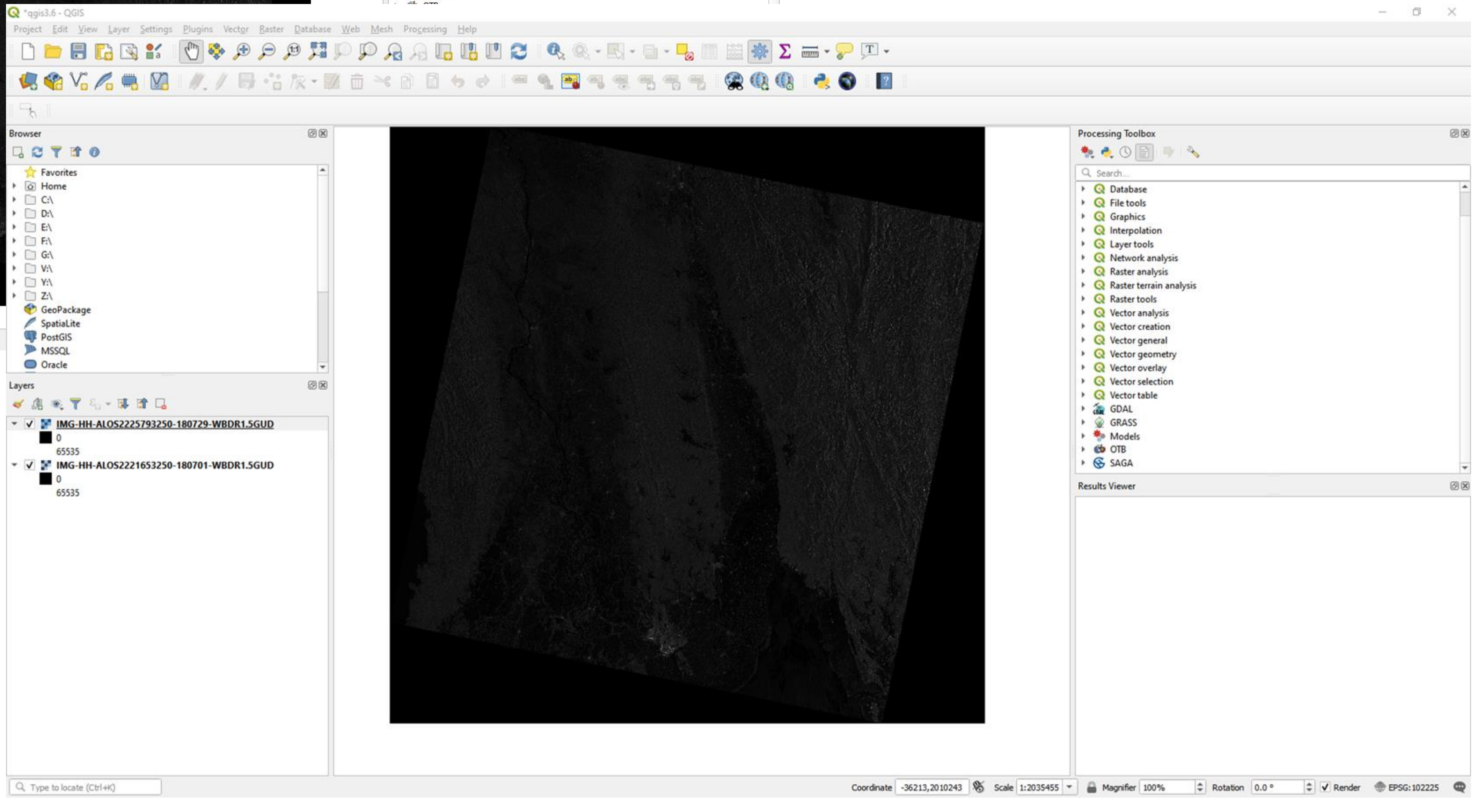
1.2 Browse the path to your image



1.3 Select the HH polarized image [Pre-Image (18/07/01)]

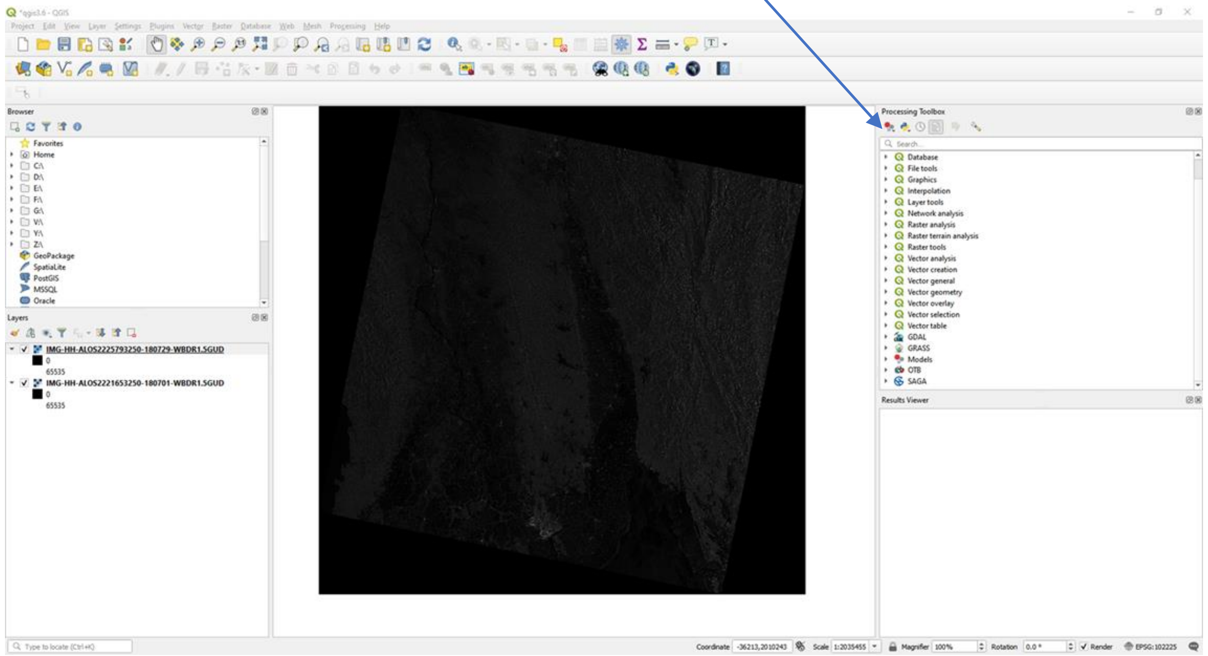


1.4 Similarly add the Post Image ➡
[Post-Image (18/07/29)]

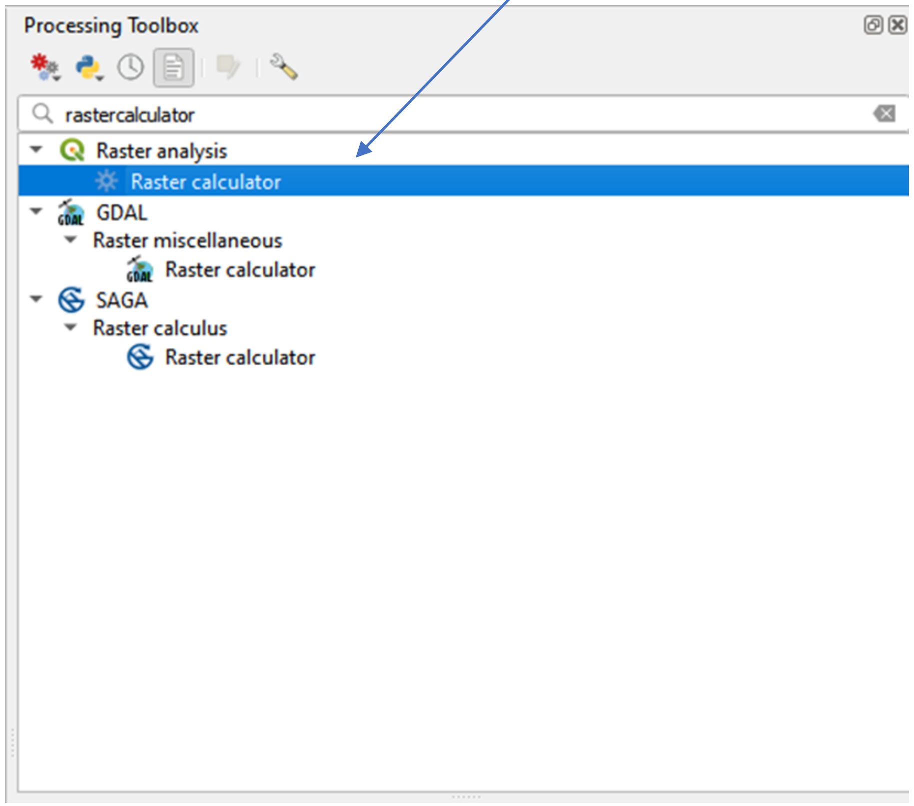


2 Image Calibration

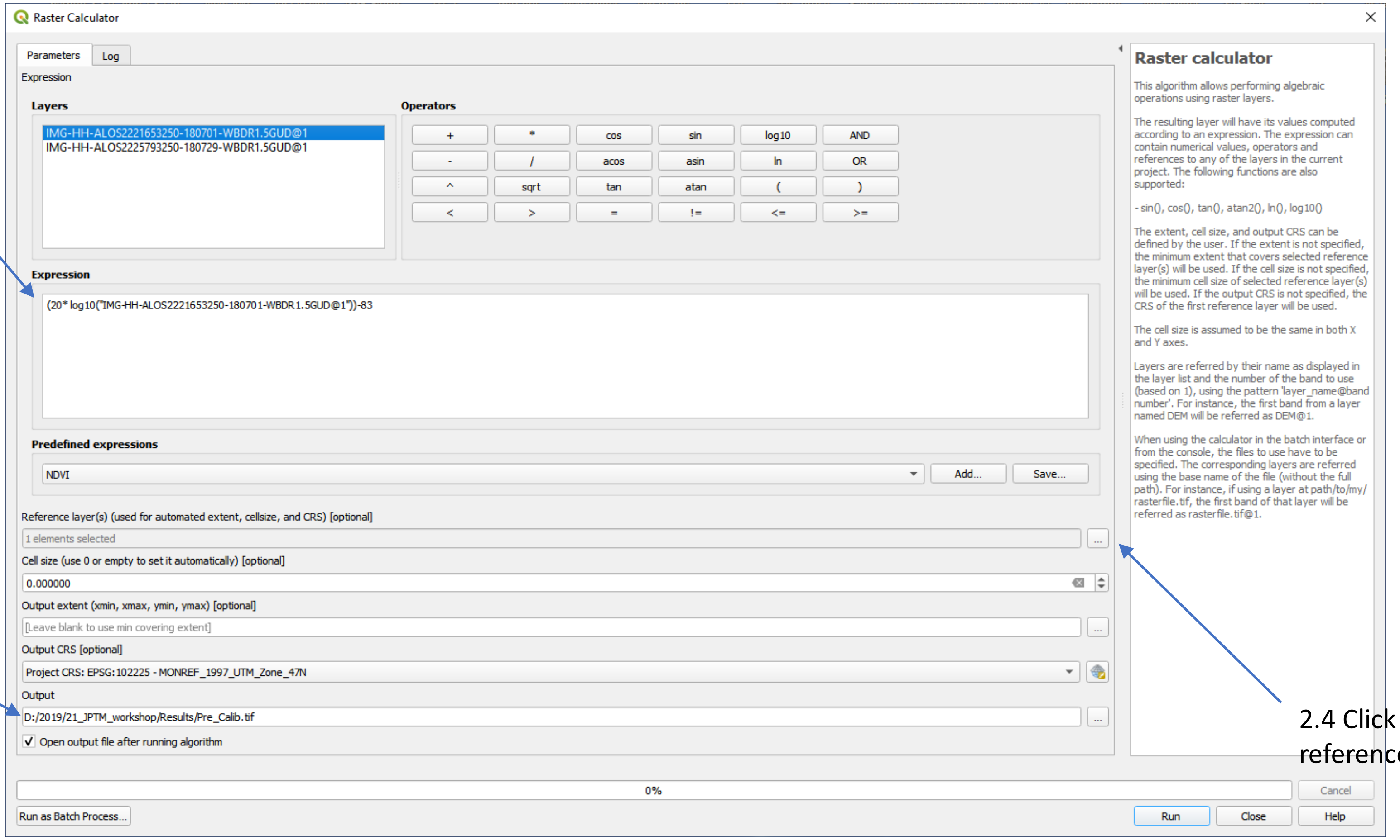
2.1 In Processing toolbox search bar type raster calculator.



2.2 Select the **Raster calculator** under QGIS processing tools.



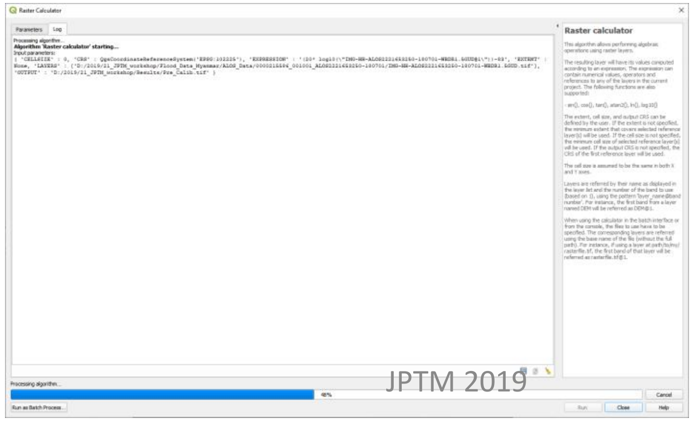
2.3 Input the Calibration Expression here

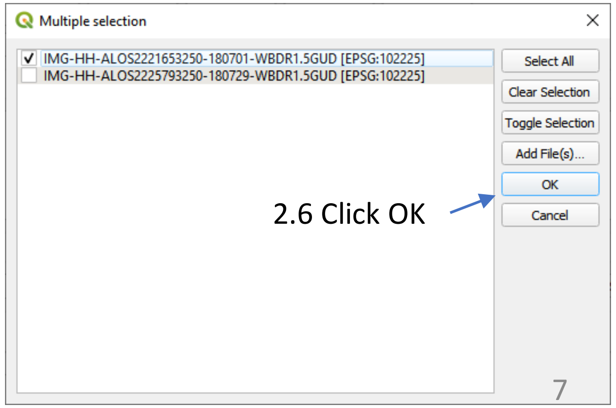


2.5 Browse to the output folder and give it a name and save it as a .tif file

2.4 Click on this icon and select a reference layer

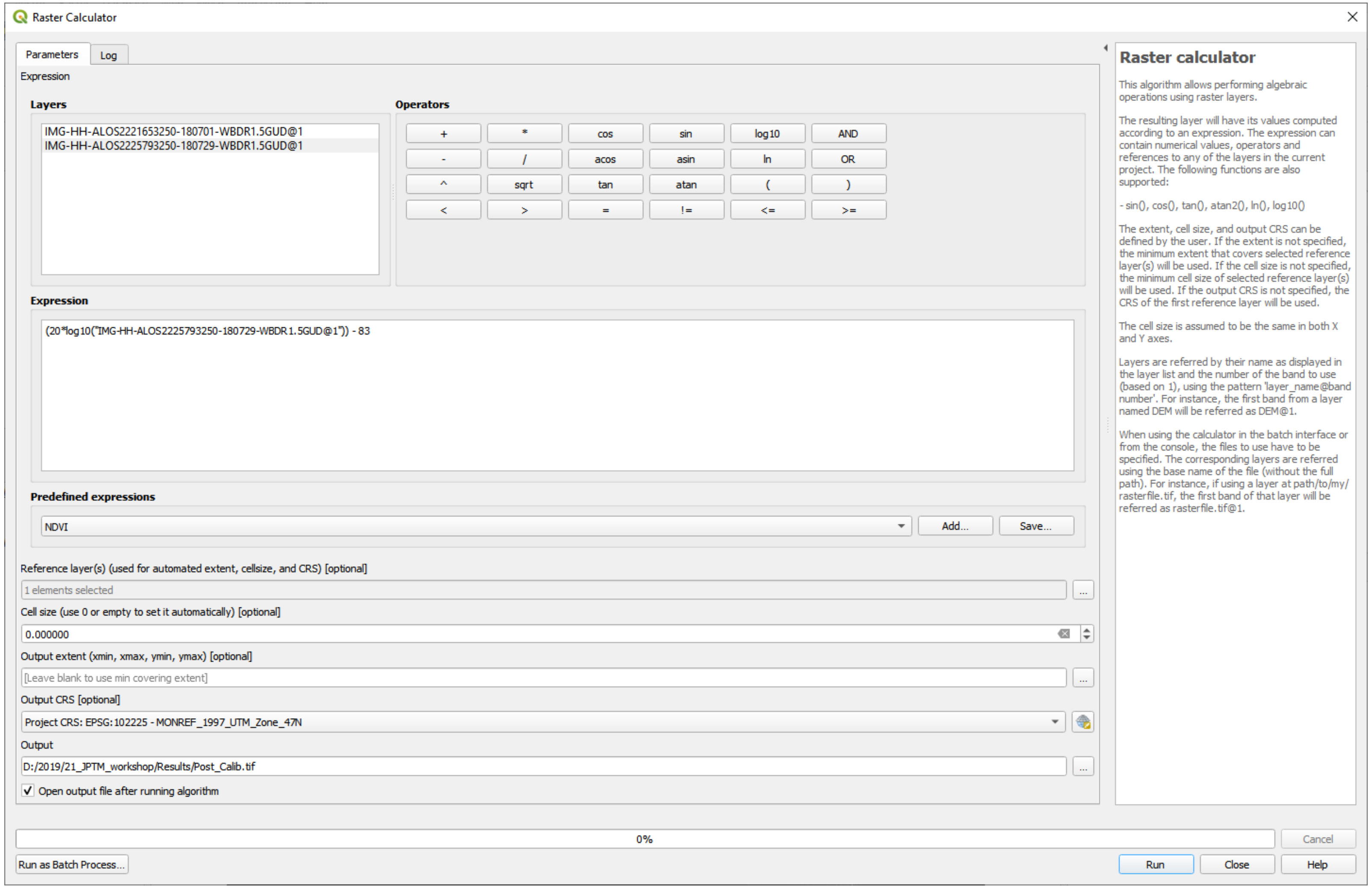
2.7 Click Run





2.6 Click OK

2.8 Do the same calibration for the post image



3 Speckle filtering

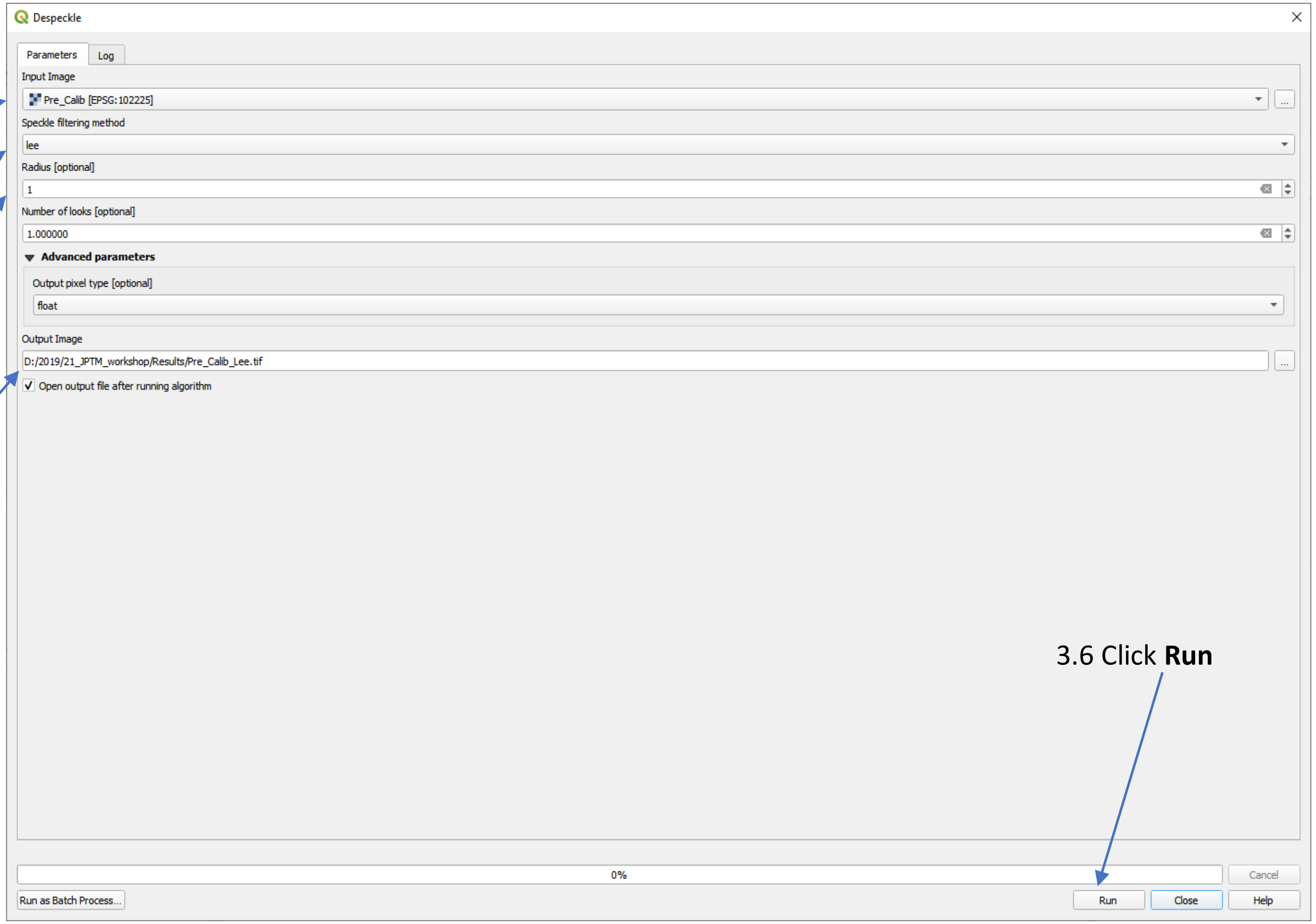
3.1 Type **Despeckle** in processing toolbox search bar Select the Despeckle in OTB toolbox.

3.2 Select the calibrated **pre-image** from the drop down.

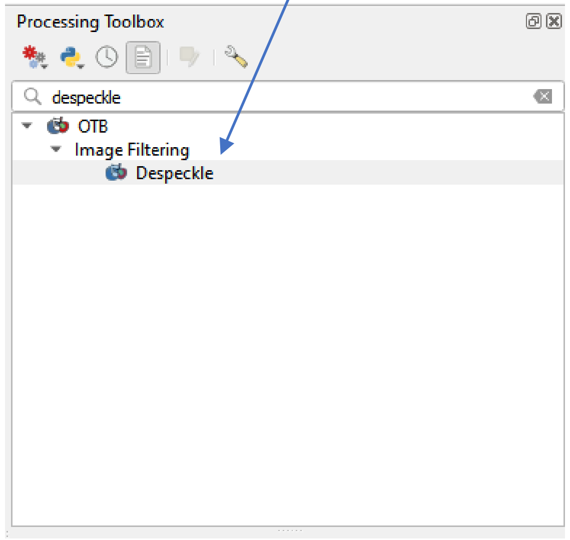
3.3 Select the filter type as **Lee**

3.4 Specify radius of the filter as **1** (3*3)

3.5 Browse to output folder and give it a relevant name and **.tif** file type

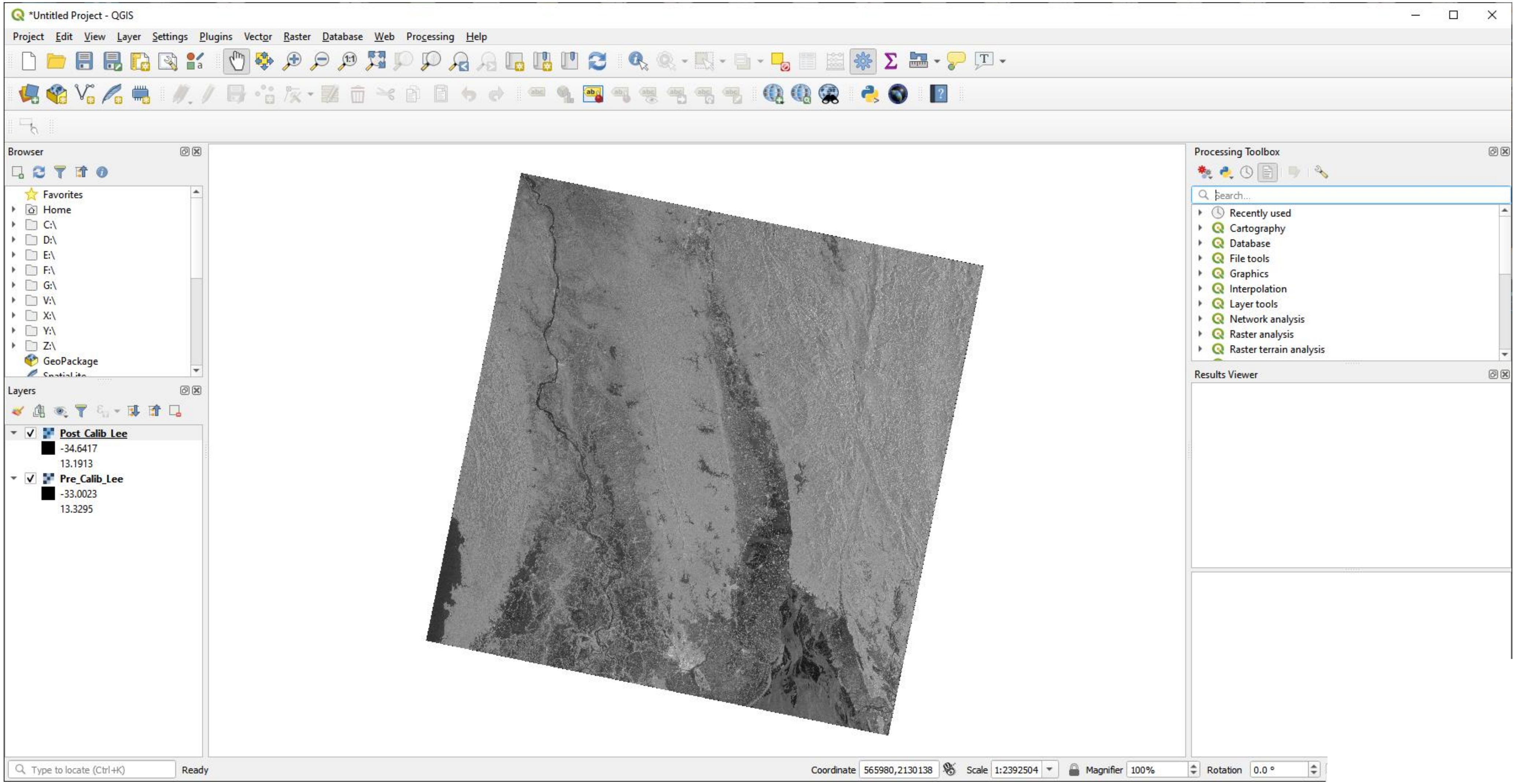


3.6 Click **Run**



Do the same process for the **post image**

Images after speckle filtering



4 Re-project images into WGS84 system

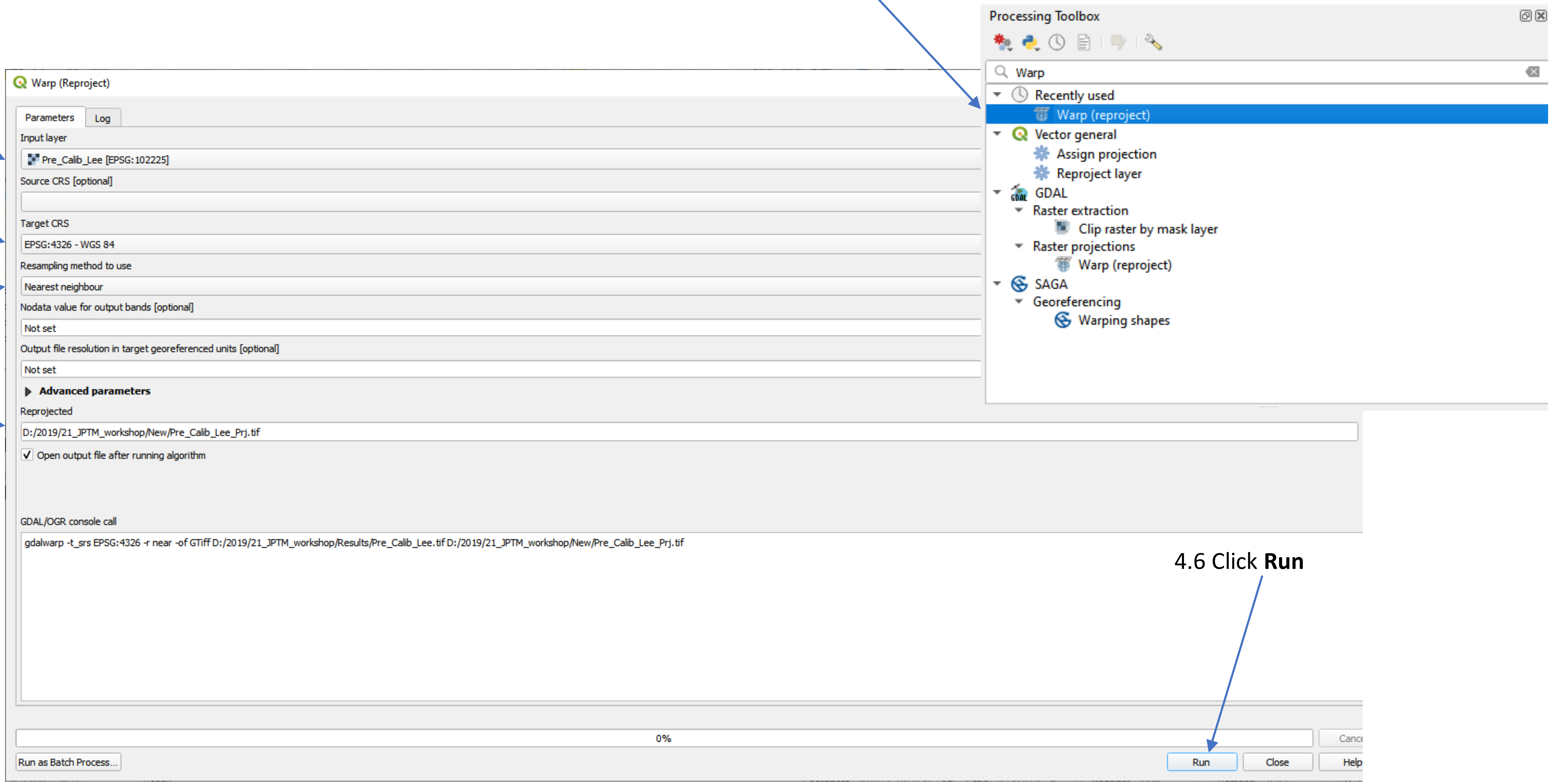
4.1 Type **Warp** in processing toolbox search bar Select the Warp under **GDAL**

4.2 Select the filtered **pre-image** from the drop down.

4.3 Select the Target CRS as EPSG: 4326

4.4 Specify the resampling as Nearest neighbor

4.5 Browse to output folder and give it a relevant name and **.tif** file type



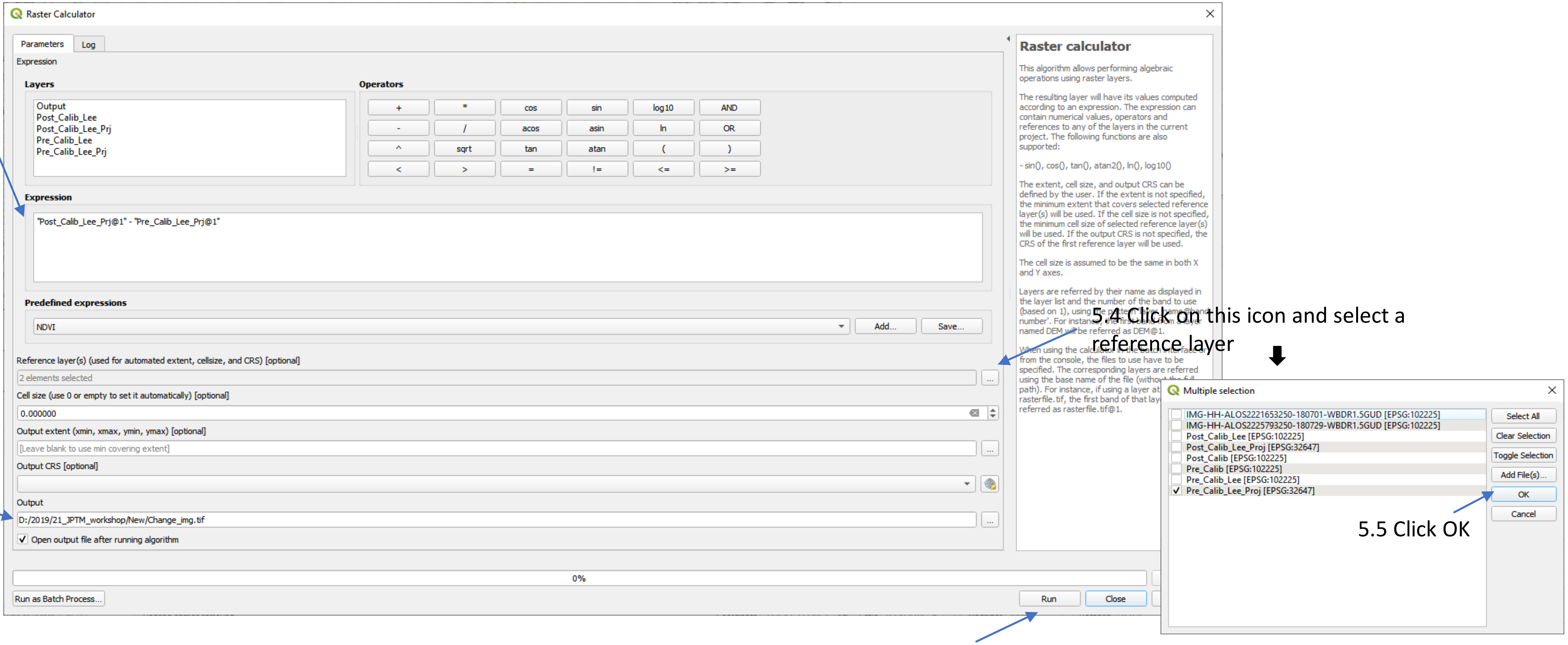
4.6 Click **Run**

Do the same process for the **post filtered image**

5 Generating the pre-post difference image

5.1 Type **Raster calculator** in processing toolbox search bar Select the **Raster calculator** under **QGIS tools**

5.2 Obtain the difference between projected pre and post images by Inputting the Expression as follows



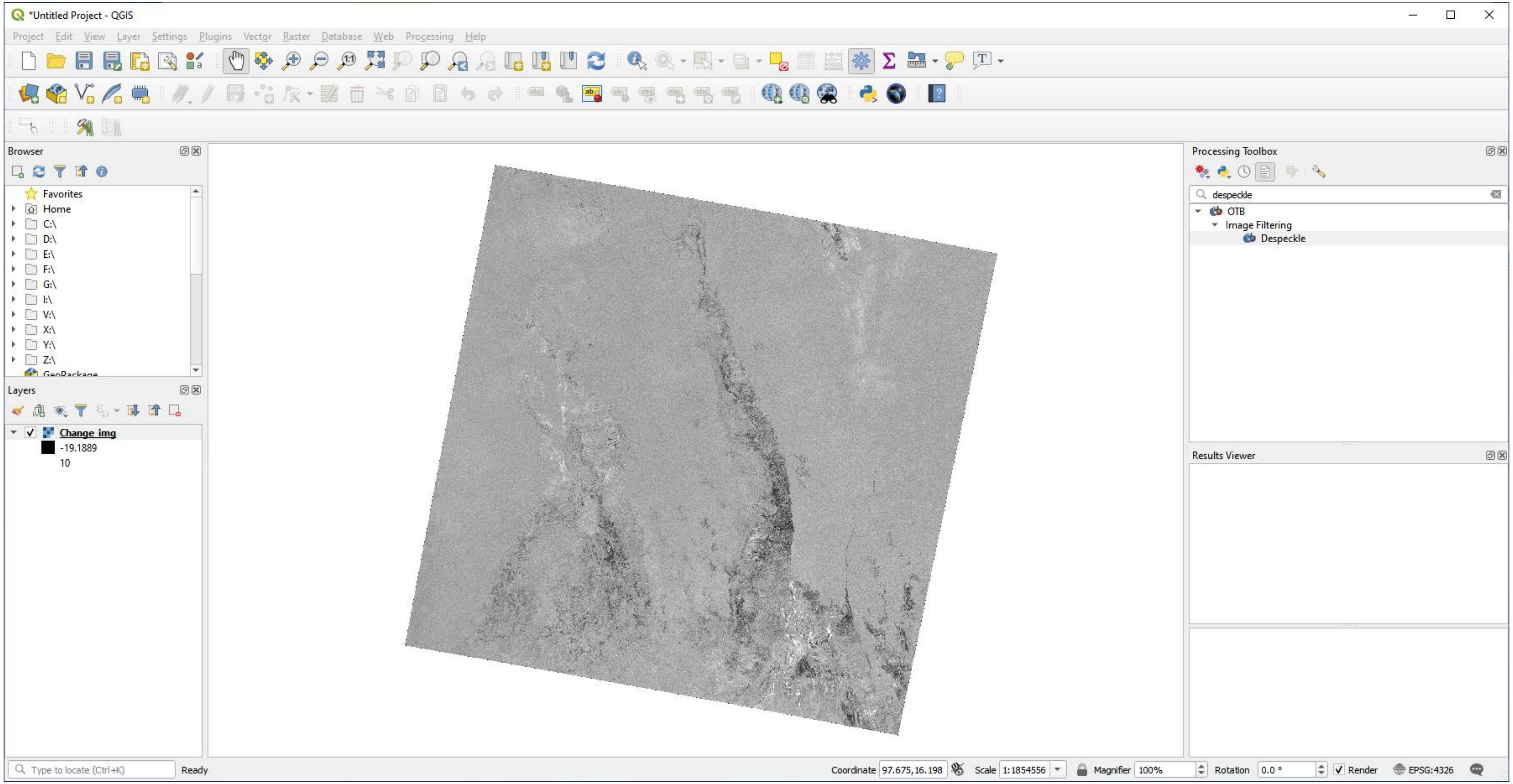
5.3 Browse to the output folder and give it a name and save it as a .tif file

5.4 Click on this icon and select a reference layer

5.5 Click OK

5.6 Click Run

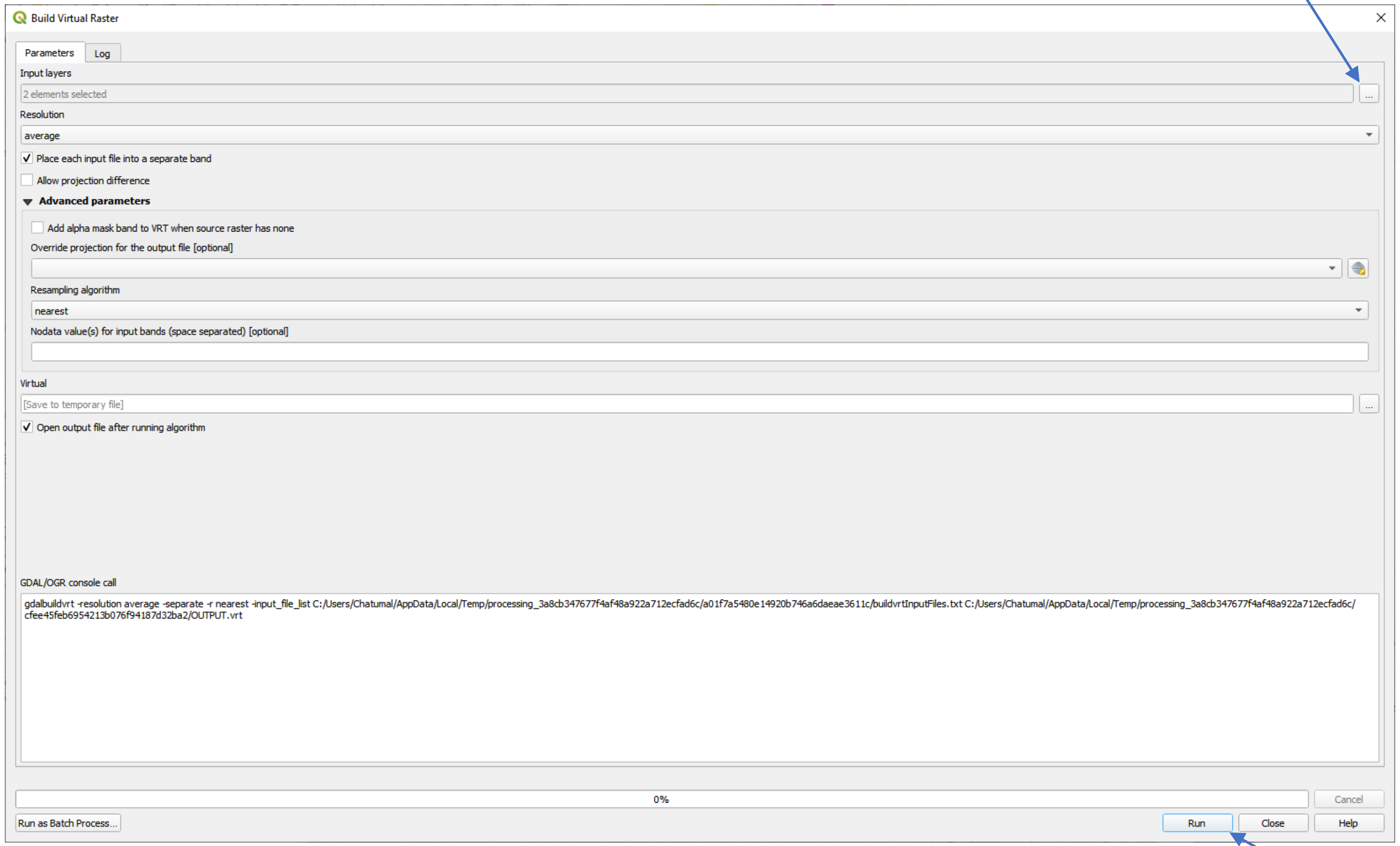
Change Image after raster calculation

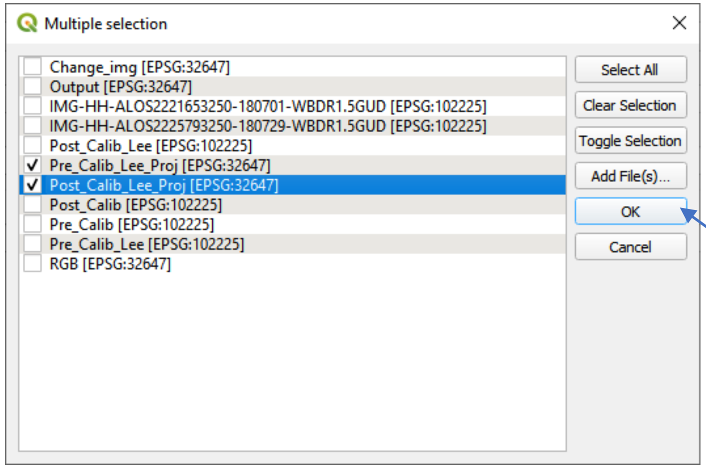


6 RGB visualization of post and pre-images

6.1 Goto **Raster > Miscellaneous > Build virtual raster**

6.2 Click this icon and select the Pre-Processed, pre and post images from this tab

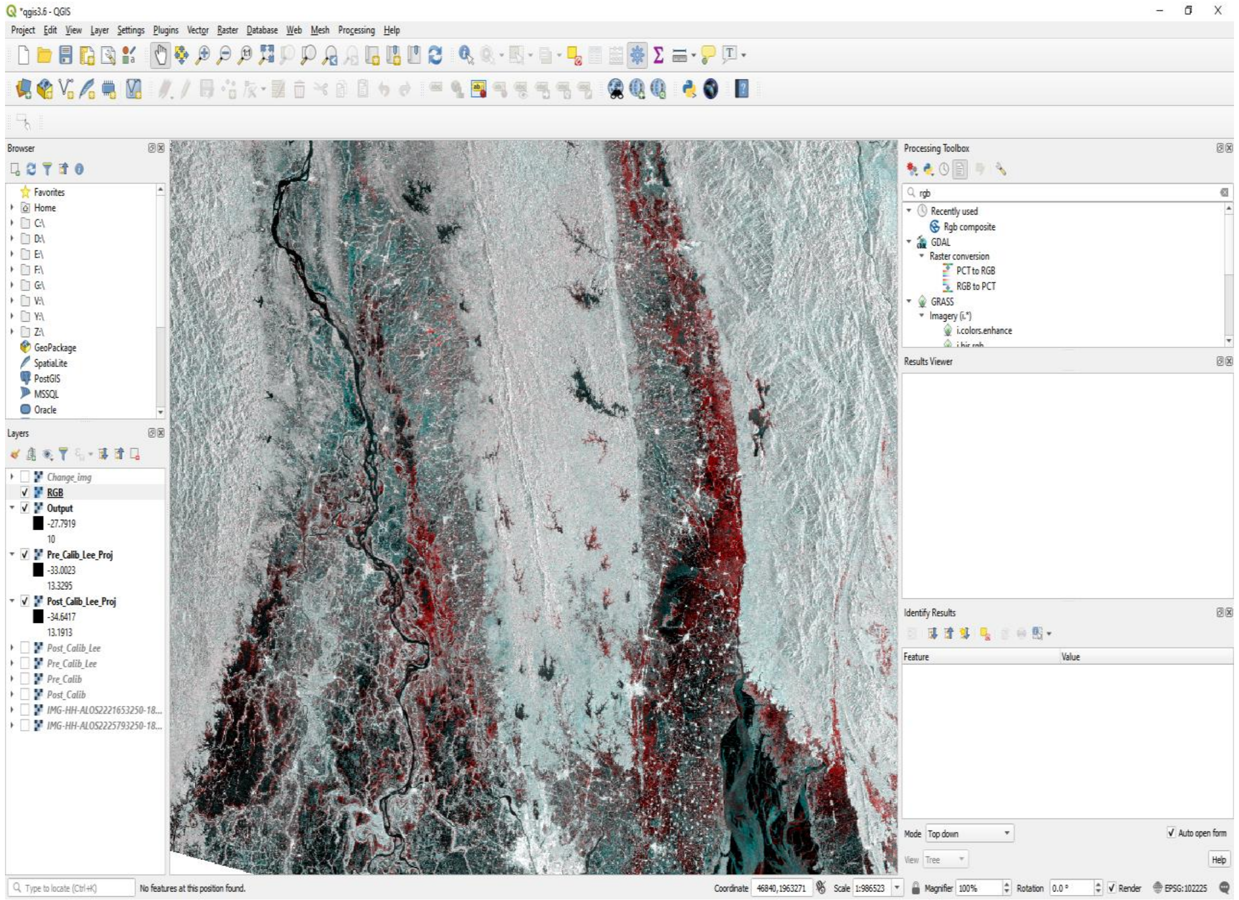




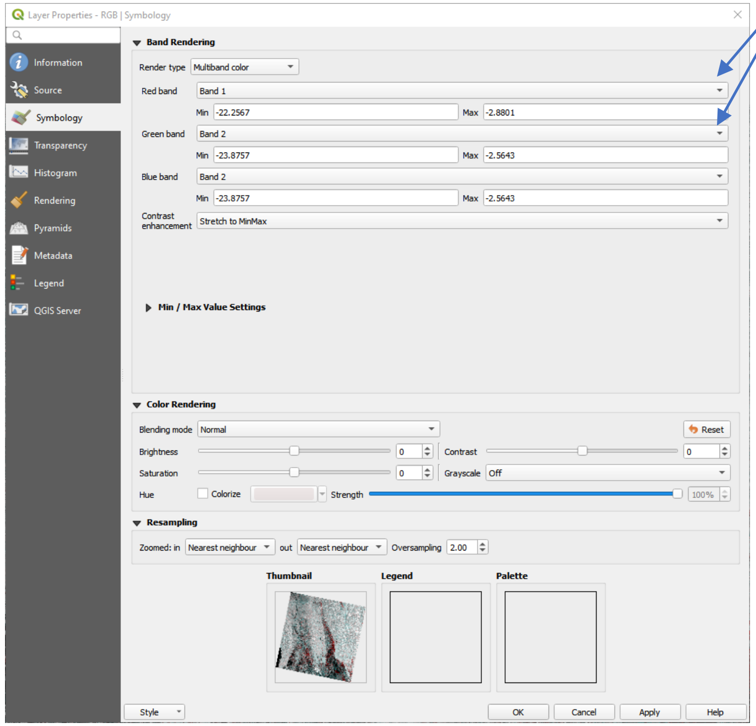
6.3 Click OK

6.4 Click Run.

6.5 Right click on the created virtual band and select **Properties > Symbology**



6.6 Select band 1(pre), band 2(post) from the dropdowns as follows

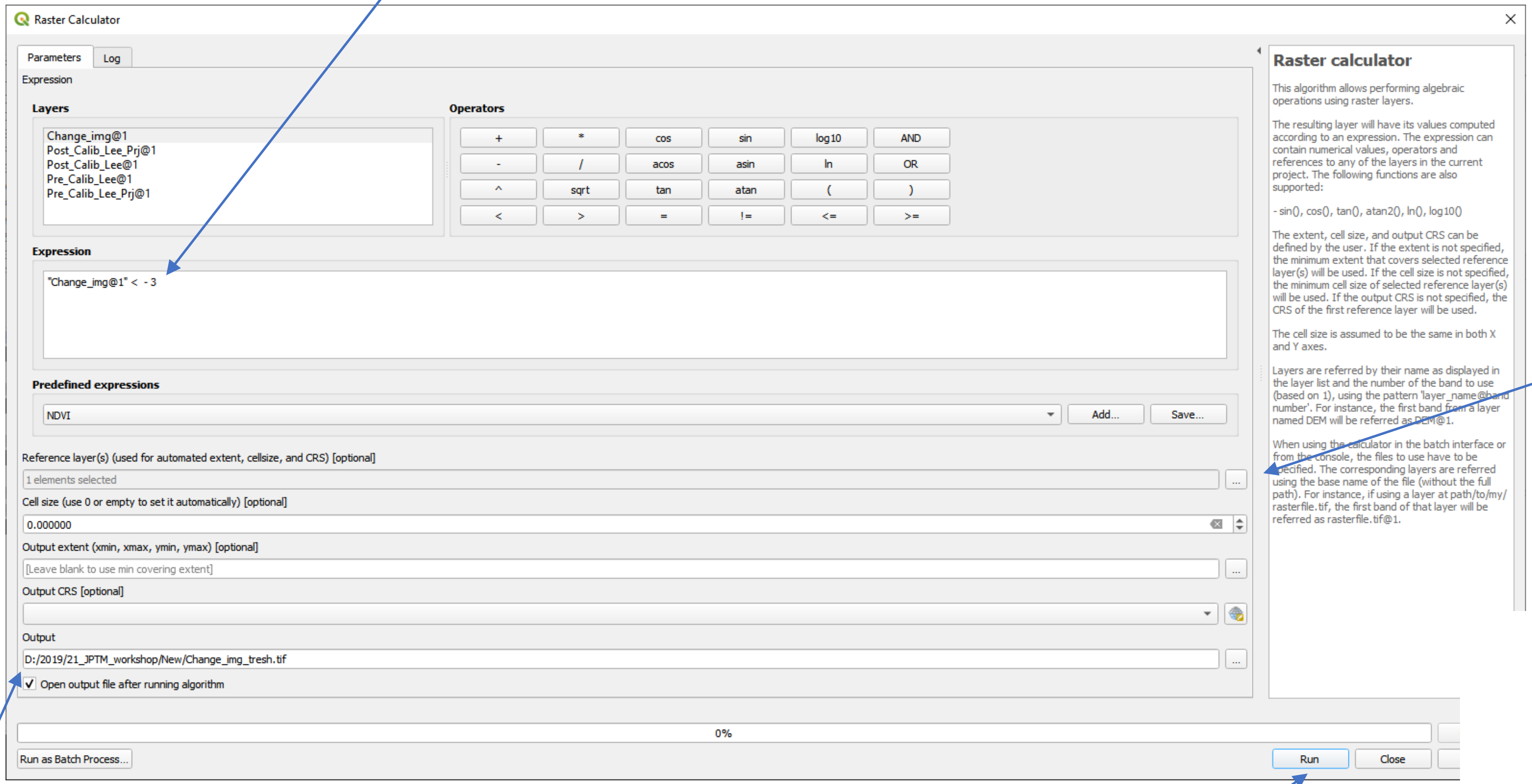


Red Band : Pre-image
Green band: Post-image
Blue Band : Post-image

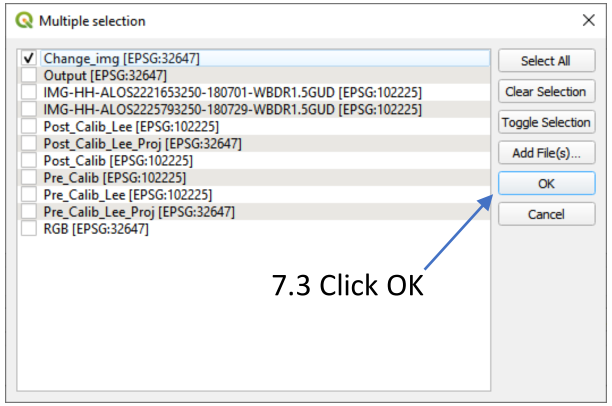
The areas likely to be flooded will appear as red, under this particular band combination. Observing change image and this RGB visualization, you can find the radar backscatter value range in the flood region. A threshold value can be selected for delineate the flood extent.

7 thresholding the Pre, Post difference image

7.1 Input Expression as follows (threshold value for detected water selected as -3 here)



7.2 Click on this icon and select a reference layer

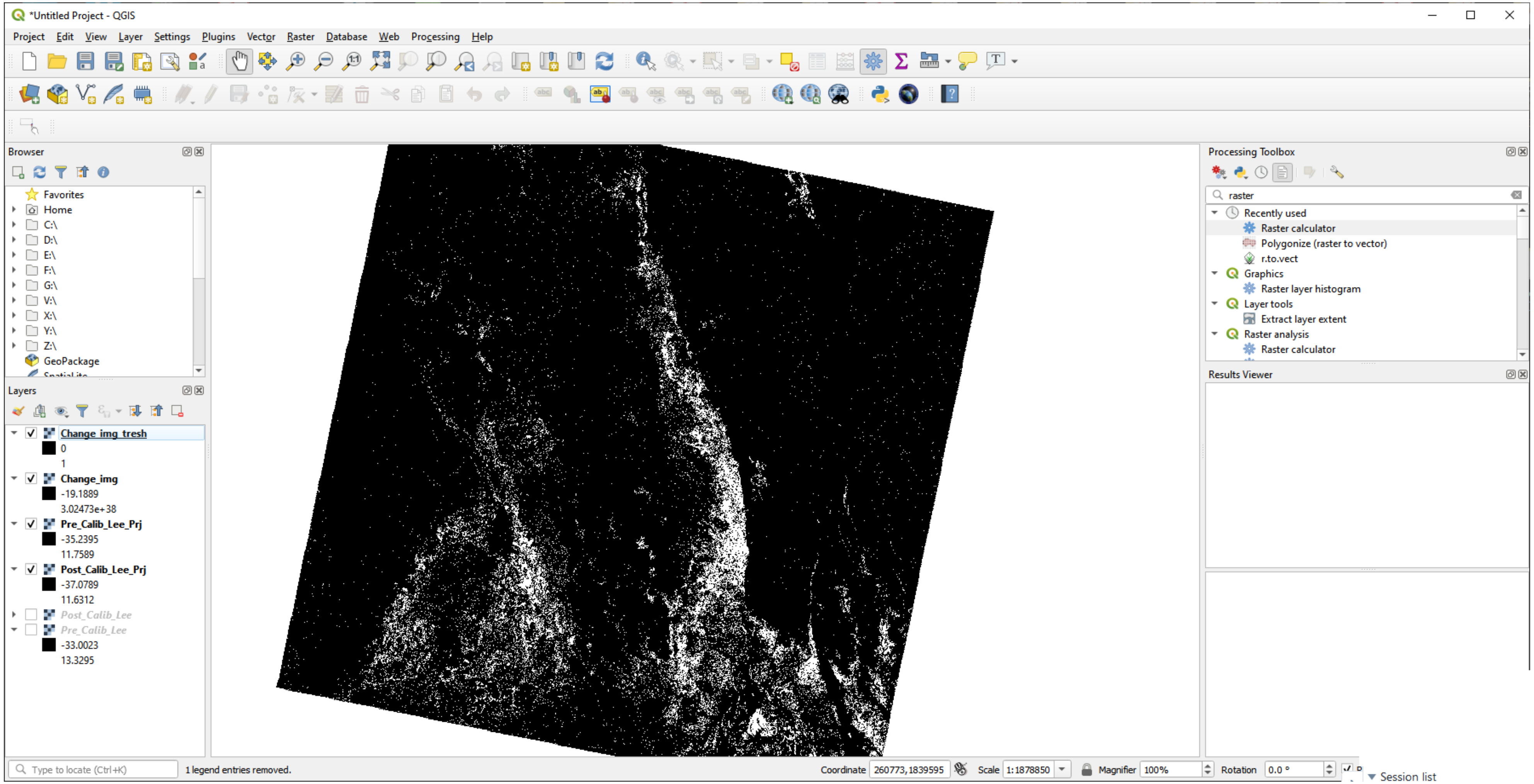


7.3 Click OK

7.4 Browse to the output folder and give it a name and save it as a .tif file

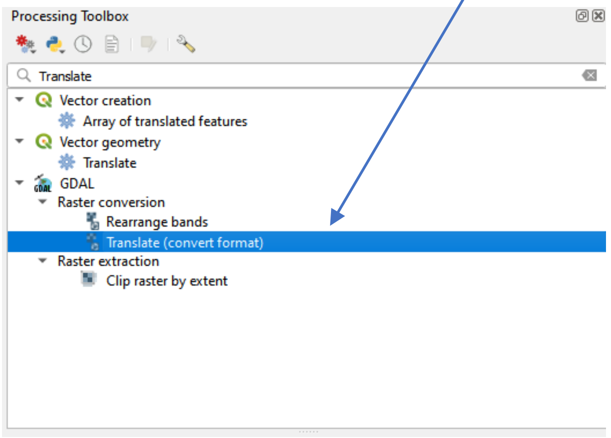
7.5 Click Run

Change Image after thresholding



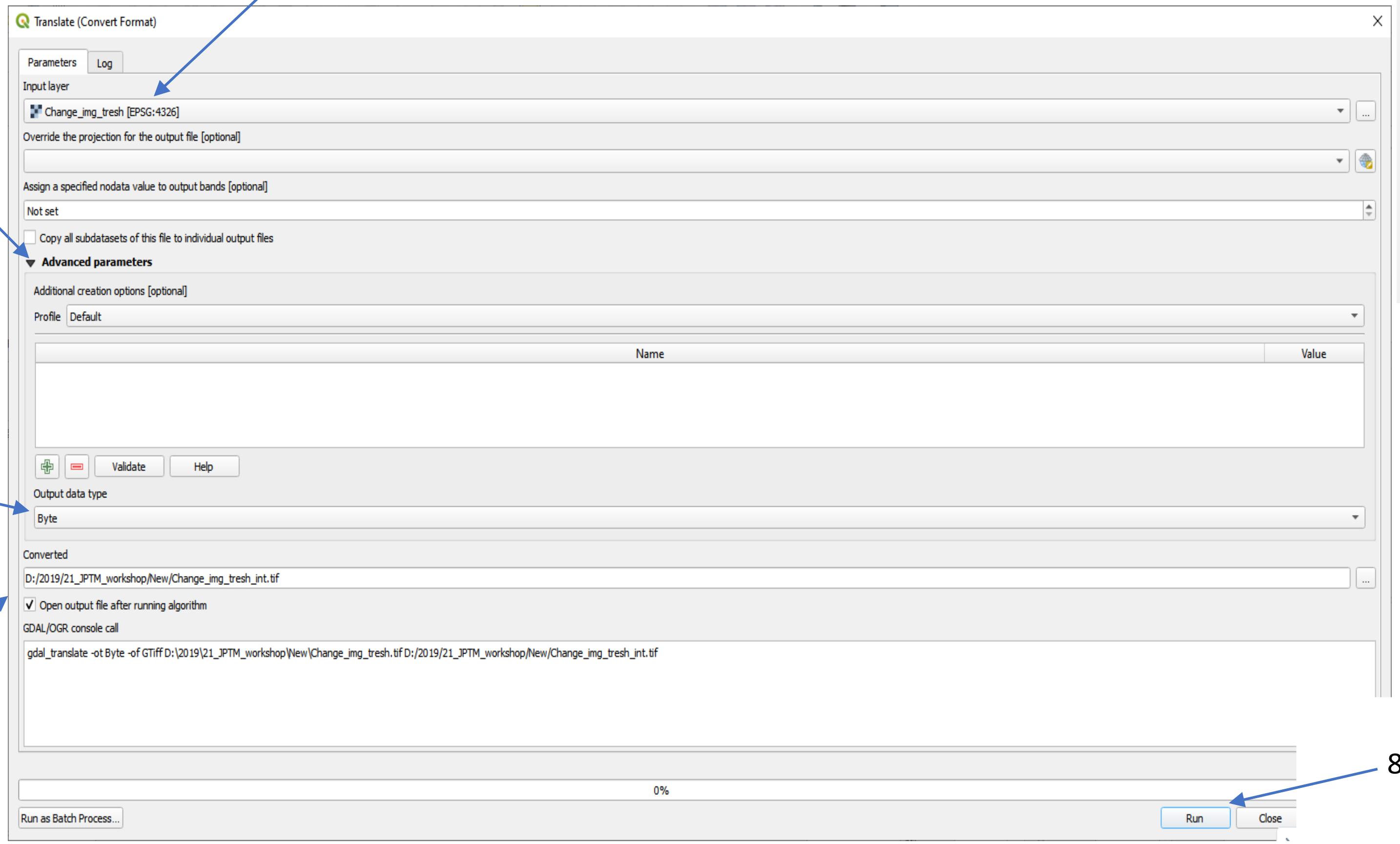
8 Converting the data type of the threshold image

8.1 Type **Translate** in processing toolbox search bar and select the **Translate(convert format)** under **GDAL**



8.2 Select the **threshold image** from the drop down.

8.3 click on advanced parameters



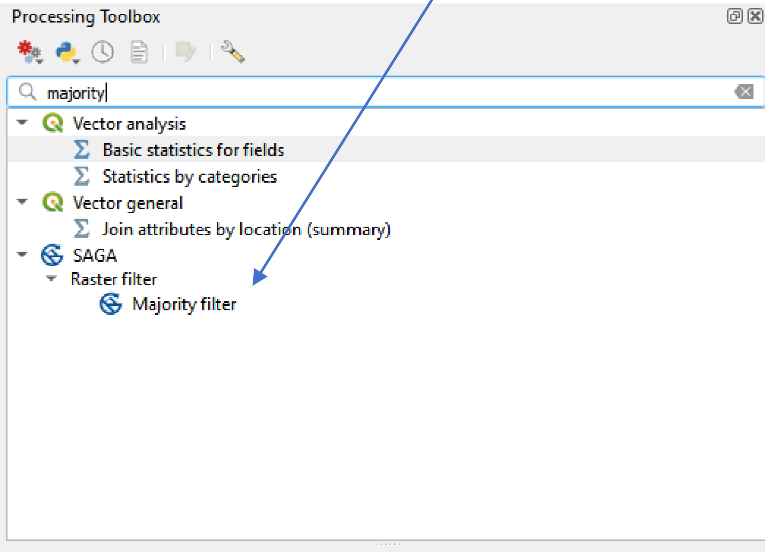
8.4 Change the output datatype as **byte**

8.5 Browse to the output folder and give it a name and save it as a .tif file

8.6 Click **Run**

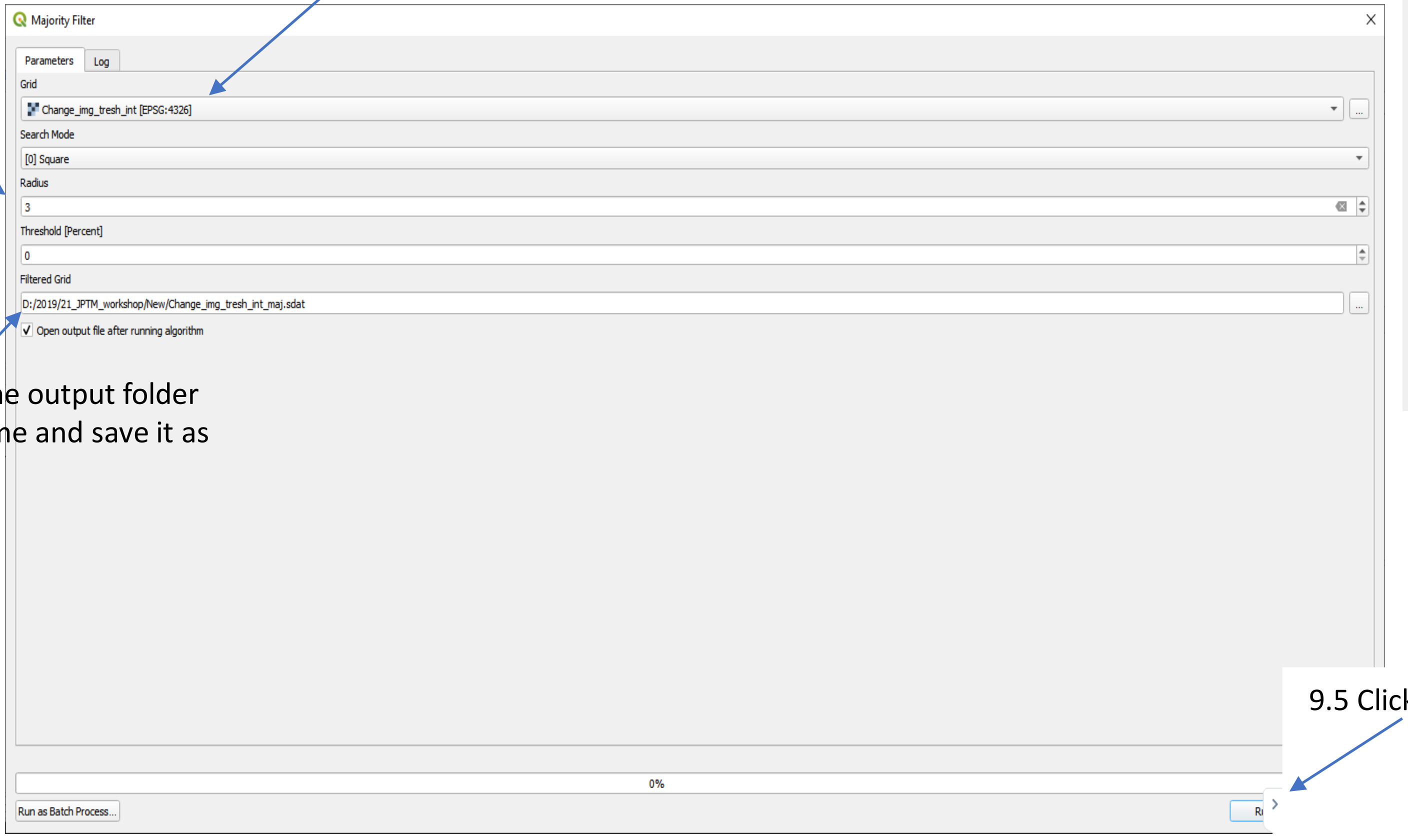
9 Application of majority filter to reduce the noise pixels

9.1 Type **Majority** in processing toolbox search bar and select the **Majority filter** under **SAGA**



9.2 Select the **threshold image (Byte)** from the drop down.

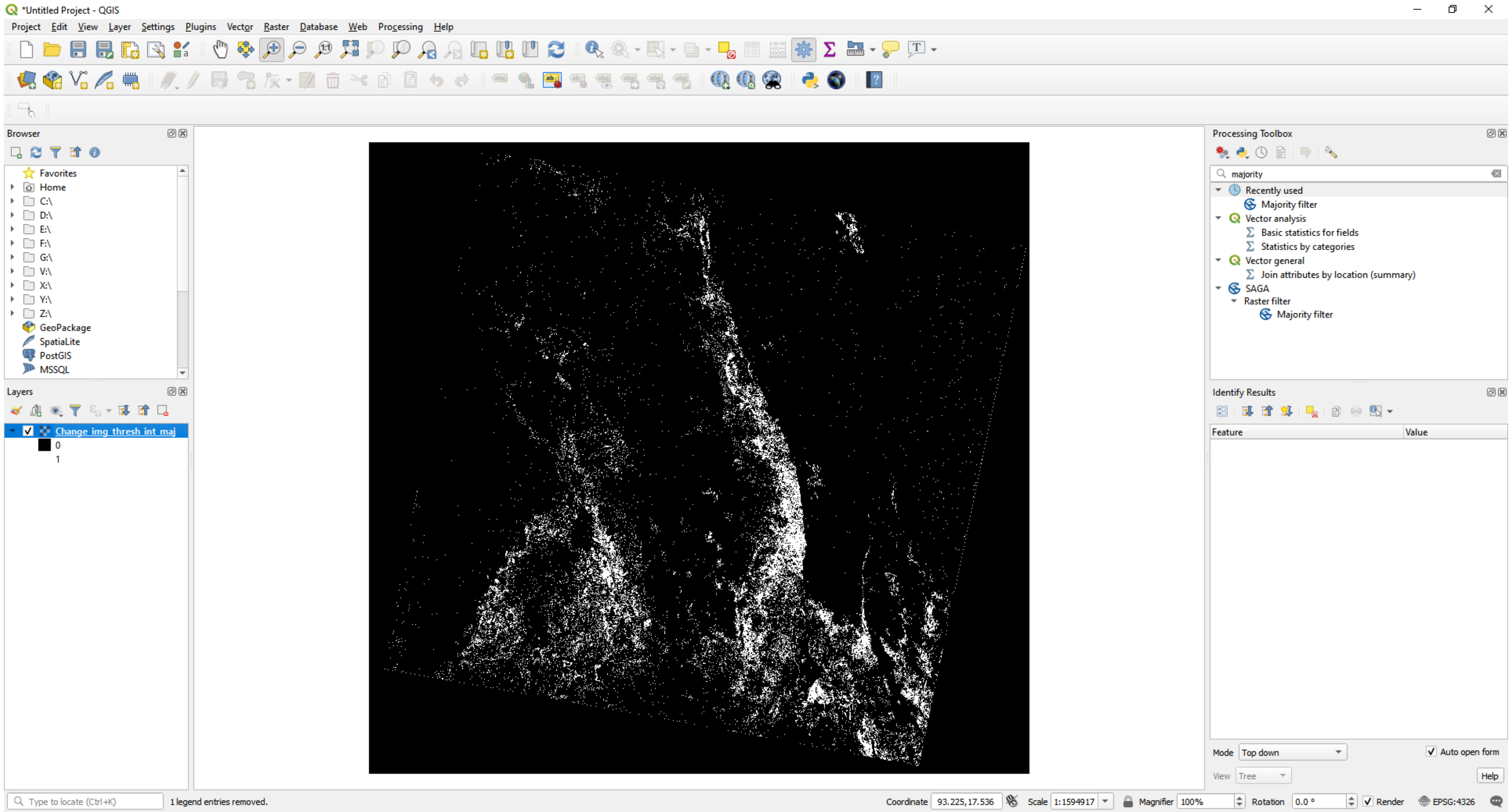
9.3 Input radius as 3 (5*5)



9.4 Browse to the output folder and give it a name and save it as a .sdat file

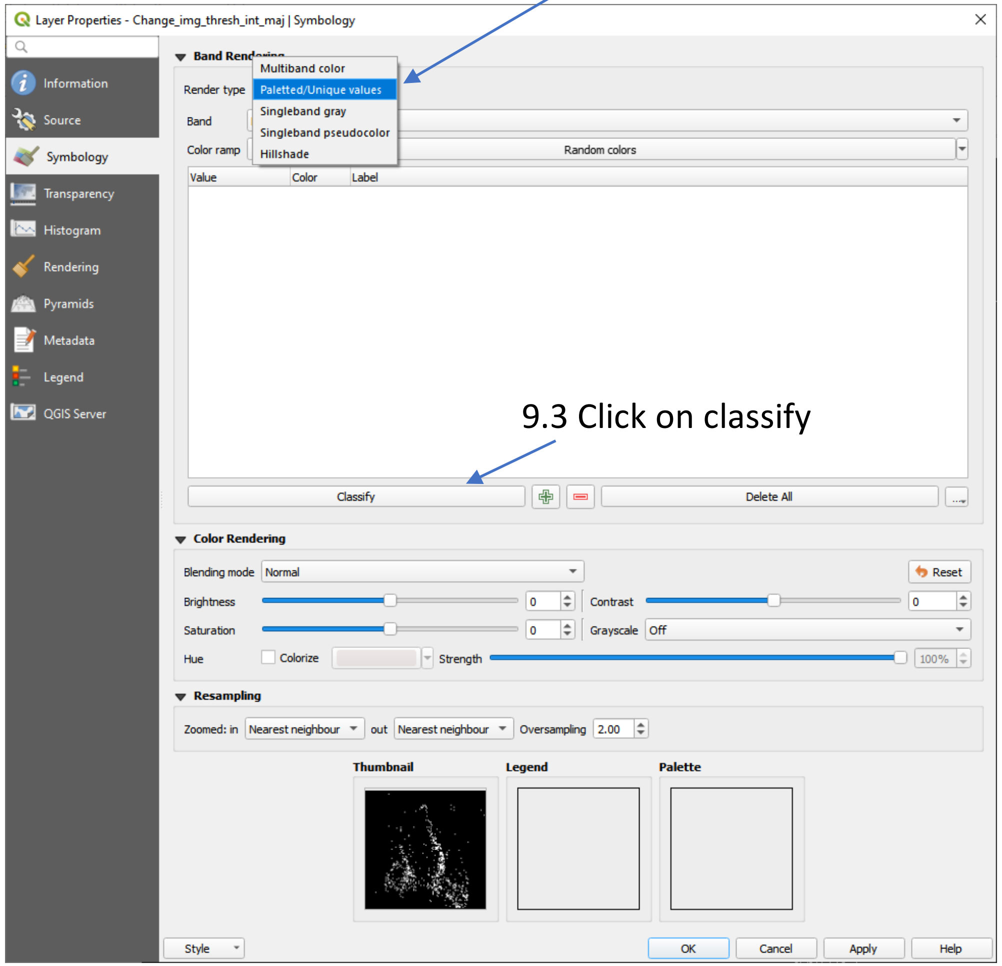
9.5 Click **Run**

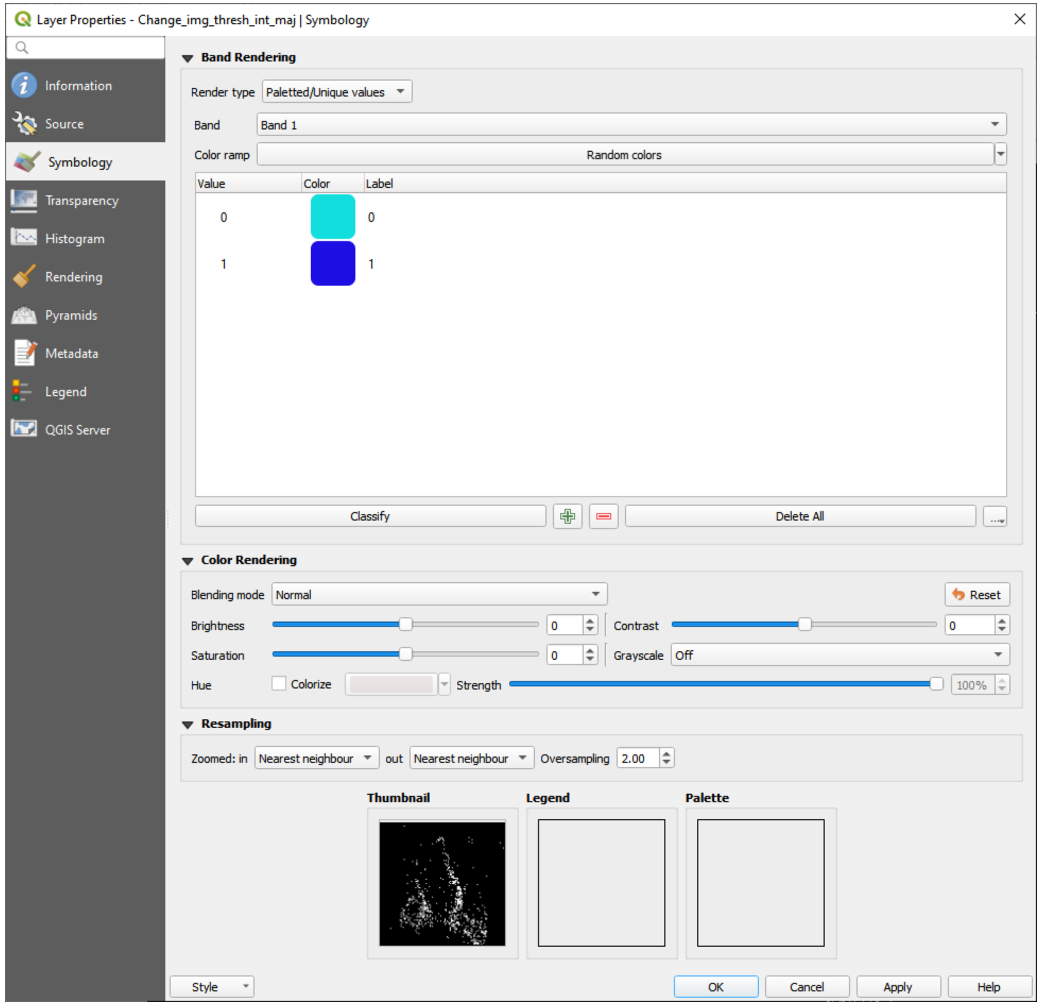
Majority filtered image



9.6 Right click on the majority filtered image> **Properties**

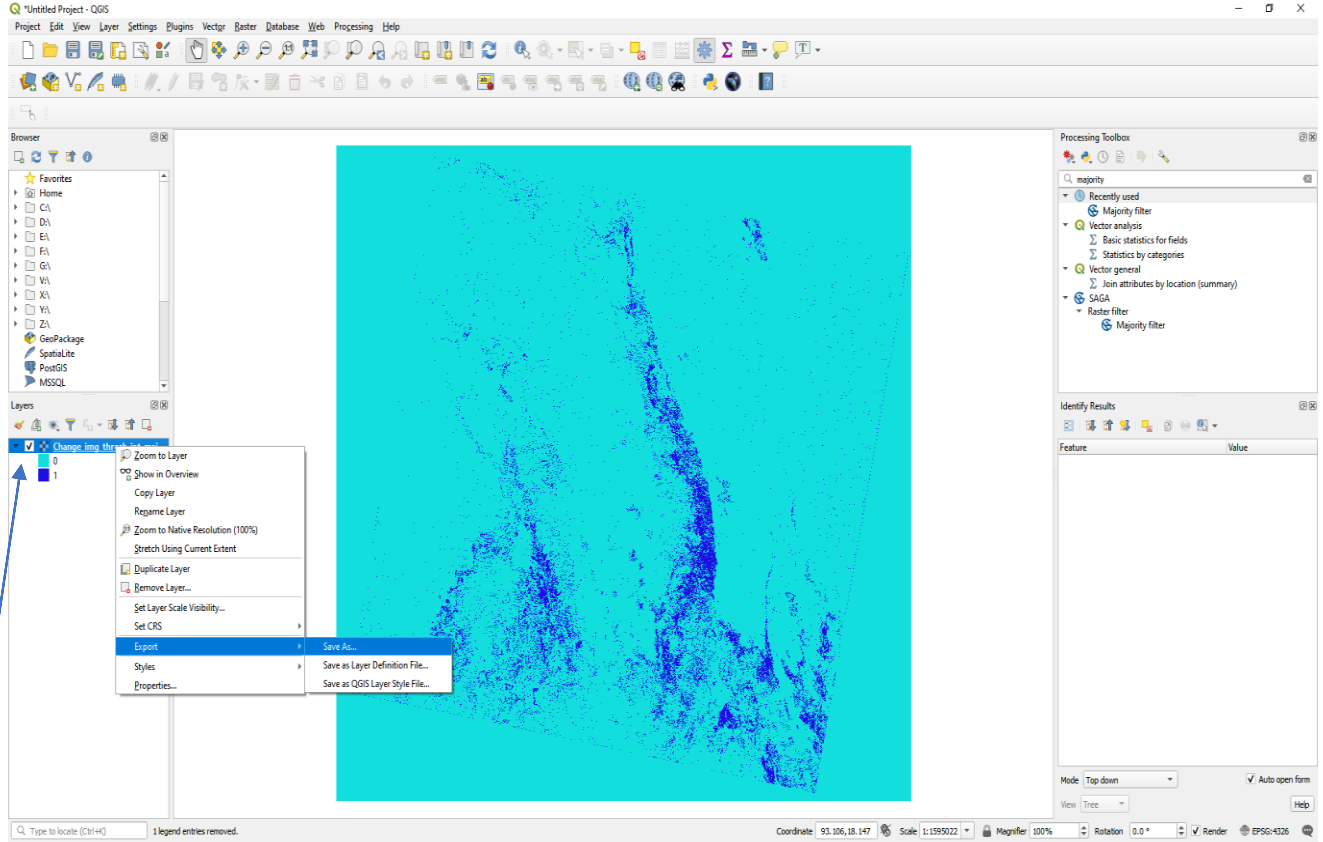
9.7 select symbology and under render type select **unique values**





9.8 Click OK

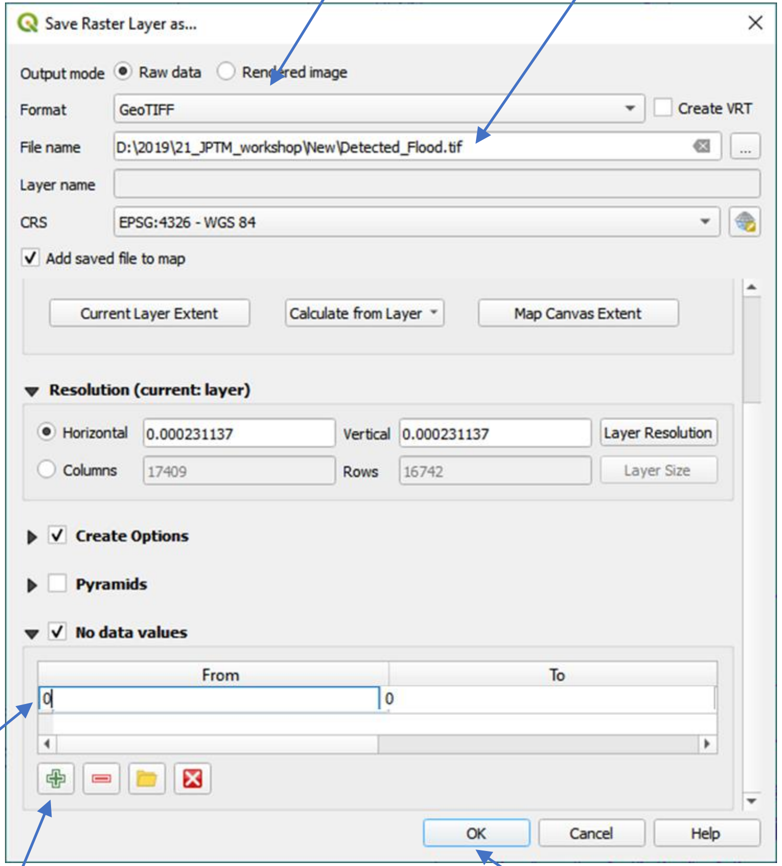
Classified image (water-1, non water-0)



9.9 Right click on the classified image > **Export > Save As**

9.10 Set the format as Geotiff

9.11 Browse to the output folder and give it a name and save it as a .tif file

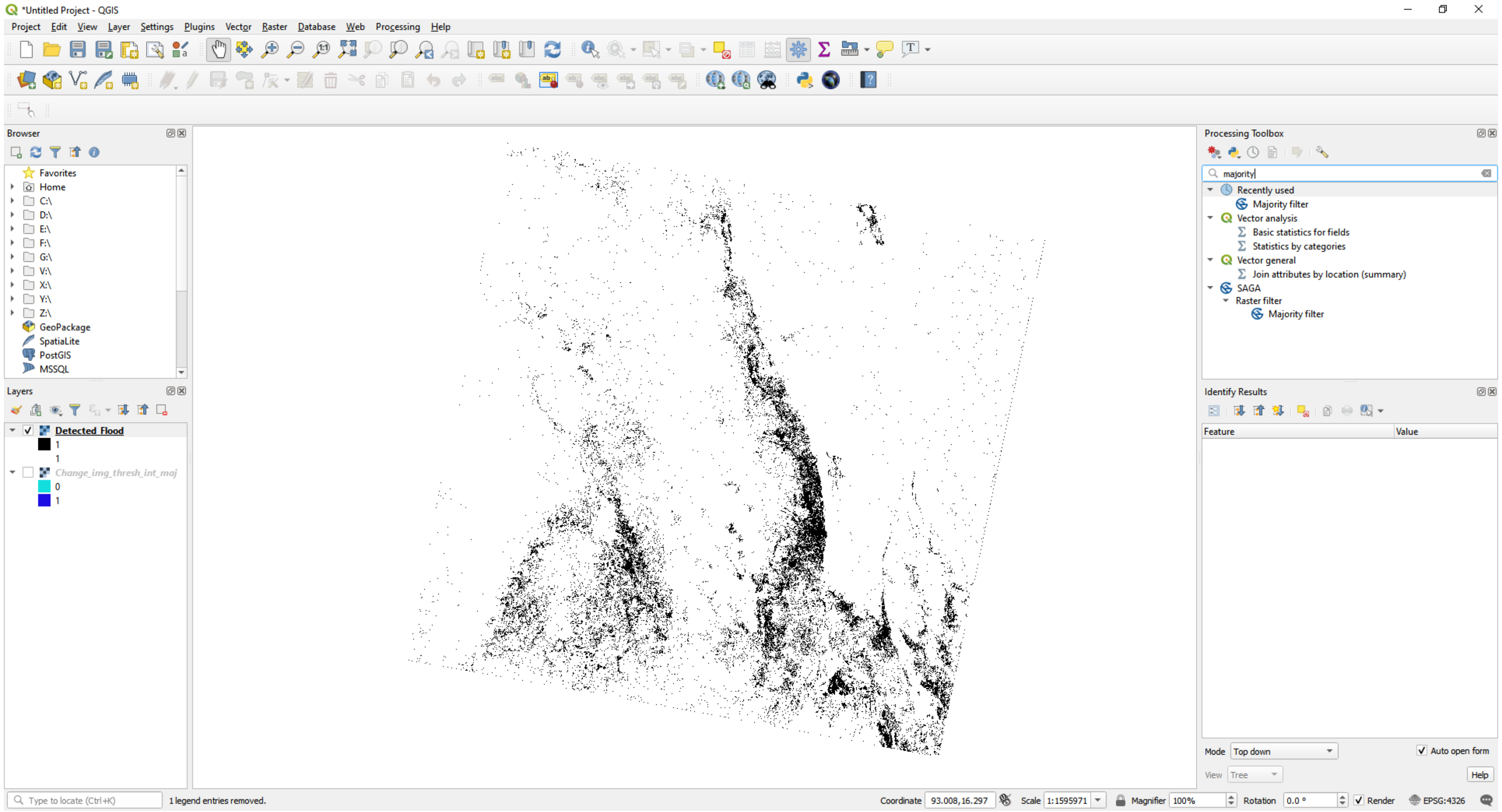


9.13 type 0 here

9.12 Add the no data value as 0 by click on this icon

9.14 click OK

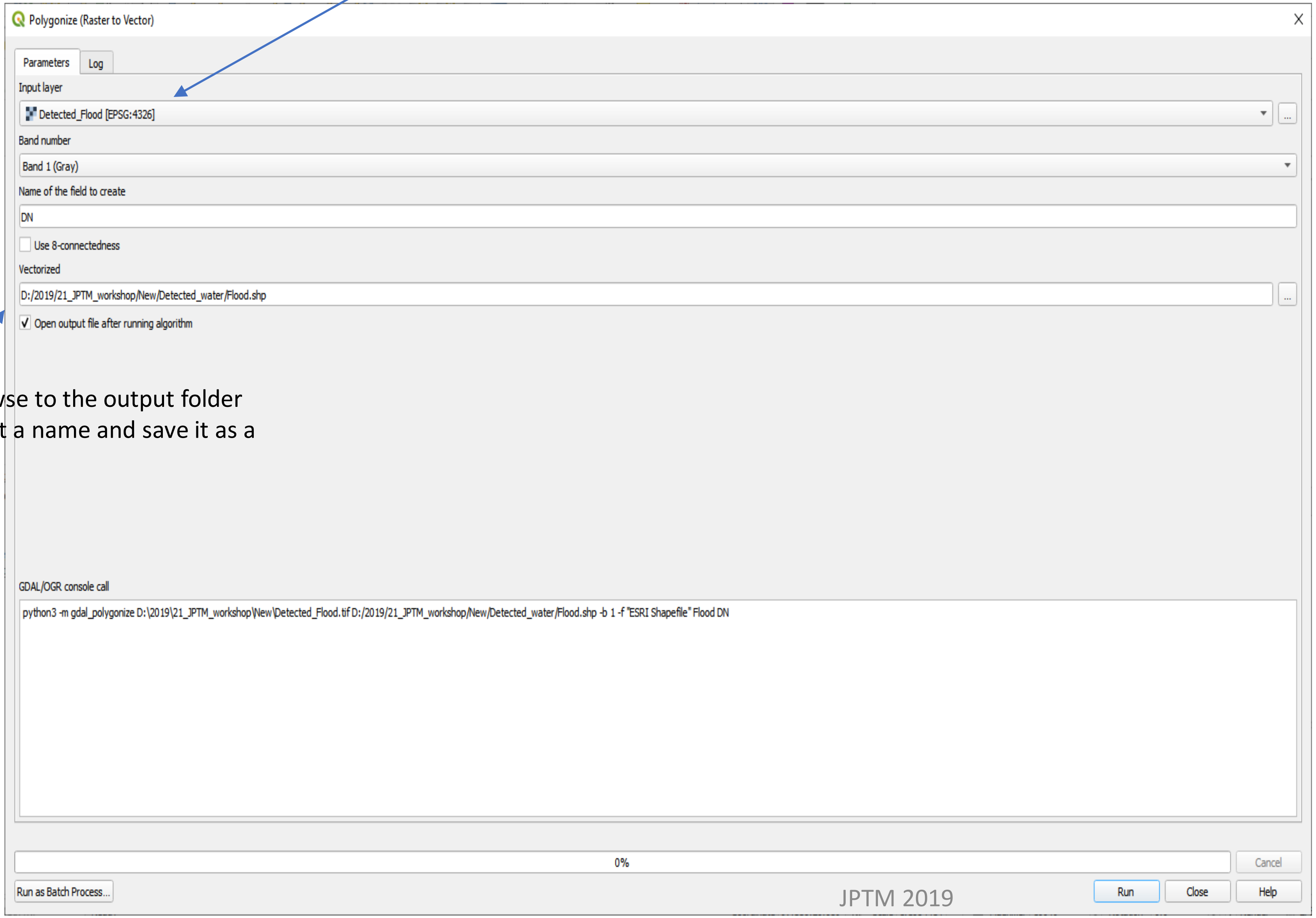
Detected Flood raster image.



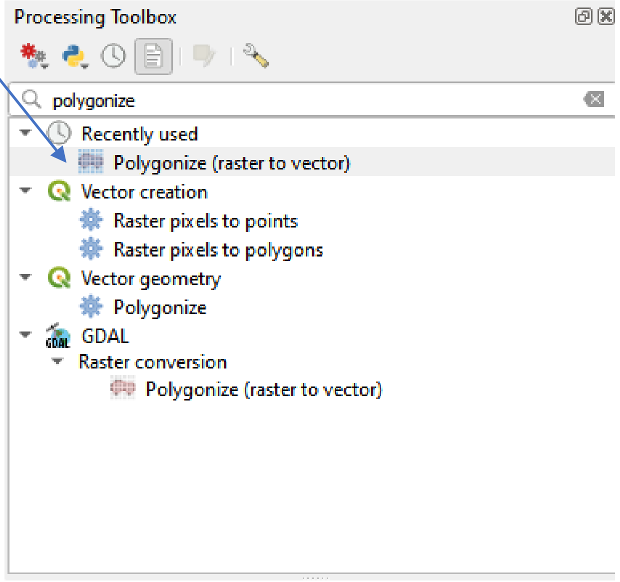
10 Conversion the **Detected Flood** raster file into a vector file

10.1 Type **polygonize** in processing toolbox search bar and select the **Polygonize** under **GDAL**

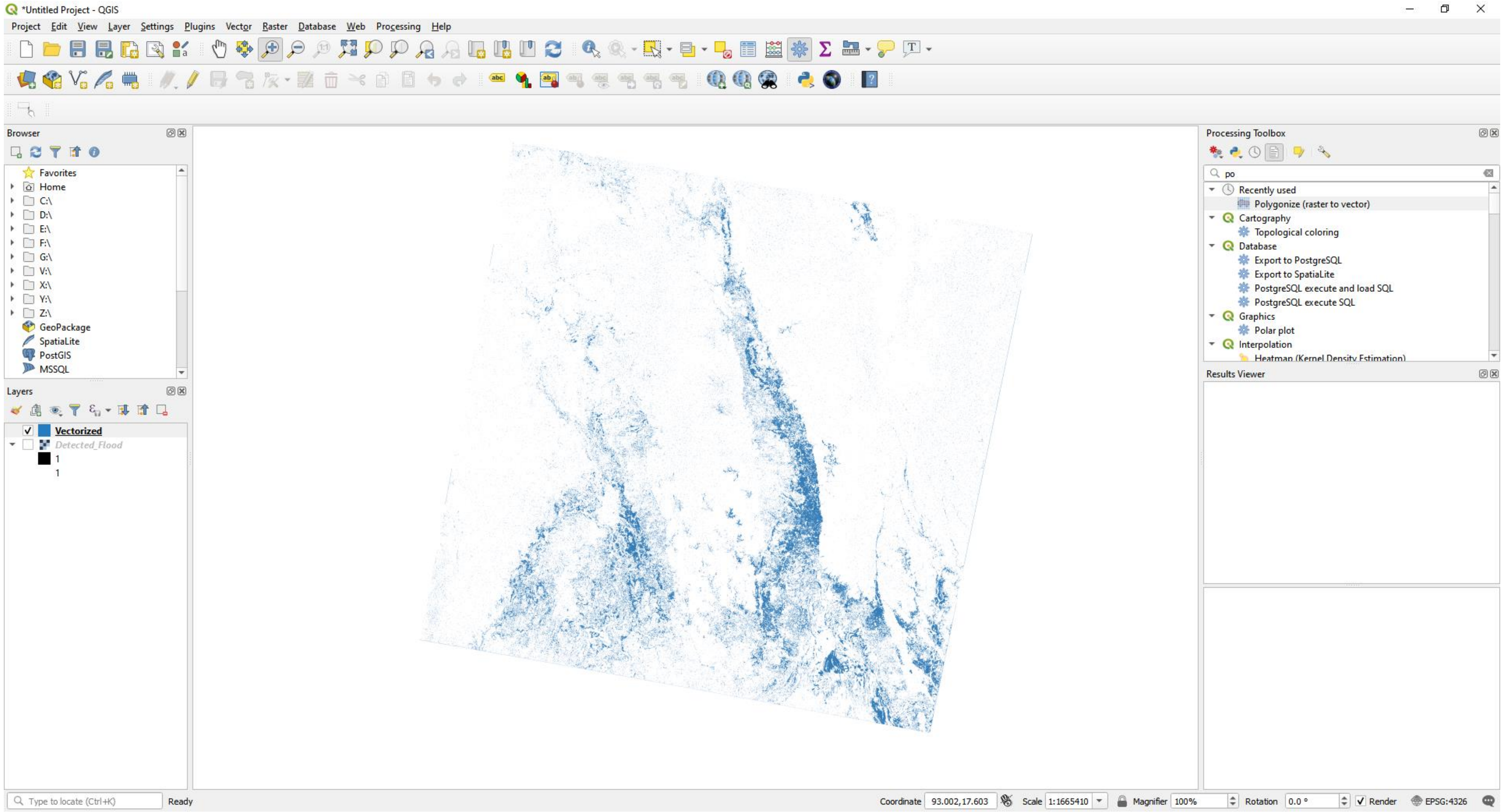
10.2 Select the **Detected flood** raster from the drop down.



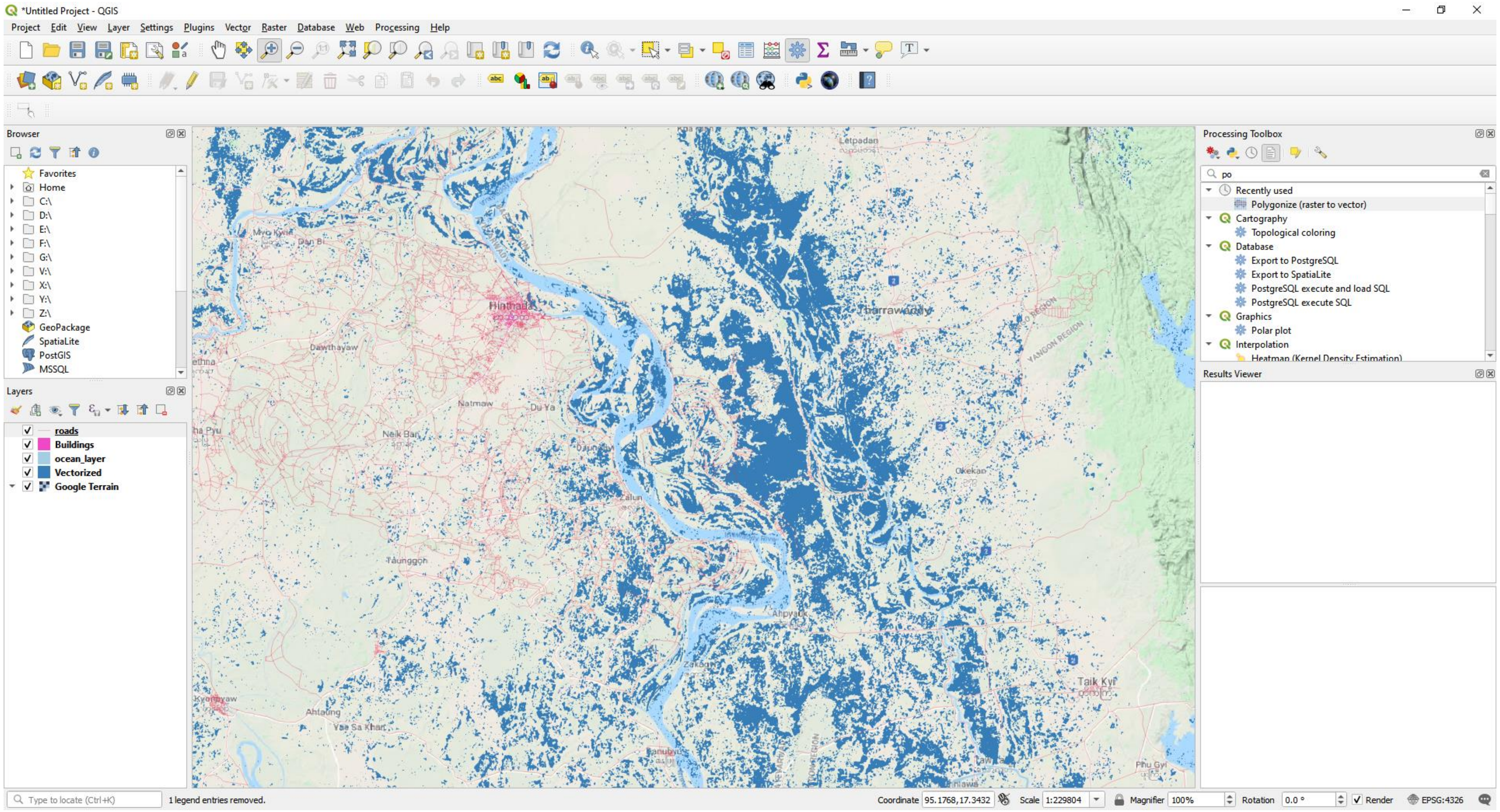
10.3 Browse to the output folder and give it a name and save it as a .shp file



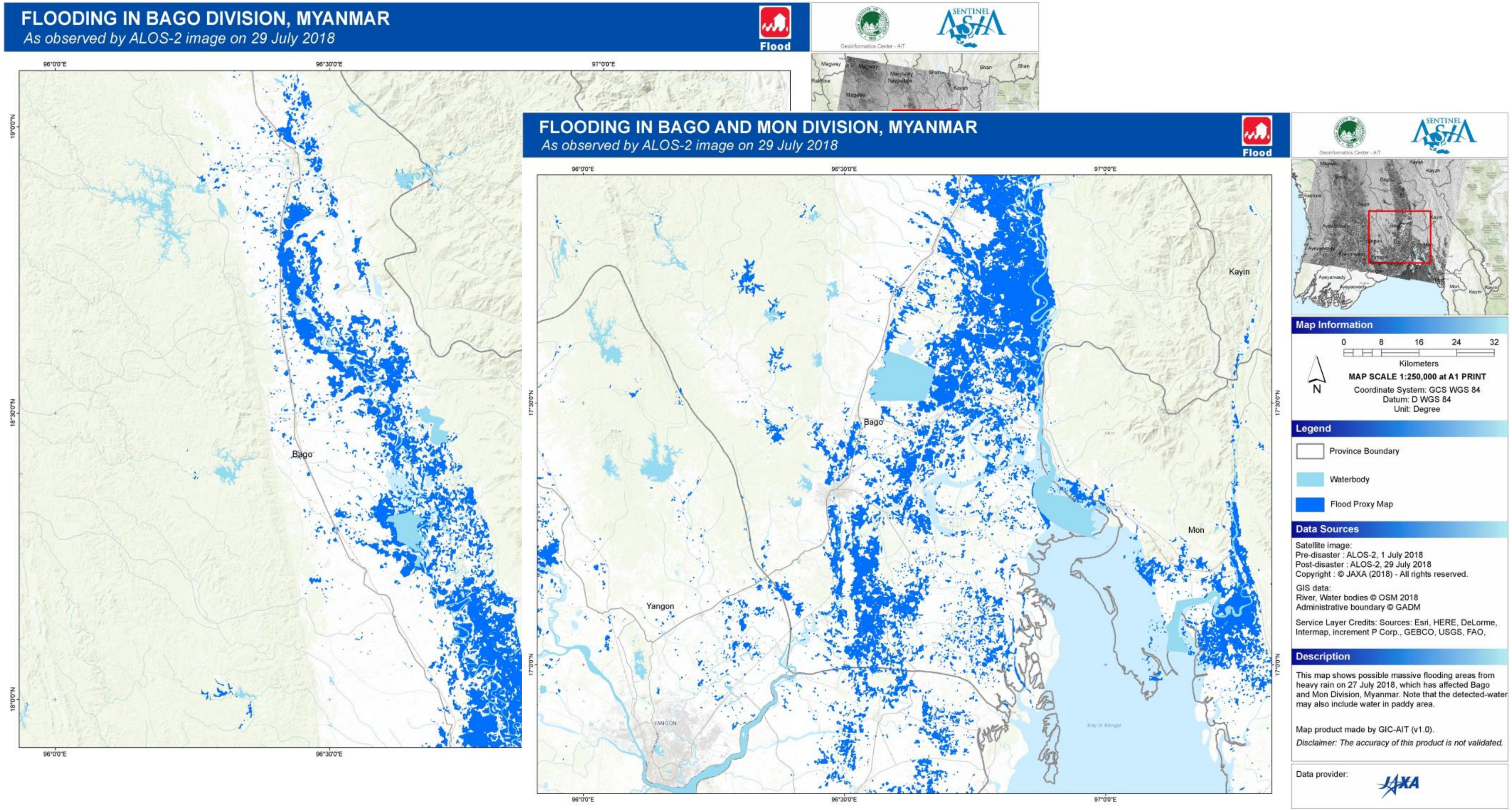
Detected Flood in Vector format



To make Value Added Product more informative, you can combine OSM data with these processed product.



Value added products after combined with more information



Useful links:

OSM Data Download : https://download.geofabrik.de/

Marine region shape file Download : http://www.marineregions.org/gazetteer.php?p=details&id=1904

Thank You!