

Flood Mapping with Sentinel-2 imagery

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Objective

• The main objective of this hands-on exercise is to extract water body areas using Sentinel-2 imagery.



How to map flood areas from Sentinel-2 data?

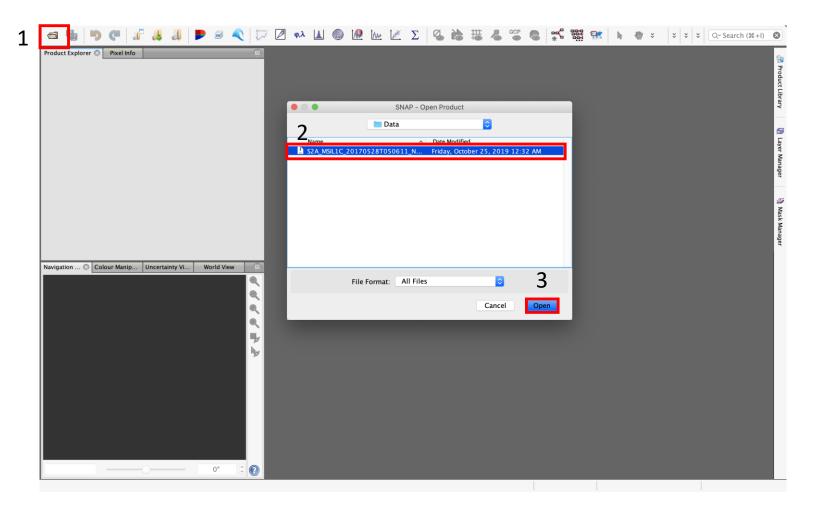
- Open data product
- Create a subset image
- Calculate NDWI
- Extract water areas using threshold
- Export result to other format (ex. tif) for map layouting

Hands on exercise



Open Sentinel-2 data

Use the Open Product button



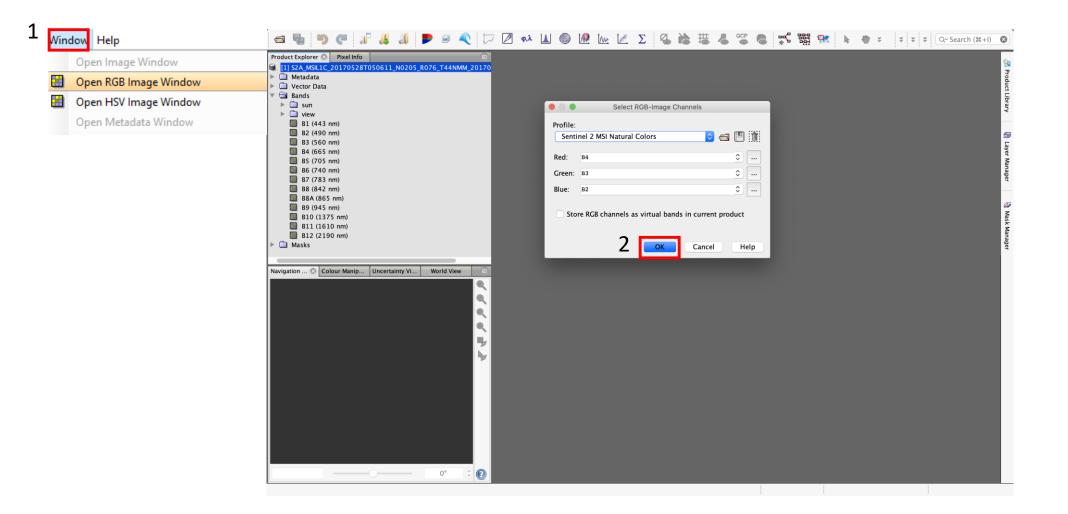


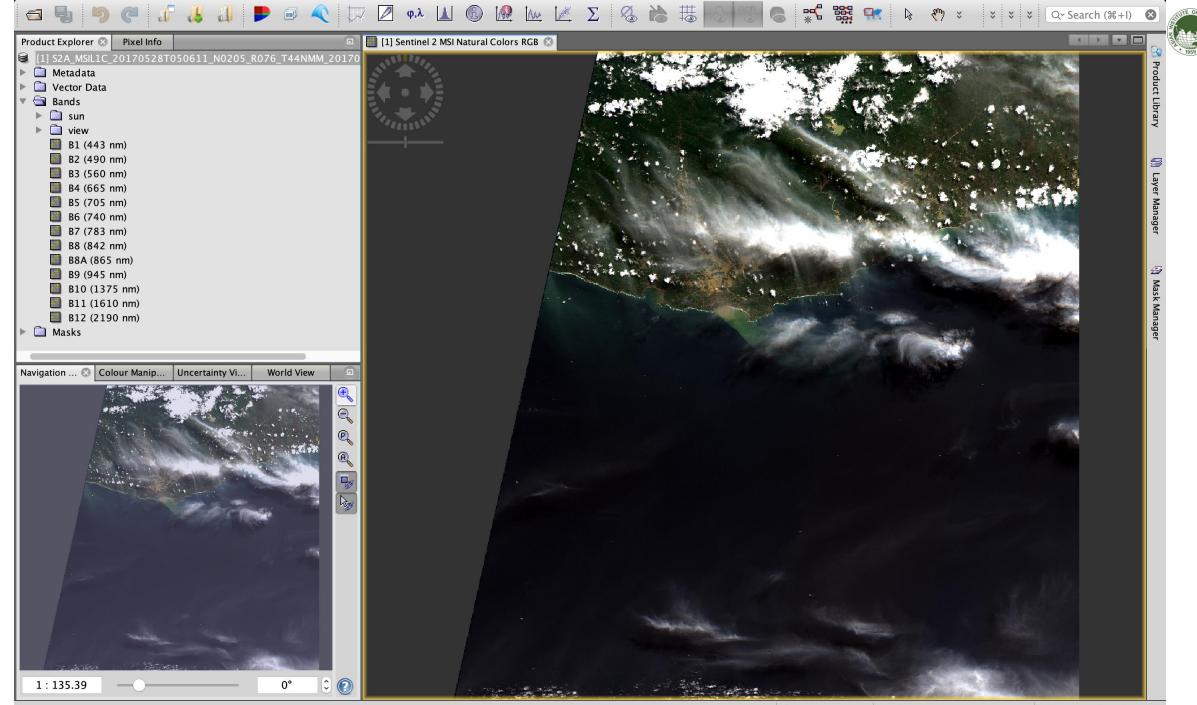
Product Explorer

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B2 (490 nm) B3 (560 nm) B4 (665 nm) B5 (705 nm) B6 (740 nm) B7 (783 nm) B8 (842 nm)				(1) Layer Manager
 B8A (865 nm) B9 (945 nm) B10 (1375 nm) B11 (1610 nm) B12 (2190 nm) Masks 				🕄 Mask Manager
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Open RGB image window







Close

Run

Creating a subset image

From the Raster menu, select Subset...

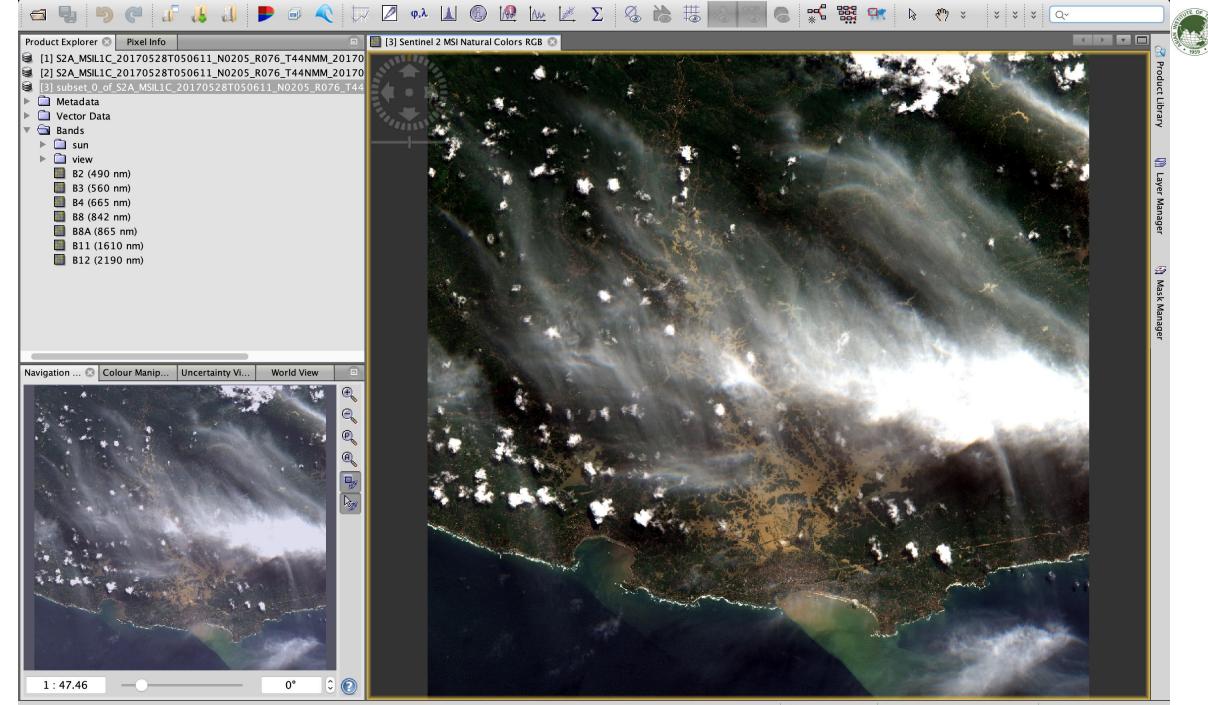
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Target Product	
Name:	
S2A_MSIL1C_2	20170528T050611_N0205_R076_T44NMM_20170528T050606_resampled
Save as:	BEAM-DIMAP
Directory:	
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/Users/da	ntran/Desktop/Forest Mapping
🗹 Open in SN	IAP
	Run Close

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e Help	Resampling Parameters			
Define size of resampled product				
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	Resulting target height	:: 10980		
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	Target height:		10,980	٢
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	Resulting target height	:: 1830		
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Downsampling method:	First			\$
Flag downsampling method:	First			\$
Resample on pyramid levels (for faster in	naging)			



Creating a subset image

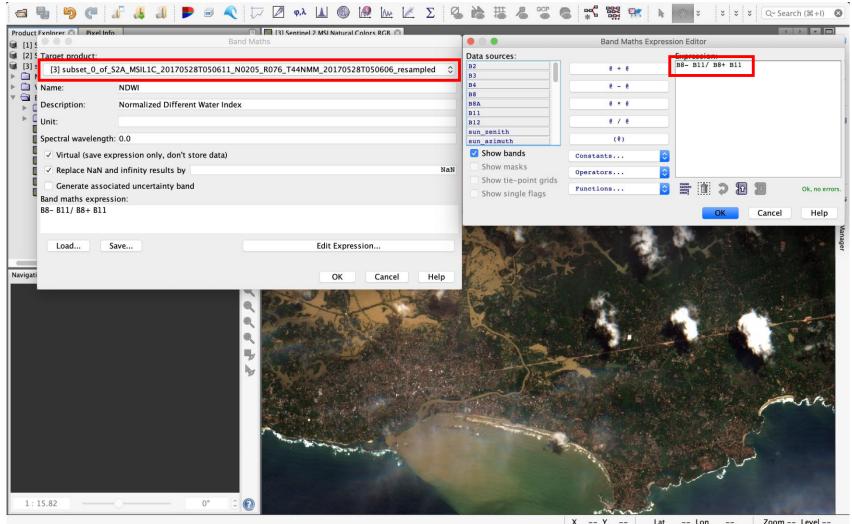
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and the second sec	Scene end X: Scene end Y:	6660 ¢	B6 B7	Reflectance in band B6 Reflectance in band B7			
			✓ B8	Reflectance in band B8			
	Scene step X:	1 3	✓ B8A─ B9	Reflectance in band B8A Reflectance in band B9			
	Scene step Y:	1 0	B10	Reflectance in band B10			
	Subset scene width: Subset scene height:	3923.0 3849.0	 B11 B12 	Reflectance in band B11 Reflectance in band B12			
	Source scene width: Source scene height:	10980 10980	view_zenith_mean	Viewing incidence zenith angle			
	Use Preview	Fix full widthFix full height		n Viewing incidence azimuth angle		Select all Selec	t none
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	ОК	Cancel Help		ОК	Cancel Help		OK Cancel Help



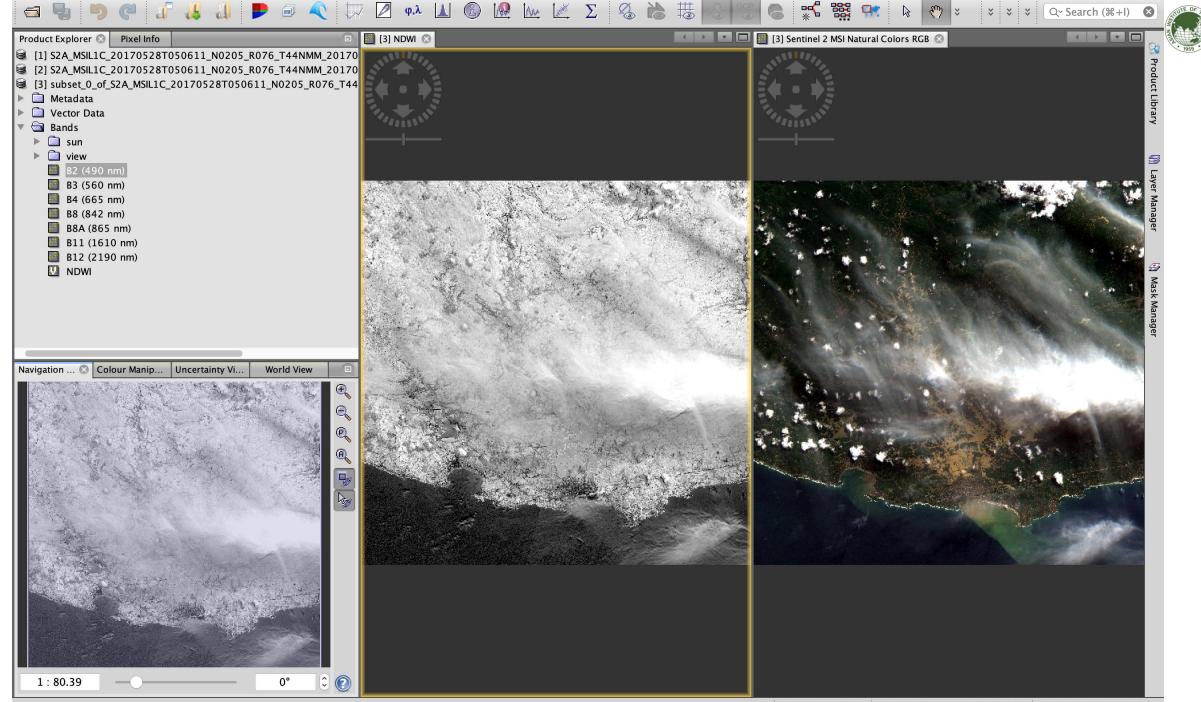


Calculate NDWI

From the Raster menu, select Band Maths



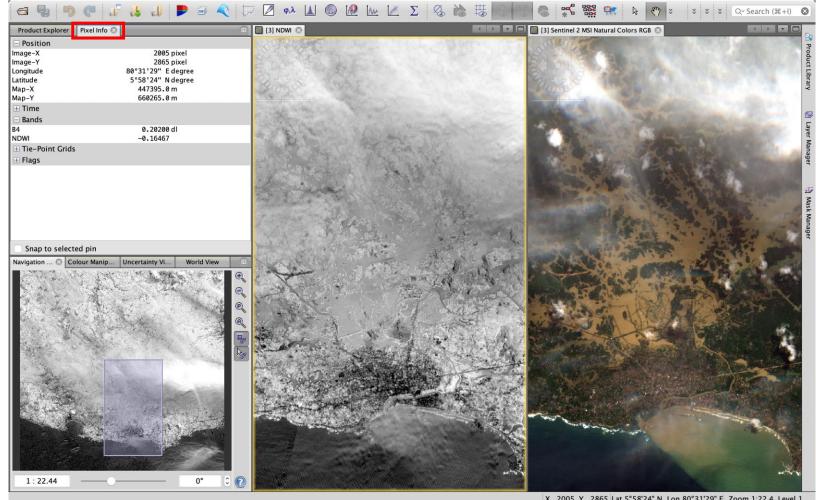
X -- Y -- Lat -- Lon --Zoom -- Level --



X 2340 Y 2516 Lat 6°00'17" N Lon 80°33'18" E Zoom 1:80.4 Level 3



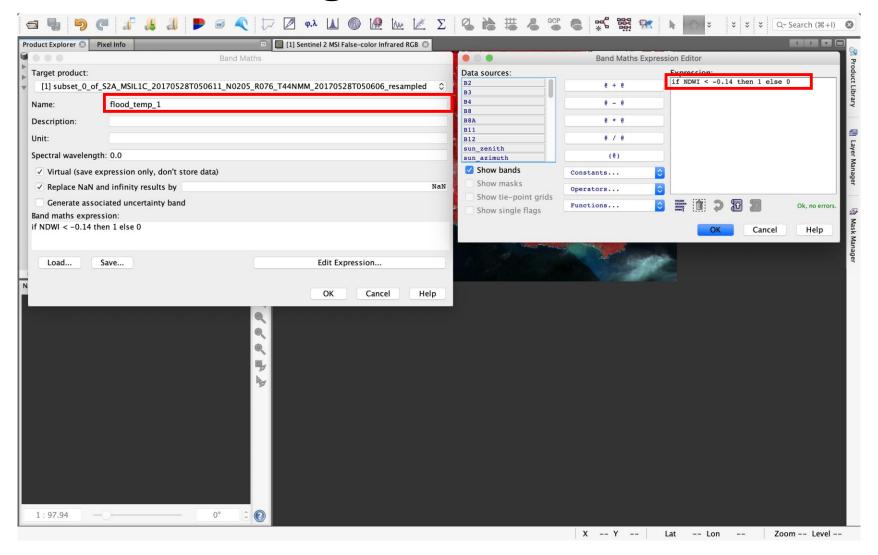
Find threshold to extract water

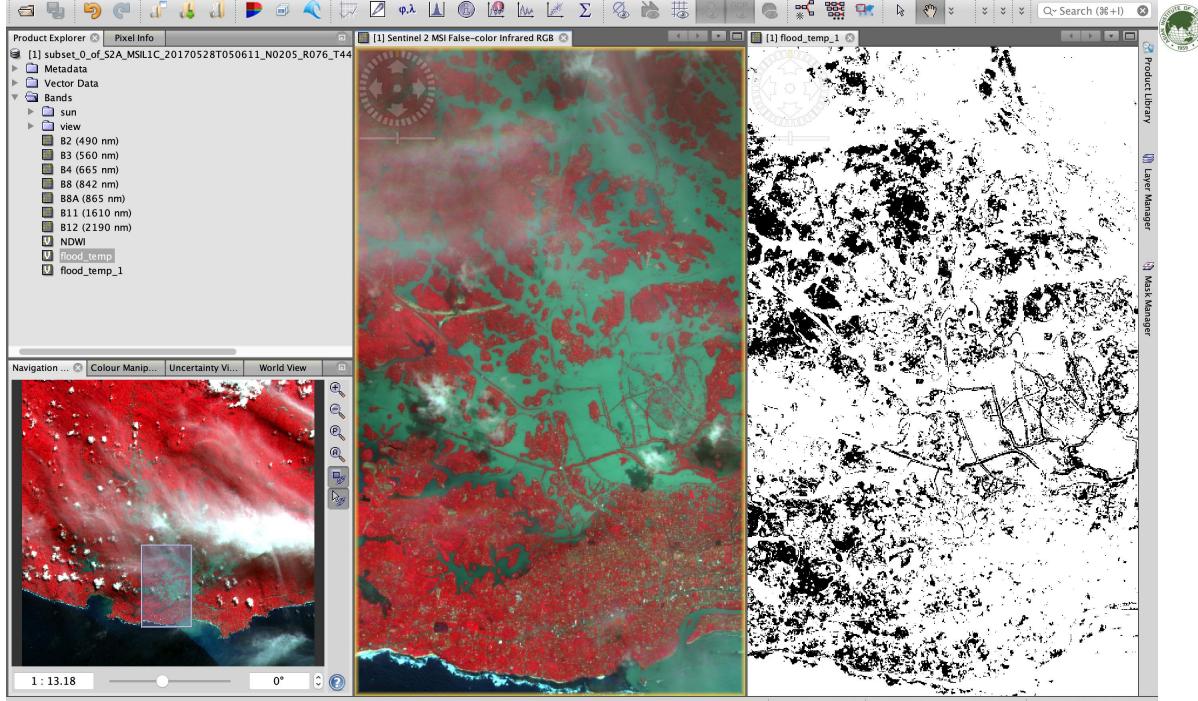


X 2005 Y 2865 Lat 5°58'24" N Lon 80°31'29" E Zoom 1:22.4 Level 1



Extract water using threshold

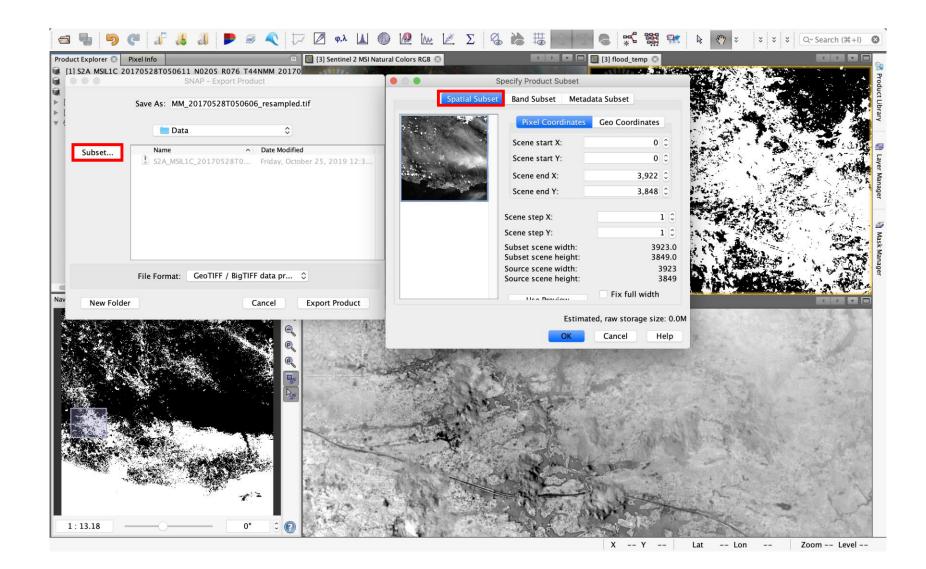




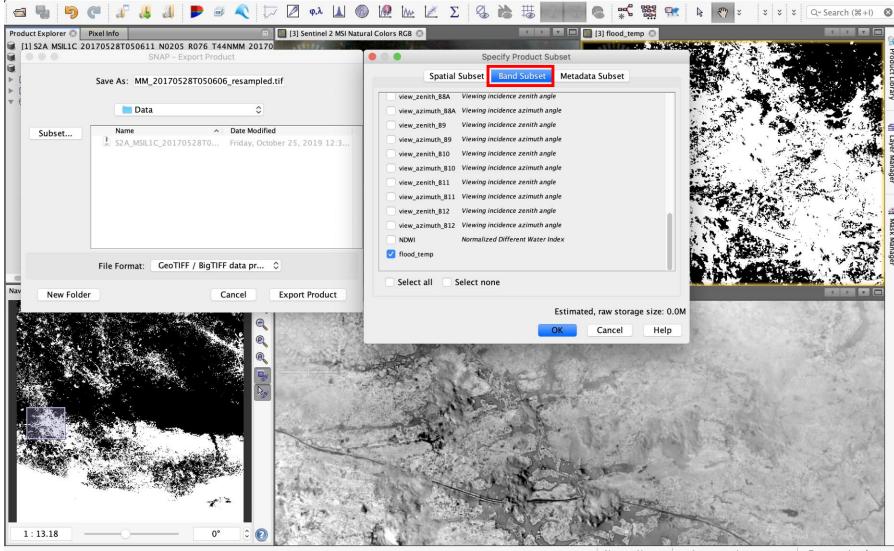
X 2173 Y 2763 Lat 5°58'57" N Lon 80°32'24" E Zoom 1:13.2 Level 0

Export result to other format for further analysis GIC

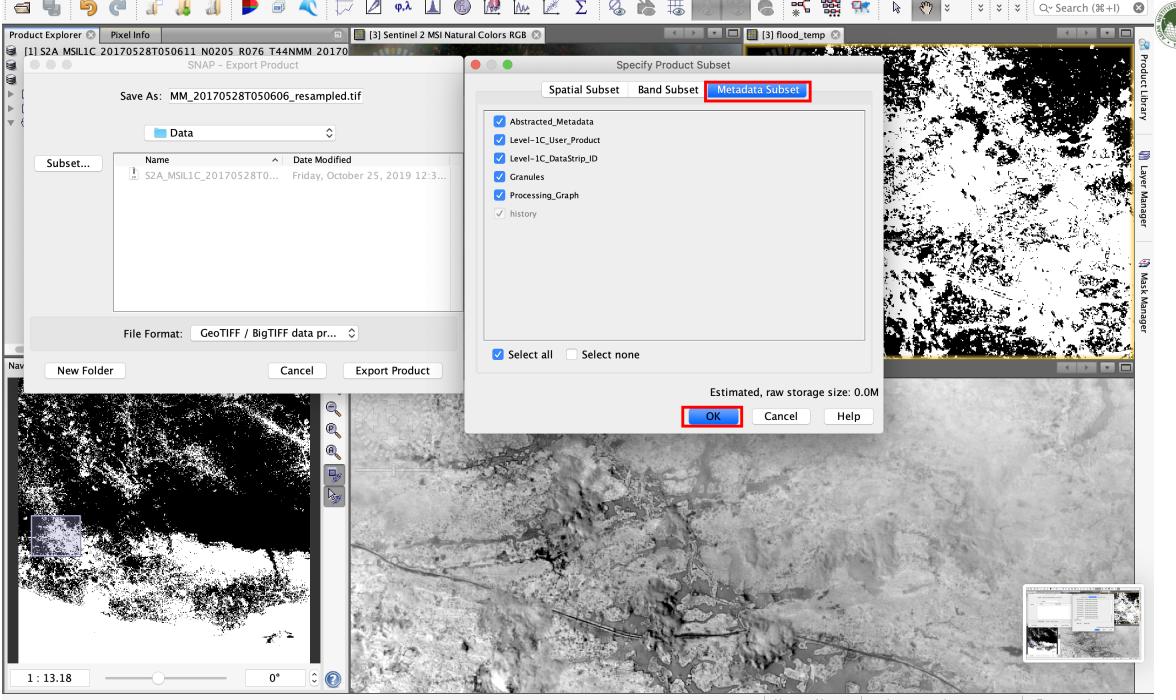
From the File menu, select Export, hen select GeoTIFF







X -- Y -- Lat -- Lon -- Zoom -- Level --





•••	🚞 Data			
< >		Q Search		
Favorites	Name ^	Date Modified	Size	Kind
iCloud	S2A_MSIL1C_20170570528T050606.data	Nov 11, 2019 at 00:17		Folder
	S2A_MSIL1C_201705170528T050606.dim	Nov 11, 2019 at 00:11	8.5 MB	SNAP sIMA
iCloud Drive	S2A_MSIL1C_201705170528T050606.zip	Oct 25, 2019 at 00:32	630.6 MB	ZIP archive
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🗖 Dan's Mac	subset_0_of_S2A_MS0606_resampled.dim	Nov 11, 2019 at 00:11	8.5 MB	SNAP sIMA
	subset_0_of_S2A_MS50606_resampled.tif	Nov 11, 2019 at 00:09	142.7 MB	TIFF image
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Important				

Advanced Preparation for the Training Course : "How to process satellite data (optical and SAR) to produce VAP with particular foci on flood and water-related disasters"

6 Nov 2019

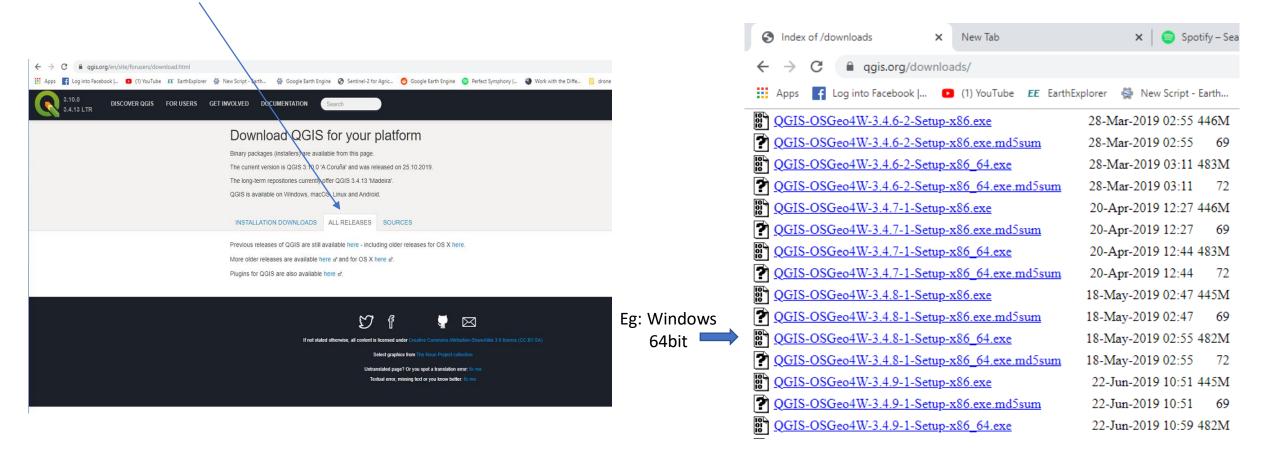
Dr. Dan Tran (AIT)

Mr. Chathumal (AIT)

(1) Installing the QGIS software into your personal computer.

1.1 Copy and paste the following link in a web browser <u>https://qgis.org/en/site/forusers/download.html</u>

1.2 Goto All releases and find an installer (QGIS 3.4.8 version is preferred) depending on your system specification

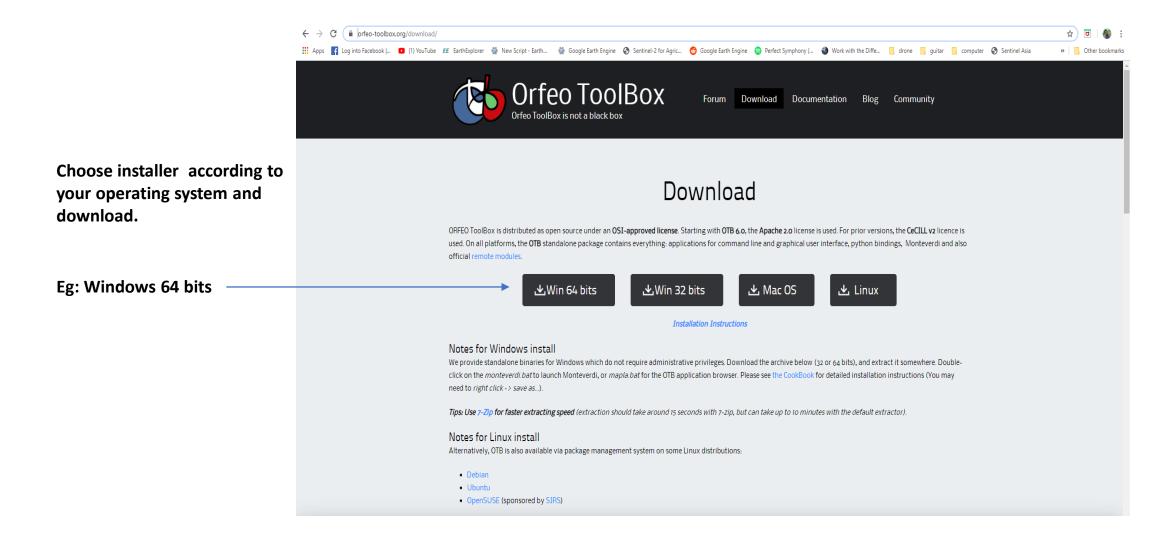


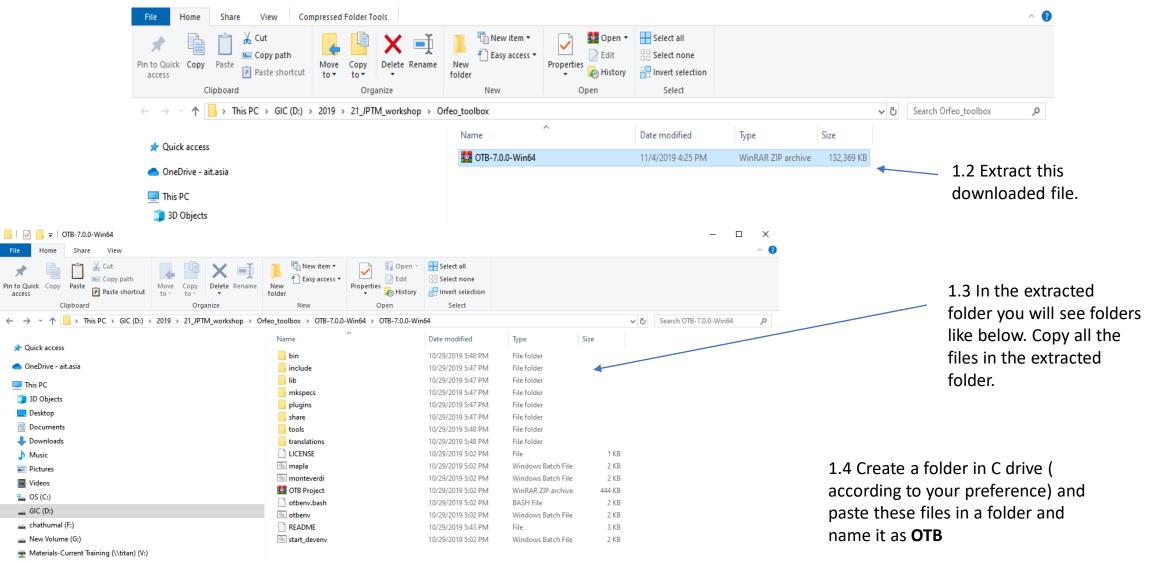
1.3 Download the installer (32 bit/64 bit) according to operating system and install the software.

(2) Installing Orfeo toolbox for remote sensing image processing

1.1 Copy and paste the following link in a web browser

https://www.orfeo-toolbox.org/download/





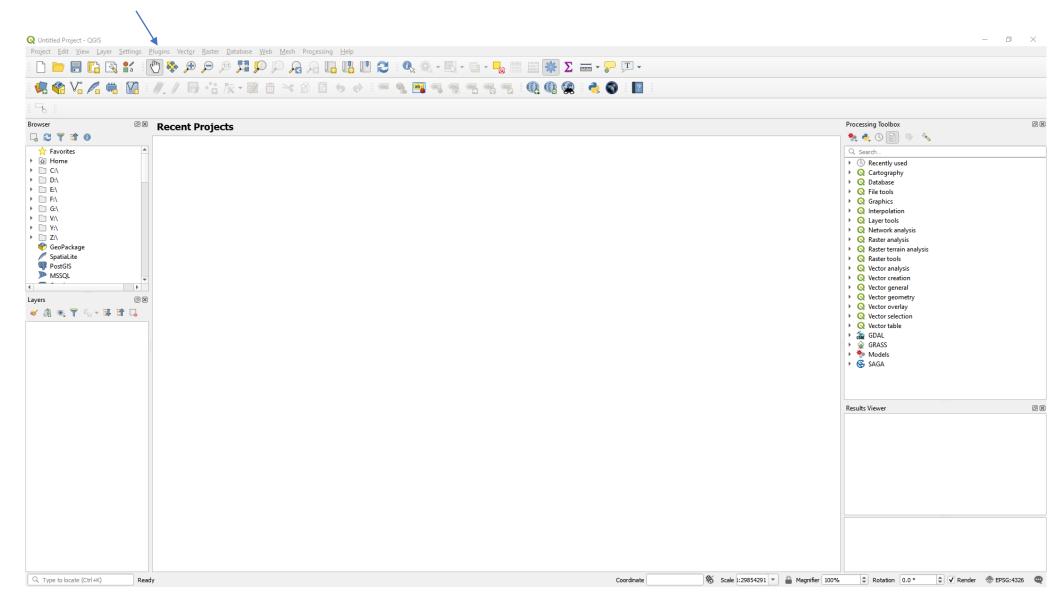
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🛖 Kepler (\\kepla) (Y:)

×

access

1.5 Open QGIS software and click on Plugins



1.6 Goto Plugins > Settings Click Add under Plugin repository

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🖄 All	Check for updates on startup
installed	every time QGIS starts
Not installed	Note: Ιφ τηισ φυνχτιον ισ εναβλεδ, ΘΓΙΣ ωιλλ ινφορμ ψου ωηενεσερ α νεω πλυγιν ορ πλυγιν υπδατε ισ ασαιλαβλε. Οτηερωισε, φετχηινγ ρεποσιτοριεσ ωιλλ βε περφορμεδ δυρινγ οπενινγ οφ τηε Πλυγιν Μαναγερ ωινδοω.
Tinvalid	Show also experimental plugins
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Settings	πλυγινσ αρέ ιν εαρλψ σταγεσ οφ δεωελοπμεντ, ανδ σηουλδ βε χονσιδερεδ ∋ινχομπλετε∋ ορ ∋προοφ οφ χονχεπτ∋ τοολσ. ΘΓΙΣ δοεσ νοτ ρεχομμενδ ινσταλλινγ τηεσε πλυγινσ υνλεσσ ψου ιντενδ το υσε τηεμ φορ τεστινγ πυρποσεσ.
	▼ Show also deprecated plugins
	Note: Δεπρεχατεδ πλυγινσ αρε γενεραλλψ υνσυιταβλε φορ προδυχτιον υσε. Τηεσε πλυγινσ αρε υνμαινταινεδ, ανδ σηουλδ βε χονσιδερεδ ∋οβσολετε∋ τοολσ. ΘΓΙΣ δοεσ νοτ ρεχομμενδ ινσταλλινγ τηεσε πλυγινσ υνλεσσ ψου στιλλ νεεδ ιτ ανδ τηερε αρε νο οτηερ αλτερνατισεσ ασαιλαβλε.
	Plugin repositories
	Status Name URL
	Image: Connected QGIS Official Plugin Repository https://plugins.qgis.org/plugins/plugins.xml?qgis=3.6 Image: Connected QGIS Official Plugin Repository https://plugins.qgis.org/plugins.xml?qgis=3.6 Image: Connected QGIS Official Plugin Repository https://plugins.qgis.org/plugins.ygis.org/plugins.xml?qgis=3.6 Image: Connected QGIS Official Plugin Repository https://plugins.qgis.org/plugins.ygis.org/plugins.xml?qgis=3.6 Image: Connected QGIS Official Plugin Repository https://plugins.qgis.org/plugins.ygis.org/plu
	Close Help

1.7 Add these details in the following tabs.

Name: Orfeo Repository URL : http://orfeo-toolbox.org/qgis/plugins.xml

🔇 Repository d	etails	\times
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URL	http://orfeo-toolbox.org/qgis/plugins.xml]
Parameters	?qgis=3.6	
Authentication	Clear Edit	
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	OK Cancel	

After adding information Press OK

Plugin repositories

Status	Name	URL
Connected	Orfeo Repository	http://orfeo-toolbox.org/qgis/plugins.xml?qgis=3.6
Connected	QGIS Official Plugin Repository	https://plugins.qgis.org/plugins/plugins.xml?qgis=3.6
4		•
Reload all Reposi	tories	Add Edit Delete
	Click	bdd

1.8 Goto Plugins > Manage and Install Plugins

All C otb	
Processing OTB provider	
Processing OTB provider	
Not installed Processing provider to use OTB applications	
Invalid Orfeo ToolBox (OTB) is an open-source project for state- of-the-art remote sensing. It can process high resolution	
Install from ZIP optical, multispectral and radar images at the terabyte scale. A wide variety of its applications such as Mosiac,	
Settings Ortho-rectification, Pansharpening, Classification, Deep Learning (via tensorflow) are accessible in QGIS through this processing provider. OTB 6.6.0 or higher is required to use this plugin	

More info homepage	
Author CNES Available version 1.4.2	
1.9 Type otb in the se	arch
bar and click on insta	
plugin	
Upgrade All Install Plugin Close Help	

2.0 Goto Settings > options > Processing

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Then you can access all the tools under OTB

CTB 🕲

Calibration

Deprecated

Geometry

Learning

SAR

Stereo

Hyperspectral

Image Filtering

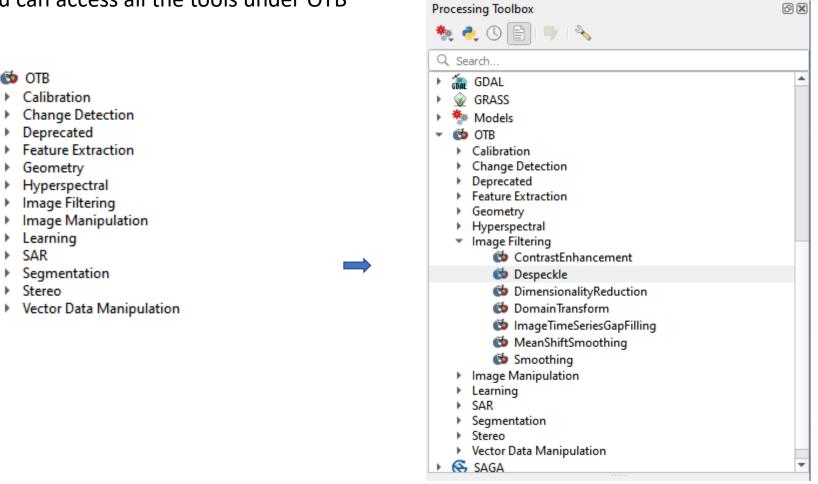
Segmentation

Image Manipulation

Change Detection

Feature Extraction

w.

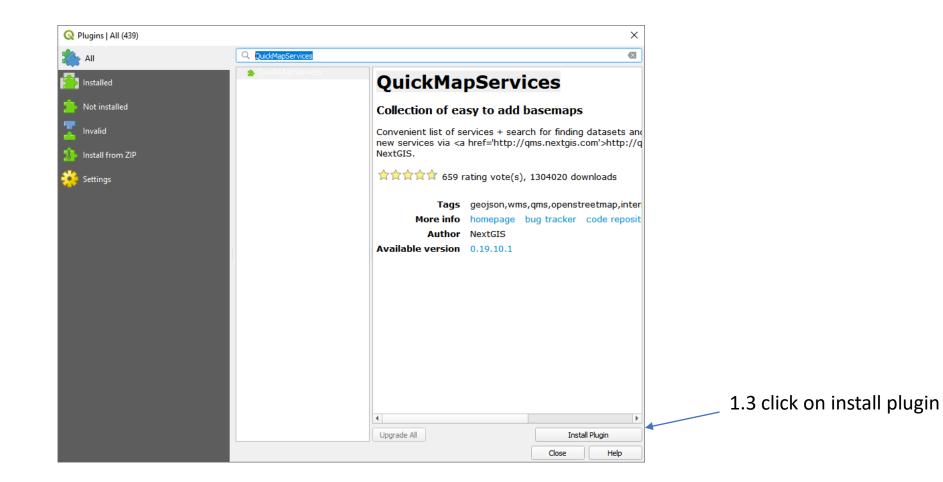


OTB toolbox installation procedure is same for the other operating systems.

(3) Adding base maps for QGIS

1.1 Goto Plugins > Settings Click Add under Plugin repository

1.2 Type **QuickMapServices** in the search bar



1.3 Goto **Web > QuickMapServices** To access the Base maps.

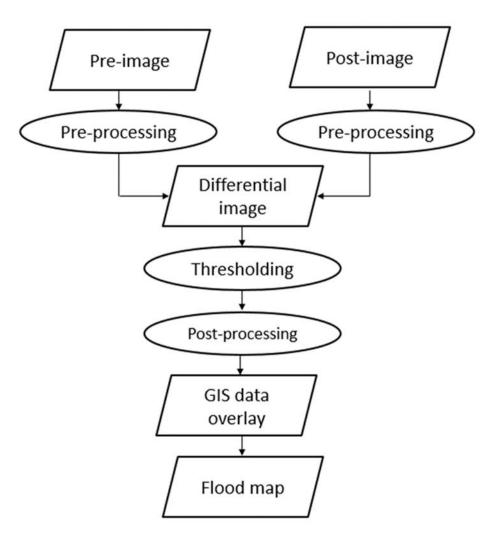
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R Type to locate (Ctrl+K) 1 legend entries removed.		Coordinate 94858,2086670 🛞 Scale 1:708040 🔻 🔒 Magnifier 100% 🗘 Rotation 0.0 ° 🌩 🗸 Rende	er 💮 EPSG: 32647 🛛 😨

Thank you

Flood Extraction Using ALOS 2 PALSAR 2 Data

Chathumal Madhuranga (AIT)

Methodology behind the Flood extraction



ALOS 2 PALSAR 2 Data Calibration

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

 σ^0 – Radar Backscatter

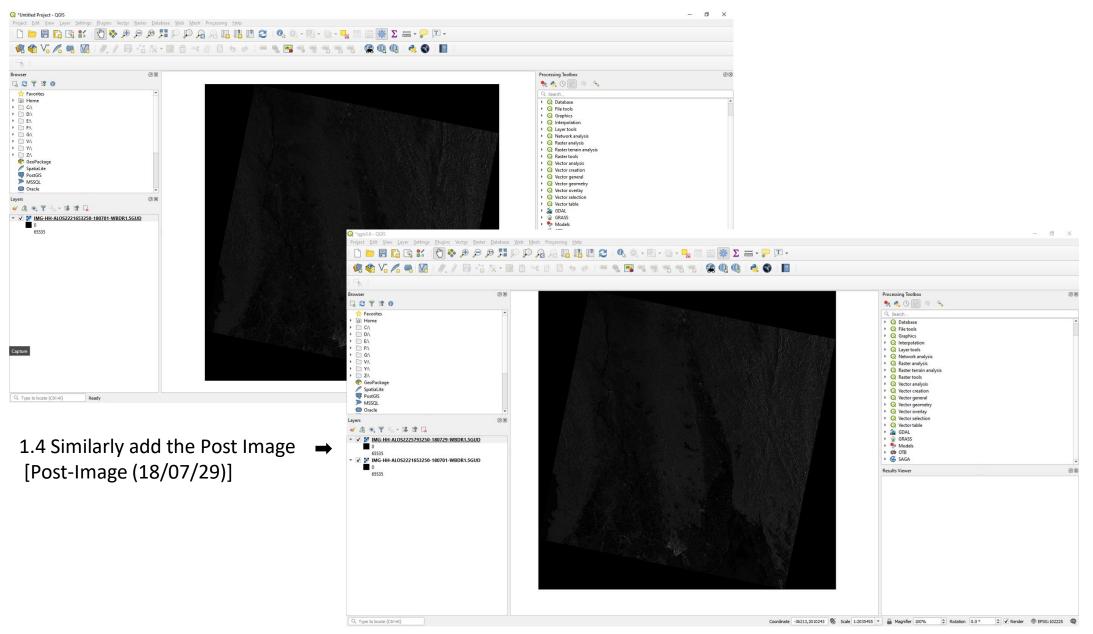
DN – Pixel DN values

CF - Calibration Factor

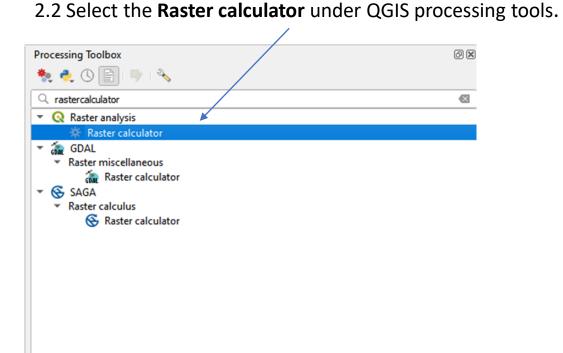
1 Open **QGIS** installed on your computer

1.1 Goto Layer > Add Layer > Add Raster Layer

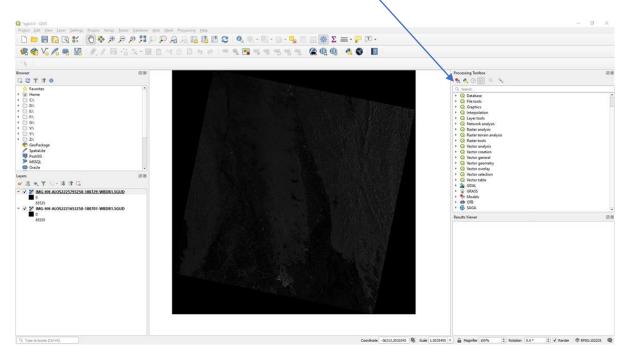
						1.2 Browse t	he path to your image
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JPTM 2019



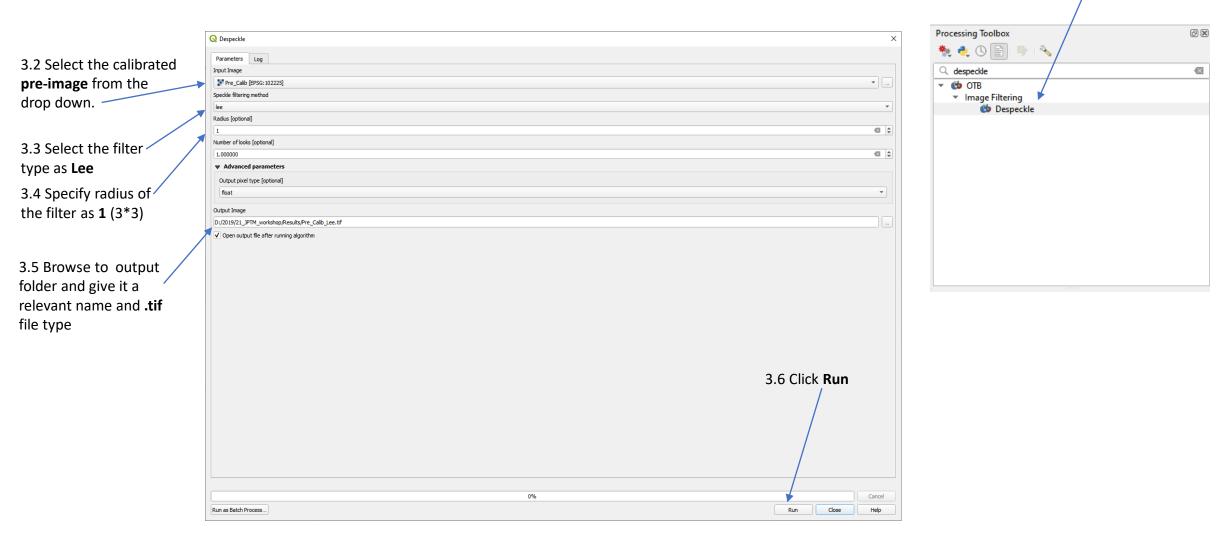
2.1 In Processing toolbox search bar type raster calculator.



2.3 Input the Calibration	Q Raster Calculator		×	<
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	IMG-HH-ALOS2221653250-180701-WBDR1.5GUD@1	+ * cos sin log10 AND	The resulting layer will have its values computed according to an expression. The expression can	
	IMG-HH-ALOS2225793250-180729-WBDR1.5GUD@1	- / acos asin In OR	contain numerical values, operators and references to any of the layers in the current	
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\mathbf{X}			The extent, cell size, and output CRS can be	
			defined by the user. If the extent is not specified, the minimum extent that covers selected reference layer(s) will be used. If the cell size is not specified,	
	Expression		the minimum cell size of selected reference layer(s) will be used. If the output CRS is not specified, the	
	(20* log 10("IMG-HH-ALOS2221653250-180701-WBDR 1.5GUD @1"))-83	CRS of the first reference layer will be used.	
			The cell size is assumed to be the same in both X and Y axes.	
			Layers are referred by their name as displayed in	
			the layer list and the number of the band to use (based on 1), using the pattern 'layer_name@band	
			number'. For instance, the first band from a layer named DEM will be referred as DEM@1.	
	Dradofined expressions		When using the calculator in the batch interface or	
	Predefined expressions		from the console, the files to use have to be specified. The corresponding layers are referred	
	NDVI	▼ Add Sav	using the base name of the file (without the full path). For instance, if using a layer at path/to/my/	
	Reference layer(s) (used for automated extent, cellsize, and CRS) [option	onal	rasterfile.tif, the first band of that layer will be referred as rasterfile.tif@1.	
	1 elements selected	·		
	Cell size (use 0 or empty to set it automatically) [optional]			
	0.000000			
2.5 Browse to the output folder	Output extent (xmin, xmax, ymin, ymax) [optional]			
-	[Leave blank to use min covering extent]			
and give it a name and save it as	Output CRS [optional] Project CRS: EPSG: 102225 - MONREF_1997_UTM_Zone_47N			
a .tif file	Output			
	D:/2019/21_JPTM_workshop/Results/Pre_Calib.tif		2.4 Cli	ck on this icon and select a
	✓ Open output file after running algorithm			
			referer	nce layer
		0%	Cancel	
	Run as Batch Process		Run Close Help	
l			X	
	😪 Raster Cal		Q Multiple selection	×
	Parameters Personney Jacobs Jacobs	100 Raster calculator daring	Click Run	0-180701-WBDR1.5GUD [EPSG:102225] Select All
	l - callad Binne, fak - cottestr	B) 1, 527 (Second and a constrainty of the second secon	IMG-HH-ALOS2225793250	0-180729-WBDR1.5GUD [EPSG:102225] Clear Selection
		(are(), cos(), tare(), atari2(), in(), inp 20()		
		The extents of the num of and the control of the test of the control of the test of the control of the test of the control of		Toggle Selection
		He investigate of the standard standard standard standard standard standard standard standard standard standard He is a standard standa		Add File(s)
		and Trans. - Laves are thread by their name as displayed in - Parama their displayed and the second se		ОК
		to call of the an annual frame a larger means (10 m and 10 m and 10 m and 10 m annual frame a larger Velow and pre-based and 10 m and 10 m annual frame		2.6 Click OK Cancel
		From the answer, the finance task the temperature of the second s		
		rolend ac intellis (§).		
	Precision allo	JPTM 2019		7
	Four as Datch	en Cool		

Q Raster Calculator								×
Parameters Log								Raster calculator
Expression Layers	Operators							This algorithm allows performing algebraic operations using raster layers.
IMG-HH-ALOS2221653250-180701-WBDR1.5GUD@1		*				AND		The resulting layer will have its values computed according to an expression. The expression can
IMG-HH-ALOS2225793250-180701-WBDR1.5GUD@1	+		cos	sin	log10			contain numerical values, operators and references to any of the layers in the current
	-	/	acos	asin	l In	OR		project. The following functions are also supported:
		sqrt	tan	atan	<)		- sin(), cos(), tan(), atan2(), ln(), log10()
		>]				The extent, cell size, and output CRS can be defined by the user. If the extent is not specified, the minimum extent that covers selected reference layer(s) will be used. If the cell size is not specified, the minimum cell size of selected reference layer(s) will be used. If the output CRS is not specified, the
Expression								CRS of the first reference layer will be used.
(20 ⁴⁴ og10("IMG-HH-ALOS2225793250-180729-WBDR1.5GUD@1")) - 83								The cell size is assumed to be the same in both X and Y axes.
								Layers are referred by their name as displayed in the layer list and the number of the band to use (based on 1), using the pattern layer_name@band number'. For instance, the first band from a layer named DEM will be referred as DEM@1.
								When using the calculator in the batch interface or from the console, the files to use have to be specified. The corresponding layers are referred using the base name of the file (without the full path). For instance, if using a layer at path/to/my/
Predefined expressions								rasterfile.tif, the first band of that layer will be referred as rasterfile.tif@1.
NDVI							Add Save	
Reference layer(s) (used for automated extent, cellsize, and CRS) [optional]								
1 elements selected								
Cell size (use 0 or empty to set it automatically) [optional]								
0.00000								
Output extent (xmin, xmax, ymin, ymax) [optional]								
[Leave blank to use min covering extent] Output CRS [optional]							[]	
Project CRS: EPSG: 102225 - MONREF_1997_UTM_Zone_47N							•	
Output								
D:/2019/21_JPTM_workshop/Results/Post_Calib.tif								
✓ Open output file after running algorithm								
			0)%				Cancel
Run as Batch Process								Run Close Help

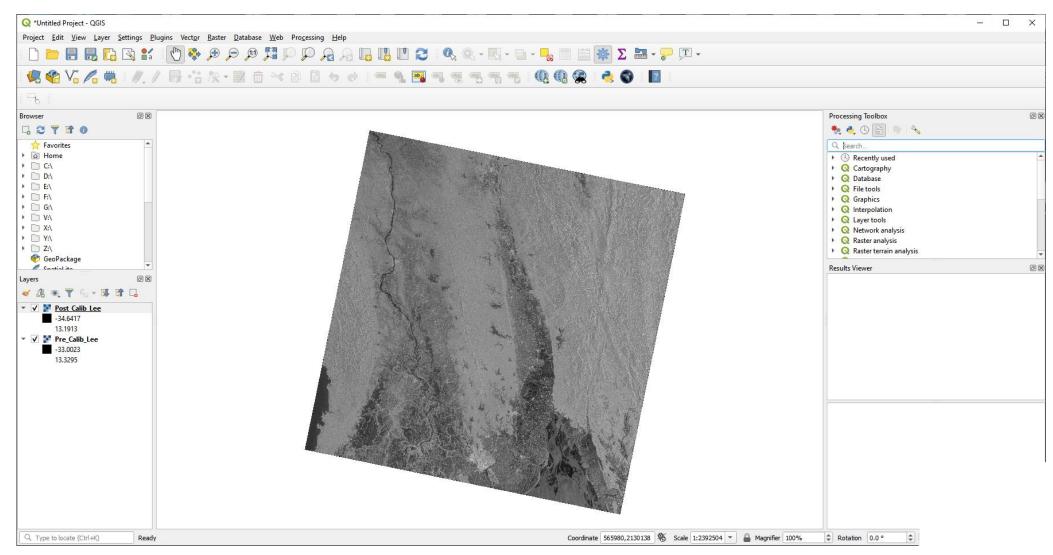
3 Speckle filtering



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

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

Images after speckle filtering



4 Re-project images into WGS84 system

		Processing Toolbox	0 ×
		🎨 🌏 🕓 🖹 I 🔍 I 🗞	
4.2 Select the filtered	Q Warp (Reproject)	Q Warp	⊠
pre-image from the 🥄	Durantee L	Recently used Warp (reproject)	
drop down.	Parameters Log Input layer	▼ Q Vector general	
	Pre_Calib_Lee [EPSG: 102225]	🔅 Assign projection	
	Source CRS [optional]	Reproject layer	
4.3 Select the Target		- v Gold GDAL - v Raster extraction	
CRS as EPSG: 4326	Target CRS	Clip raster by mask layer	
	EPSG: 4326 - WGS 84	 Raster projections 	
4.4 Specify the	Resampling method to use	₩ Warp (reproject) ✓ SAGA	
	Nearest neighbour Nodata value for output bands [optional]	 Georeferencing	
resampling as Nearest	Not set	- S Warping shapes	
neighbor	Output file resolution in target georeferenced units [optional]		
	Not set		
4.5 Browse to output	Advanced parameters		
	Reprojected		
folder and give it a	D:/2019/21_JPTM_workshop/New/Pre_Calib_Lee_Prj.tif		
relevant name and .tif	✓ Open output file after running algorithm		
file type			
	GDAL/OGR console call		
	gdalwarp +t_srs EPSG:4326 -r near -of GTiff D:/2019/21_JPTM_workshop/Results/Pre_Calib_Lee.tif D:/2019/21_JPTM_workshop/New/Pre_Calib_Lee_Prj.tif		
		4.6 Click Run	
	0%	Cance	
	Run as Batch Process	Run Close Help	

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

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**

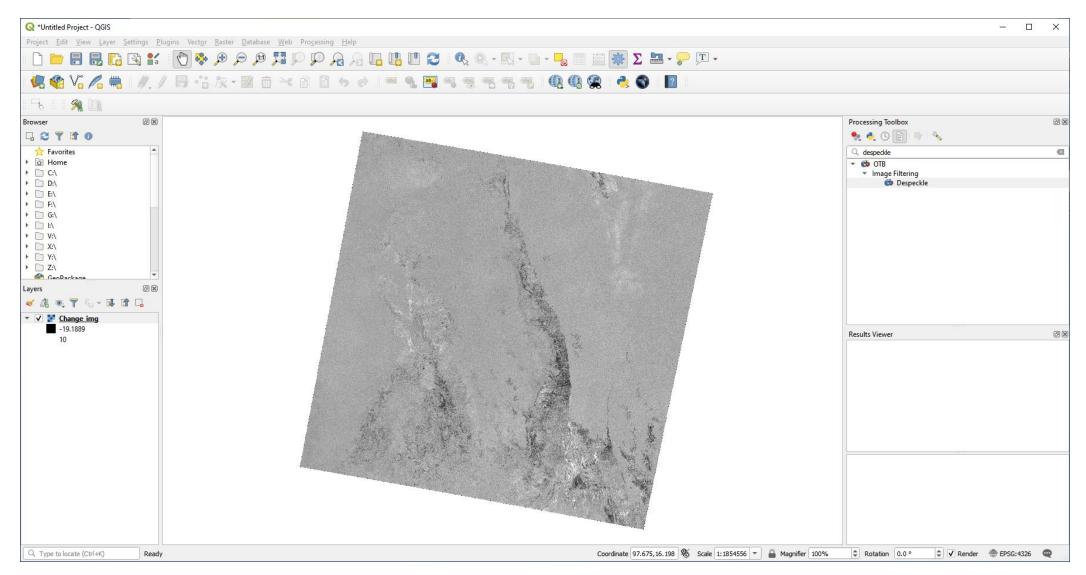
images by Inputting the	Q Raster Calculator									×	
Expression as follows	Parameters Log								Raster calculator		
	Expression							This algorithm allows performing algebra	ic l		
	Layers Operators							operations using raster layers.			
\backslash	Output Post_Calib_Lee	+	*	cos	sin	log 10	AND		The resulting layer will have its values co according to an expression. The express contain numerical values, operators and	sion can	
	Post_Calib_Lee_Prj Pre_Calib_Lee Pre_Calib_Lee Pre_Calib_Lee_Prj		/ sqrt	acos	asin atan	ln (OR)		references to any of the layers in the cu project. The following functions are also supported:		
	rie_Callo_Lee_rij		>		!=	<=	>=		- sin(), cos(), tan(), atan2(), ln(), log10(D	
	Expression								The extent, cell size, and output CRS ca defined by the user. If the extent is not the minimum extent that covers selected	specified,	
	Post_Calb_Lee_Prj@1" - "Pre_Calb_Lee_Prj@1"								I syver(s) will be used. If the cell size is not specified, the minimum cell size of selected reference layer (s) Will be used. If the output CRS is not specified, the CRS of the first reference layer will be used. The cell size is assumed to be the same in both X and Y axes. Layers are referred by their name as displayed in the layer list and the number of the band to use (based on 1), using Car Jiach Chic Chemother this is icon and select a named DEF with the referred as DEM@1. When using the calculated as DEM@1. When using the calculated as DEM@1. Using the base name of the file (without the calculated as DEM@1. path). For instance, if without the calculated as DEM@1.		
	Predefined expressions NDVI Add Save										
	Reference layer(s) (used for automated extent, cellsize, and CRS) [optional]										
	2 elements selected Cell size (use 0 or empty to set it automatically) [optional]										
								IMG-HH-ALOS2225793250-180729-WBDR1.5GUD [EPSG:10	MG-HH-ALOS2221653250-180701-WBDR1.5GUD [EPSG:102225]		
	Output extent (xmin, xmax, ymin, ymax) [optional]								IMG-HH-ALOS2225793250-180729-WBDR1.5GUD [EPSG:102225] Post_Calib_Lee [EPSG:102225]		
	[Leave blank to use min covering extent]									Post_Calib_Lee_Proj [EPSG:32647] Post_Calib [EPSG:102225]	
	Output CRS [optional]									Pre_Calib [EPSG:102225]	
5.3 Browse to the output								▼ 8		Pre_Calib_Lee [EPSG:102225] ✓ Pre_Calib_Lee_Proj [EPSG:32647]	
folder and give it a name	Output										
-	D:/2019/21_JPTM_workshop/New/Change_img.tif									5.5 Click OK	
and save it as a .tif file	✓ Open output file after running algorithm										
					0%						
	Run as Batch Process								Run Close		

5.2 Obtain the difference between projected pre and post



Select All Clear Selection Toggle Selection Add File(s)... OK Cancel

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

	\mathbf{X}		
Q Build Virtual Raster	×		
Parameters Log			
Input layers	🖌 🖌	Q Multiple selection	×
2 elements selected]		
Resolution		Change_img [EPSG:32647]	Select All
average	•	Output [EPSG:32647]	
V Place each input file into a separate band		 IMG-HH-ALOS2221653250-180701-WBDR1.5GUD [EPSG:102225] IMG-HH-ALOS2225793250-180729-WBDR1.5GUD [EPSG:102225] 	Clear Selection
Allow projection difference		Post_Calib_Lee [EPSG:102225]	Toggle Selection
▼ Advanced parameters		✓ Pre_Calib_Lee_Proj [EPSG:32647]	
Add alpha mask band to VRT when source raster has none		Post_Calib_Lee_Proj [EPSG:32647]	Add File(s)
Override projection for the output file (optional)		Post_Calib [EPSG:102225]	ОК
	-	Pre_Calib [EPSG:102225]	
essempling algorithm		Pre_Calib_Lee [EPSG:102225]	Cancel
Neadhpang agus ann		RGB [EPSG:32647]	
			6.3 Click OK
Nodata value(s) for input bands (space separated) [optional]			0.5 CIICK OK
Virtual			
[Save to temporary file]			
▼ Open output file after running algorithm			
GDAL/OGR console call			
gdabuldvrt resolution average -separate - nearest -+put_file_jist C:/Jsers/Chatumal/AppDataj.ocal/Temp/processing_388cb34767746498922a712ecfadsc/a017763480e14920b74666daeae3611c/buldvrtinputFiles.txt C:/Jsers/Chatumal/AppDataj.ocal/Temp/processing_388cb34767746498922a712ecfadsc/a017763480e14920b74666daeae3611c/buldvrtinputFiles.txt	22a712ecfad6c/		
dee45feb69542130076f94187d32ba2/0UTPUT.vrt			
I			
0%	Cancel		
Run as Batch Process Run Close	Help		
	·		
6.4 0	lick Run.		

Q *qgis3.6 - QGIS - 0 X Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help 6.6 Select band 1(pre), band 2(post) from the dropdowns as follows 🤹 🕼 🔏 🦉 🥂 / 日 岩 友·屋 古 米 白 目 ち さ 🛎 乳 湯 湯 湯 湯 湯 😤 🔍 🔍 👌 🖗 📗 Q Layer Properties - RGB | Symbology GOTTO 🍖 🍓 🛈 📄 🖷 🔌 rab Max -2.8801 Min -22,256 😻 Symbolog Recently used S Rgb composite Max -2.5643 GDAL Min -23.8757 PCT to RGB Red Band : Pre-image RGB to PCT Max -2.5643 Min -23.8757 GRASS Stretch to MinMa Imagery (i.* Green band: Post-image i colors enhance Results Viewer Blue Band : Post-image Legend MSSQL Min / Max Value Set QGIS Server Oracle ● 應 ● ▼ 4 - 7 7 1 - 7 1 7 1 👔 Change_img ✓ FRGB Color Rend Outpu Rending mode Norm Reset -27.7919 Contrast V Fre Calib Lee Proi Grayscale Off -33,0023 13.3295 100% Post Calib Lee Pro dentify Result -34,6417 13.1913 1111 Oversampling 2.00 \$ Post_Calib_Lee Pre Calib Lee Pre Calib Post Calib MG-HH-AL052221653250-18... Fing-HH-AL052225793250-18... Style OK Cancel Apply ✓ Auto open form Coordinate 46840,1963271 🕷 Scale 1:986523 💌 California Contraction 0.0 ° California Contraction 0.0 ° California Cali Q. Type to locate (Ctrl+K)

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

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.

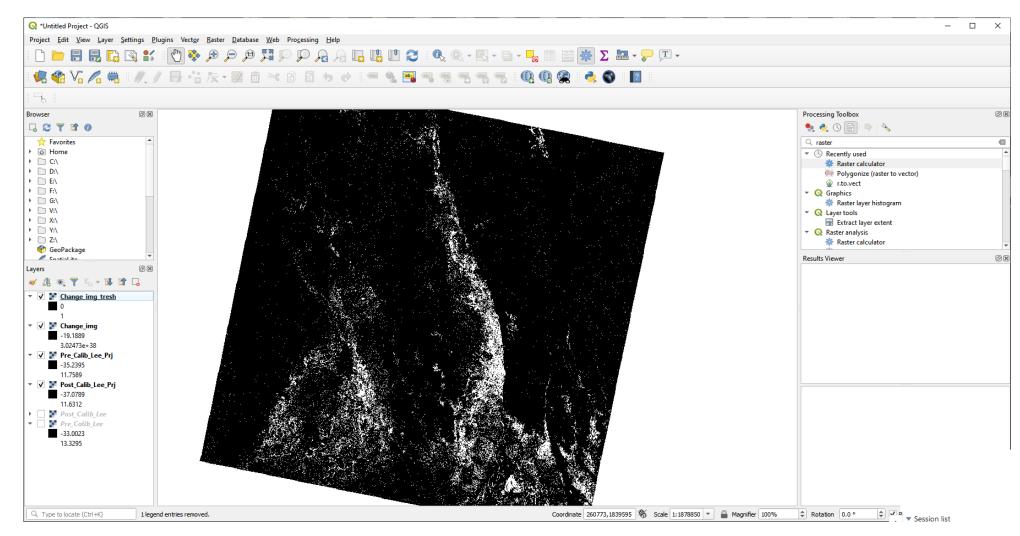
7 thresholding the Pre, Post difference image

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

Parameters Log		Raster calculator	
Expression Layers	Operators	This algorithm allows performing algebraic operations using raster layers.	
Layers Change_img@1 Post_Calib_Lee_Pi@1 Pre_Calib_Lee@1 Change_img@1*< - 3 ************************************	+ * cos sin log10 AND - / acos asin in OR ^ sqrt tan atan () < > = != <=	 Add Save Add Save Add Save 	7.2 Click on this icon and select a reference layer ✓ Multiple selection ✓ Change_img [EPSG:32647] Output [EPSG:3221653250-180701-WBDR1.5GUD [EPSG:102225] MG-HH-ALOS2225793250-180701-WBDR1.5GUD [EPSG:102225] Post_Calib_Lee [EPSG:102225] Post_Calib [EPSG:102225] Post_Calib [EPSG:102225] Pre_Calib [EPSG:10225] Pre_EX
		▼ 100 100 100 100 100 100 100 100 100 10	Pre_Calib_Lee_Proj [EPSG:32647] RGB [EPSG:32647]
Output D:/2019/21_JPTM_workshop/New/Change_img_tresh.tif			
Open output file after running algorithm			7.3 Click OK
	0%		
Run as Batch Process		Run Close	

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

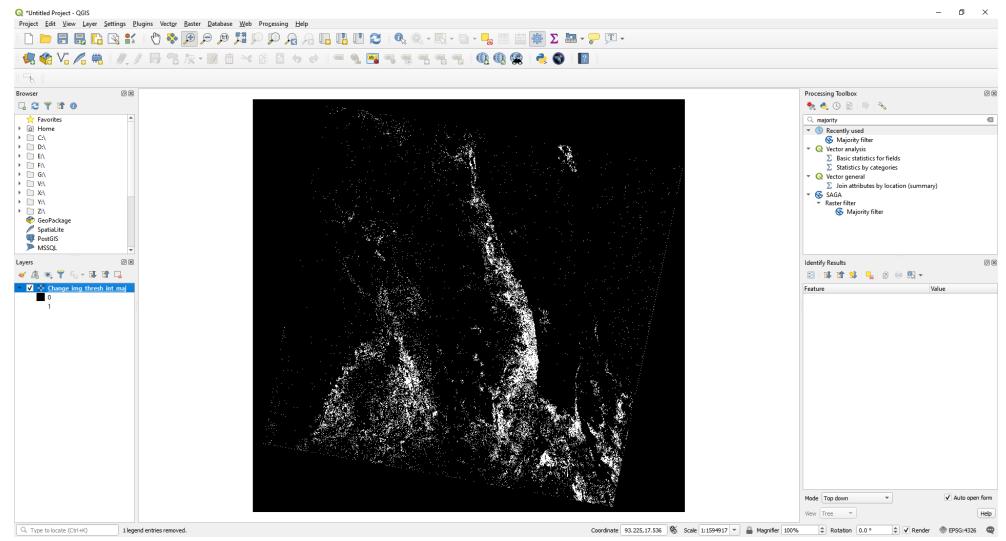
г	Timage from the drop down. T	Processing Toolbox
 8.4 Change the output datatype as byte 8.5 Browse to the output folder and give it a name and save it as a .tif file 	We wildste Help Output data type Byte Byte Image: Converted Dy(20)52(2_PTM_workshop/New/Change_img_tresh_int.tif Image: Converted V Open output file after running algorithm Image: Converted gdal_translate -of Byte.of GTiff D:(20)9(21_PTM_workshop/New/Change_img_tresh_int.tif Image: Converted 0% Image: Converted	3.6 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

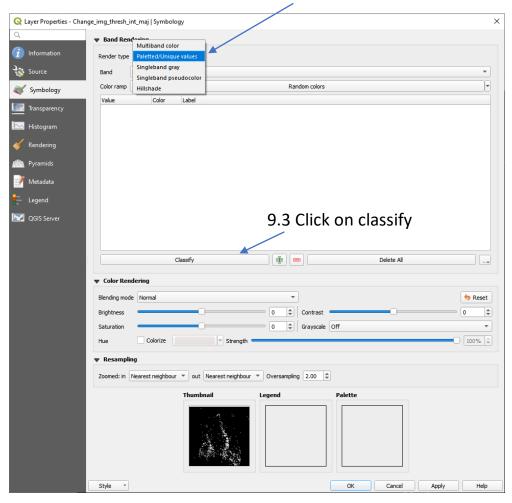
		Processing Toolbox	6 X
		🌺 💐 🕓 🖹 🤍 🔧	
		Q majority	
9.2 Select the th	reshold image (Byte) from the drop down.	▼ Q Vector analysis	
		Σ Basic statistics for fields	
	Q Majority Filter ×	Σ Statistics by categories	
	Parameters Log	 ✓ Q Vector general 	
	Grid	∑ Join attributes by locatiøn (summary)	
9.3 Input radius	V Change_ing_tresh_int [EPSG:4326]	👻 🛞 SAGA	
	Jeen (1) Houle	🔻 Raster filter 🔰	
as 3 (5*5) 🔪	[0] Square	🚱 Majority filter	
*	Radius		
	Threshold (Percent)		
	Filtered Grid		
	D:/2019/21_JPTM_workshop/New/Change_img_tresh.int_maj.sdat		
	Cpen output file after running algorithm		
9.4 Browse to th	e output folder		
and give it a nam			
a .sdat file			
	9.5 Cli	ck Run	
	0%		
	Run as Balch Process		

Majority filtered image



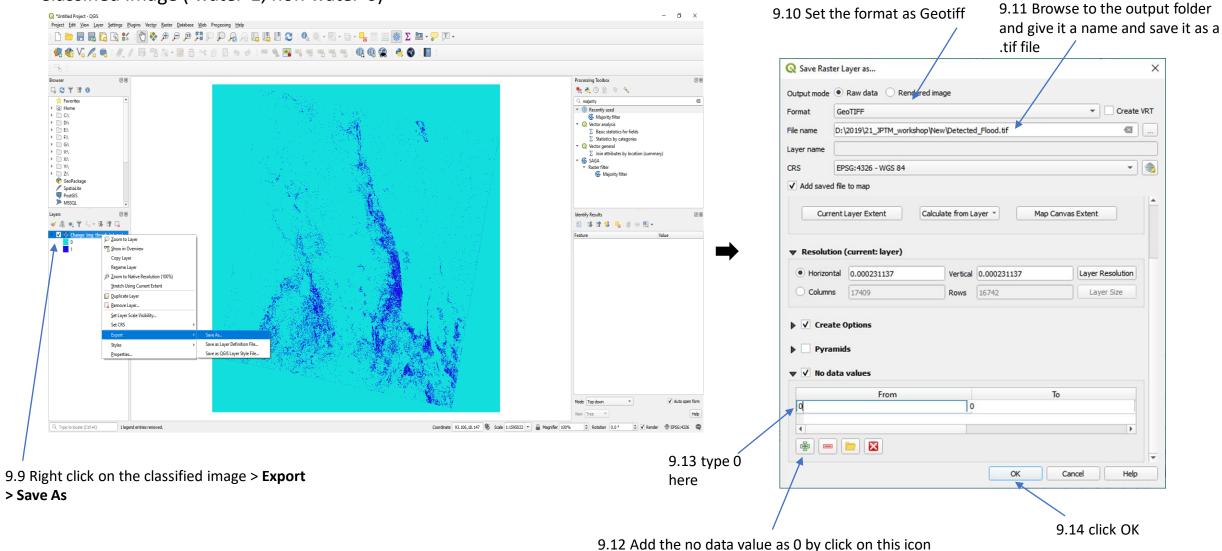
9.6 Right click on the majority filtered image> Properties

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

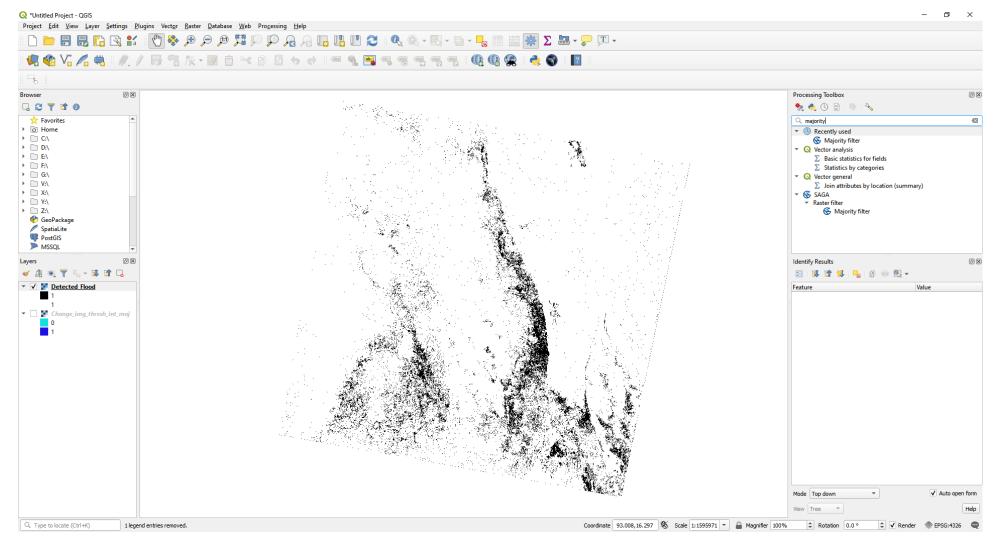


Q	Layer Properties - Chang	e_img_thresh_i	int_maj Symbology				×
Q		▼ Band Ren	dering				
i	Information	Render type	Paletted/Unique valu	es 🔻			
З ^С	Source	Band	Band 1				-
~	Symbology	Color ramp			Random colors		
	Transparency	Value		abel			
	Histogram	0)			
*	Rendering	1		I			
A	Pyramids						
2	Metadata						
÷	Legend						
	QGIS Server						
			da	-: 6.		Delete All	
			Clas	siry		Delete All	
		Color Rer	Idering				
		Blending mod	le Normal				🐤 Reset
		Brightness			0 Contrast		0 \$
		Saturation	Colorize		0 🗘 Grayscale		▼
		Hue		T Strength			100% 🜩
		▼ Resampli					
		Zoomed: in	Nearest neighbour 🔻	out Nearest neighbour	▼ Oversampling 2.00		
			1	humbnail	Legend	Palette	
		Style *				OK Cancel Apply	Help
						1	
					9.8	Click OK	

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



Detected Flood raster image.

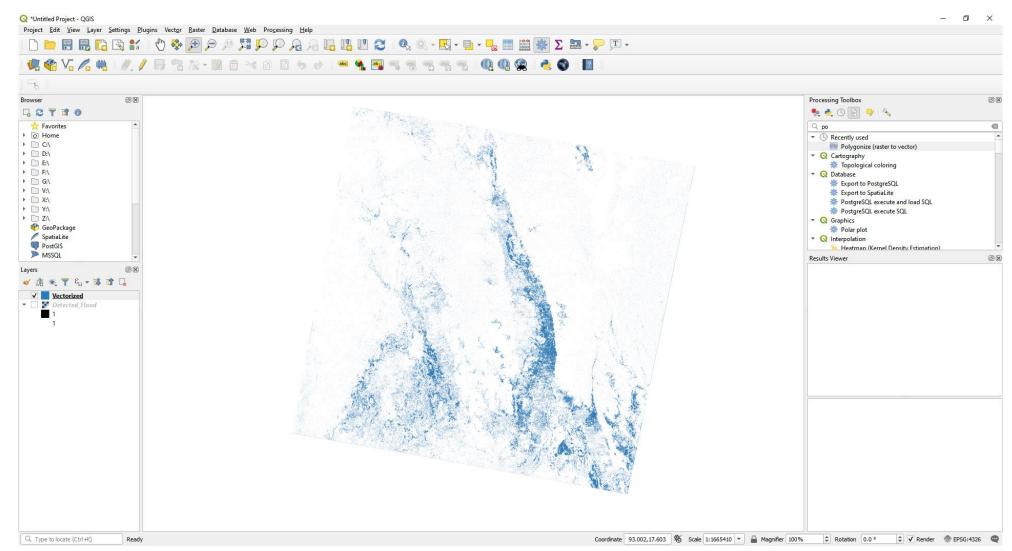


10 Conversion the **Detected Flood** raster file into a vector file

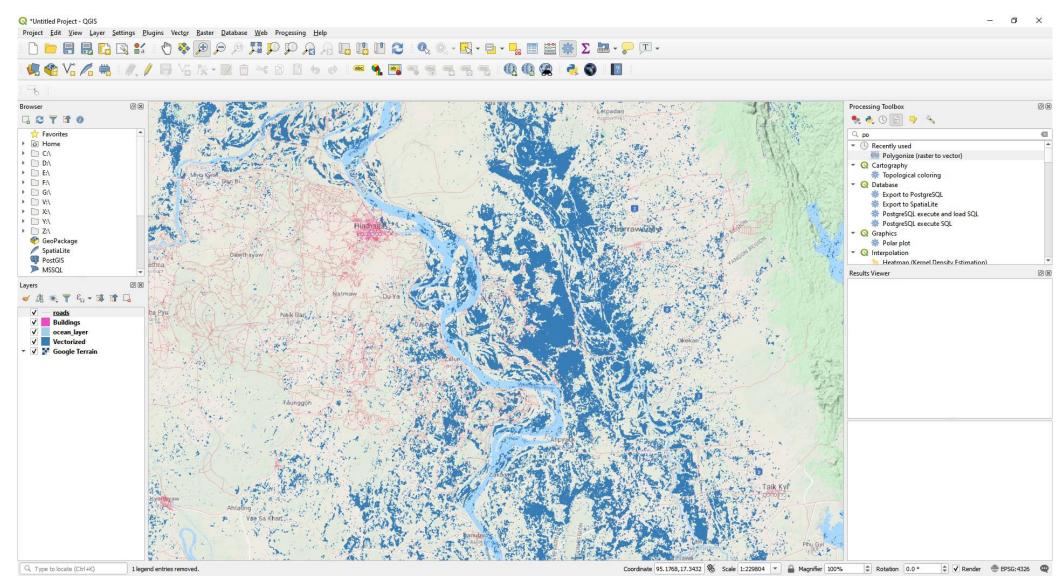
10.2 Selec	t the Detected flood raster from the drop down.		Processing Toolbox	0 ×	
	Q Polygonize (Raster to Vector)		×	🍬 之 🛇 🖹 I 🦻 I 🗞	
	Parameters Log Input layer Input layer Import Detected_Flood [EPSG:4326] Band number Band 1 (Gray) Name of the field to create DN Use 8-connectedness Vectorized D:/2019/21_PTM_workshop/New/Detected_water/Flood.shp ✓ Open output file after running algorithm see to the output folder a name and save it as a			 polygonize Recently used Polygonize (raster to vector) Vector creation Raster pixels to polygons Vector geometry Polygonize GDAL Raster conversion Polygonize (raster to vector) 	
	GDAL/OGR console call				
	python3 -m gdal_polygonize D:\2019\21_JPTM_workshop\Wew\Detected_Flood.tif D:/2019/21_JPTM_workshop,New/Detected_water/Flood.shp -b 1 -f "ESRI Shapefile" Flood DN				
	0%		Cancel		
	Run as Batch Process	JPTM 2019	Run Close Help	24	4

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

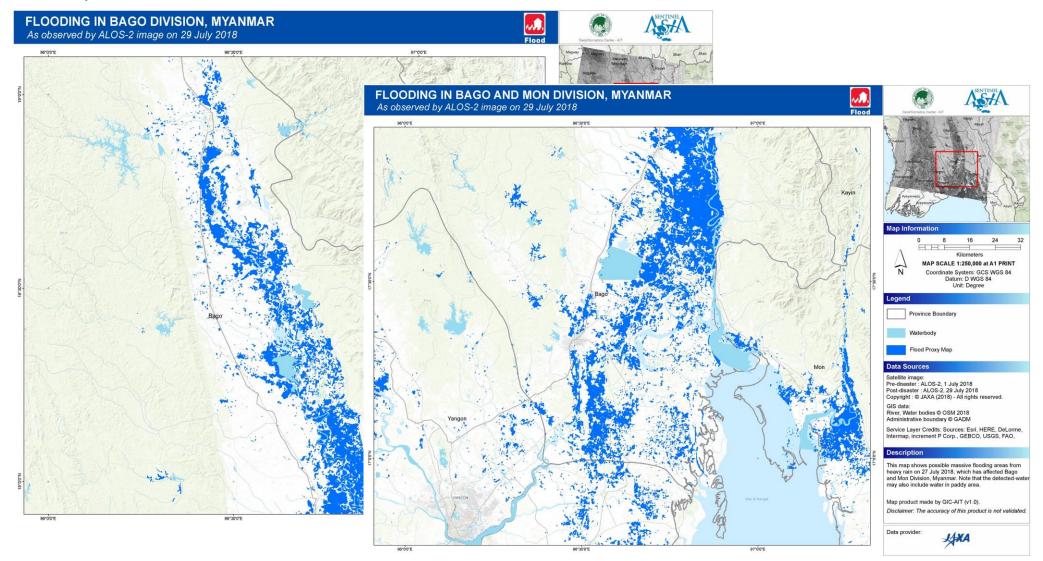
Detected Flood in Vector format



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

: <u>https://download.geofabrik.de/</u>

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

Thank You!