# Flood Extraction Using ALOS 2 PALSAR 2 Data

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# Methodology behind the Flood extraction



# ALOS 2 PALSAR 2 Data Calibration

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

 $\sigma^0$  – 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

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JPTM 2019



## 2.1 In Processing toolbox search bar type raster calculator.



2.3 Input the Calibration	<b>Q</b> Raster Calculator		×	<
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Expression here	Expression		This algorithm allows performing algebraic	
	Layers	Operators	operations using raster layers.	
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		^ sqrt tan atan ( )	project. The following functions are also supported:	
			- sin(), cos(), tan(), atan2(), ln(), log10()	
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			the minimum extent that covers selected reference	
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			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	
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	NDVI	▼ Add Save	using the base name of the file (without the full path). For instance, if using a layer at path/to/my/	
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l			×	
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								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 oath) Eer instance of twino a layer at bath the full
Predefined expressions								rasterfile.tif, the first band of that layer will be
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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 🗙
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4.2 Select the filtered	Q Warp (Reproject)			
pre-image from the 🔨		X	✓ C Recently used ₩ Ware (consciont)	
dron down	Parameters Log		▼ Q Vector general	
	Inputayer		* Assign projection	
	Source CRS [ootional]		🌸 Reproject layer	
4.3 Select the Target			- Coal GDAL	
CRS as EPSG: 4326	Target CRS		Kaster extraction     Clip raster by mask layer	
	EPSG:4326 - WGS 84		<ul> <li>Raster projections</li> </ul>	
	Resampling method to use		Warp (reproject)	
4.4 Specify the	Nearest neighbour		<ul> <li>SAGA</li> <li>Georeferenzing</li> </ul>	
resampling as Nearest	Nodata value for output bands [optional]		Warping shapes	
neighbor	Output file resolution in target georeferenced units [ontional]			
U	Not set		-	
	Advanced parameters			
4.5 Browse to output	Reprojected			
folder and give it a	D:/2019/21_JPTM_workshop/New/Pre_Calib_Lee_Prj.tif			
relevant name and <b>.tif</b>	✓ Open output file after running algorithm			
file type				
ine type				
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	0%			
	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											
	Expression								This algorithm allows performing algebra	aic		
	Layers	Operators							operations using raster layers.			
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	Post_Calib_Lee_Prj@1" - Pre_Calib_Lee_Prj@1"									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 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 prime the comparison that is icon and select a number, for instance, with the target are the target and the select the target are target are the target are target are target are the target are targe		
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	[Leave blank to use min covering extent]									Post_Calib_Lee [EPSG:102225] Post_Calib_Lee_Proj [EPSG:32647]		
	Output CRS [optional]									Post_Calib [EPSG:102225] Pre_Calib [EPSG:102225]		
5.3 Browse to the output								•		Pre_Calib_Lee [EPSG:102225]		
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tolder and give it a name	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									5.5 Chek OK		
					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

	$\mathbf{A}$		
Q Build Virtual Raster	×		
Parameters Log			
Input layers	A	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]	Clear Selection
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0%	Cancel		
Run as Batch Process	se Help		
6.4	Click 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 🗸 唐 🔍 🍸 🖣 - 🐺 🗃 📮 👔 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 💌 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.	
Change_img@1           Post_Calib_Lee_Prj@1           Post_Calib_Lee@1           Pre_Calib_Lee@1           Pre_Calib_Lee_Prj@1	+     *     cos     sin     log10     AND       -     /     acos     asin     In     OR       ^     sqrt     tan     atan     (     )       <     >     =     !=     <=	The resulting layer will have the values computed according to an expression. The expression can contain numerical values, operators and references to any of the layers in the current project. The following functions are also supported: - sin(), cos(), tan(), atan2(), In(), log10() The extent, cell size, and output CRS can be defined by the user. If the exitent is not specified, the minimum extent that covers selected reference layer(f) will be used. If the cell size is not specified,	
"Change_img@1" < -3		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	7.2 Click on this ison and solast
		and Y axes.	
Predefined expressions NDVI		Add Save Add Save	reference layer
Reference layer(s) (used for automated extent, cellsize, and CRS) [option ] elements selected	ional]	When using the ediculator in the batch interface or from the console, the files to use have to be using the base name of the file (without the full using the base name of the file (without the full to the the second sec	Multiple selection     Change_img [EPSG:32647]     Output [EPSG:32647]
Cell size (use 0 or empty to set it automatically) [optional]		party, For instance, if using a layer at partyto/my/ rasterfile. (if, the first band of that layer will be referred as rasterfile.tif@1.	IMG-HH-AL0S2221653250-180701-WBDR1.5GUD [EPSG:102225]
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[Leave blank to use min covering extent]			Post_Calib [EPSG:102225] Pre_Calib [EPSG:102225]
Output CRS [optional]			Pre_Calib_Lee [EPSG:10225]
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D-/2019/21 JPTM workshon/New/Change ing tresh tif			
Open output file after running algorithm			7.3 Click OK
	0%		
Run as Batch Process	v /e	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

<ul><li>8.2 Select the threshold</li><li>8.3 click on advanced parameters</li></ul>	A image from the drop down.	Processing Toolbox
8.4 Change the output datatype as <b>byte</b>	Valdate Hep Output data type Byte Converted Dr/2019/21_PTM_vorkshop/New/Change_mg_tresh_int.tf	
8.5 Browse to the output folder and give it a name and save it as a .tif file	GOAL/OGR console call gdal_translate of Byte of GTiff D:\2019\21_PTM_workshop\New/Change_img_tresh.it/fD:\2019\21_PTM_workshop\New/Change_img_tresh.it/f	3.6 Click <b>Run</b>

# 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
		🍬 🌏 🕓 🖹 i 🤛 i 🗞 🖉	
9.2 Select the <b>th</b>	reshold image (Byte) from the drop down.		
		Rector analysis     Sector statistics for fields	
	Q Majority Filter ×	Statistics by categories	
	Parameters Log	• Q Vector general	
	Grid	$\Sigma$ Join attributes by location (summary)	
9 3 Input radius	V Change_ing_tresh_int [EPSG:4326]	👻 🛞 SAGA	
5.5 mpat laalas	Search Mode	👻 Raster filter	
as 3 (5*5)	[0] Square	🚱 Majority filter	
*	Radius		
	Treshold Percent		
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	D:/2019/21_JPTM_workshop/New/Change_img_tresh.int_maj.sdat		
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9.4 Browse to th	e output folder		
and give it a nam	And save it as		
a .sdat file			
	9.5 Cli	ck <b>Run</b>	
	0%		
	Run as Batch 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 🔻			
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			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 <b>Detected flood</b> raster from the drop down.			Processing Toolbox	0 ×
	Q Polygonize (Raster to Vector)		×		
10.3 Brow and give it .shp file	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			<ul> <li>Recently used</li> <li>Polygonize (raster to vector)</li> <li>Q Vector creation</li> <li>Raster pixels to polygons</li> <li>Q Vector geometry</li> <li>Polygonize</li> <li>GDAL</li> <li>Raster conversion</li> <li>Polygonize (raster to vector)</li> </ul>	
	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	2	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!