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-3 start SNAP



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

Sciect them and there open		File Edit View Analysis Layer Vector Raster Optical Radar	Tools Window Help
SNAP - Open Product	×	: 🚭 🍓 : 🗞 🃸 🏭 🎖 📽 🙈 : 🛒 🗱 : 🕨 🍓	
Look In: subset_data subset_0_ALOS2-UBSL1_1_A-ORBIT_ALOS2518900770-240101.data subset_1_ALOS2-UBSL1_1_A-ORBIT_ALOS2450590770-220926.data subset_0_ALOS2-UBSL1_1_A-ORBIT_ALOS2518900770-240101.dim subset_1_ALOS2-UBSL1_1_A-ORBIT_ALOS2450590770-220926.dim	Advanced	Product Explorer × Pixel Info <pre> Pixel Info Ill subset_1_ALOS2-UBSL1_1_A-ORBIT_ALOS2450590770-220926 Metadata Metadata Wector Data Inte-Point Grids Bands I_HH q_HH Intensity_HH Intensity_HH </pre>	_
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Step-4 Open the images

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Product Explorer × Pixel Info

File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help

GCP

Step-6 go to Bands and double click

on the bands to display them

h.

SNAP

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SNAP SNAP

Step-7 Radar>Radiometric>Calibrate



Step-8 select the pre image

and select the destination folder Calibration File Help as 'calibration' I/O Parameters Processing Parameters Source Product [1] subset 1 ALOS2-UBSL1 1 A-ORBIT ALOS2450590770-220926 \sim Target Product Name: subset_1_ALOS2-UBSL1_1_A-ORBIT_ALOS2450590770-220926_Cal Save as: BEAM-DIMAP V Directory: :L_ASIA_PHIL_EXERCISE\ALOS2_DATA\data\PROCESS_SUBSET_IMAG calibration Open in SNAP Run Close Step-10 Perform the same on the post date image Processing completed in 33 seconds (73 MB/s 19 MPixel/s) **Processing Parameters** [2] subset_0_ALOS2-UBSL1_1_A-ORBIT_ALOS2518900770-240101 \sim subset 0 ALOS2-UBSL1 1 A-ORBIT ALOS2518900770-240101 Cal V

Run

Close

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 [1] subset_1_ALOS2-UBSL1_1_A-ORBIT_ALOS2450590770-220926 - [C:\SENTINEL_ASIA_PHIL_]

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Save

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P Help

Run

Step-12 Radar> Coregistration> DEM assisted Coregistration

🔚 [1] subset_1_ALOS2-UBSL1_1__A-ORBIT__ALOS2450590770-220926 - [C:\SENTINEL_ASIA_PHIL_EXERCISE\ALOS2_DATA\data\PROCESS_SUBSET_IMAGE\subset_data\subset File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help ↘ 국 🗖 🗣 🗣 🏠 🐁 : 🔲 🗏 🖿 🗀 : ****** Apply Orbit File * × a 🖷 Q Radiometric Product Explorer × Pixel Info [1] i_HH × [1] q_HH × [1] Intensity_HH × [2] i_HH Speckle Filtering > Il subset 1 ALOS2-UBSL1 1 A-ORBIT ALOS2450590770 Coregistration [2] subset_0_ALOS2-UBSL1_1_A-ORBIT_ALOS2518900770-Interferometric S1 TOPS Coregistration [3] subset_1_ALOS2-UBSL1_1_A-ORBIT_ALOS2450590770-DEM-Assisted Coregistration > Polarimetric [4] subset_0_ALOS2-UBSL1_1_A-ORBIT_ALOS2518900770-Stack Tools DEM Assisted Coregistration with XCorr Geometric Sentinel-1 TOPS > Cross InSAR resampling ENVISAT ASAR SAR Applications > SAR Utilities

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Step-19 Select the calibrated

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	Degree of "Flat Earth" polynomial 5
arget Product	Number of "Flat Earth" estimation points 501
ame:	Orbit interpolation degree
subset_I_ALOS2-OBSLI_I_A-ORBII_ALOS2430390770-220926_Cal_Stack_con	Subtract topographic phase
Save as: BEAM-DIMAP	Digital Elevation Model: SRTM 3Sec (Auto Download)
	Tile Extension [%] 100
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Step-23 Select the c	coherence image	Range Doppler Terrain Correction	1	×
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I/O Parameters Processing Parameters as Source Product source:	'terrain_correction'	I/O Parameters Processing Para Source Bands:	coh_HH_26Sep2022_01Jan2024	
[6] subset_1_ALOS2-UBSL1_1_A-OFBIT_ALOS24505	90770-220926_Cal_Stack_coh	Select the defau	ult parameter	s and Rur
Target Product Name:				
subset_1_ALOS2-UBSL1_1A-ORBITALOS24505907	70-220926_Cal_Stack_coh_TC	Digital Elevation Model:	SRTM 3Sec (Auto Download)	~
Save as: BEAM-DIMAP		DEM Resampling Method:	BILINEAR_INTERPOLATION	~
Directory:	SS SUBSET IMAG Diterrain correction	Image Resampling Method:	BILINEAR_INTERPOLATION	~
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		Map Projection:	WGS84(DD))
		Mask out areas without elevation	Output complex data	
		Output bands for:		0-1
	Run Close	Incidence angle from ellipsoid	Local incidence angle Project	ed local incidence angle
		Layover Shadow Mask	_ ,_ ,	
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	coh_HH_26Sep2022_01Jan2024	
	^	
Source bands:		
Ste	p-31 In the Tab 'Processing	
Pa	rameters', select the raster band	
Cli	ck 'Run'	
Source masks:		
	Run	Close

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

Name	Date modified
subset_1_ALOS2-UBSL1_1A-ORBITALOS2450590770-220926_Cal_Stack_coh_TC_extractor	10/30/2024 10:
subset_1_ALOS2-UBSL1_1_A-ORBIT_ALOS2450590770-220926_Cal_Stack_coh_TC_extractor.tif.ovr	10/30/2024 10:



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

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0	The target product has been successfully written to LOS2450590770-220926_Cal_Stack_coh_TC_extractor.tif
	and has been opened in SNAP.
	Total time spend for processing: 00:00:00.192 Don't show this message anymore.
	OK Cancel

[1] subset_1_ALOS2-UBSL1	1_A-ORBIT_ALC	DS24505	90770-22	0926 - [C:	SENTINE	EL_ASIA_F	PHIL_EXER
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Save Product	SL1_1_A-ORBIT_	_ALOS24	50590770	-220926_0	al_Stack	_coh	
Save Product As	SL1_1_A-ORBIT_	ALOS24	50590770	-220926_0	al_Stack	_coh_TC	
Session >	Open Session	24	50590770	-220926_0	Cal_Stack	_coh_TC_	extractor
Projects >	Save Session						
Import >	Save Session As						
Export >	Close Session						
Exit							



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



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

Save In:	session	1 II.	
ile Name:	coherence_mapping_pre_post_earthquake		
ile Name: iles of Type:	coherence_mapping_pre_post_earthquake SNAP session files (*.snap)		~

SNAP - Save	Session As	×
Session	saved.	
	ОК	Cancel



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

Step-36 Click 'Yes'



Step-38 Now launch QGIS





Step-39 Open an new empty Project

Project Templates

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	New Empty Project
	EPSG:4326 - WGS 84
1	

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

🔇 Untitled Project — 0	QGIS		
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🦛 😵 🗸	Add Layer →	V _□ Add Vector Layer	Ctrl+Shift+V
66.4.	Embed Layers and Groups Add from Layer Definition File	Add Raster Layer	Ctrl+Shift+R
Browser Ø	tt Georeferencer	🤊 Add Delimited Text Layer	Ctrl+Shift+T
	Copy Style	Read Add PostGIS Layers	Ctrl+Shift+D
☆ Favorites	Paste Style	🎤 Add SpatiaLite Layer	Ctrl+Shift+L
Spatial Bookman	Copy Layer	Madd MS SQL Server Layer	
Home	Paste Layer/Group	Add Oracle Spatial Layer	Ctrl+Shift+O

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

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Consult <u>GTiff driver help page</u>	for detailed explanation	s on optior	ns
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Step-42 Add the raster file



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



Q Plugins | All (1352)

All

Installed

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✓ @ QuickMapServices

Step-44 Install the plugin 'Quick Map Services'

AI Plugins

Uninstall Plugin

Beinstall Plugin

Filter by extent

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Help

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Add

All

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Step-48 Go to Transparency > Put no data

value as '0' L

click> Apply

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

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		Va /	Add Layer		V. Add Vector Layer	Ctrl+Shift+V
	-		Embed Layers and Groups		👫 Add Raster Layer	Ctrl+Shift+R
	G .	- Ca .	Add from Layer Definition File		🗱 Add Mesh Layer	
			1.4			



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

Step-51 select the building shapefile

Q Data Source March Diffet Ildings_noto_OSM.shp" ● File <u>D</u>irectory Database Protocol: HTTP(S), cloud, etc. OGC API Automatic Encoding Add Source Vector Dataset(s) ata¥shapefiles¥building_footprint_Noto¥buildings_noto_OSM.shp 🛛 Options Consult ESRI Shapefile driver help page for detailed explanations on options ENCODING DBF_DATE_LAST_UPDATE ADJUST TYPE <Default> ADJUST_GEOM_TYPE <Default> AUTO_REPACK <Default> Close <u>A</u>dd Help

Step-53 Go to the 'Processing Toolbox'

in QGIS and search for 'zonal statistics'

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Processing Toolbox 🎭 🦺 🕓 🖹 I 🎐 🔍 Q zonal Recently used Zonal statistics Q Raster analysis Raster layer zonal statistics double click Zonal histogram Zonal statistics



oject <u>E</u>dit <u>View</u> <u>Layer</u> <u>Settings</u> <u>Plugins</u> Vect<u>or</u> <u>Raster</u> <u>Web</u> <u>Mesh</u> Pro<u>c</u>essing <u>H</u>elp

subset_1_ALOS2-UBSL1_1_A-ORBIT_ALOS2450590770-220926_Cal_Stack_coh_TC_extractor

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footprints over the

Step-52 Display the building

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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

٤ 🚺	Statistics to calculate			This algorithm calculates statistics of a raster
	Count	Select All		vector layer.
VI	Mean	Clear Selection		
	Median Staday	Toggle Selection		
	Minimum	ΟΚ		
1	Maximum			
	Range			
	Majority		52	
	Variety			
	Variance			
а	new shapefile			

0%	$\overline{}$	Cancel
dvanced 👻 Run as Batch Process	Run Clos	e Help





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

Classify , > Apply

Q	Layer Properties - Zor	nal Statistics — Sy	mbology			×
Q		🗧 😑 Graduated				-
i	Information	Value	1.2 _mean			3 -
3	Source	Symbol				
~	Symbology	Legend format Color ramp	%1 - %2			ecision i 🖾 💠 🗸 Trim
abc	Labels	Classes	Histogram			
abc	Masks	Symbol Va	lues Legend			
9	3D View	▼ 0. ▼ 0.	12978 - 0.18465 0.13 - 0.185 18465 - 0.25672 0.185 - 0.257			
	Diagrams	√ 0.	25672 - 0.81683 0.257 - 0.817			
	Attributes Form					
•	Joins	Mode 🕕 Equa	Il Count (Quantile)			Classes 4
	Auxiliary Storage	Classify	oundaries			Advanced *
.	Actions	Layer Rer	dering		C	
9	Display	Style -		ОК	Cancel	Apply Help



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

Sentinel Asia

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'



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



Right click on zonal statistics>Properties



egend format %1 - %2 K Symbology bc Labels Histogram RDA Macke 💡 3D View 600 Diagrams 500 Fields 400 -🔗 Attributes Form . 005 Gunt auxiliary Stora 200 Actions 100 Display Rendering 0.3 🕔 Temporal Histogram bir (3) \$ Variable Show mean value Show standard deviatio Elevation Laver Rendering

once verified, click ok (remember the class breaks)



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	Layers ≪ ⓓ 🍸 ᢄ₀ ▾ 🕵			
YAMAGUCHI	▼ Zonal Statistics ▼ 0.018 - 0.096 ▼ 0.096 - 0.123 ▼ 0.123 - 0.146 ▼ 0.146 - 0.817 ■ buildings_noto_02 ▶ subset_1_ALOS2-U ▼ ✓ ♥ ♥ Google Satellite	 Zoom to Layer(s) Zoom to Selection Show in Qverview Show Feature Count Show Feature Count Show Labels Copy Layer Remore Layer Quplicate Layer Remove Layer Move to Bottom Open Attribute Table Toggle Editing Filter Change Data Source Set Layer Scale Yisibility Layer CRS Make Permanent Export Styles Add Layer Notes Broperties 	Q ZONAL_STA	New field (Ctrl+W) All _mean 0.075840499026 0.183023445452 0.089371466579 0.069233793765



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

Expression

N <u>a</u> me	category	
Туре	abo Text (string)	•
Provider typ	pe string	
Length	10	\$

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

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(
CASE	V V
WHEN " mean" >	= 0 AND " mean" <= 0 11 THEN 'category-1'
WHEN _mean >	0.11 AND _mean <= 0.15 THEN category-
WHEN "_mean" >	• 0.15 AND "_mean" <= 0.18 THEN 'category-
ELSE 'category-4'	
Zonal Statistics — Field Calculator	
Only update 0 selected features	
Create a new field	✓ Update existing field
Create virtual field	
Output field name	
Output field type 123 Whole Number (inte	ger)
Output field length 10 🗣 Precision	3
Expression Function Editor	
	Q S···· Show Help
CASE	feature
WHEN "_mean" >= 0 AND	geometry ta
"_mean" < 0.11 THEN	row_number
'category-1' WHEN " mean" >= 0.11	Aggregates Arrays
AND "_mean" < 0.15 THEN	► Color
'category-2'	Conditionals Conversions
WHEN "_mean" >= 0.15	Date and Time
'category-3'	 Fields and Values Files and Paths
ELSE 'category-4'	Fuzzy Matching
END	General Geometry
	Map Layers
	Maps
= + - / * _ () ¥n	Operators
Feature r16945110 -	Resters Record and Attri
Preview: 'category-2'	Sensors

class values

Step-64 Open Field Calculator



Step-66 Toggle Editing Mode > Save





Step-67 Go to Processing Toolbox

> search : statistics by categories



Step-69 Select 'category'

'Run'



Parameters	Log	
Field(s) with categories	
full_id		Select All
osm_i	d	
osm_t	ype	Clear Selection
buildin	ng	Tanala Salastia
mean		Toggle Selectio
1 cotons	ND/	OK



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





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

Layers 💐 🔍 🏹 🖏 🛪 🗊	
 Statistics by category ✓ Conal Statistics buildings_noto_OSM ✓ subset_1_ALOS2-UBS ✓ ✓ Google Satellite 	Show Feature <u>C</u> ount Show Labels Copy Layer Re <u>n</u> ame Layer Duplicate Layer Remove Layer Move to <u>B</u> ottom
	image: Determined to per Attribute Table ✓ Toggle Editing Eilter Change Data Source Change Data Source Export Make Permanent Export Export > Add Layer Notes Properties

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







Thank you



