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**Module 2: The application of EO for Coastal line changes with the example
of assessments via PONTOS platform**

VIRTUAL TRAINING MODULES

2022

PONTOS-EU.AUA.AM

AUA ACOPIAN CENTER
for the ENVIRONMENT



CERTH
CENTRE FOR
RESEARCH & TECHNOLOGY
HELLAS



ΔΗΜΟΚΡΙΤΕΙΟ
ΠΑΝΕΠΙΣΤΗΜΙΟ
ΘΡΑΚΗΣ



**GREEN
ALTERNATIVE**





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Module 2

**The application of EO for Coastal line changes
with the example of assessments via PONTOS
platform**



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Responsible Partner Democritus University of Thrace

Supporting Partner - **Environmental Protection and Monitoring Inspection Body of RA**

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This module is developed in the frames of the BSB 889 PONTOS Project



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LEARNING OBJECTIVES OF MODULE 2

Familiarize with the open source satellite image platforms

Download historical satellite images

Process of shoreline extraction from satellite images

Evaluation of shoreline movements through the years



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MODULE STRUCTURE



Introduction in Coastal Erosion and Remote Sensing



Description of the Methodology Workflow



Results Visualization



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Introduction to satellite sensors characteristics

Spatial Resolution

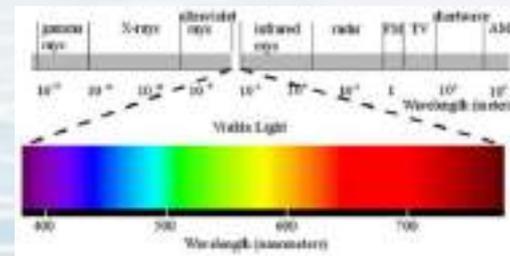
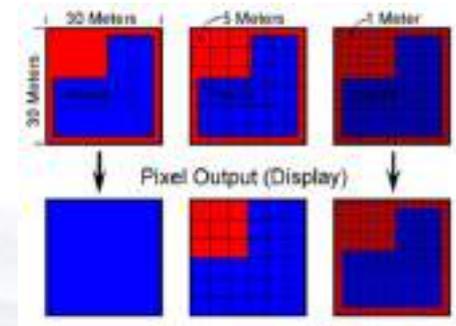
The spatial resolution specifies the pixel size of satellite images covering the Earth surface.

Temporal Resolution

The temporal resolution specifies the revisiting frequency of a satellite sensor for a specific location.

Spectral Resolution

The number of spectral bands in which the sensor can collect reflected radiance. But also the position of bands in the electromagnetic spectrum.





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Common borders. Common solutions. Introduction to satellite sensors characteristics

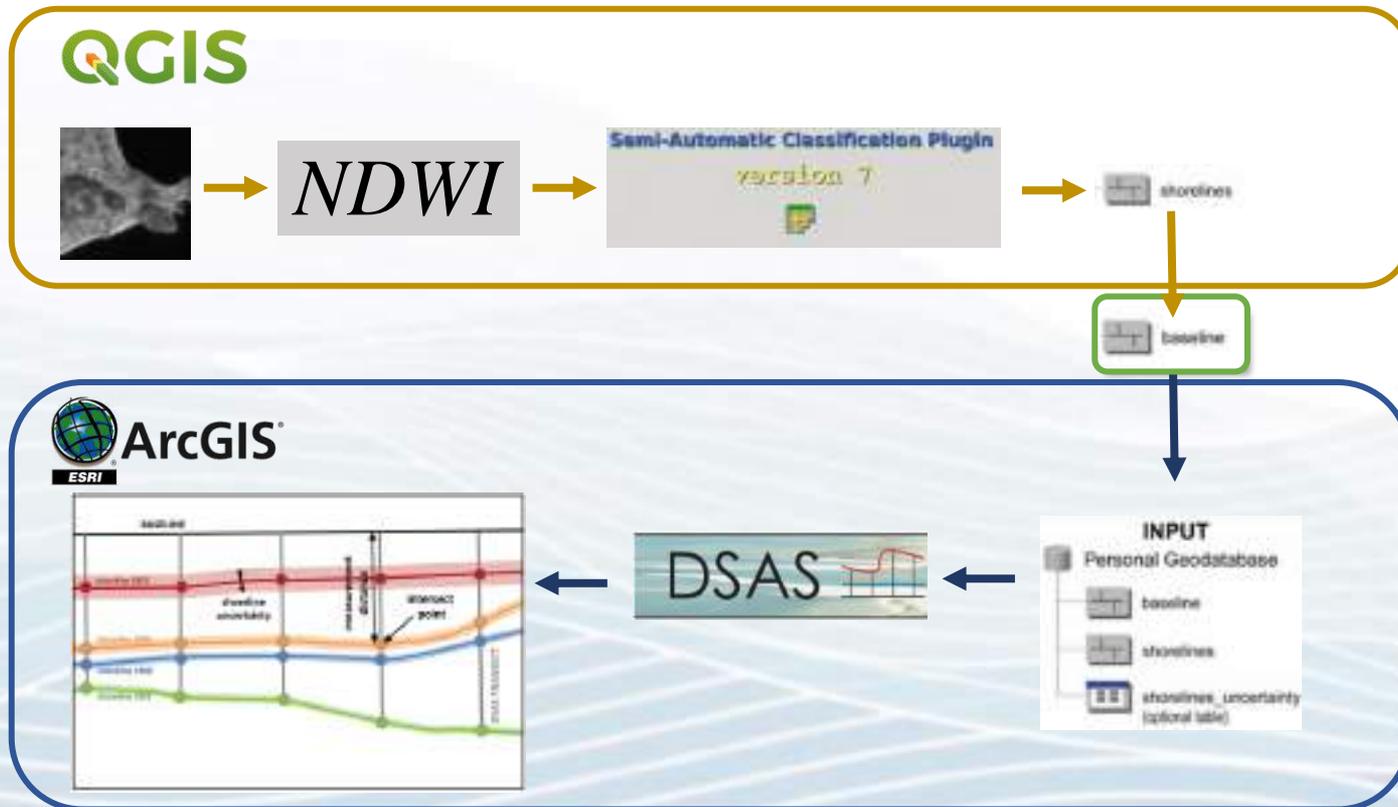
Cloud percentage	Percentage of the image covered by clouds
Ground sample distance	The distance in meters between pixel centers measured on the ground
Pixel Resolution	Pixel resolution of the image in meters
Off-nadir angle	Spacecraft across-track off-nadir viewing angle used for imaging, in degrees (“+” being East and “-” being West)
Sun elevation	Elevation angle of the sun in degrees (0-90)
Sun azimuth	Angle from the true North to the sun vector projected on the horizontal plane in degrees (0-360)



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Methodology applied in a coastal erosion assessment

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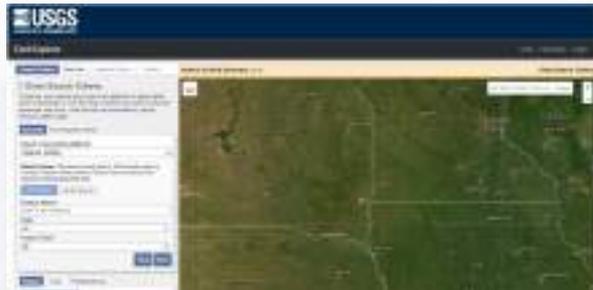


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Open source databases for satellite images



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Open source databases for satellite images



<https://earthexplorer.usgs.gov/>



<https://scihub.copernicus.eu/dhus>



<https://www.planet.com/explorer/>

Common borders. Common solutions. Open source databases for satellite images

<https://sentinel.esa.int/web/sentinel/sentinel-data-access>



The screenshot displays the ESA Sentinel Data Access website. The header features the ESA logo and navigation tabs for 'Home', 'User Guides', 'Technical Guides', 'Thematic Data', 'Data Access', and 'Feedback'. The main content area is divided into sections for 'Access to Sentinel data via download' and 'Access to Sentinel data via cloud'. The 'Access to Sentinel data via download' section prominently features the Copernicus logo and a 'sentinel open access hub' button. Below this, there is a grid of logos for partner organizations: CREODIAS, ONDA, and soblo. The right-hand side of the page contains a 'Data Access' sidebar with links for 'Data Access', 'Access to Sentinel data via download', 'Access to Sentinel data via cloud', and 'Access to Sentinel data via archive'. Below the sidebar, there is a 'Maintenance Announcements' section with a list of updates and a 'Key Resources' section with links to 'Sentinel Data Access', 'Sentinel Data Access User Guide', and 'Sentinel Data Access User Guide (PDF)'. The background of the website is a dark blue space-themed image with a satellite orbiting Earth.

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Earth Explorer



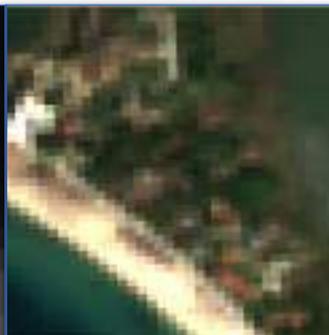
Landsat 5 ETM

- Spatial Res.: 30m
- 1984 – 2013
- Number of Bands: 7

Landsat 8

- Spatial Res.: 30m
- 2013 – Still active
- Number of Bands: 8

Copernicus Hub



Sentinel 2A & 2B

- Spatial Res.: 10, 20, 60m
- 2015 – Still active
- Number of Bands: 13
- Number of Sat.: 2

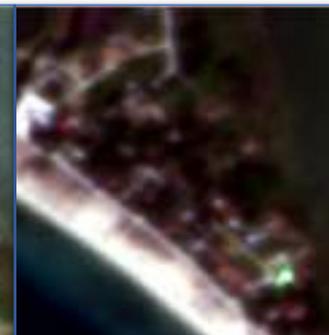
Planet Explorer



RapidEye

- Spatial Res.: 5 m
- 2009 – March 2020
- Number of Bands: 5
- Number of Sat.: 5

Planet Explorer



PlanetScope

- Spatial Res.: 3.6 m
- 2016 – Still active
- Number of Bands: 4
- Number of Sat.: more than 120 optical satellites



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Earth Observation Tools



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GIS Software



<https://qgis.org/en/site/forusers/download.html>



<https://pro.arcgis.com/en/pro-app/get-started/install-and-sign-in-to-arcgis-pro.htm>

Plug-ins



<https://plugins.qgis.org/plugins/SemiAutomaticClassificationPlugin/>



https://www.usgs.gov/centers/whcmssc/science/digital-shoreline-analysis-system-dsas?qt-science_center_objects=0#qt-science_center_objects



Common borders. Common solutions. Install QGIS

<https://qgis.org/en/site/forusers/download.html>

The screenshot shows the QGIS website homepage. At the top, there is a navigation bar with the QGIS logo and menu items: 'HOME', 'ABOUT QGIS', 'CONTACT', 'GET QGIS', 'FOR CONTRIBUTORS', and a search bar. The main heading reads 'QGIS A Free and Open Source Geographic Information System'. A large green banner in the center announces 'QGIS 3.26 Buenos Aires has been released!'. Below the banner, there are two green buttons: 'Download Now' and 'Support QGIS'. The page also includes a 'PROJECT NEWS' section at the bottom.



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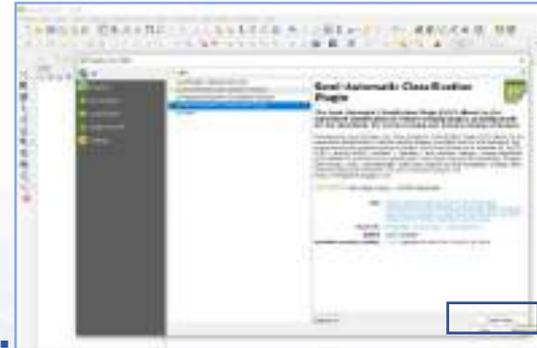


Common borders. Common solutions. Install Semi Automatic Classification plugin in QGIS

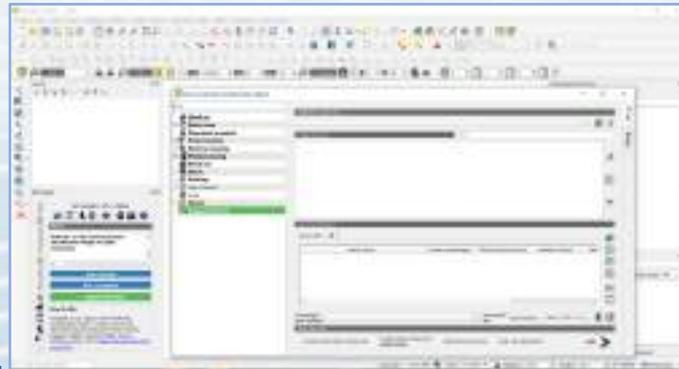
1.



2.

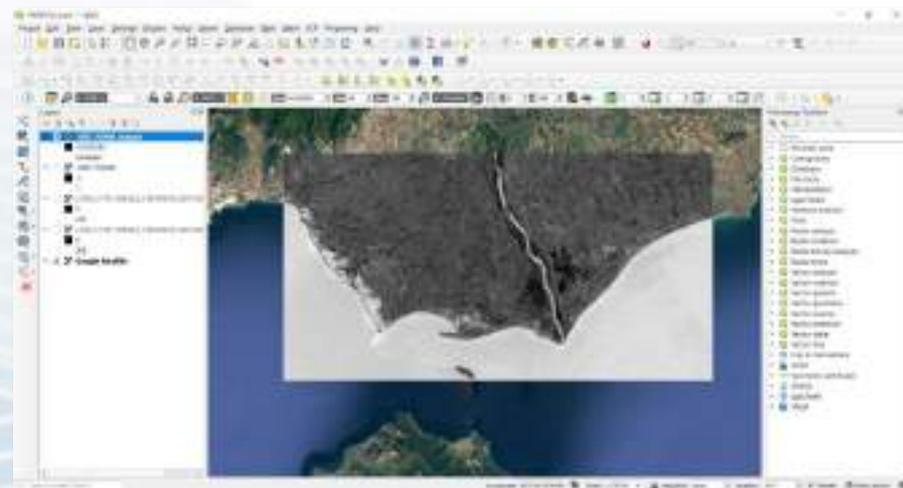
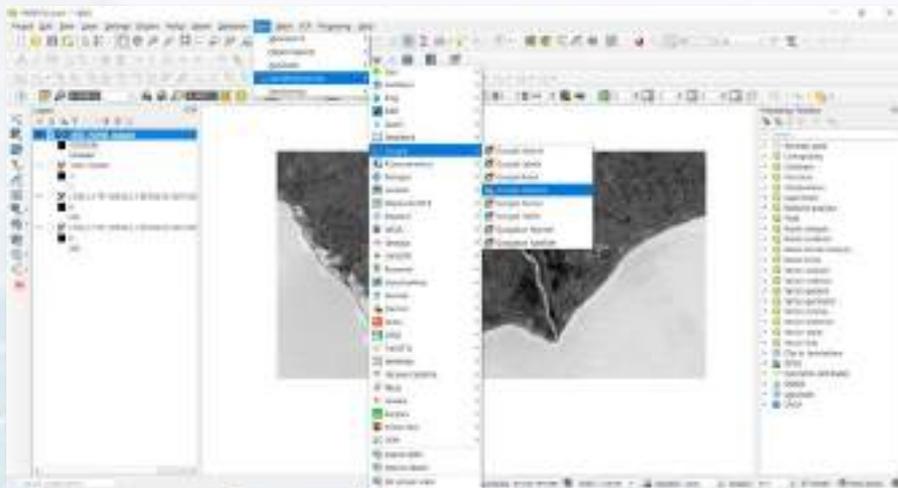


3.



Common borders. Common solutions. Install QuickMapServices plugin in QGIS

- Plugins → Manage and Install Plugins... → search **QuickMapServices** → install
- Web → **QuickMapServices** → Settings → More Services → Get Contributed pack → Save
- Web → **QuickMapServices** → select your basemap





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Practical Session 1

Earth Explorer and Copernicus Open Access Hub



Common borders. Common solutions.

Earth Explorer

Common borders. Common solutions. Satellite image selection criteria

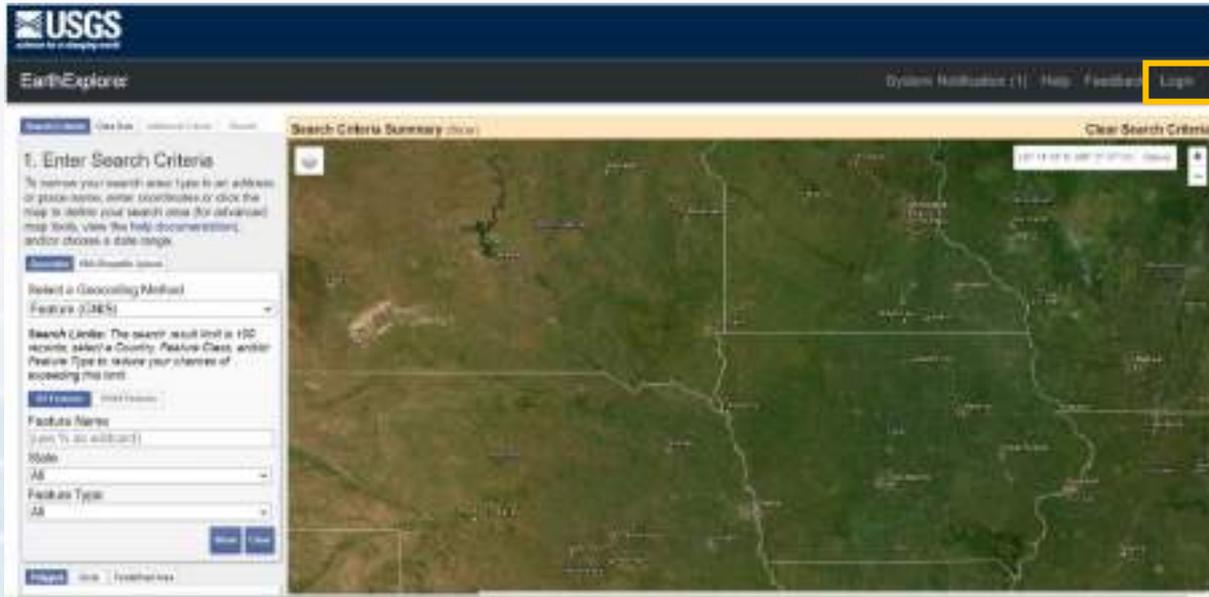
Image selection should be based on:

- **Clarity** from cloud cover
- The correct **geo-reference & Orthorectification**
- The **seasonality** (e.g. all images retrieved in the summer months)
- **Sea surface height** (CMEMS data) / Tidal phase

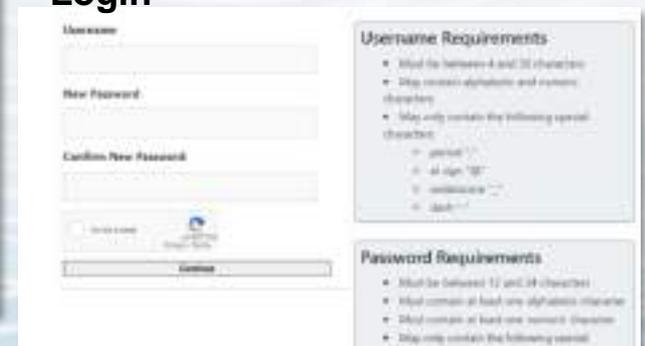


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Step 1: Create an account and login the Earth Explorer or sign in



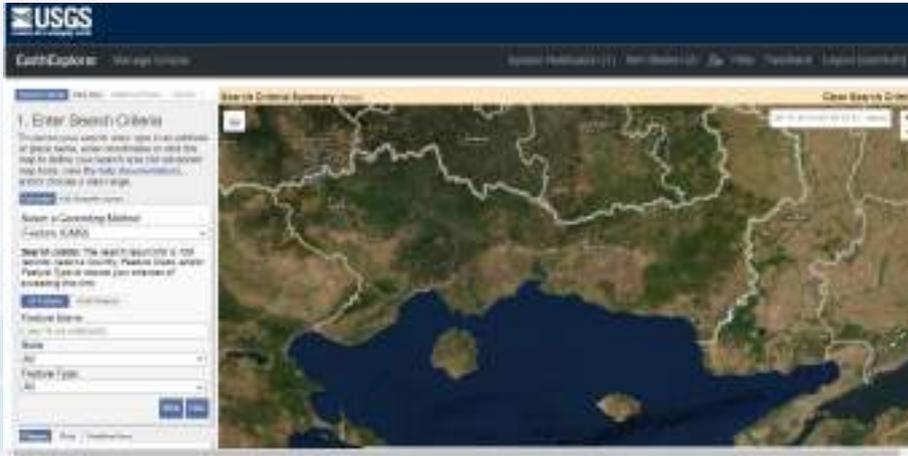
Login



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Step 2: Define the Area of Interest

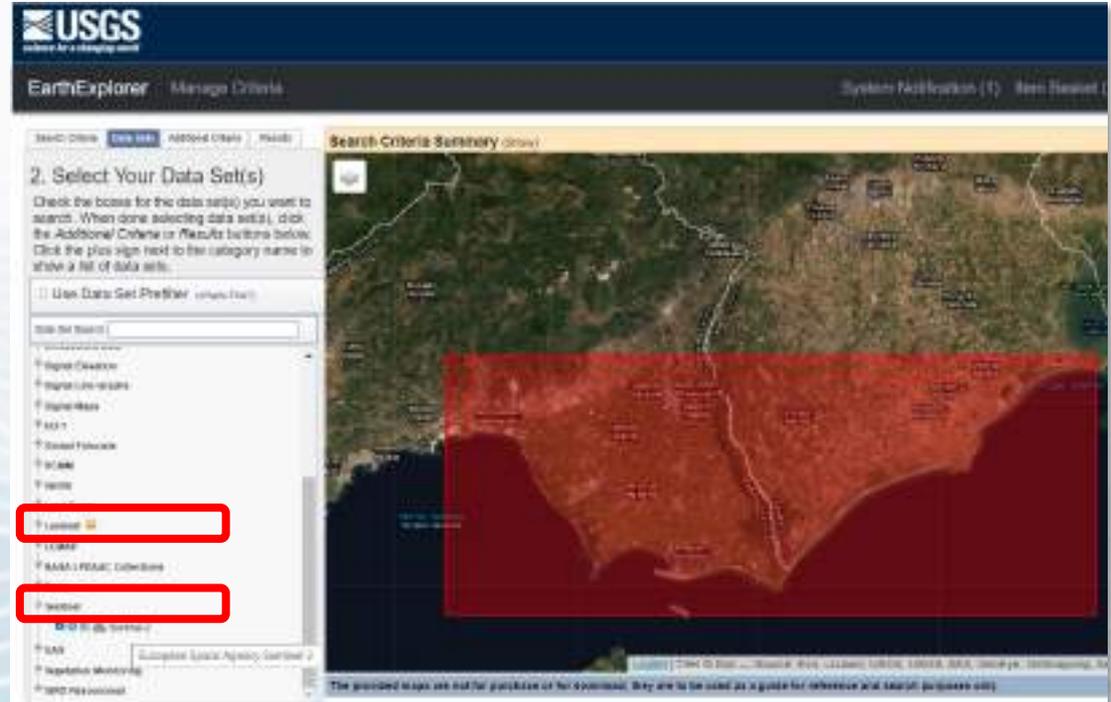
- Use the interactive map and zoom to your area of interest
- In the “Enter Search Criteria” tab select “use map” and the area enclosed to the screen is selected



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Step 4: Select your Data Sets

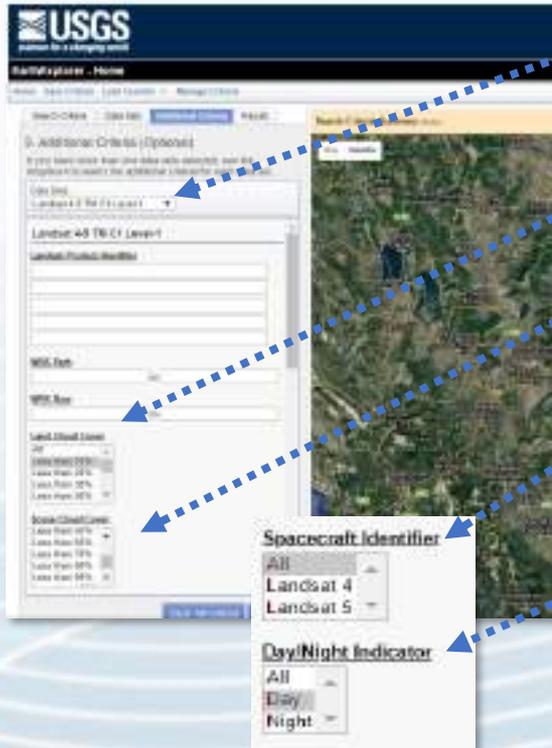
- In the “*Data Sets*” tab
- Select your data set Landsat or Sentinel



The screenshot shows the USGS EarthExplorer interface. The main heading is "2. Select Your Data Set(s)". Below this, there is a list of data sets with expandable arrows. The "Landsat" and "Sentinel" options are highlighted with red rectangular boxes. The background of the interface shows a satellite map of a coastal region.

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Step 5: Additional criteria



The screenshot shows the USGS Earth Explorer search interface. The 'Add Search Criteria (Optional)' section is expanded, showing several filter categories:

- Data Set:** Landsat 4 5 (L4/L5)
- Land Cloud Cover:** Landsat 45 TOC1 Level1
- Cloud Cover in the image:** Landsat 45 TOC1 Level1
- Spacecraft Identifier:** Landsat 4, Landsat 5
- Day/Night Indicator:** Day, Night

A 'Day/Night Indicator' popup is shown at the bottom, with options for 'All', 'Day', and 'Night'.

1. Data Set

2. Land Cloud Cover

3. Cloud Cover in the image

4. Spacecraft Identifier

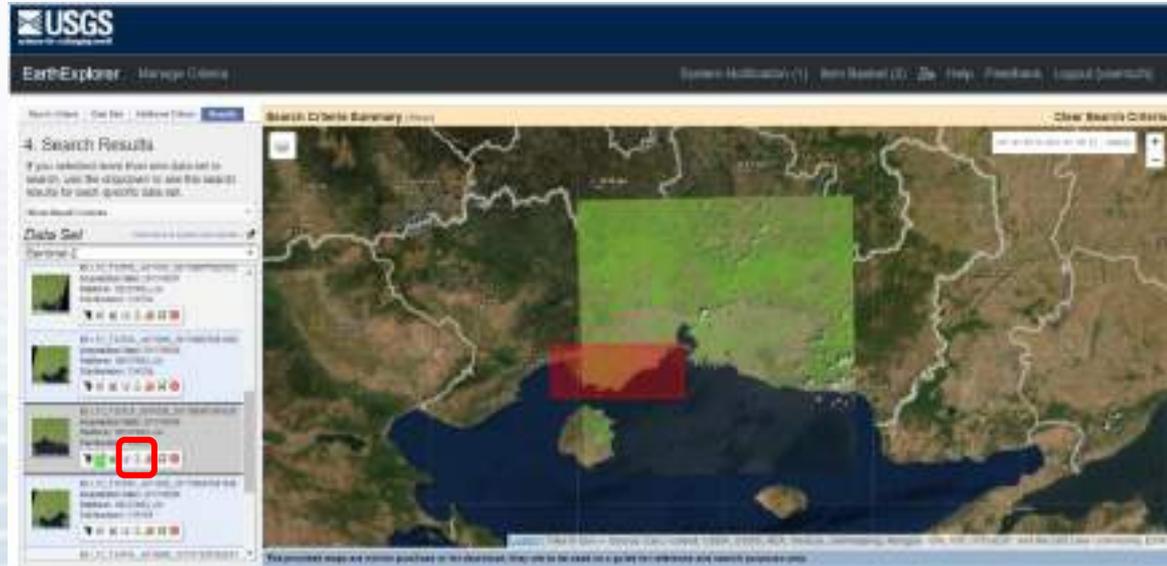
5. Day / Night Indicator

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Step 6: image selection

In the tab “Results”

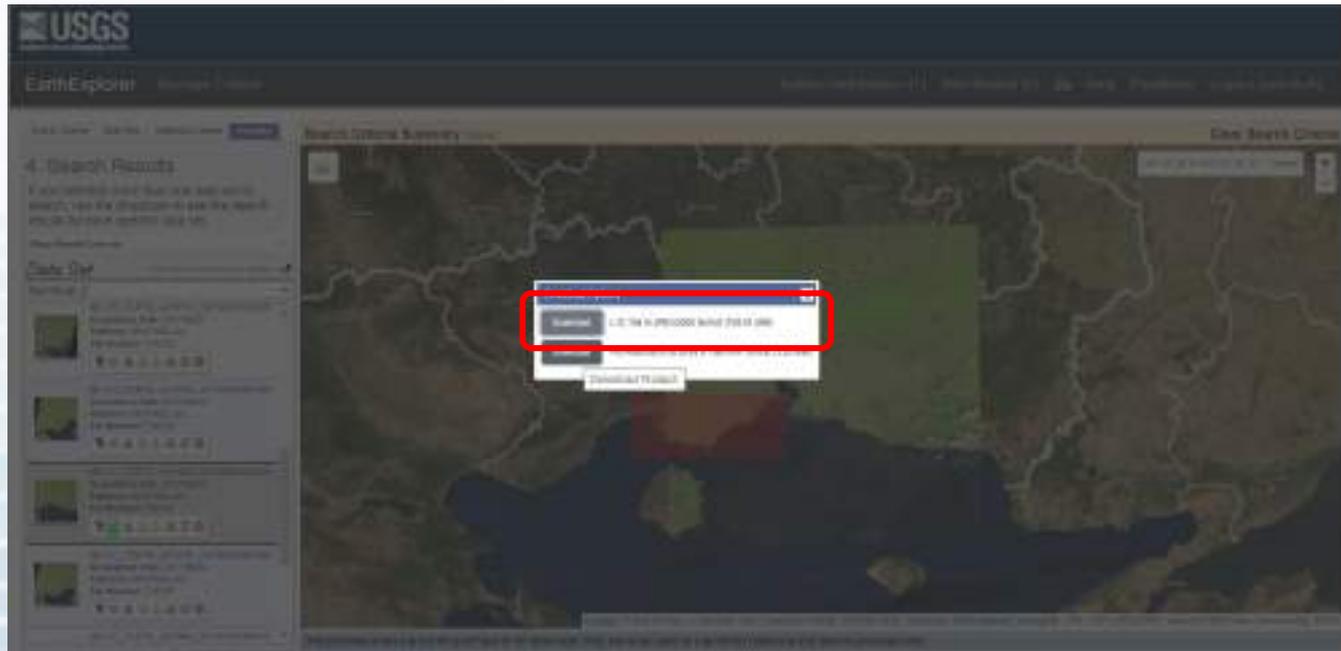
- Select the Data Set and a list of images is shown
- Download images with no cloud cover



The screenshot displays the USGS EarthExplorer web interface. The main content area shows search results for a query, with a list of data sets on the left and a map on the right. The map shows the Black Sea region with a green rectangular area of interest. A red box highlights a specific data set in the results list, which is the one selected for the next step.

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Step 8: Download image



The screenshot displays the USGS EarthExplorer interface. On the left, there are search results for '4 Search Results'. The main area shows a map of the Black Sea region with a green rectangular selection box. A white dialog box is overlaid on the map, containing a 'Download' button and the text '1.2 TB in 100,000 small files (1 MB)'. The 'Download' button is highlighted with a red rectangular box.



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Copernicus Open Access Hub

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Step 1: Open Copernicus Open Access Hub



The screenshot displays the Copernicus Open Access Hub website. The header features the Copernicus logo and the text "Copernicus Open Access Hub". A navigation bar includes the ESA logo and a language selector set to "EN". The main content area is titled "Welcome to the Copernicus Open Access Hub" and contains a paragraph of introductory text. Below this, a yellow arrow points to a row of four service tiles: "Open Hub", "API Hub", "E-SP-Pre-Exp", and "POD Hub". To the right, a "Reports & Stats" section shows "38,892 prod. published in the last 24h" and "338,550 downloads in the last 24h". A "Recurates" section at the bottom right lists "EMIS Open Source Portal".



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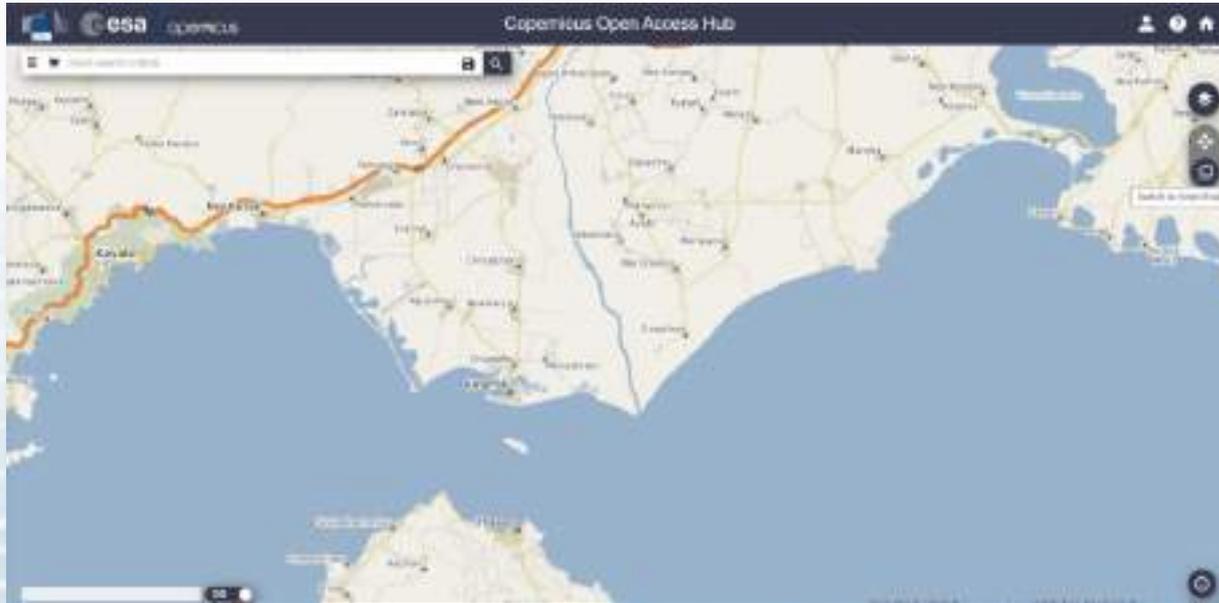
Step 2: Create an account and Login or sign in





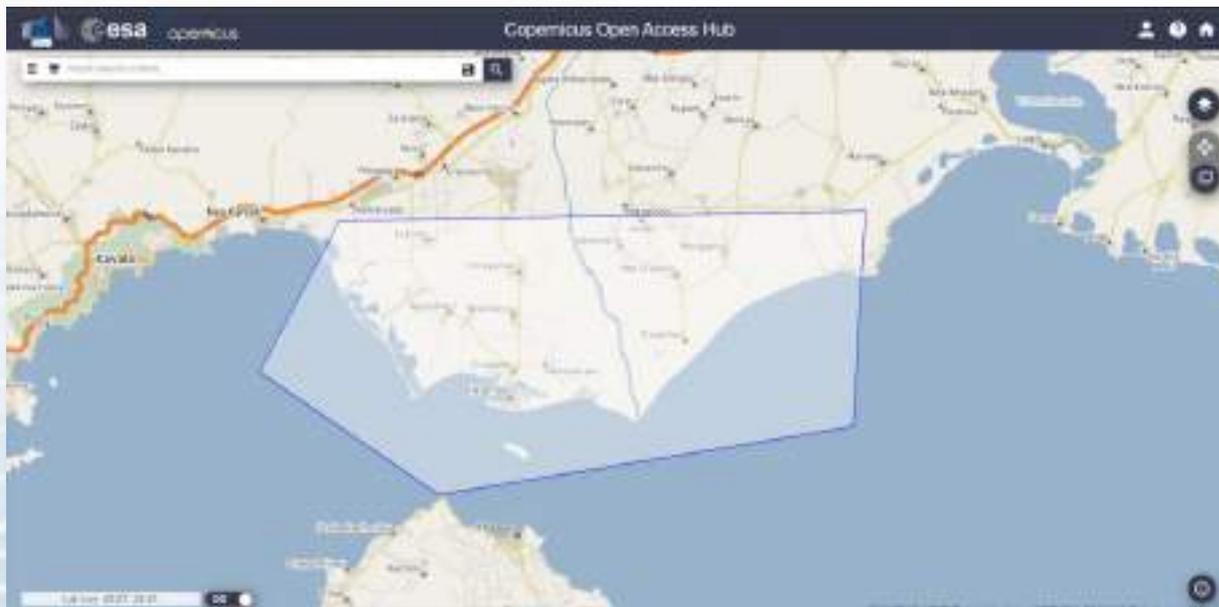
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Step 4: Zoom in you Region of Interest



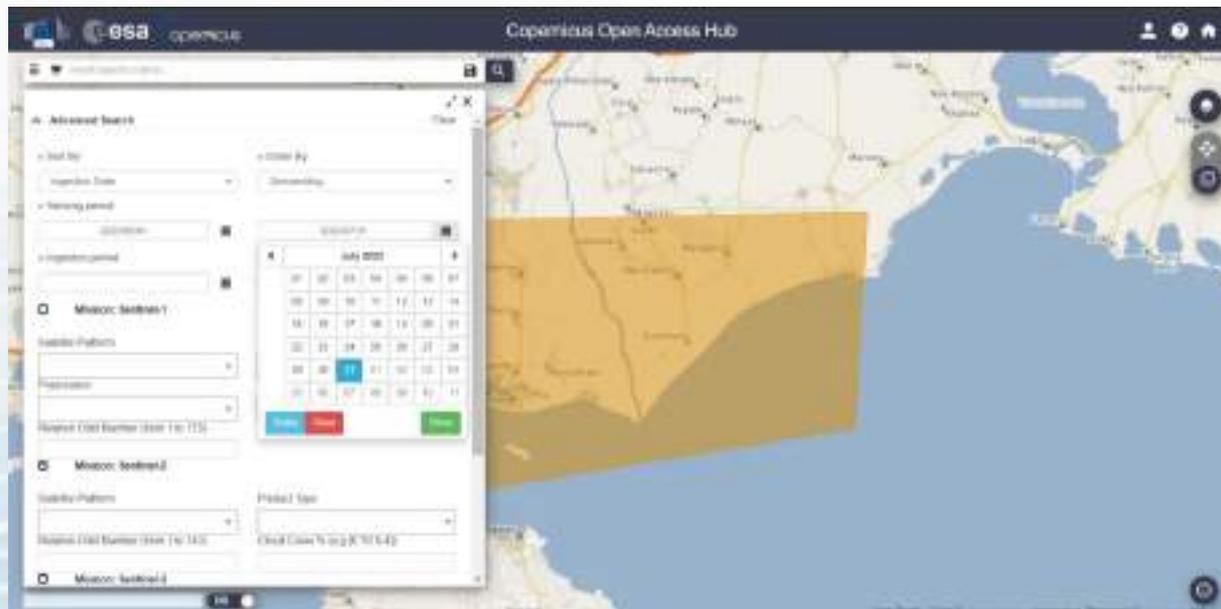
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Step 3: Create a polygon to define your ROI



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Step 4: Define the date range for satellite image selection



The screenshot displays the Copernicus Open Access Hub interface. A search filter is active for 'Mission: Sentinel-1'. The 'Date range' section shows a calendar for July 2021, with the date '21' selected. The map in the background shows a coastal area with a highlighted orange region.

Advanced Search

Start by:

Sort by:

Filtering period:

Geographic period:

Mission: Sentinel-1

Satellite platform:

Application:

Request Code Number (max 16):

Mission: Sentinel-1

Satellite platform:

Request Code Number (max 16):

Product type:

Request Code Number (max 16):

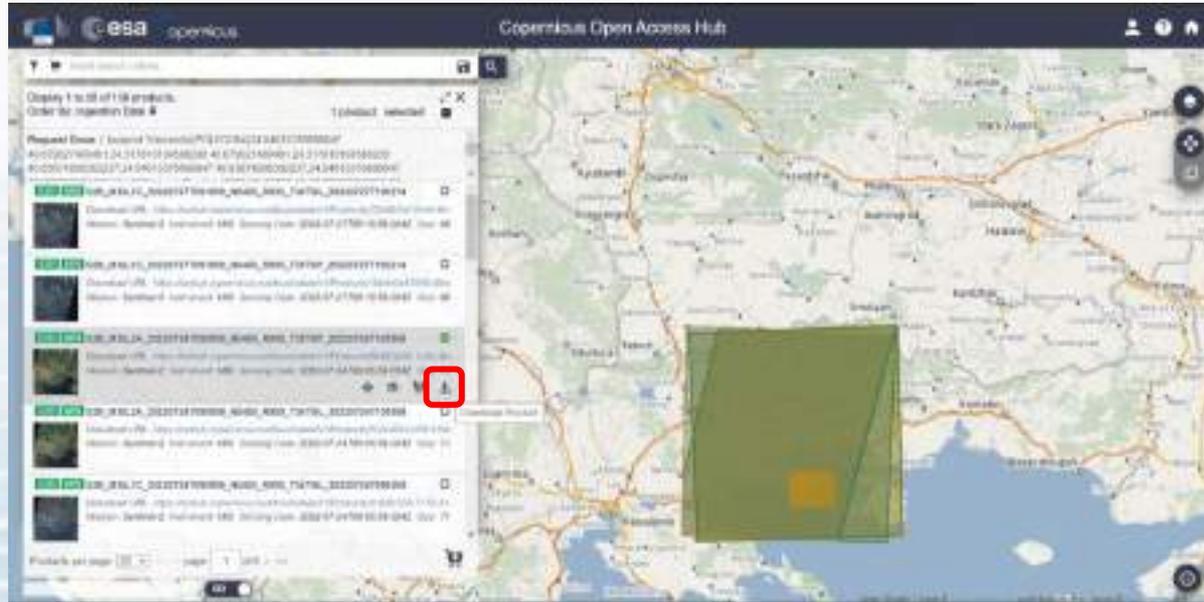
Calendar: July 2021

01	02	03	04	05	06	07
08	09	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				
01	02	03	04	05	06	07
08	09	10	11	12	13	14

Buttons:

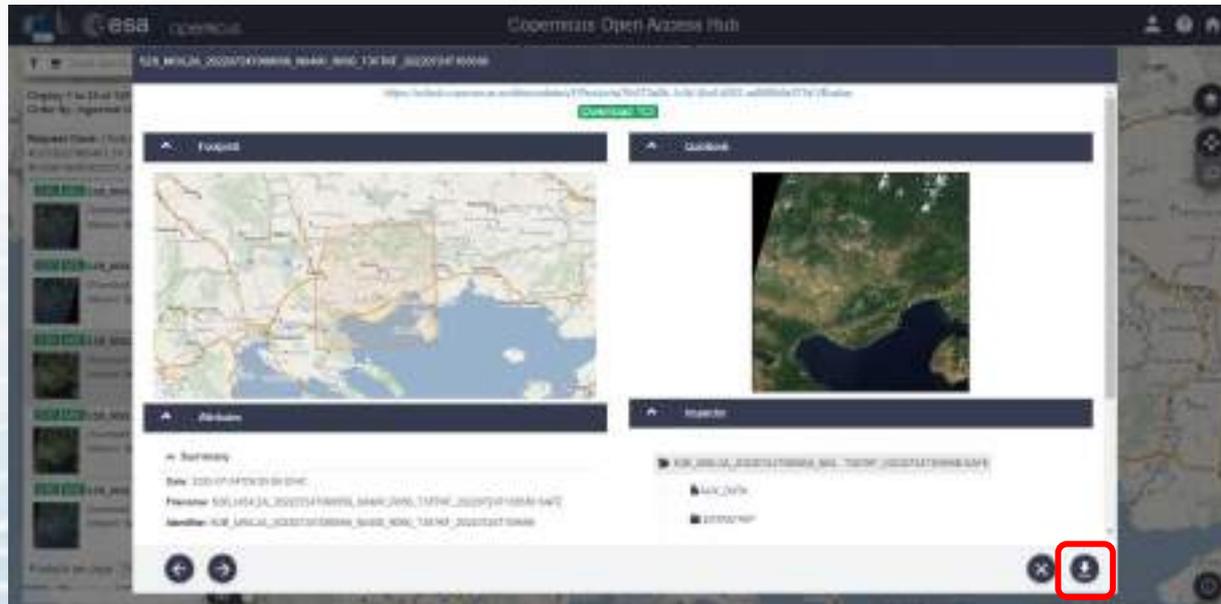
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Step 6a: Select and download the satellite image



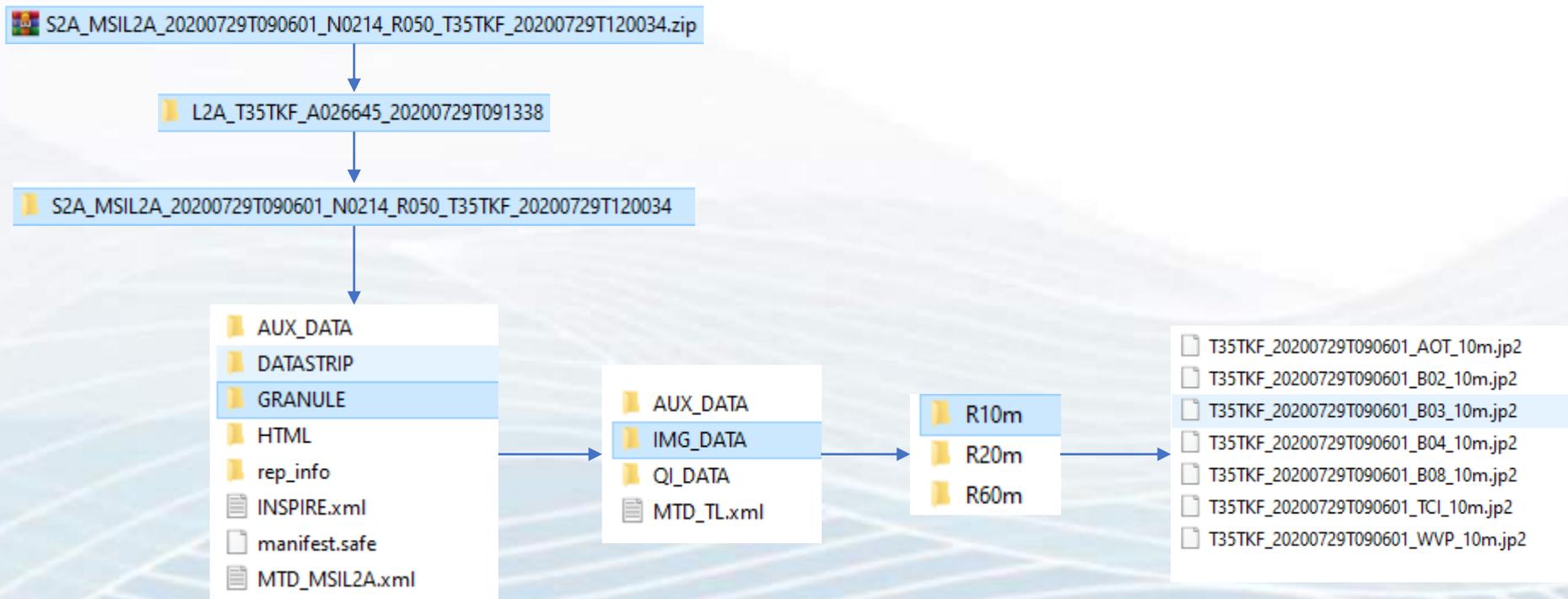
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Step 6b: Preview and download the satellite image



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Step 9: Open Sentinel 2 Downloaded file





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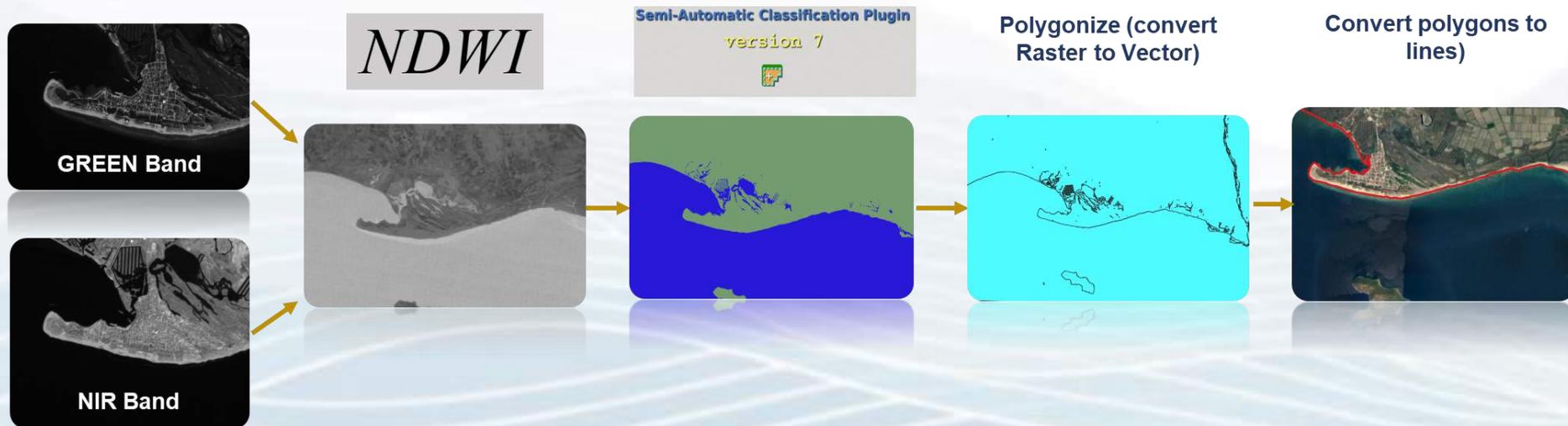
Practical Session 2

Shoreline Extraction

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Shoreline extraction methodology - Step by Step

QGIS



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Step 1: Import the Green and NIR Band images

- I. Decompress the downloaded file
- II. Find the **GREEN** and **NIR** band images
- III. Import band images in the QGIS (Drag & Drop or Copy & Paste).

Landsat 4-5 = Green B2 & NIR B4
Landsat 8 = Green B3 & NIR B5
Sentinel 2 = Green B3 & NIR B8

-  T35TLF_20210729T090559_AOT_10m.jp2
-  T35TLF_20210729T090559_B02_10m.jp2
-  T35TLF_20210729T090559_B03_10m.jp2
-  T35TLF_20210729T090559_B04_10m.jp2
-  T35TLF_20210729T090559_B08_10m.jp2
-  T35TLF_20210729T090559_TCI_10m.jp2
-  T35TLF_20210729T090559_WVP_10m.jp2

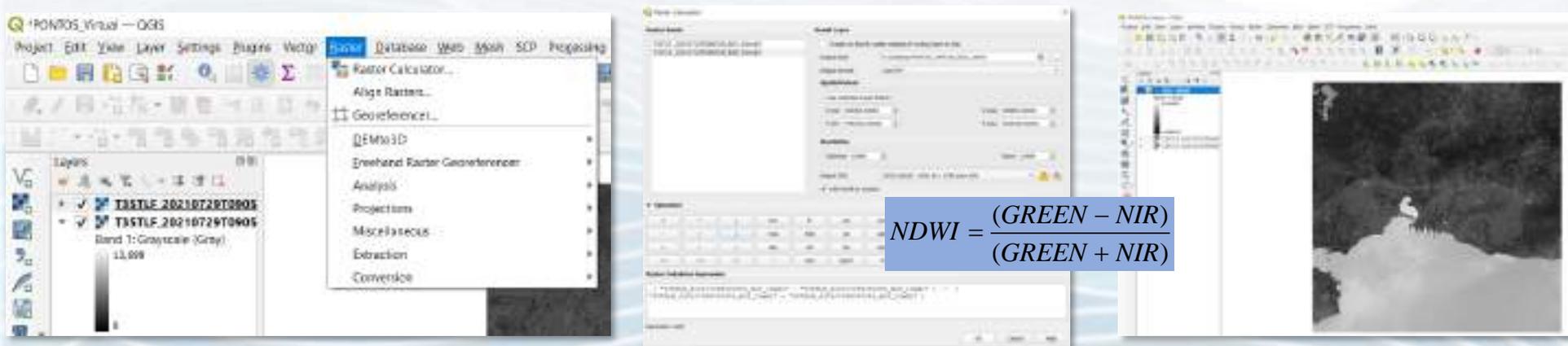


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Step 2: NDWI calculation using raster calculator

From the top bar select **Raster** → **Raster Calculator**, and the raster calculator window opens

- In the “**output layer**” field select the file to save the new layer (2021_NDWI.tif)
- In the field “**Raster calculator expressions**”, import the **NDWI equation** using the bands from the “**raster bands**” field
- Import the brackets and the equation symbols from the “**Operations**” field
- Then press **OK**
- The new NDWI image (2021_NDWI.tif) is created and uploaded in the layer panel



The screenshot displays the QGIS interface with the Raster Calculator window open. The 'Raster Calculator' window shows the 'Raster bands' field populated with 'T82TLF_20210728T0805' and 'T82TLF_20210729T0905'. The 'Operations' field contains the equation:
$$NDWI = \frac{(GREEN - NIR)}{(GREEN + NIR)}$$
 The 'Output layer' field is set to '2021_NDWI.tif'. The main QGIS window shows the 'Layers' panel with the two input rasters and a grayscale legend for the '2021_NDWI.tif' layer.

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Step 3: Clip NDWI image

From the top bar select **Raster** → **Extraction** → **Clip Raster by Extent...**, and the **Clip Raster by Extent** window opens

- In the “**input layer**” field select the NDWI image
- In the “**Clipping extent**” field, select the button on the right and select the “**Draw on canvas**”
- Select the area of interest on the QGIS map by drawing a rectangular
- In the field “**Clipped (extent)**” define the name of the new image (2021_NDWI_clip.tif) and save it to the working directory file
- Press **RUN** and a new raster file will be generated

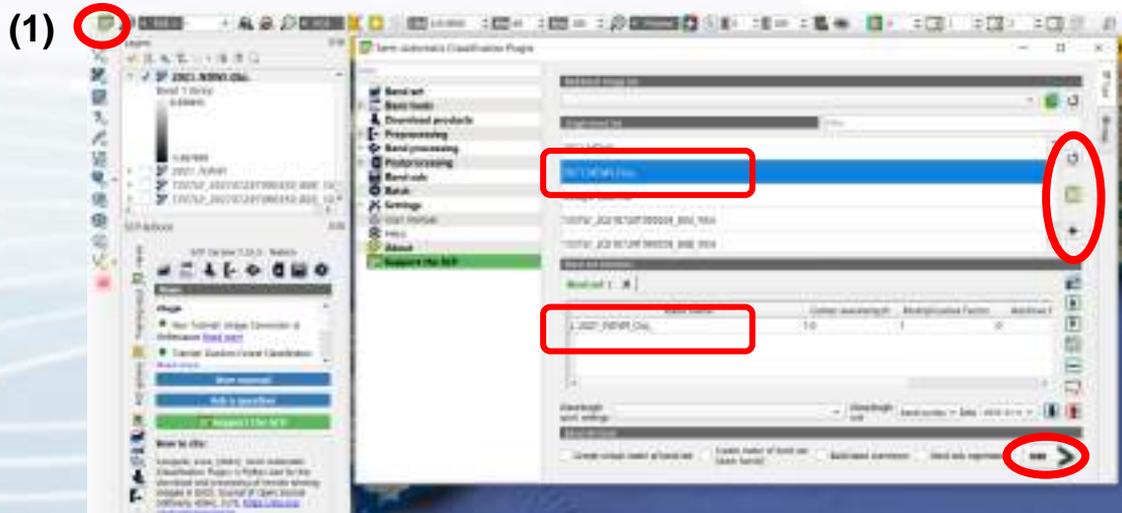


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Step 4: SCP Working file definition and training file creation

Open the Semi-Automatic Classification Plug-in window from the button (1), and select the tab “**Band set**”

- In the field “**band list**” press the button refresh, select the NDWI clipped file (2021_NDWI_clip.tif) and then press the + button to import the file in the band set definition field and in the tab “**Band set 1**”
- Press **RUN** and the working file is set



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Step 5: Create Regions of Interest (ROI)

Create a training file to save the ROIs

- Select the Training input tab from the SCP Dock. Select the button **“Create SCP training input”**, name as train.scp and save in the working directory file



Train the Algorithm for Sea cover

- In the ROI & Signature list and in the field MC Name set **Water**, in the field C Name set **Sea**
- From the SCP toolbar select the **“Activate ROI pointer”**
- Select Sea pixels on the 2021_NDWI_clip layer
- Press the **“Save Temporary ROI”** Button to import the Sea ROI into the ROIs list
- Import more than 10 Sea ROIs into the ROI Signature list with the same procedure

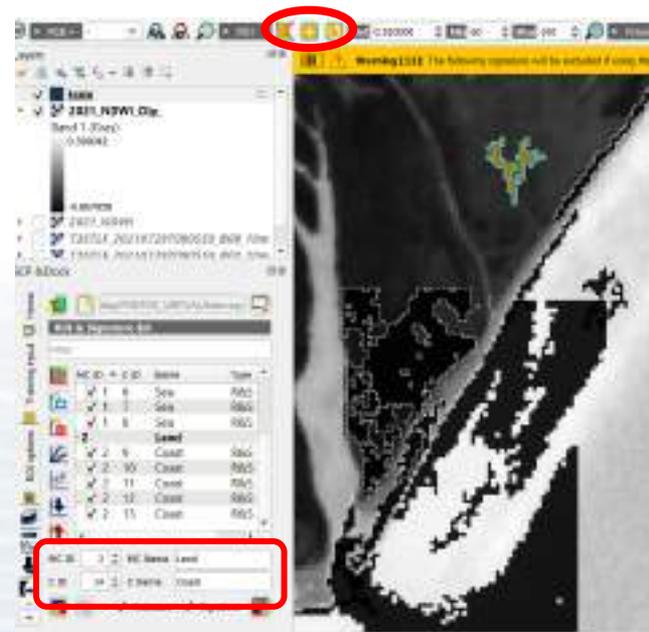


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Step 5: Create Regions of Interest (ROI)

Train the Algorithm for Coast cover

- In the **ROI & Signature** list and in the field **MC Name** set **Land**, in the field **C Name** set **Coast**
- Change the MC ID to 2
- From the SCP toolbar select the “**Activate ROI pointer**” or “**Create a ROI polygon**”
- Select Land pixels on the 2021_NDWI_clip layer
- Press the button “**Save Temporary ROI**” Button to import the Land ROI into the ROIs list
- Import more than 10 Land ROIs into the ROI Signature list with the same procedure

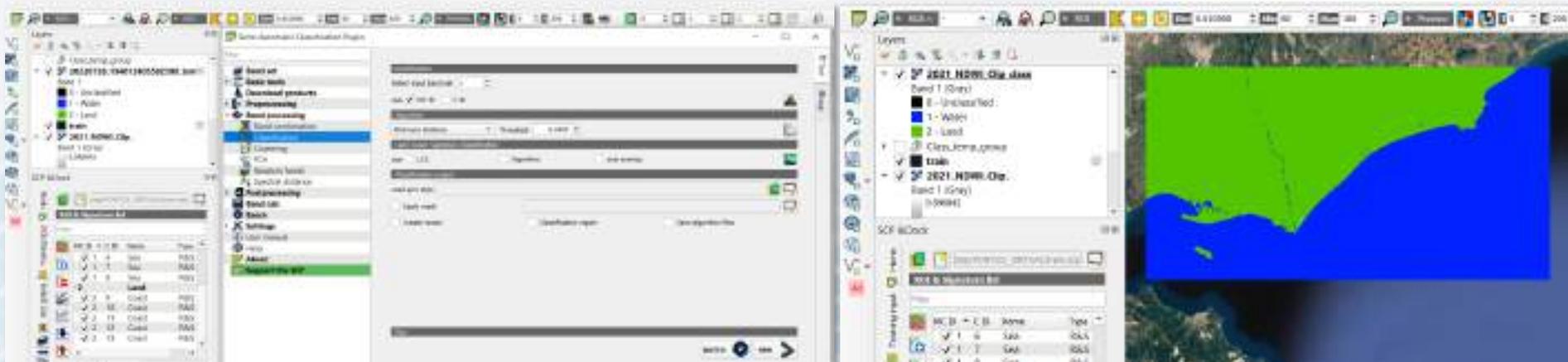


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Step 7: Satellite image Classification

Open the Semi Automatic Classification Plug-in window and select from the Band Processing the tab Classification

- in the field Classification Check the box MC ID
- In the Algorithm field select the Minimum distance classification method
- Press **RUN** and save the classified raster file (*2021_NDWI_Clip_class.tif*) in the working directory
- A new classified raster file is created

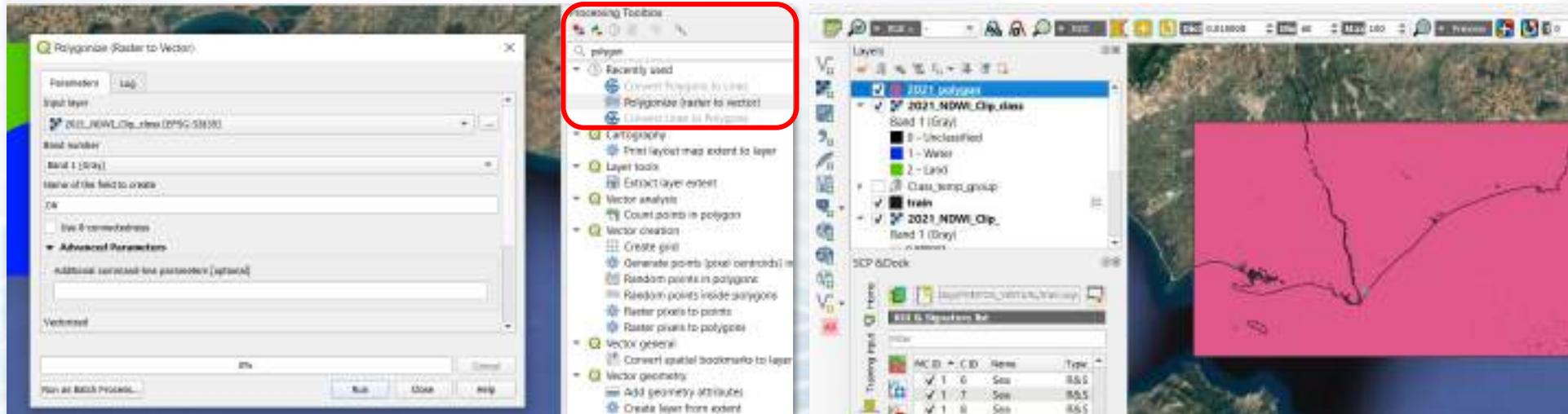


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Step 8: Convert the Classified Raster file to Vector

Search on Processing Toolbox the ***Polygonize (Raster to Vector)*** tool

- In the field ***Input layer*** select the classified raster file
- In the field ***Vectorized*** define the name of the new file and the folder to save (*2021_polygon.shp*)
- Select **Run** and a new vector file will be generated



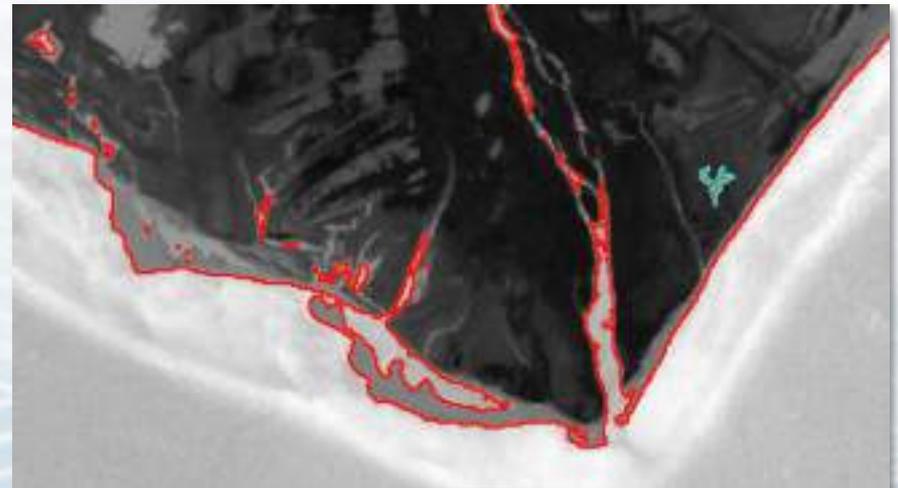
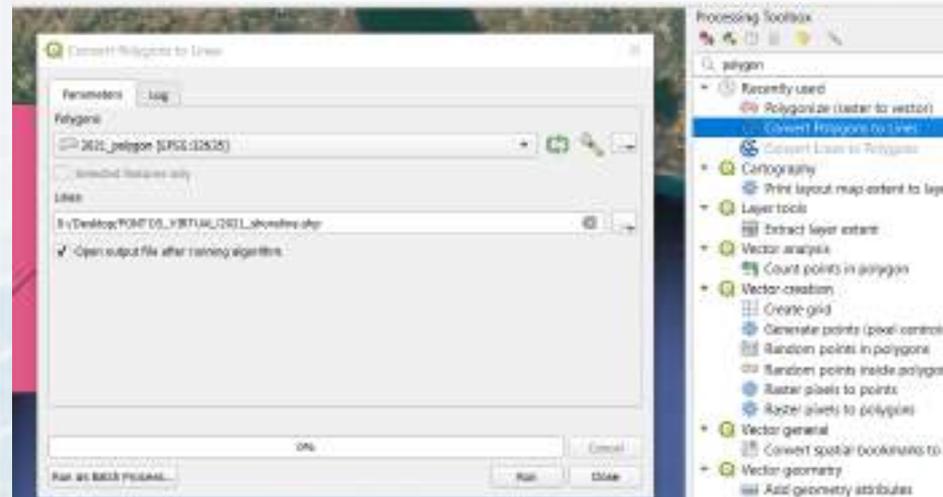
The screenshot displays the QGIS interface during the conversion of a classified raster to a vector. On the left, the 'Polygonize (Raster to Vector)' dialog box is open, showing the 'Input layer' set to '2021_NDWL_Clip_class' and the 'Vectorized' field set to '2021_polygon.shp'. The 'Advanced Parameters' section is expanded. In the center, the 'Processing Toolbox' is visible, with the 'Polygonize (Raster to Vector)' tool highlighted in a red box. On the right, the 'Layers' panel shows the newly created '2021_polygon' vector layer, along with the original '2021_NDWL_Clip_class' raster layer. The map view on the far right shows the resulting vector polygons overlaid on the satellite imagery.

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Step 9: Convert the Polygons to Lines

Search on Processing Toolbox the **Convert Polygons to Lines** tool

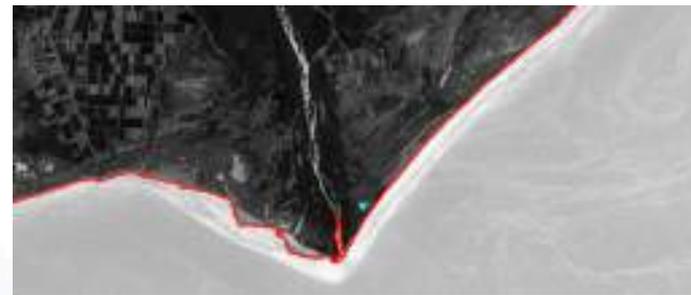
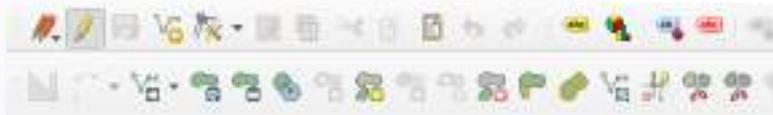
- In the field **Polygons** select the Polygon file (*2021_Polygon*)
- In the field **Lines** define the name of the new file and the folder to save (*2021_Shoreline.shp*)
- Select **Run** and a new vector file will be generated



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Step 10: Edit and smooth shoreline

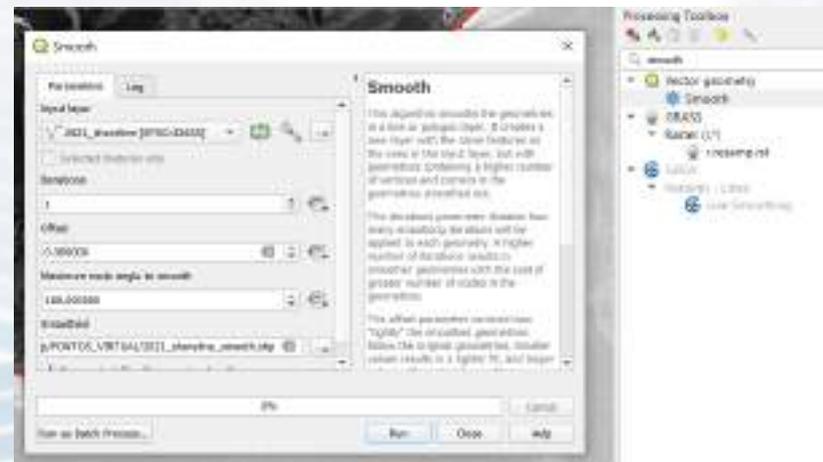
- Select the shoreline file (2021_shoreline.shp)
- Select **Toggle editing** tool and edit the shoreline using the tools:
 - Split Parts
 - Split Features
 - Vertex Tool etc
- Delete the outer lines and keep only the main shoreline
- For stop editing press Toggle editing tool



Smooth Shoreline

Select **Smooth** tool from the Processing Toolbox

- Input layer → 2021_shoreline
- Offset → 0.5
- Smoothed → save as 2021_shoreline_smooth.shp



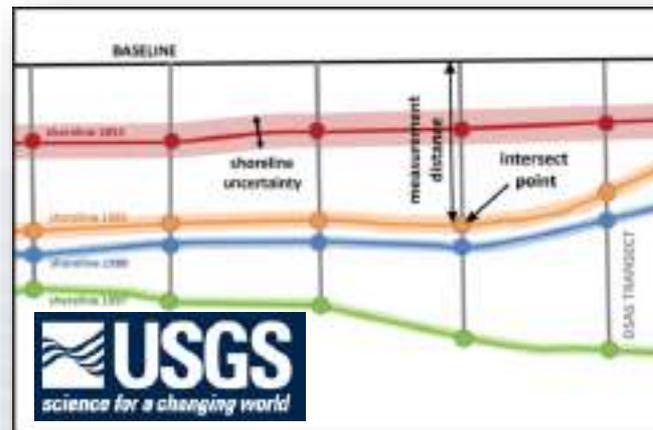
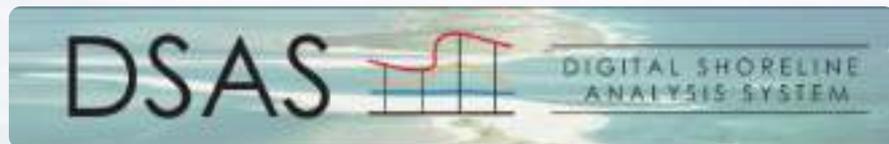


Common borders. Common solutions.

Practical Session 3

Evaluation of the Shoreline Evolution

Common borders. Common solutions. Introduction in DSAS tool



Common borders. Common solutions. Introduction in DSAS tool



DSAS version	ArcGIS version	Windows version
v5.0	v10.4 - 10.5	Windows 7 - Windows 10
v4.4	v10.4 - 10.5	Windows XP, Vista and Windows 7
v4.3	v10.0 - 10.3	Windows XP, Vista and Windows 7
v4.2	V9.2 - 9.3.x	Windows XP, Vista

USGS

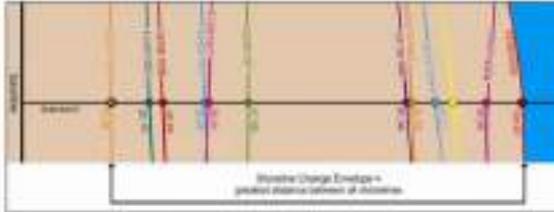
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Introduction in DSAS Statistics

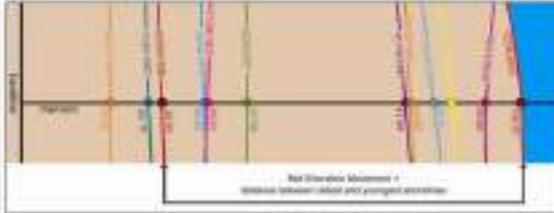
NSM	Net Shoreline Movement
SCE	Shoreline Change Envelope
EPR	End Point Rate
LRR	Linear Regression Rate
LSE	Standard Error of Linear Regression
LCI	Confidence Interval of Linear Regression
LR2	R-squared of Linear Regression
WLR	Weighted Linear Regression Rate
WSE	Standard Error of Weighted Linear Regression
WCI	Confidence of Weighted Linear Regression
WR2	R-squared of Linear Regression
LMS	Least Median of Squares

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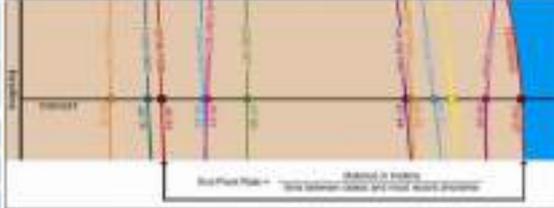
Shoreline Change Envelope (SCE)



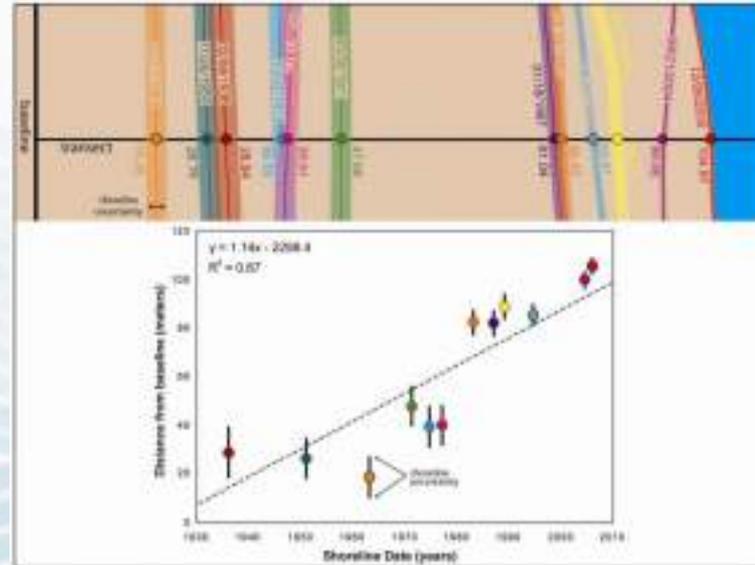
Net Shoreline Movement (NSM)



End Point Rate (EPR)

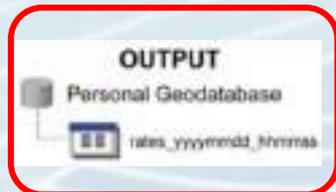
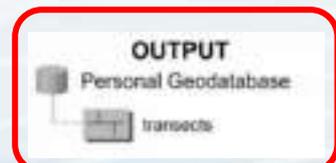
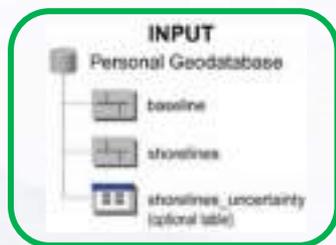


Weighted Linear Regression (WLR)



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Methodology in steps - ArcMap & DSAS



Step 1st: Create a Personal Geodatabase (.mdb) and new Feature Classes

Step 2nd: Import the historical shorelines In ArcMap

Step 3rd: Pre-process of the shorelines and Edit the Shorelines Feature class

Step 4th: Pre-process of the baseline and import in baseline Feature Class

Step 5th: Define the technical characteristics of the vertical Transects in DSAS toolbox

Step 6th: Edit Transects

Step 7th: Calculate the Statistical Parameters

Step 8th: Visualization of the results

Step 9th: Open the Attribute tables from the generated files

Step 10th: Export the parameters in .txt file

Step 11th: Indicative Results – East Nestos Estuaries

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Step 1: Create a new Personal Geodatabase and two Feature Classes

- Open **ArcMap 10.9**
- Define the **Working directory** saving the file in the **DSAS_Transects** folder:

File → **Save as** → File name: **DSAS_Transects.mxd**

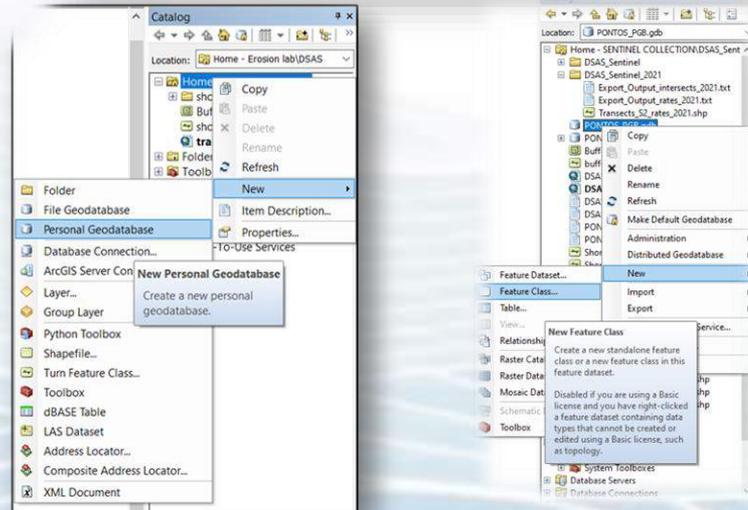


Create a new Personal Geodatabase

- **Catalog** → **New Personal Geodatabase**
- **Rename** → **PONTOS_PGB.mdb**

Create 2 Feature Classes (shoreline & baseline)

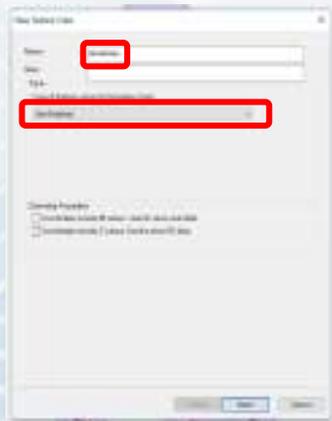
- **PONTOS_PGB.mdb** (Right click) → **New** → **Feature class...**



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Step 1a: Create a new shoreline Feature Classes

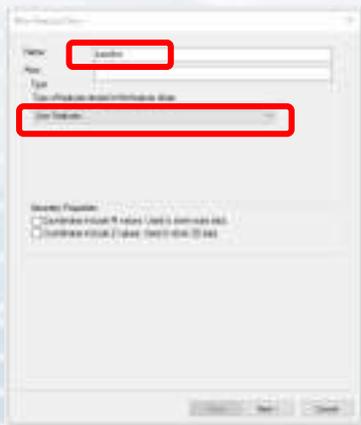
- In the Tab **Catalog** → **PONTOS_PGB.mdb** (right click) → **New** → **Feature class...**
- In the field **Name** type shorelines
- Select Line Features in the field “**Type of features stored...**”, press next
- Select the coordinate system of your study site, and press next
- Fill the table with the Field name and the Data Type as given in the figure
 - In the field **DATES_** in the “**Field Properties**” in **Length** type **10**



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Step 1b: Create a new baseline Feature Classes

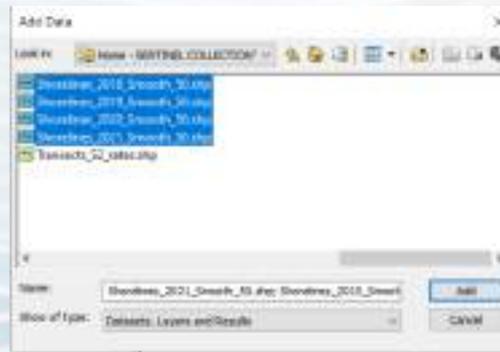
- In the Tab **Catalog** → **PONTOS_PGB.mdb** (right click) → **New** → **Feature class...**
- In the field **Name** type baseline
- Select Line Features in the field “Type of features stored...”, press next
- Select the coordinate system of your study site, and press next
- Fill the table with the Field name and the Data Type as given in the figure



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Step 2: Import the historical shorelines In ArcMap

- i. Create a new Folder (e.g. **DSAS_Transects**)
- ii. Copy the **shoreline shapefiles** to the **DSAS_Transects** folder
- iii. Right click on the layers panel
- iv. Add Data...
- v. Select all the shoreline files
- vi. Select **Add**
- vii. The shorelines are imported in the ArcMap

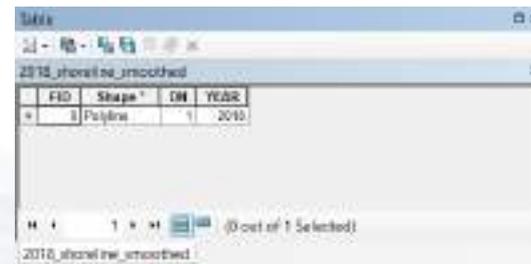


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Step 3a: Pre-process of the shorelines and Edit the Shorelines Feature class

Create new field in the attribute table of the historical shoreline files

- Right click on the **Shoreline Layer**
- Open attribute table → Table options → Add Field
 - Name: **YEAR**
 - Type: **Short Integer**
 - → **OK**
- Editor → Start Editing
- In the field **YEAR** define the shoreline date e.g. **2018**
 - → **Stop Editing**
- Apply the same process on every historical shoreline file





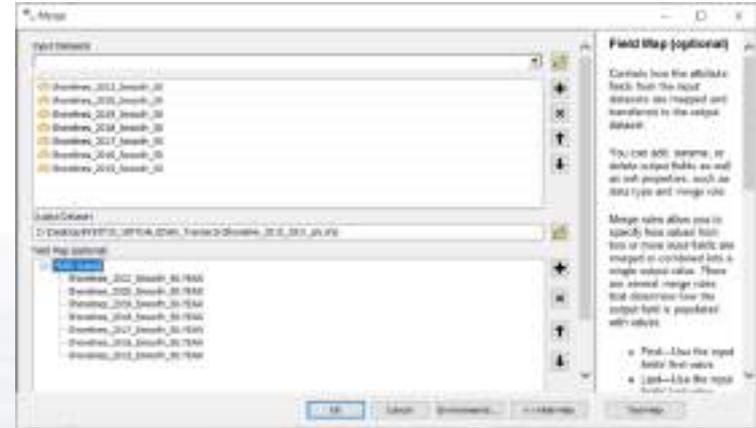
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Step 3b: Pre-process of historical shorelines

Create a new shapefile Merging the historical shorelines.

Open **Search** tab → **Merge** → **Merge Data Management**

- In the field Input, insert the historical shorelines (**Drag and Drop**)
- In the field output, define the file name and the saved folder
Save as → **Shoreline_2015_2021_sm**
- In the Field Map, **Delete** the all fields e.g. **DN (Long)**, Keep only the field **YEAR**, press **OK**



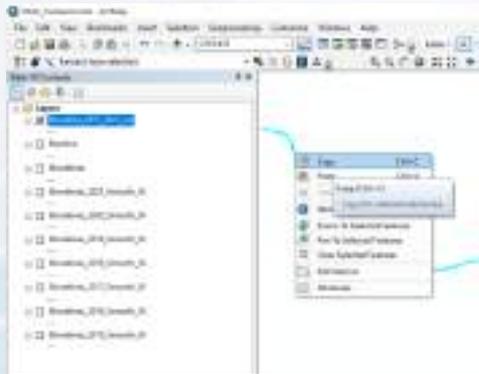
Open attribute table to check the fields

FID	Shape*	YEAR
1	Polyline	2015
2	Polyline	2016
3	Polyline	2017
4	Polyline	2018
5	Polyline	2019
6	Polyline	2021

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Step 3c: Edit the Shorelines Feature class

- Editor → Start Editing → shorelines → OK
- Copy the shorelines from the layer Shoreline 2015-2020
- Paste to Shorelines layer



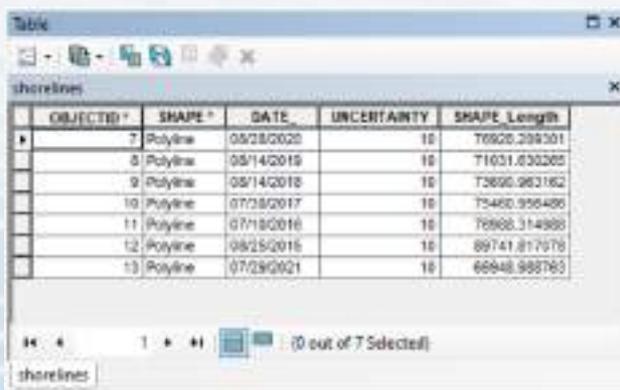
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Step 3d: Edit the Shorelines Feature class

- Select **shorelines** layer (right click) → **Open Attribute Table**
- **Editor** → **Start Editing** → **shorelines**

On the fields **DATE_** και **UNCERTAINTY**

- **DATE_**: the format is related to your PC settings (e.g. **DAY/MONTH/YEAR** or **MONTH/DAY/YEAR**)
- **UNCERTAINTY**: set the uncertainty in meters (e.g. 10 m for SENTINEL historical shorelines)



OBJECTID	SHAPE	DATE	UNCERTAINTY	SHAPE_Length
7	Polyline	05/28/2020	10	76920.209301
8	Polyline	05/14/2019	10	71631.630265
9	Polyline	05/14/2018	10	73690.963182
10	Polyline	07/28/2017	10	73480.956486
11	Polyline	07/18/2016	10	76906.314908
12	Polyline	08/25/2015	10	89741.817978
13	Polyline	07/29/2021	10	66948.988763

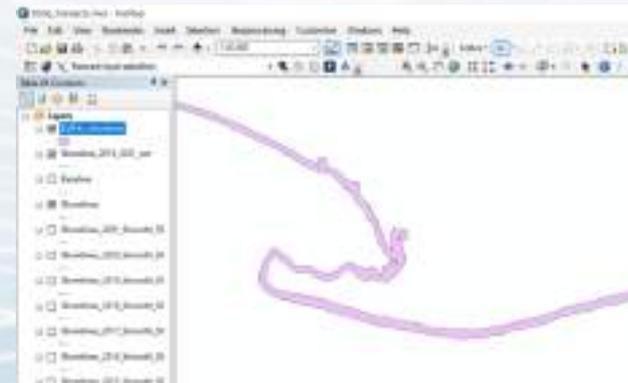
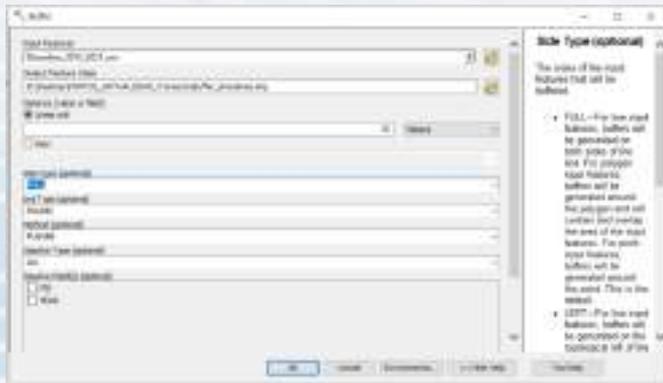
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Step 4a: Pre-process of the baseline and import in baseline Feature Class

Create a baseline parallel to the coastlines either creating a buffer line or editing manually a new polyline

Create a buffer:

- In the tab **Search** → type **Buffer** → select **Buffer Analysis (Tool)** and the **Buffer** window opens
- In the field **input feature** select the Shoreline_2015_2020 file
- In the **Output Feature Class** define the name of the buffer file and the saved file\
- In the field **Distance** (value or field) → select the buffer width in meters
- In the **Dissolve Type** → All
- Press **OK**
- A new buffer file is created



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Step 4b: Create a baseline layer

- **Editor** → **Start Editing** → **baseline** → **OK**
- **Create Features** → select **baseline**
- Select the **Editor** from the toolbar, then select **Create Features**
- In the tab **Create Features** select **baseline**
- From the toolbar **Editor** select the tool **Trace**
- Set the pointer on the **Buffer_shorelines** → Left click → slide the pointer on the **Buffer_shorelines**
- Finish the sketch: **left – right** click and from the pop up window **Finish Sketch**
- **Stop Editing**



BASELINE							
OBJECTID	SHAPE	ID	Group	Offshore	CastDir	SHAPE_Length	
1	Polyline	1	1	0	1	0.000 000320	

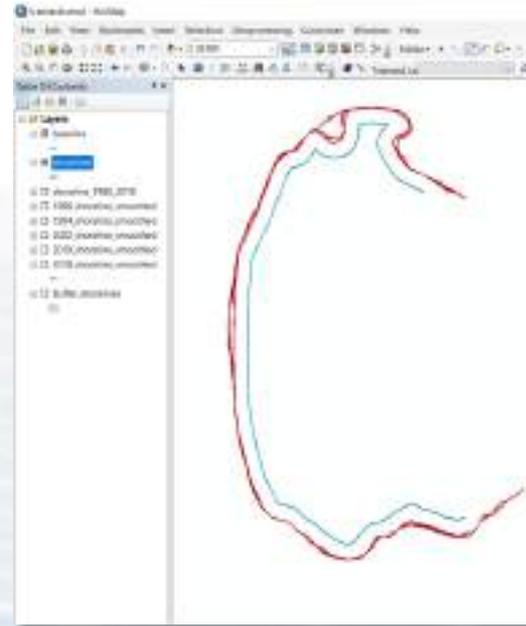
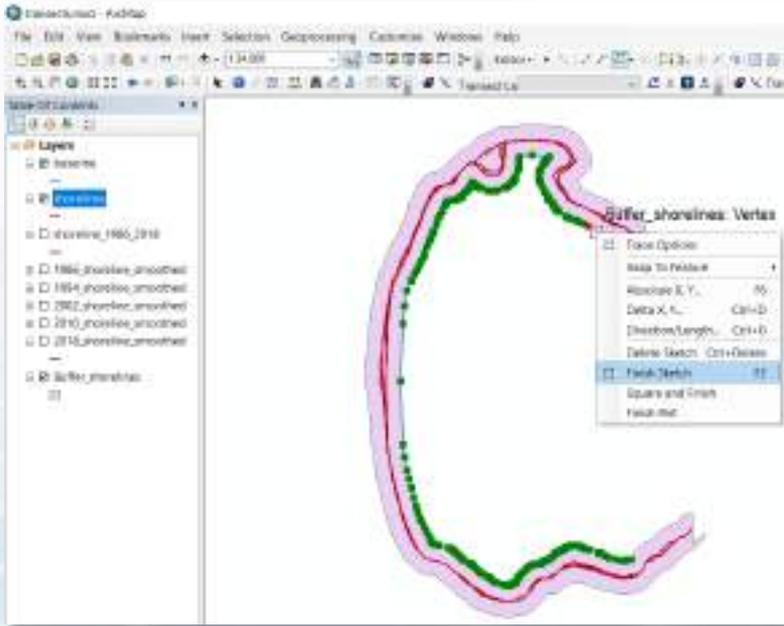


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Step 4c: Create a baseline layer



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Step 5a: Define the technical characteristics of the vertical Transects in DSAS toolbox

Select “Set Default Parameters” button from the DSAS toolbar

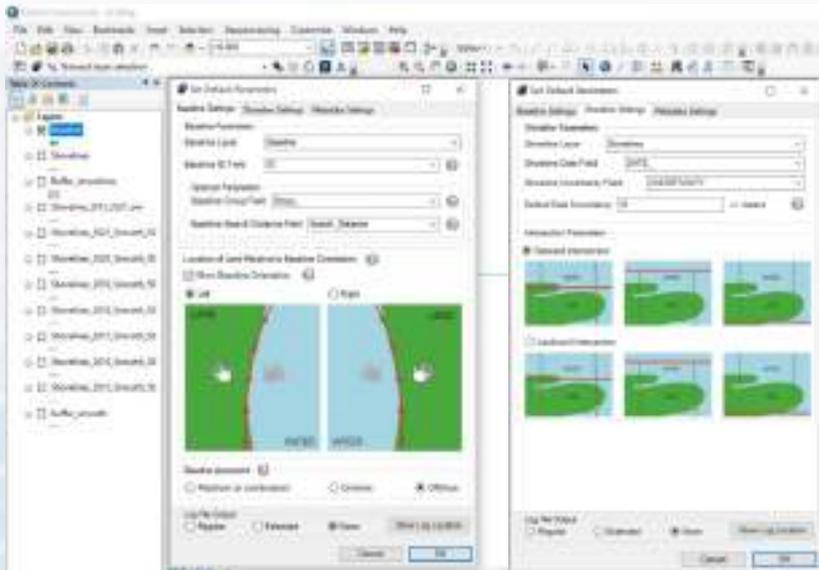
Select the Baseline Settings tab

- Baseline Layer → baseline
- Baseline ID Field → ID
- In the field Location of Land relative to Baseline Orientation, select Left or right.

Select the Shoreline Settings tab

- Shoreline Layer → shoreline
- Shoreline Data Field → DATE_
- Shoreline Uncertainty Field → UNCERTAINTY
- In the intersection parameter select if the transects are seaward or landward

Press **OK** and the window closes



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Step 5b: Define the technical characteristics of the vertical Transects in DSAS toolbox

Select “Cast Transects” button from the DSAS toolbar

In the tab “Cast Transects” in the fields:

- “**Transect Storage Parameter**” select the Geodatabase (PONTOS_PGB.mdb)
- “**Select Existing or Enter New Transect Name**” type a name for the new transects

In maximum Search Distance

- In baseline field select the transect length in meters
- In Transect spacing field select the space between new Transects
- In Smoothing Distance select the smoothing value (500)

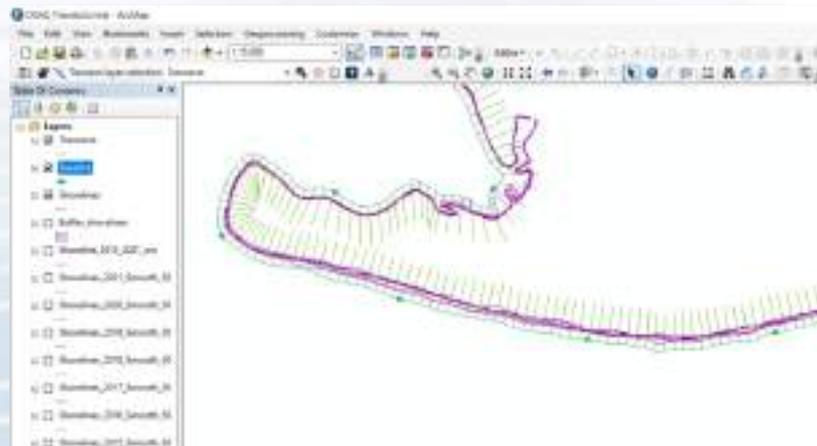
Press OK and vertical transects to the shoreline are generated, as Shapefile



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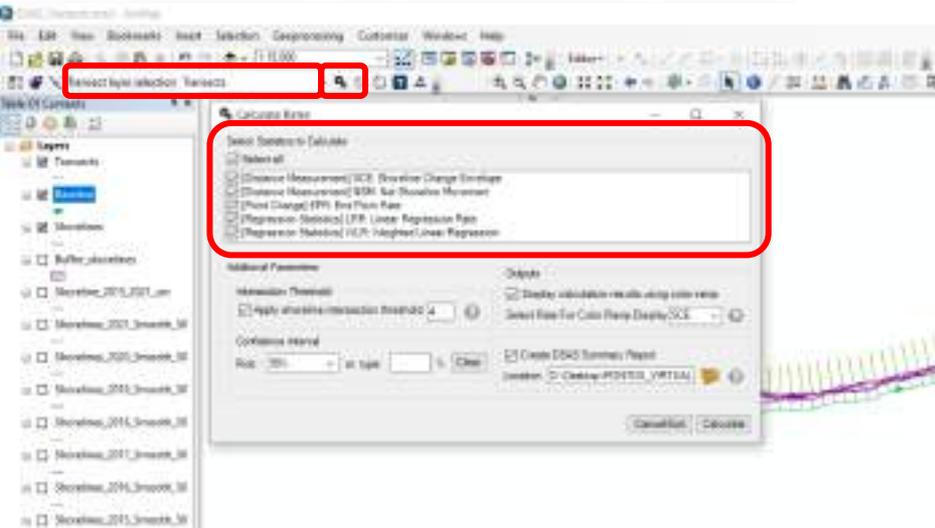
Step 6: Edit Transects

We can **edit** (Delete, Add new transect or Rotate or move in space) **transects**, using the editing tools, we can:
Select the layer transects → Editor → Start editing → transects
To end the process select → Stop Editing



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Step 7: Calculate the Statistics from DSAS tool



Select “**Calculate Rates**” button from the DSAS toolbar

- In the field “**Select Statistics to Calculate**” select the parameters you wish to calculate

In the field additional parameters

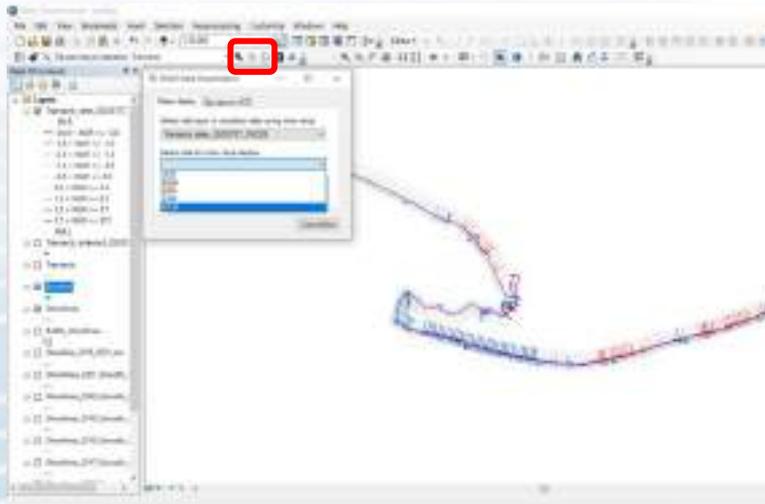
- Select the to apply a shoreline intersection threshold
- The confidence interval
- The output options
- And the Folder where the DSAS Summary Report is saved

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Step 8: Visualization of the DSAS results in ArcGIS

Select “DSAS Data Visualization” button from the DSAS toolbar

- In the field “**Select rate to visualize using color ramp**” → select the Transects_rates layer
- In the field “**Select rate for color ramp display**” → select the statistic parameter to visualize
- Select “**Scale to my data**” or “**Apply color ramp**”



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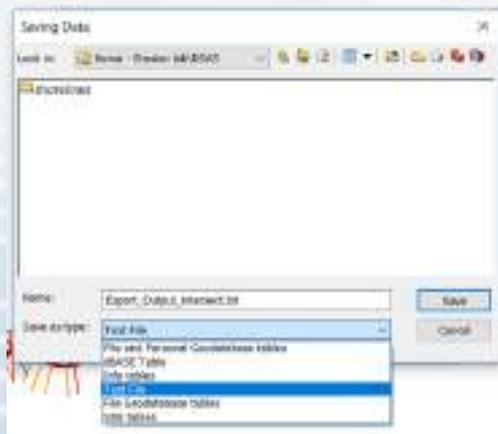
Step 10: Export the parameters in .txt file

The parameters estimated from DSAS are:

- **TRANSECT INTERSECT** (data of the transect position)
- **TRANSECT RATES** (results of the **Statistical Analysis** for each transect)

Save the file as “.txt”:

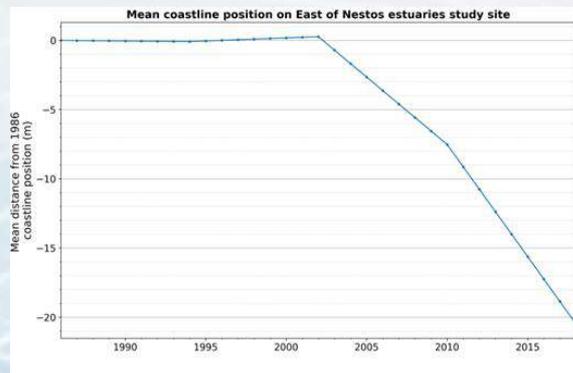
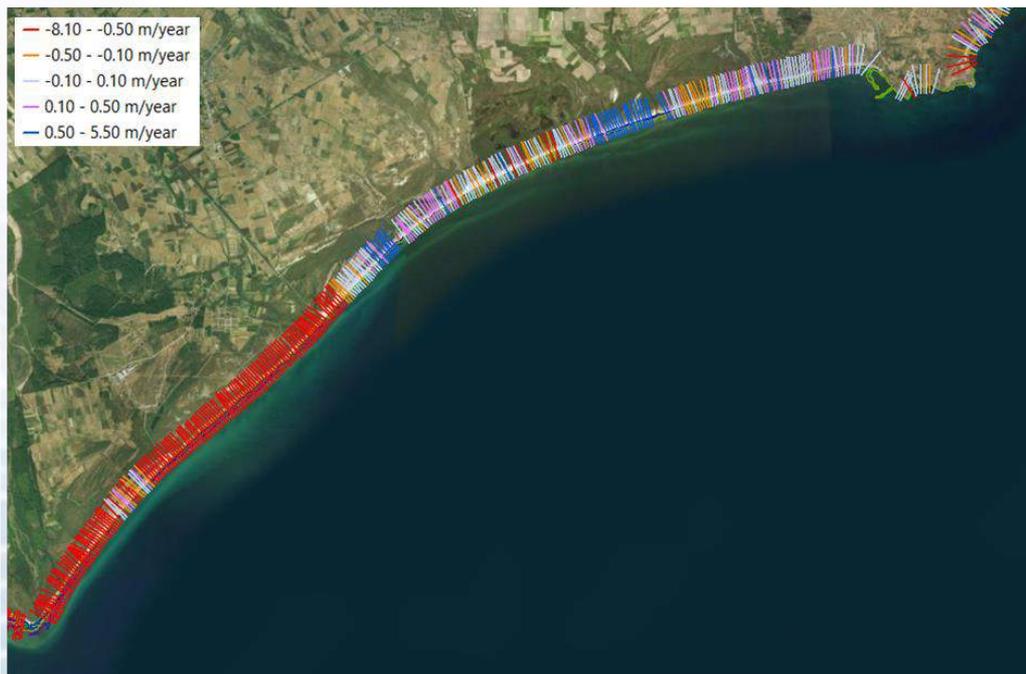
Table of Contents → **List by source** → **transects_intersect** (right click) → **Data** → **Export** → **Save**



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Step 11: Indicative Results – East Nestos Estuaries

	Value	Units
Average rate	-0.70	m/year
max accretion	1.93	m/year
max erosion	-3.78	m/year
Average Error	0.35	m





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Copernicus Assisted Environmental Monitoring across the Black Sea Basin - PONTOS
2022

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