

User Guide

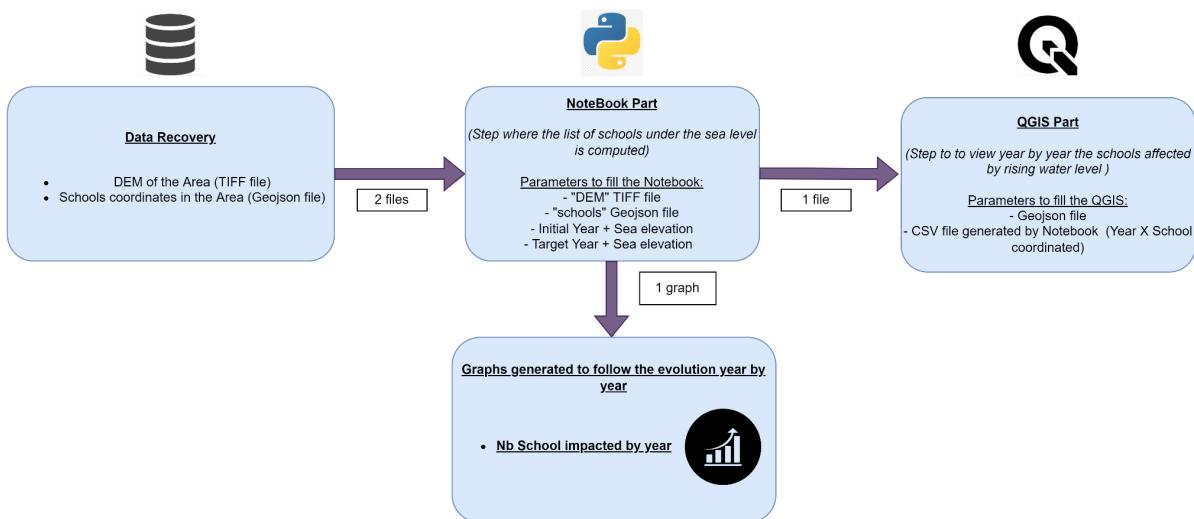
ClaraVista's submission user guide for 2022 IIEP-UNESCO Hackathon

This document aims to present to you the detailed methodology to visualize schools impacted by sea level rise. From the data recovery to the year by year visualization in QGIS of the impacted schools this methodology is applicable for all regions in the world



The ClaraVista team, at your service !

Part 1: Diagram relationships between the different tools



How are the tools linked?

The methodology presented requires the different tools, MAP visualization tool, programming tool, etc. to correctly and dynamically visualize the affected schools. This part presents to you the chronology processus to follow to realize this process.

The proper functioning of the project relies on 2 input files. These 2 files correspond to a DEM file in TIFF format which indicates the heights of all the points in a region. The second file gives the coordinates of the schools in a region.

Once these two files are generated, they need to be imported in Python to calculate the flooded schools for a year.

The process in Python will generate a CSV file that will give the list of flooded schools in a year that will be given as input to in QGIS to visualize dynamically on a map the affected schools for a given year. The Python notebook will also generate a visualization of the count of flooded schools per year as a PNG image.

Part 2: Data Recovery: DEM & Schools Coordinates

How to download in GeoTIFF format the DEM data for a desired area?

The first step of data retrieval consists of downloading data from Copernicus GLO-30 Digital Elevation Model which lists for each point on the world map the elevation of that point including the flatness of water bodies and the constant flow of rivers. This data will allow us to identify all points that are below sea level.

The whole globe is modeled, so you are free to choose the region you want to observe for water level modeling.

Warning : the larger the region, the heavier the data ! Therefore, be aware of your computing capabilities when choosing the region to analyse.

To proceed to the download of the data of the area in TIFF format (photos in raster format with Geolocation data) you must access to the web address:

[OpenTopography - Copernicus GLO-30 Digital Elevation Model](https://www.opentopography.org/)

OpenTopography

Private Partnership between the German State, represented by the Federal Institute for Geosciences and Natural Resources and the Federal Agency for Air Protection and Climate Protection, and the United Nations Educational, Scientific and Cultural Organization (UNESCO)

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Note:

- GLO-30 coverage is not entirely global because a small subset of tiles covering specific countries are not yet released to the public by the Copernicus Programme. See the AWS landing page for details on which countries are excluded.
- In the original datasets (available via OpenTopography bulk download or the Sinergise aws bucket), the longitudinal spacing of cells increases as a function of latitude for latitudes north of 50°N and south of 50°S. See the original documentation for details. However, in order to keep the pixel dimensions uniform, OpenTopography resamples data north of 50 degrees latitude and south of -50 degrees latitude in order to output a consistent 30m or 90m product for data accessed through the web-interface or API.
- GLO-30 is available on a free basis for the general public under the terms and conditions of the license found [here](#).

Platform: Satellite Data
[Full Metadata](#)

Survey Area: 146,540,912 km²
[Data Citation](#)

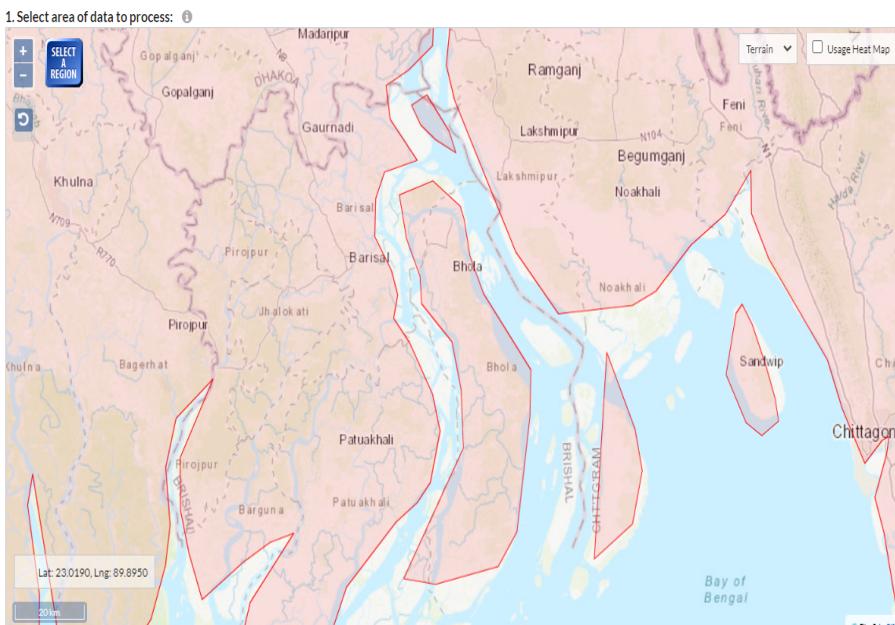
Raster Resolution: 30 meter
[Use License](#)

Survey Date: 01/01/2011 - 07/01/2015
Funder: [ESA](#) Partner: [DLR, Airbus](#)

Other Available Data Products: [Copernicus 90m](#), [Raster Bulk Download](#) (Sign in required)

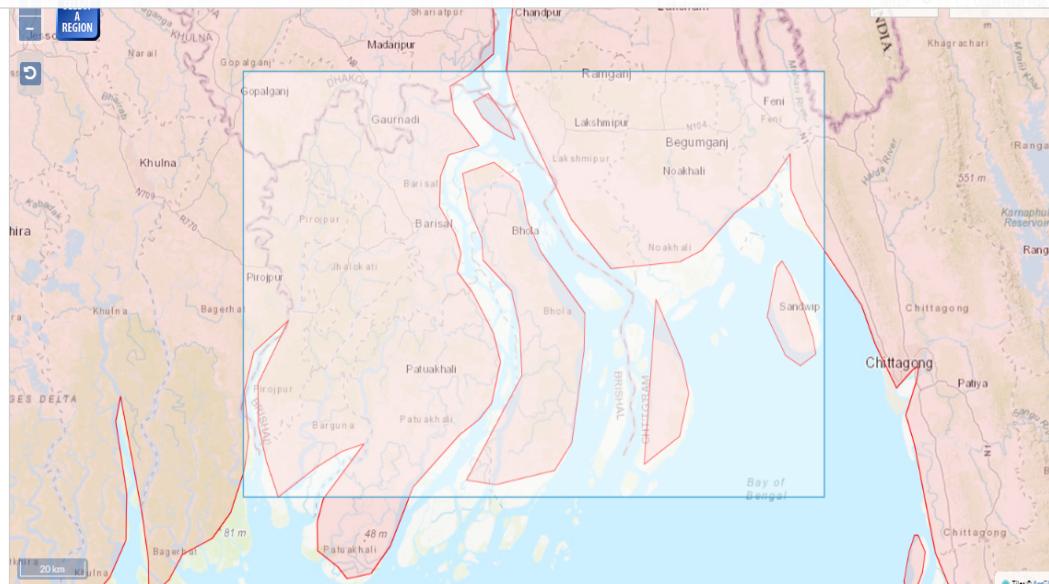


- Zoom in the area you want (here we zoom in area of Bangladesh)



- Click on "select a Region" and select your analysis area

OpenTopography

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1. Coordinates

Horizontal Coordinates: WGS84 [EPSG: 4326]

Vertical Coordinates: EGM2008 [EPSG: 3855]

Units: meter

Data Selection Coordinates: Manually enter selection coordinates (in the horizontal coordinate system listed above)

$X_{\min} = 89.8491923002659$ $Y_{\min} = 22.022822192670716$ $X_{\max} = 91.58170654200615$ $Y_{\max} = 23.090795645593303$

The selection area is approximately 21 127 km².

The coordinates are automatically calculated and the air surface is also indicated (here 21 127 km²)

- Keep the output format in Geotiff. Fill in the necessary information in the Job Description section, then click on the Submit button.
- Note:** you will be required an email address in order to submit the process. However, you will not need to create any account.

2. Data Output Formats

Select Data Output Format:

3. Visualization

Generate hillshade images from DEMs
 Generate additional color-relief and colored hillshades
 Generate additional Google Earth KMZ files

Altitude of the light: (In range: [0-90] degrees)
Azimuth of the light: (In range: [0-360] degrees)

Job Description

These options allow users to describe and keep track of their jobs. Information entered below is recorded along with other job parameters in your personal lidar job archive accessed via myOpenTopo (available only to registered OpenTopography users).

Job title (up to 150 characters)
Job description (up to 750 characters)
Enter your e-mail address for notification upon completion of processing Sign in

By accessing data via OpenTopography you agree to acknowledge OpenTopography and the dataset source in publications, presentations, and other materials produced using these data:
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- Your .TIFF file is being generated

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High-Resolution Topography Data and Tools

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Raster Job Results

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Full job metadata
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View job configuration 

Dataset Citation: European Space Agency, Sinergise (2021). Copernicus Global Digital Elevation Model. Distributed by OpenTopography. <https://doi.org/10.5069/G9028PQB>. Accessed: 2022-05-08

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Job Id	Dataset	Title	Submission	Completion	Duration	Last Update
rt1652004629368	COP30		2022-05-08 10:10:29	N/A	N/A	RasterSelectService 

 [Querying: Extracting Digital Elevation Model \(DEM\) data for area of interest.](#)
 [Visualization: Generating hillshade images and Google Earth files from DEMs.](#)

Depending upon the size of your job and system load, your job may take greater than an hour to complete. You may close this page at any time. Status of running jobs can also be monitored through [Raster Jobs](#). You will receive an email notification once the job is complete.

- The file is named **rasters_COP30.tar.gz** and you can also view the generated image by clicking on it

Job Id	Dataset	Title	Submission	Completion	Duration	Final Status
rt1652004629368	COP30		2022-05-08 10:10:29	2022-05-08 10:11:00	31secs	Done ✓

Download Data 

DEM Results • Download compressed raster results: rasters_COP30.tar.gz (69.9 MB)

Visualization Products:

Global

• View on map



At this stage you have at your disposal the DEM data representing the altitude points of the entire area that you have selected. You can save this file and proceed to the school data recovery step.

How to download in GeoJSON format the coordinates for each school in a desired area

OpenStreetMap is a complete and open solution containing many geographical data. We use its API in order to recover the school coordinates. However, we use a tool called **Overpass** (<https://overpass-turbo.eu/>), also free and open-access in order to retrieve the data of the considered region:

- Go to the website <https://overpass-turbo.eu/>
- Write the tag "amenity"="school" to focus only on schools (see below) and run

```
way["amenity"="school"]({{bbox}});  
out center;
```

- Export results to GeoJSON file

Now you have a database with all schools in a desired area, associated with their coordinates.

Third Part: Temporal visualization with QGIS

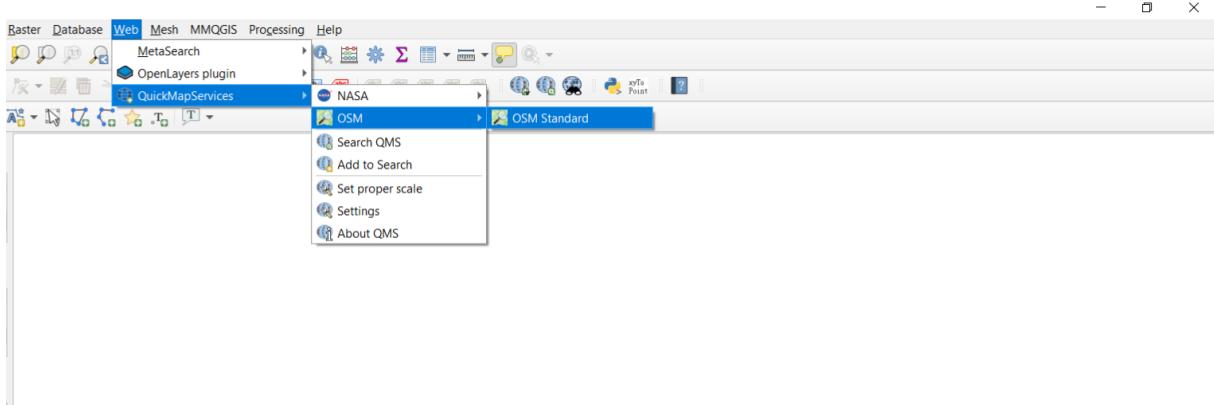
Once you have collected the data and performed the necessary computations in the Python notebook, you can retrieve the generated data to perform a temporal animation in [QGIS](#).

Two files are required to obtain this animation:

- 1 GeoJSON file with all schools in a desired area associated with their coordinates
- 1 csv file with all flooded schools associated with their coordinates and their flood date it is necessary to have date format contrary to the first case that could take years as input data)

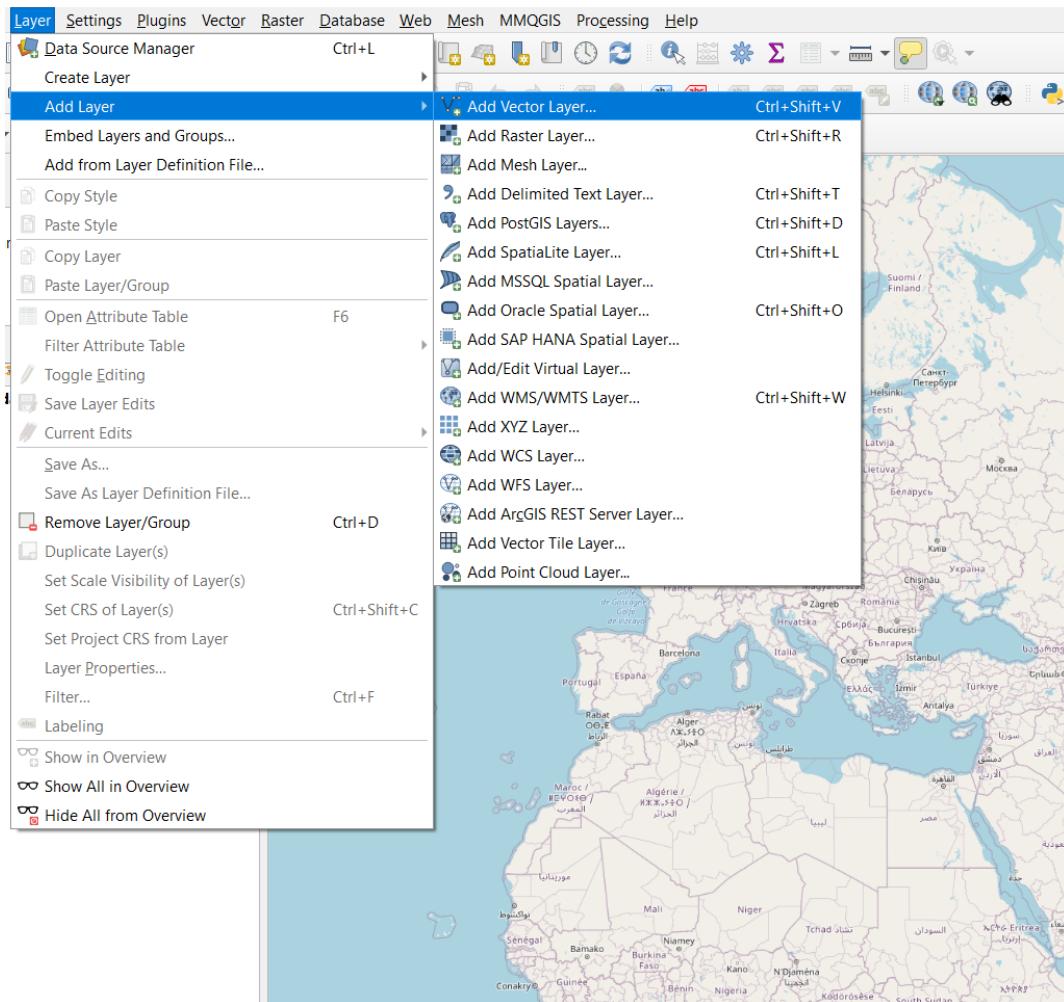
First, go to the [QGIS website](#), download and install QGIS. Once the latest version of QGIS is installed, run it. You will have to display the world map in the background. To do this:

- Install the plugin “QuickMapServices” in the *plugin* tab
- In the *Internet* tab, click on *QuickMapServices*, then *OSM* and finally *OSM Standard*



Then get the GeoJSON file using the steps detailed above and the csv file which is the output from the python notebook, and import them in QGIS:

- In the *layer* tab, click on *Add Layer* and then *Add Vector Layer*



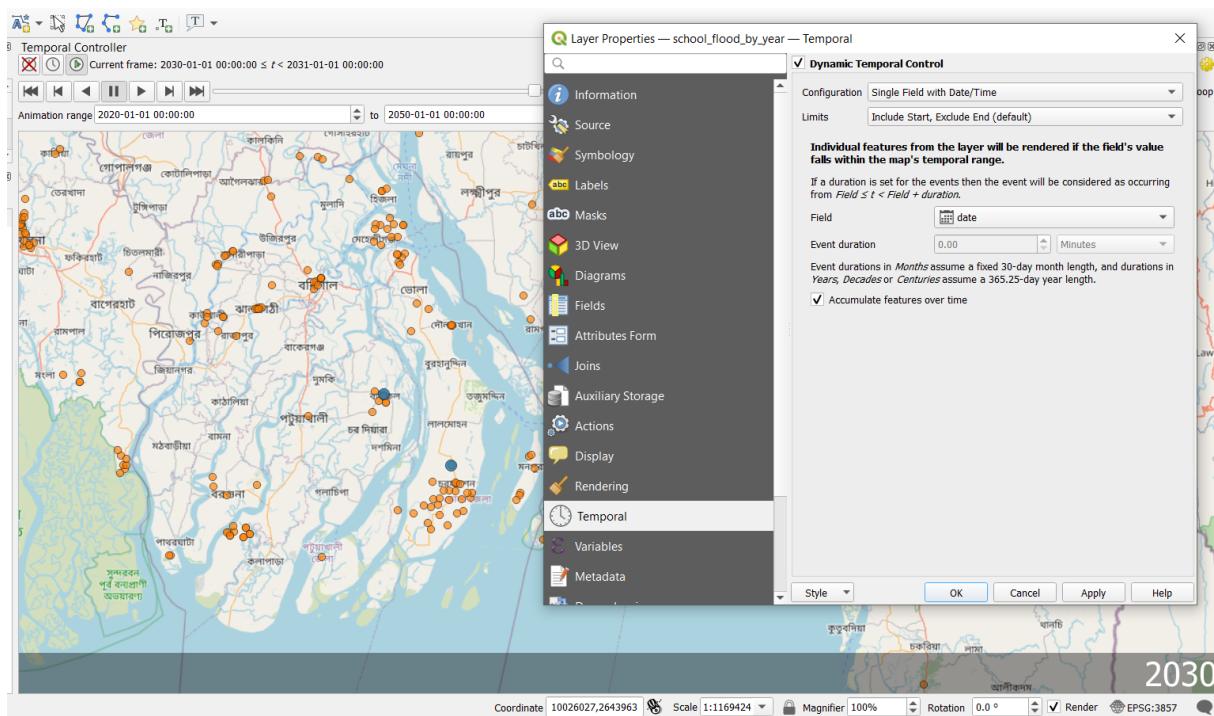
- In the *Vector* tab, indicate the path where the GeoJSON file is located
- In the *Delimited Text* tab, indicate the csv file path, variables formats and variables corresponding to x and y coordinates (*don't forget to check the coordinate system which must be EPSG :4326 – WGS 84*)

Now all schools in the desired area are represented on the map, whereas all flooded schools are represented in a different color.

The last step is to set up the time controller:

- Go to the the csv layer parameters in the *Temporal* tab and check the first box
- Choose the "Single Field with Date/Time" configuration and the "Include Start and Exclude End" limits
- Choose the variable corresponding to the date
- Check "Accumulate features over time" and apply.

The following screenshot illustrate this feature:



After clicking on the clock button, you just have to click on the *Play* Button to see the animation representing flooded schools over time.

Enjoy !