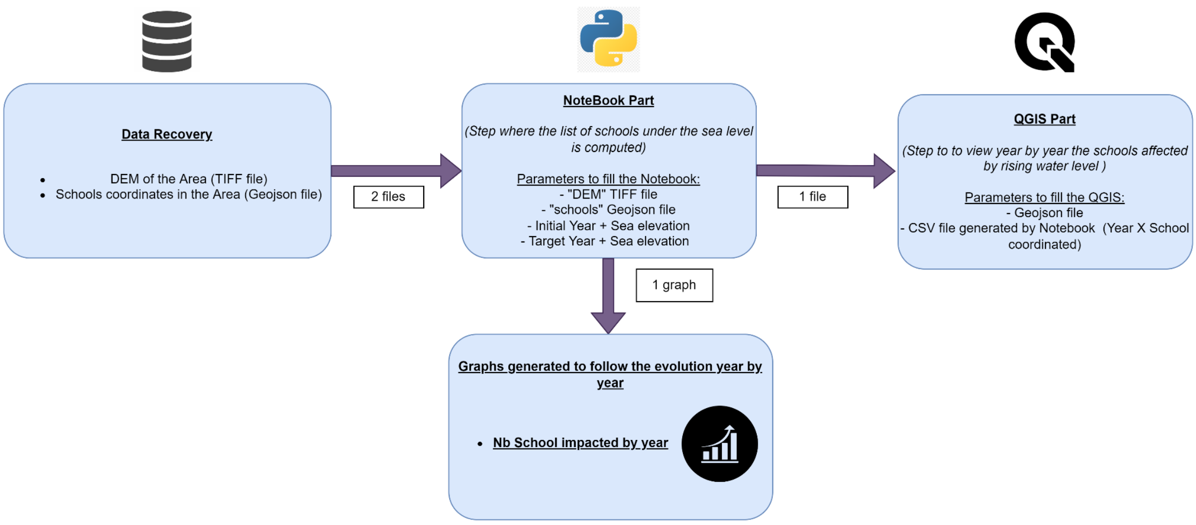
User Guide

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

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?

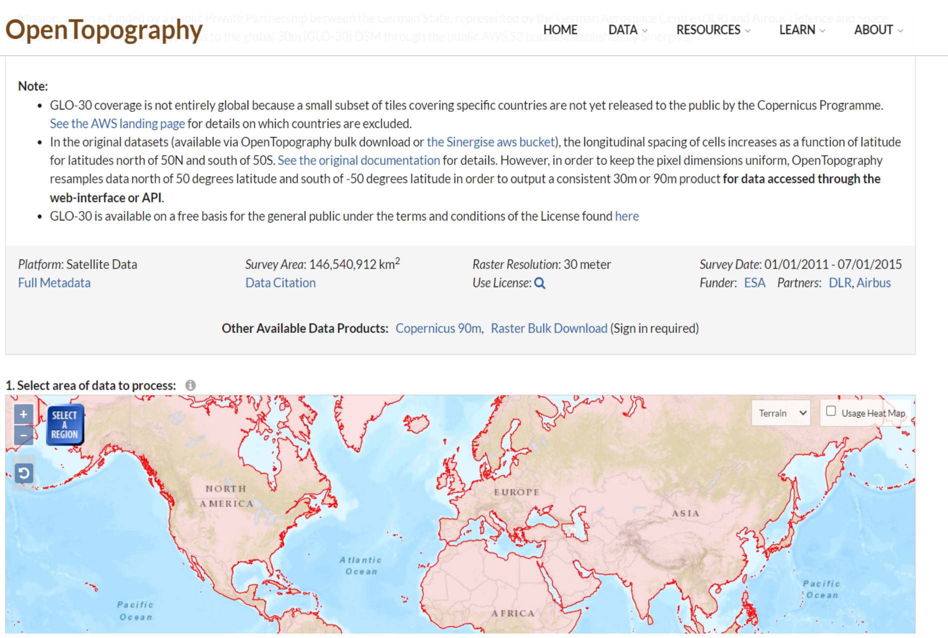
The first step of data retrieval consists of downloading data from Copernicus GLO-30 Digital Elevation Model which lists for each point on the world map the elevation of that point including the flatness of water bodies and the constant flow of rivers. This data will allow us to identify all points that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

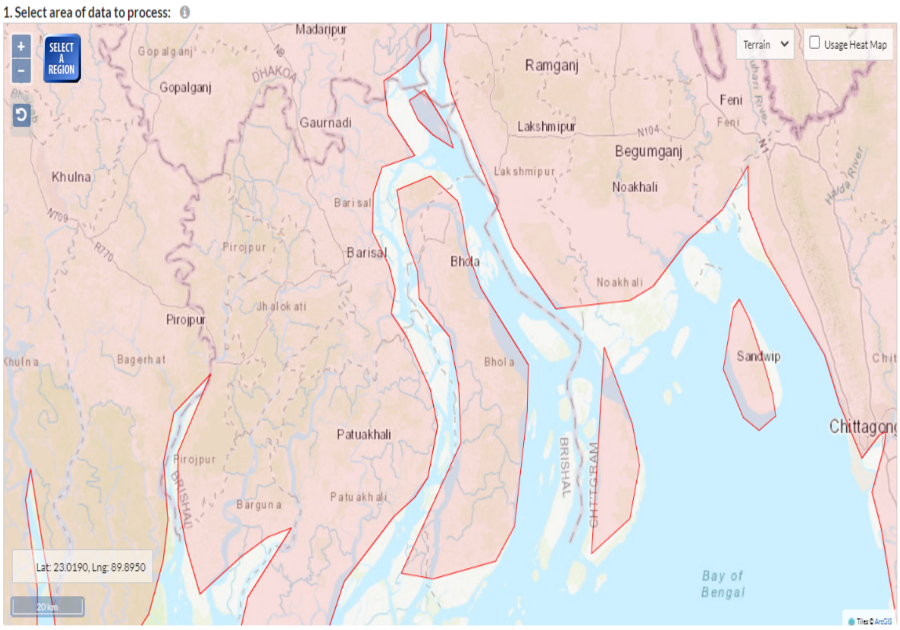
> **Warning** : the larger the region, the heavier the data ! Therefore, be aware of your computing capabilites when choosing the region to analyse.

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:

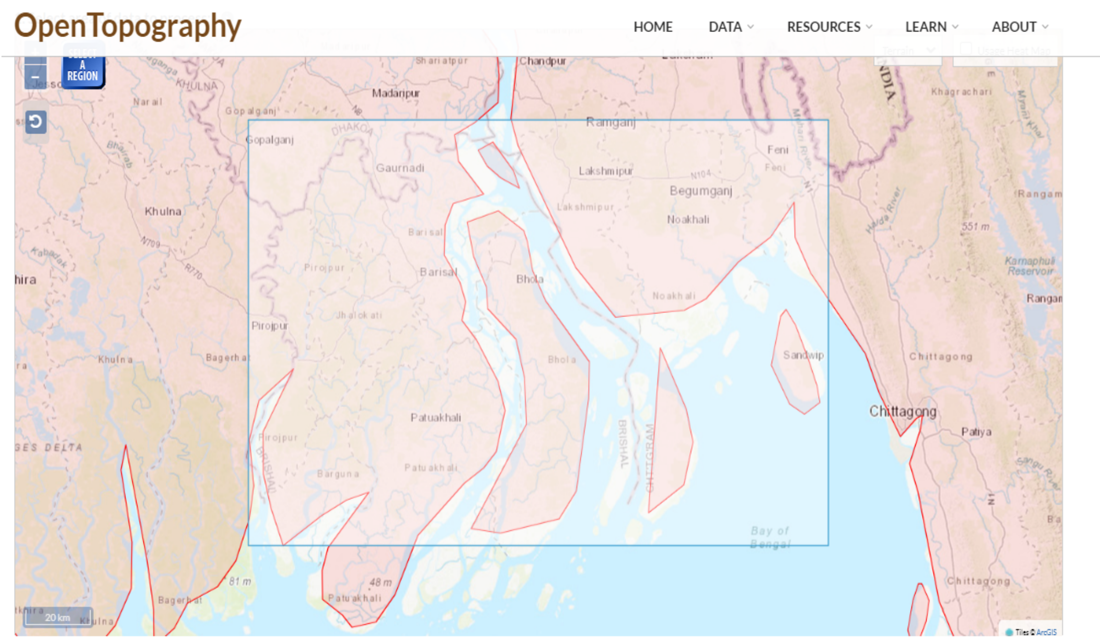
[OpenTopography - Copernicus GLO-30 Digital Elevation Model]



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



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



1. Coordinates

Horizontal Coordinates: WGS84 [EPSG: 4326]
Vertical Coordinates: EGM2008 [EPSG: 3855]
Units: meter

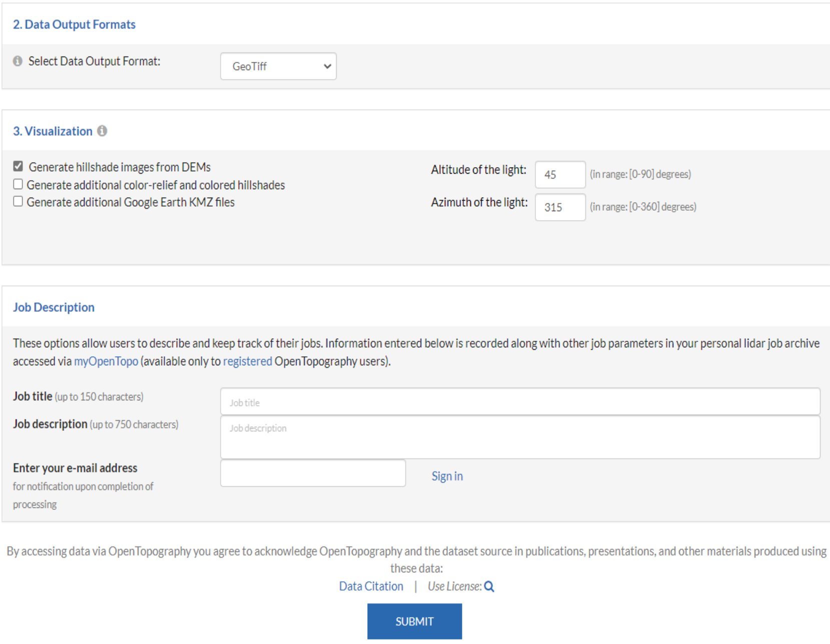
Data Selection Coordinates: ☐ Manually enter selection coordinates (in the horizontal coordinate system listed above)

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

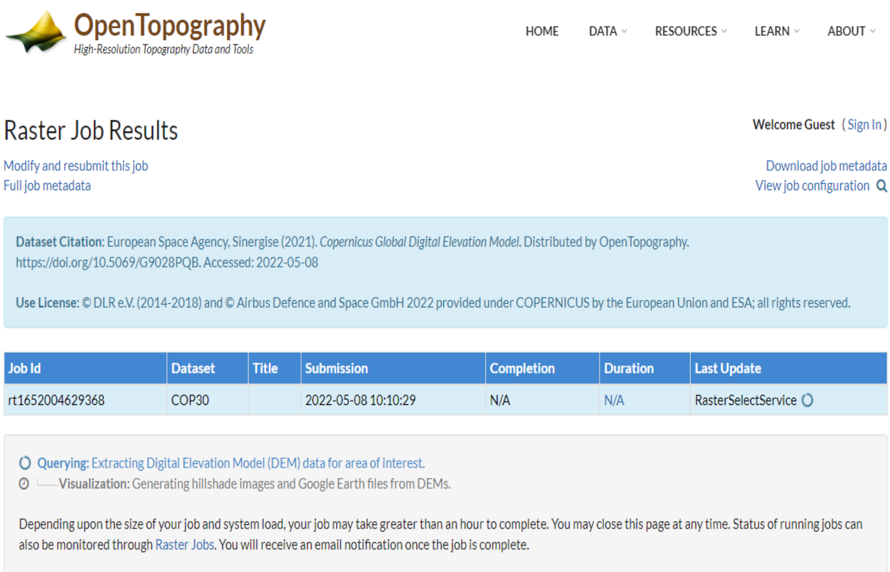
The selection area is approximately 21 127 km^2.

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

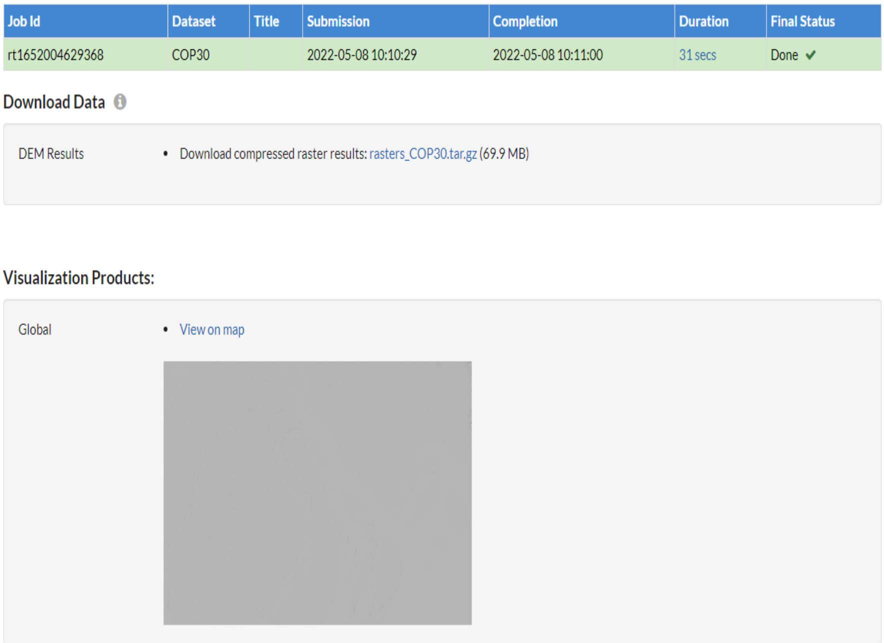
- Keep the output format in Geotiff. Fill in the necessary information in the Job Description section, then click on the Submit button.
  Note: you will be required an email address in order to submit the process. However, you will not need to create any account.



- Your .TIFF file is being generated



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



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. We present here two ways of doing this :

- by using a pre-arranged project (contained in the Github deposit),
- by building the animation from scratch.

By using the existing QGIS project

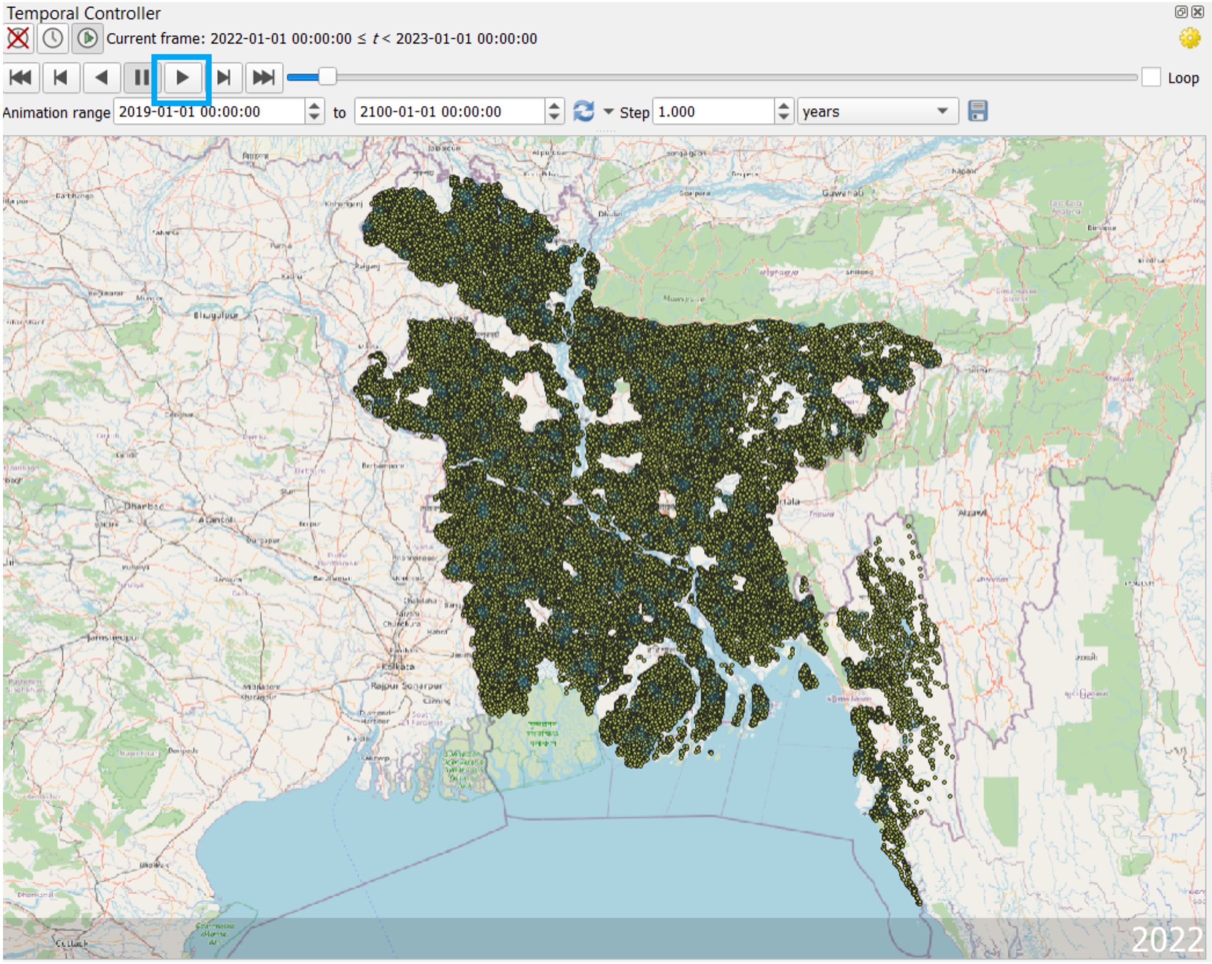
The deposit contains a pre-arranged QGIS project with parameters adjusted upstream. We will first explain which parameters to change to adapt the project to new data.

With the steps detailed above, two files are generated and will be required :

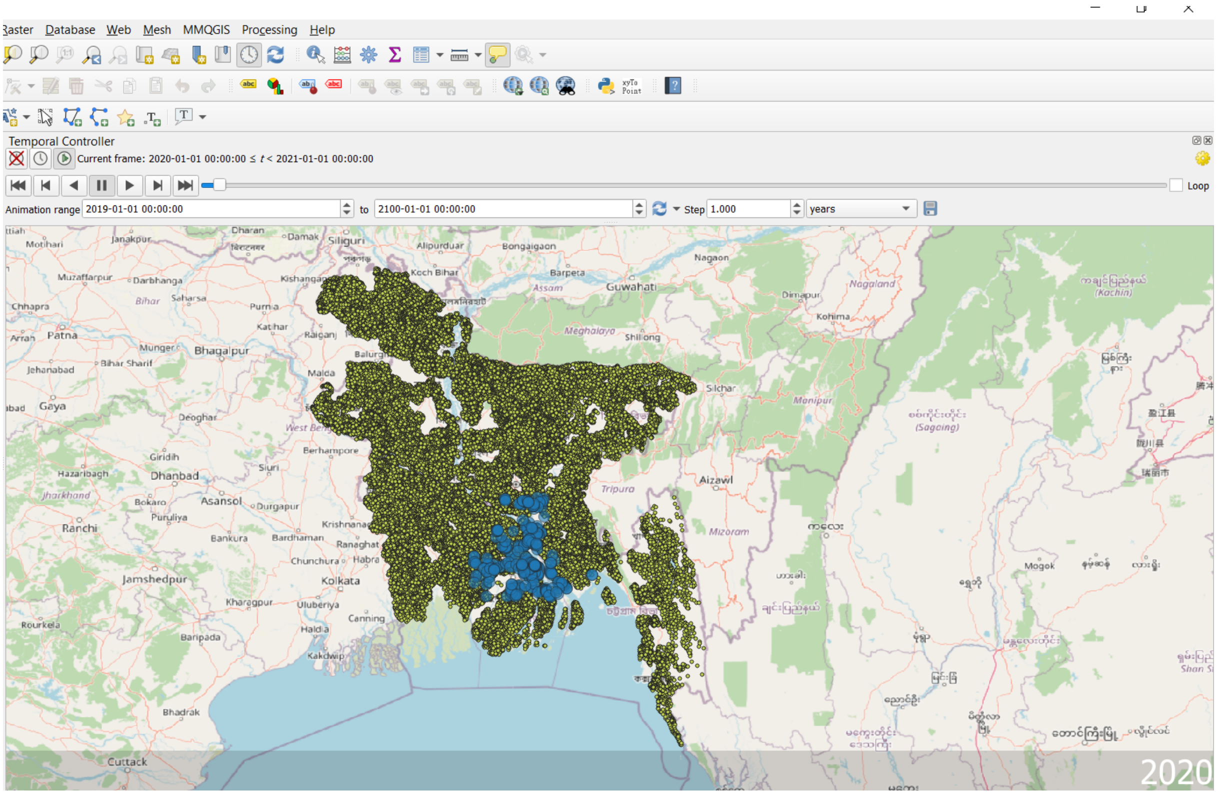
- 1 GeoJSON file with all schools in a desired area associated with their coordinates
- 1 csv file with all flooded schools associated with their coordinates and their flood year

Once the QGIS project is launched, you will have to change these two data sources. Then you will have to focus on the desired area. Schools are normally represented in this zone.

The last step is to click on the Play Button (see just below).



In yellow are represented all the schools, whereas flooded schools appear in blue as the years go by.



Without using the existing QGIS project

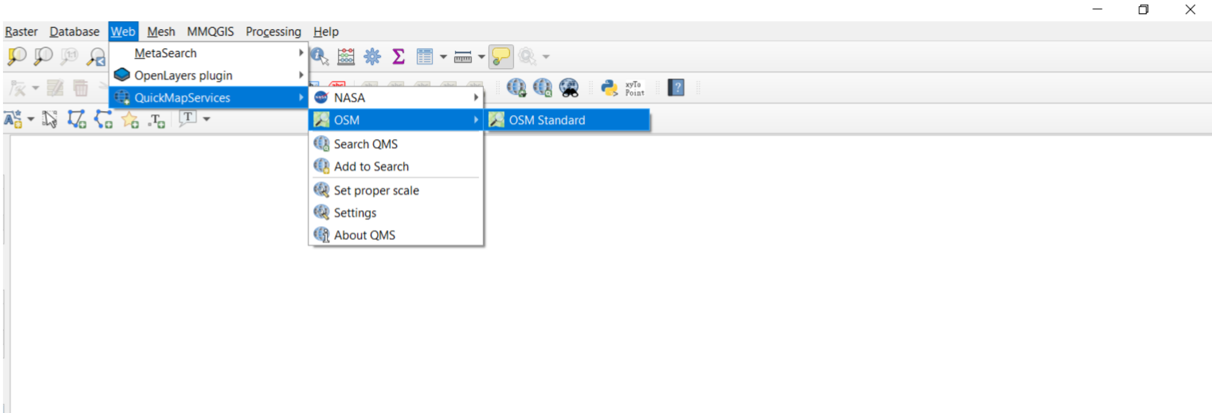
Two files are required to obtain the result of the first case:

- 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)

Once the QGIS latest version is installed and launched, you will have to display the world map in the background. To do this :

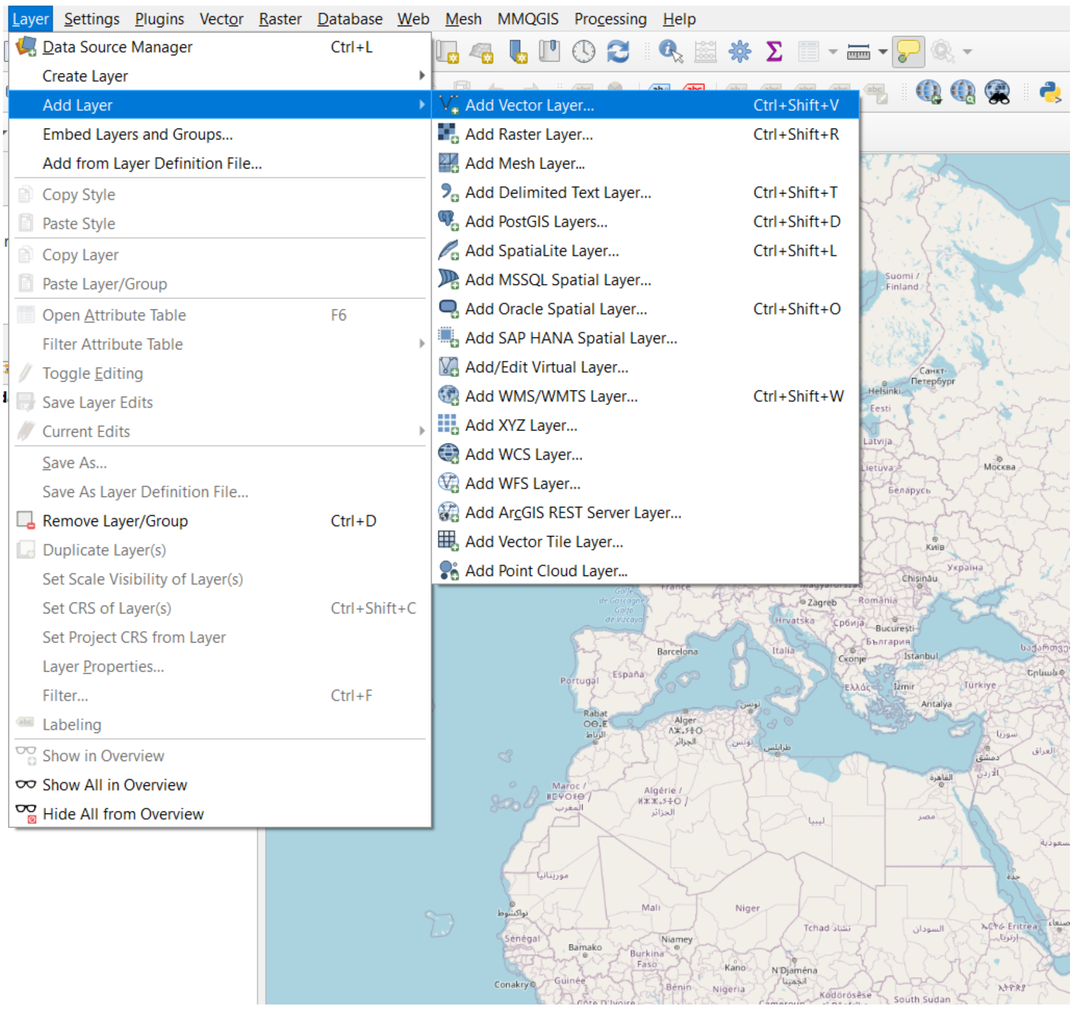
- Install the plugin “QuickMapServices” in the *plugin* tab

- 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 the the csv lawer 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.

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