MAPPING THE HUMAN AND ECONOMIC RISKS LINKED TO THE SEISMIC ACTIVITY IN THE WORLD

LETAILLEUR Marine, SCHWINDENHAMMER Marc

SUMMARY

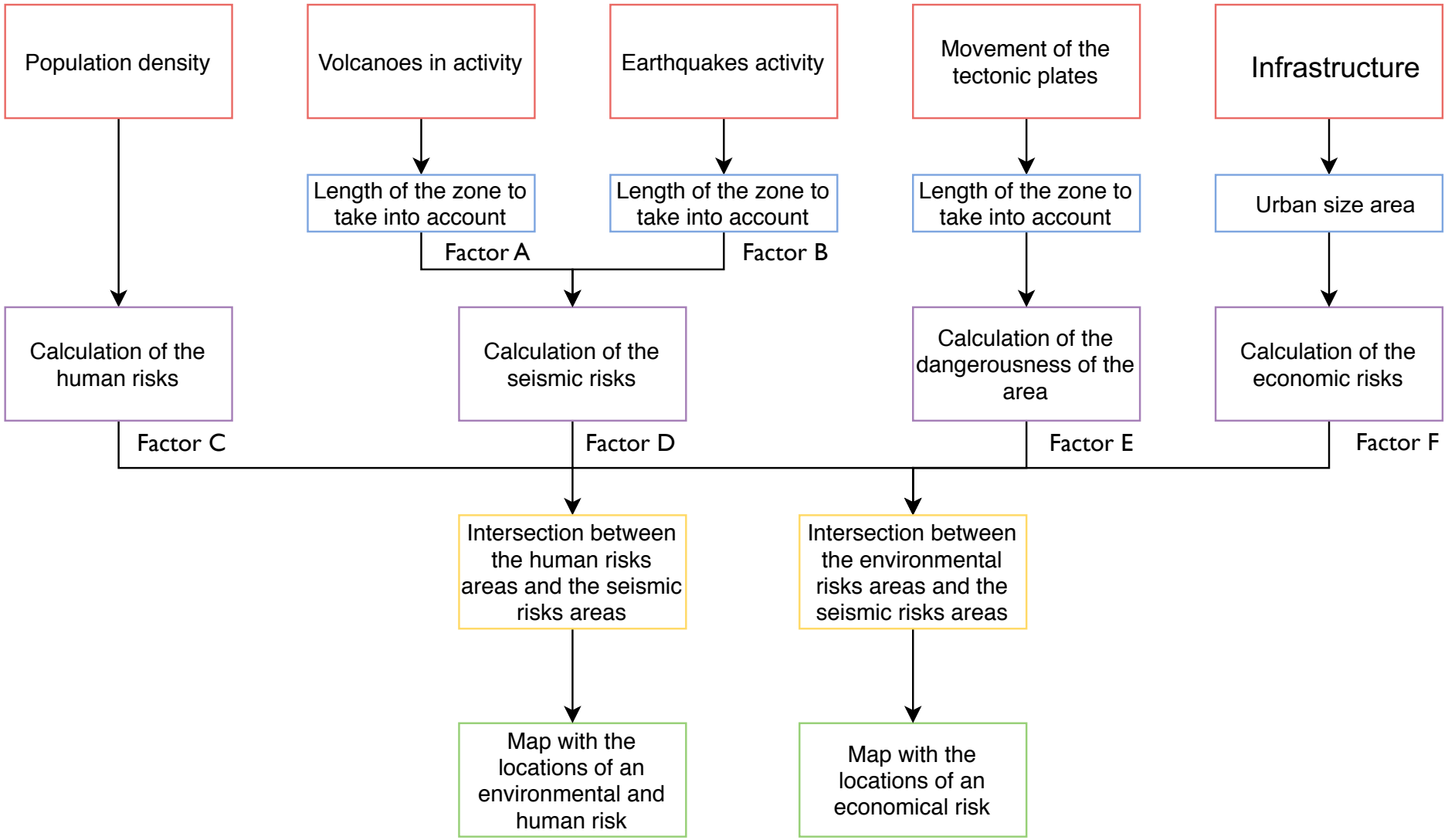
- Why the study,
- How we work on the study,
- Data,
- Code Presentation,
- Results.

WHY STUDYING THE SEISMIC RISKS ?

- Every year around 60 volcanoes go into eruption, and we have between 500 000 and 1 millions earthquakes.
- Sources have estimated that since the year 1500, volcanoes have killed about 280,000 people.

⇒ It is very difficult to impossible to predict future earthquakes or eruptions : we can only study the areas at most risks

HOW WE DECIDED TO STUDY THE RISKS



LETAILLEUR Marine, SCHWINDENHAMMER Marc

DATA USE

- We use existing map from ArcGIS Pro, to create the final map of our project.
- All this map were layer data. We do some treatment to convert the useful data for us into raster we can assemble to obtain the final map.

WHERE OUR DATA COME FROM ?

EARTHQUAKES :

- LIVING ATLAS: "Major Earthquakes since –2501BCE"
- LIVING ATLAS: "Recent Earthquake "

VOLCANOES :

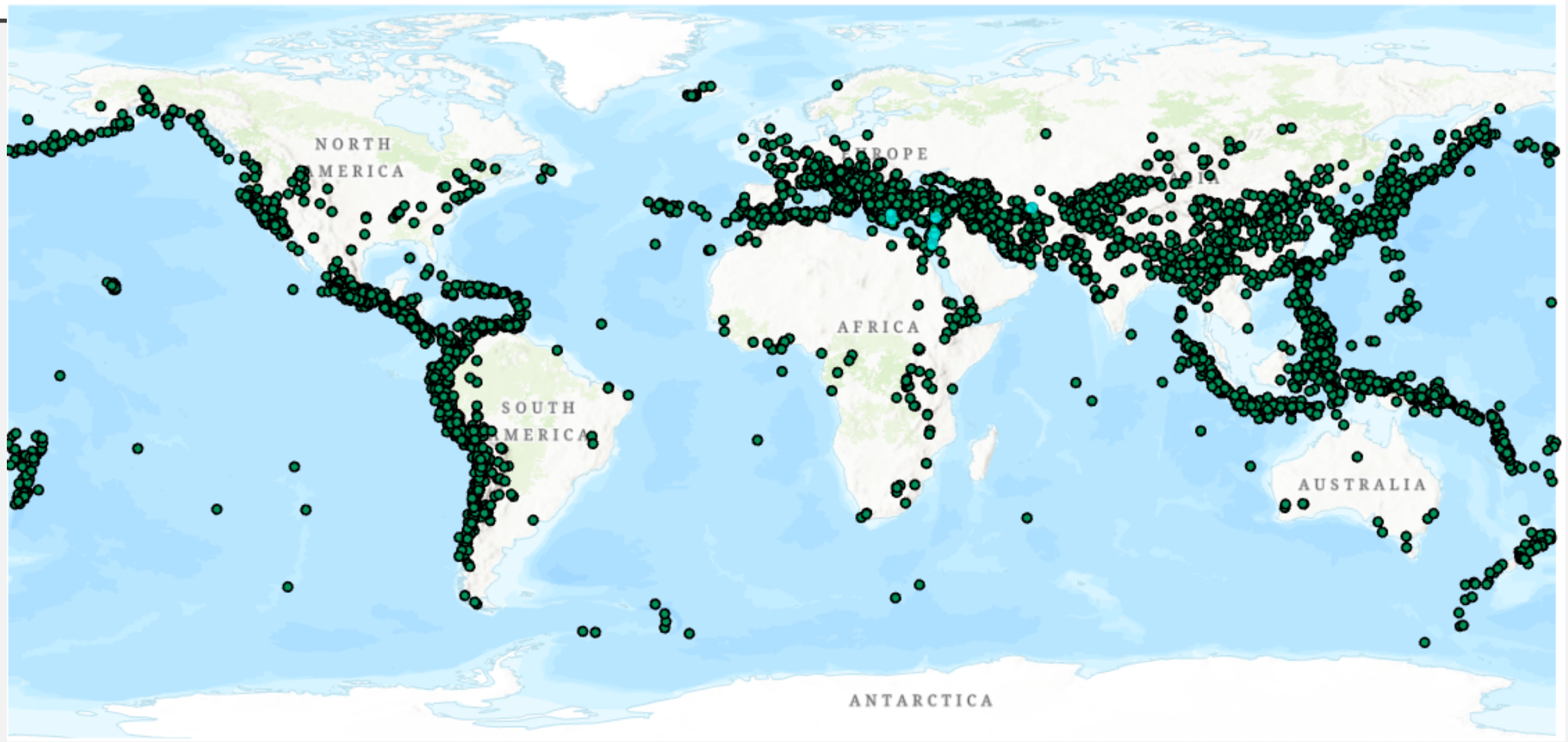
- LIVING ATLAS : "Significant Volcanic Eruptions"

POPULATION DENSITY AND POVERTY :

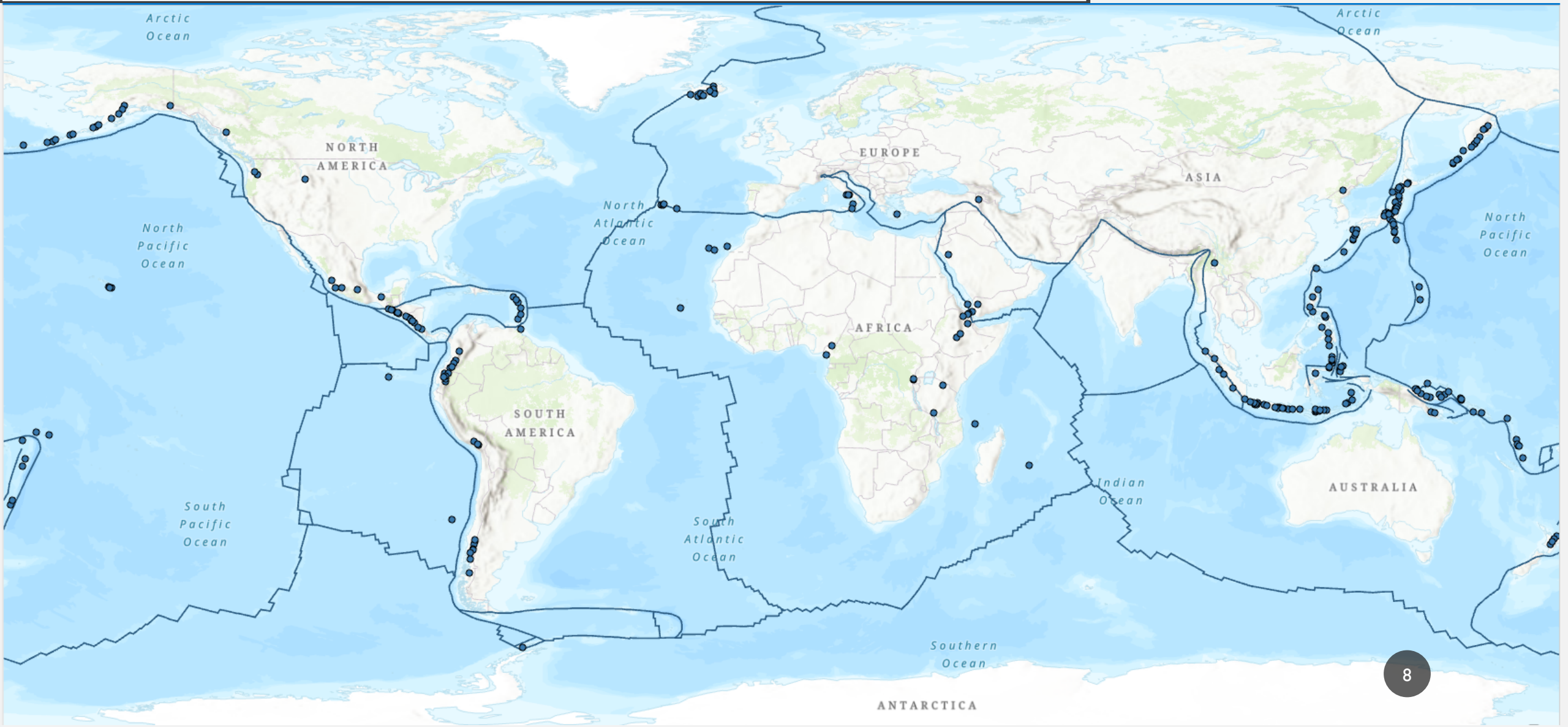
- SOCIOECONOMIC DATA AND APPLICATIONS CENTER (SEDAC)
- Population Density from 2020
- Urban size area

$\Longrightarrow$ We tried to take only data from verified sources

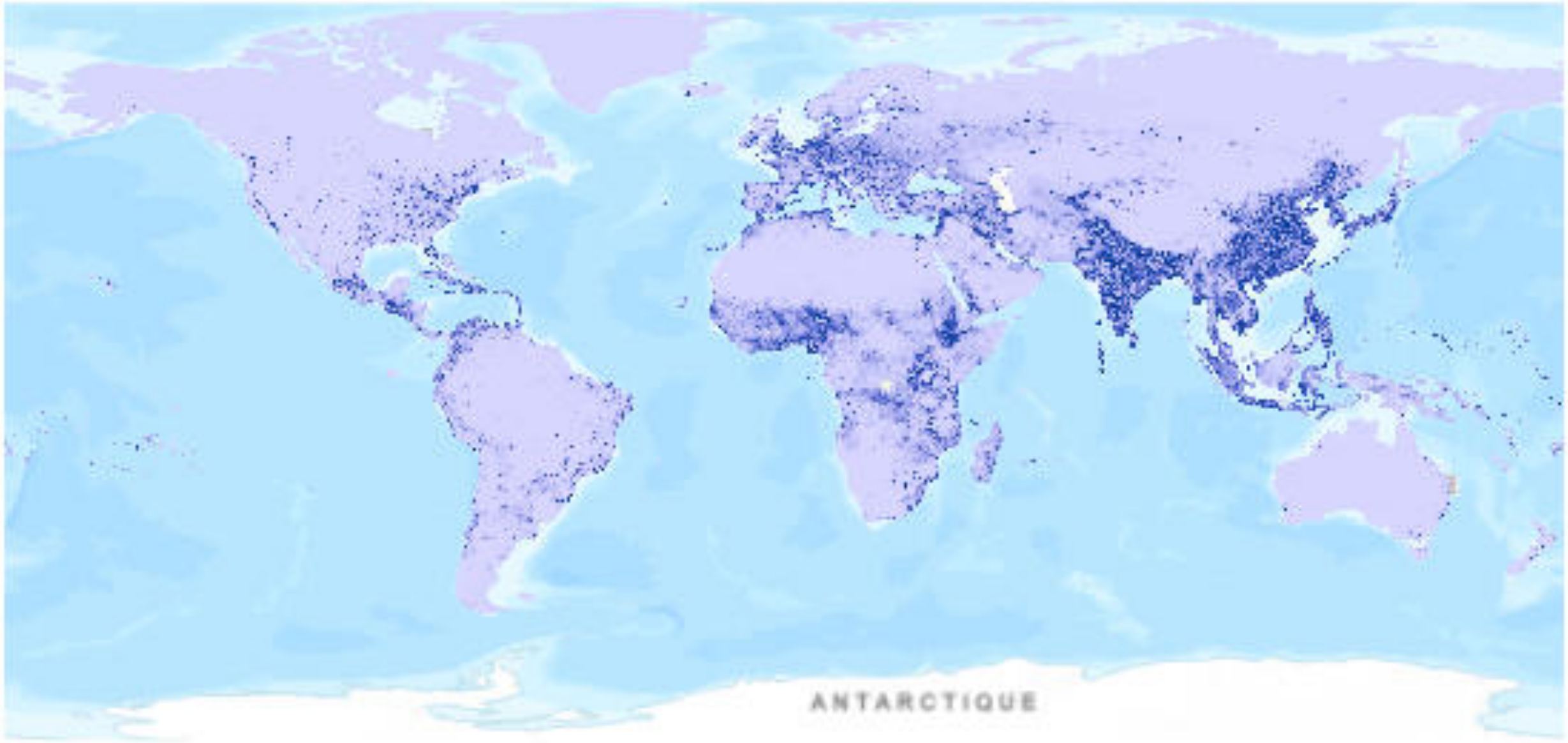
MAJOR EARTHQUAKES MAP



VOLCANOES AND TECTONIC PLATE MAP



POPULATION DENSITY MAP



HOW WE STUDIED THE VOLCANIC RISKS

Volcanic Explosivity Index (VEI) already in the data.

Relative measure of the explosiveness of volcanic eruption.

VEI	Ejecta volume	Classification	Description	Plume	Frequency
0	< 10,000 m³	Hawaiian	Effusive	< 100 m	constant
1	> 10,000 m³	Hawaiian / Strombolian	Gentle	100–1000 m	daily
2	> 1,000,000 m³	Strombolian / Vulcanian	Explosive	1–5 km	weekly
3	> 10,000,000 m³	Vulcanian / Peléan	Catastrophic	3–15 km	few months
4	> 0.1 km³	Peléan / Plinian	Cataclysmic	10–25 km	≥ 1 yr
5	> 1 km³	Plinian	Paroxysmic	20–35 km	≥ 10 yrs
6	> 10 km³	Plinian / Ultra-Plinian	Colossal	> 30 km	≥ 100 yrs
7	> 100 km³	Ultra-Plinian	Mega-colossal	> 40 km	≥ 1,000 yrs
8	> 1,000 km³	Supervolcanic	Apocalyptic	> 50 km	≥ 10,000 yrs

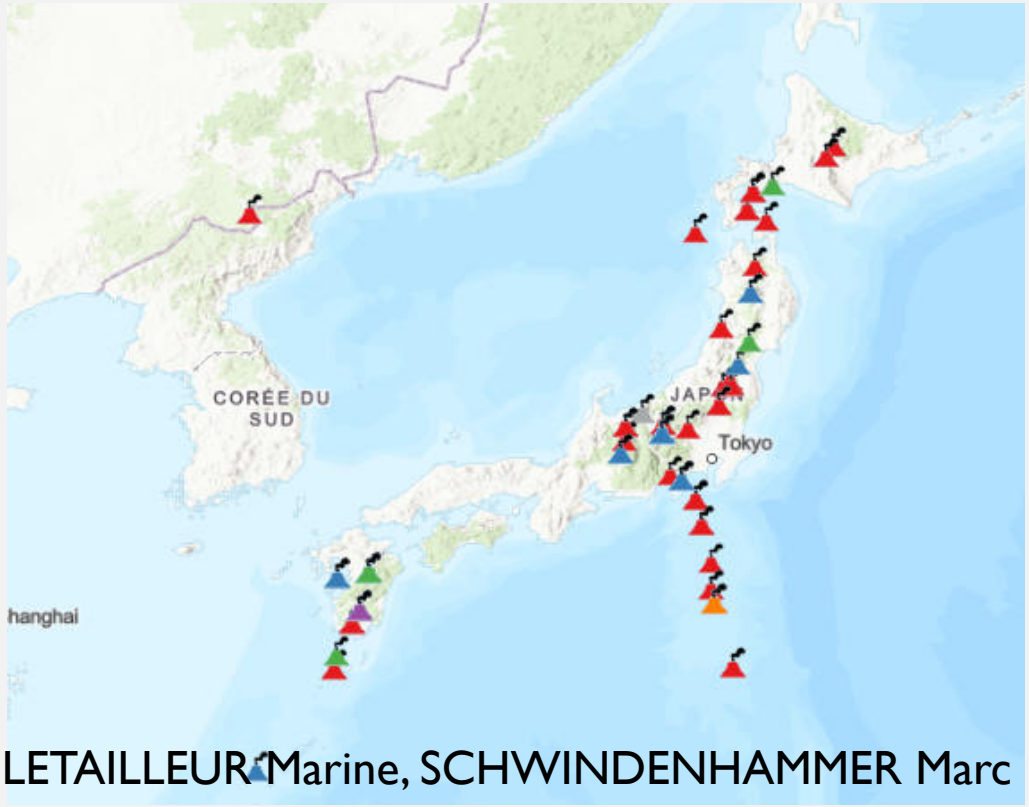
```
def DistanceInsertion(name_table, name_column):
    expression = "getDistanceVEI(!VEI!)"
    codeblock = """
def getDistanceVEI(VEI):
        if VEI == 1:
            return "1 Kilometers"
        elif VEI == 2:
            return "5 Kilometers"
        elif VEI == 3:
            return "15 Kilometers"
        elif VEI == 4:
            return "25 Kilometers"
        elif VEI == 5:
            return "35 Kilometers"
        elif VEI == 6:
            return "40 Kilometers"
        elif VEI == 7:
            return "50 Kilometers"
    """
```

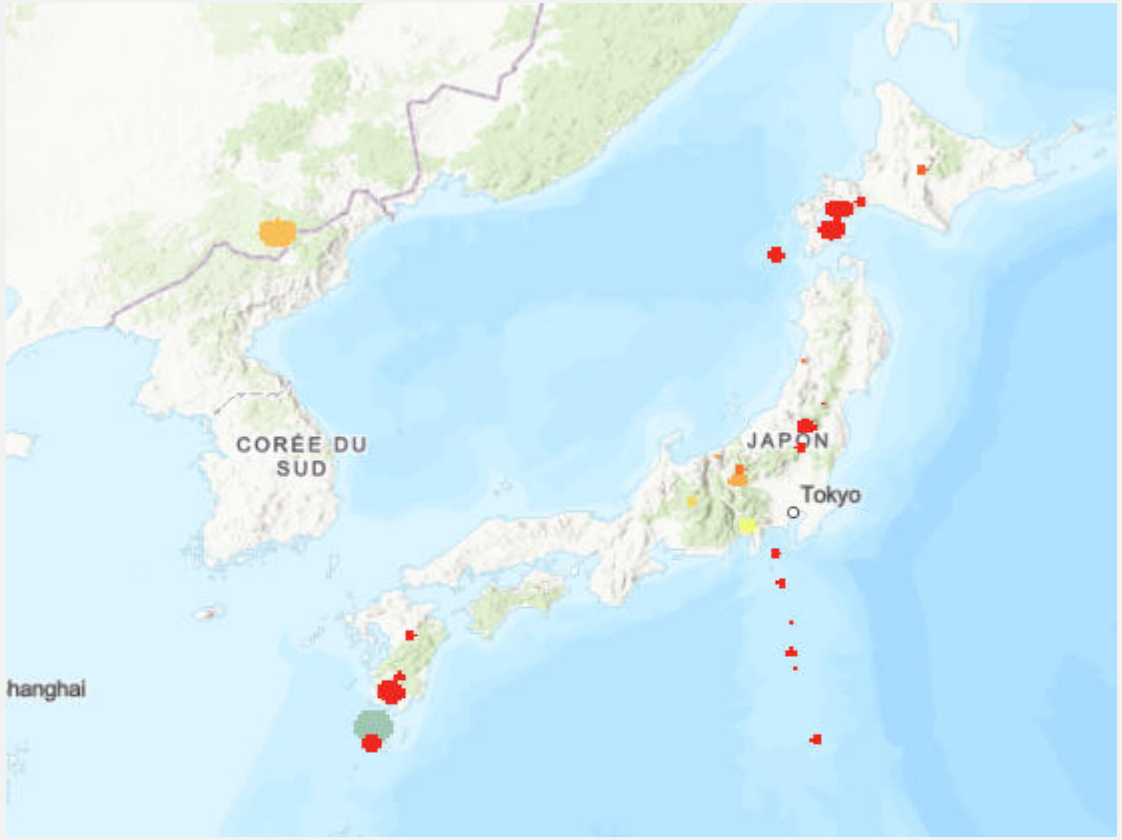
```
def NextEruption(name_table,name_column):
    expression = "getNextEruption(!Year!,!VEI!)"
    codeblock = """
def getNextEruption(Year, VEI):
        if VEI == 1:
            return (2020 - Year - 1/365)
        if VEI == 2:
            return (2020 - Year - 1/52)
        if VEI == 3:
            return (2020 - Year - 1)
        if VEI == 4:
            return (2020 - Year - 10)
        if VEI == 5:
            return (2020 - Year - 100)
        if VEI == 6:
            return (2020 - Year - 100)
        if VEI == 7:
            return (2020 - Year - 1000)
    """
```

HOW WE STUDIED THE VOLCANIC RISKS

ADDITION WITH FACTOR GIVEN BY THE USER :

- ELEVATION LAYER
- POTENTIAL NEXT ERUPTION LAYER





LETAILLEUR Marine, SCHWINDENHAMMER Marc

HOW WE STUDIED THE SEISMIC RISKS

- Two data set, one for the major earthquakes in History and one for the recent earthquakes.
- For the major earthquakes in History, I first take only the event where we have the intensity of the earthquake, next I select by year of occurrence, and then I look at the Kernel density of event in the world.
- For the recent earthquakes, I simply do an IDW to see the actual present of risk for earthquake.

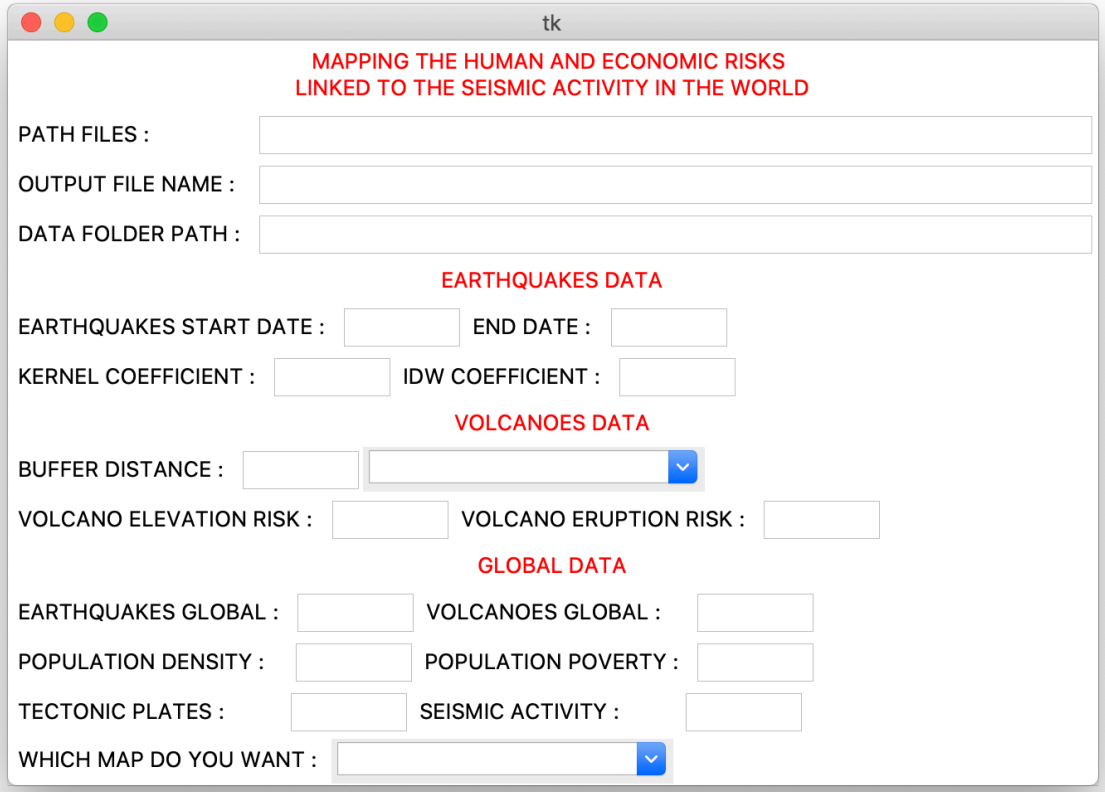
HOW WE STUDY THE TECTONIC PLATES RISKS

- Observation: most of the earthquakes and volcanoes are located around the tectonic plates

FINAL RESULTS

LETA

CODE PRESENTATION



LETAILLEUR Marine, SCHWINDENHAMMER Marc

CONCLUSION AND PERSPECTIVES

- Idea to continue the project:
  - For the recent earthquake, use data from multiple station to have a better view of the recent earthquake in the world,
  - Add more criteria to have the most optimum map to see the risk from seismic and volcanic activity.
- Challenge encounter in the project:
  - Resolution of error in the use of the build-in function,
  - Finding the best way to highlight the data,

THANK YOU FOR YOUR ATENTION