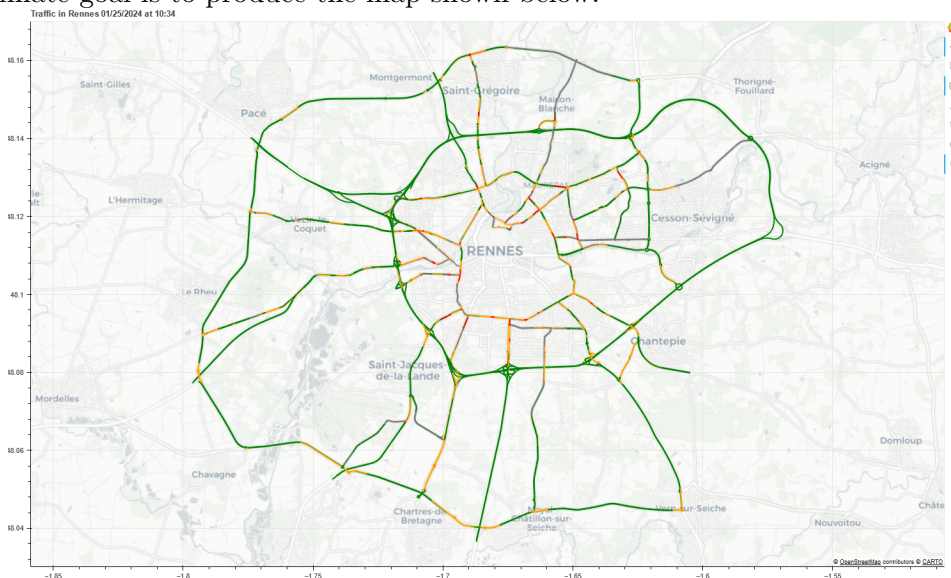


Exercises Course 4: Bokeh - Maps

Download the source file TD4.zip from Moodle and extract it.

Exercise 1 : Road Traffic in Rennes Métropole

Rennes Metropole provides information about the road traffic density in a file `etat-du-traffic.json`. The ultimate goal is to produce the map shown below.



The code of this exercise must be done in the file `exercice1_source.py`. The archive provides a file `etat-du-traffic.json`, that can be used for all the tests.

When your code will be ready, the source code contains a function to update this file with real-time data.

Q1 - Open the `etat-du-traffic.json` file to analyze its content. It consists of traffic zones, where each "field" is described by the coordinates of a polyline (the street layout), and the traffic status in this area.

Q2 - In the provided `exercice1.py` file, write the function `"analyze_data"`. It takes as input the data contained in the json file. It produces a dataframe containing the following columns :

- **date** : Datetime field indicating the time of data collection.
- **location** : Denomination field indicating the name of the road.
- **traffic** : Traffic status indicating whether the road is free-flowing, heavy, congested, or unknown.
- **color** : Color associated with the traffic status (green for free-flow, orange for heavy, red for congested, grey for unknown).
- **x** : List of x coordinates of the polyline for each zone, converted to web format.
- **y** : List of y coordinates of the polyline for each zone, converted to web format.

For example, the produced dataframe begins like :

date	location	traffic	color	x	y
2024-01-25 10 :34 :00	Route départementale 34	freeFlow	green	[-183850.93, -183670.79, ...]	[6114325.49, ...]
2024-01-25 10 :34 :00	Route départementale 34	freeFlow	green	[-183549.48, -183668.95, ...]	[6114312.37, ...]

Q3 - Create a figure, large enough, with a map background. For the title, use the date of one of the records.

Plot lines corresponding to traffic zones using the `multi_line` tool. The color depends on the traffic.

Q4 - Create a `HoverTool` tool to display the street name on hover.

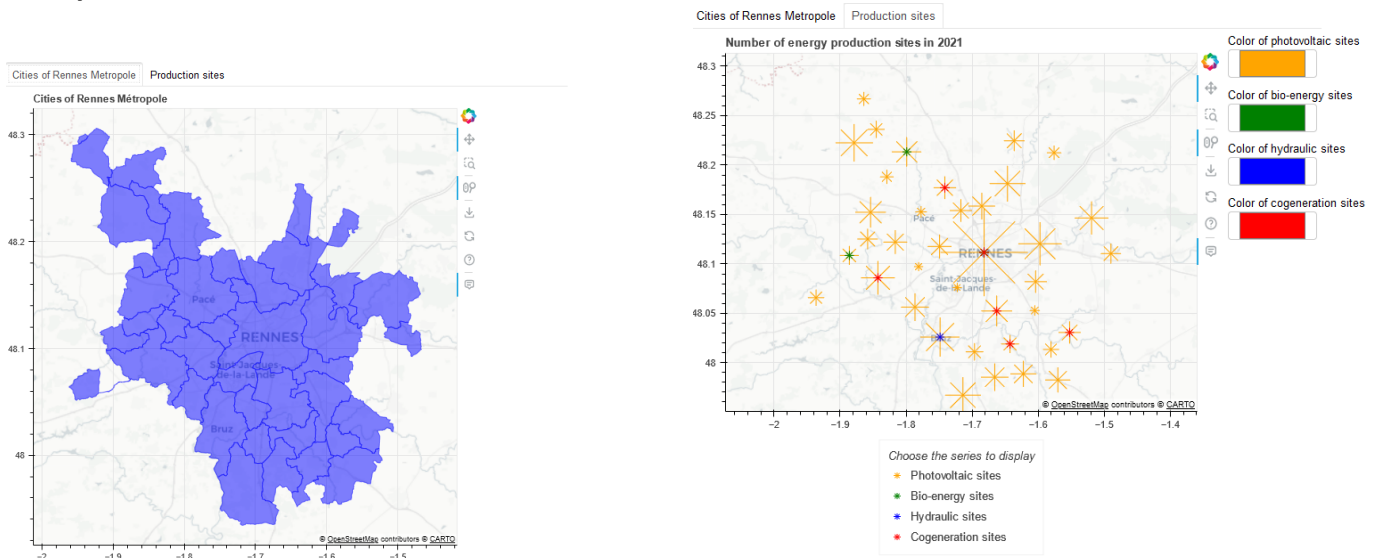
Exercise 2 : Energy Production in Rennes Métropole

The file `production-annuelle.json` contains information about the production of different types of energy in the cities of Rennes Métropole for the years 2011 to 2021. This file also contains geographical information about Rennes Métropole. Among these data, we focus on the number of production sites for each city, for the year 2021, and for 4 types of energy : photovoltaic, bio-energy, hydraulic, cogeneration.

The first part of the work is to extract the necessary data from the `production-annuelle.json` file, to keep only the necessary data. This is done by the script `exercice2_data_analysis.py`, which is given here for reference (as it is a good example of raw data processing!). The result of this script is in the file `production_2021.json`. This is the file you will use for all exercises. Note : the data preparation script has already converted the GPS coordinates, so you can use them directly to plot graphs.

The goal of this exercise is to create a Bokeh web page, consisting of 2 graphs in two tabs.

The first tab represents "patches" of the cities of Rennes Métropole, with the name of the city displayed on hover. The second tab represents the cities that have each category of production sites. A legend allows choosing the type of energy displayed. The size of the displayed asterisks is relative to the number of sites in the city.



The code of this exercise must be done in a new file : `exercice2.py`.

- Q1** - In a first tab, create a `patches` type graph that allows visualizing the cities of Rennes Métropole on a map background with a transparency of 0.5.
- Q2** - Add a hover tool to display the name of the city.
- Q3** - In the second tab, create an `asterisk` type graph to visualize, at the point of each city, an orange point, the size of which corresponds to the number of photovoltaic sites in that city.
- Q4** - Similarly, create three series of asterisks for the other energy sources.
- Q5** - Add a clickable legend to hide certain series. Use "http://docs.bokeh.org/en/latest/docs/user_guide/styling/plots.html#location" to place it under the graph.
- Q6** - Apply a hover tool to see the details of the cities.
- Q7** - Some cities contain only one site and are barely visible. Modify the size of the points to be relative to the number of sites but at least equal to 10. For example : $\text{size} = \text{nbsites} * 0.5 + 10$.
- Q8** - Add color selectors to choose the color of each item. Arrange them in a column on the right.