

Module 61-12: Option GIS-Python

Introduction Dev

hes.
SO
business.

Jean-Paul Calbimonte

School of Management

Bachelor of Science HES-SO (BSc) in Business
Information Technology



> GIS/Python: Geographic Information Systems



- Time: Fridays, 12:45-16:00
- Lecturers: Jean-Christophe Loubier, Jean-Paul Calbimonte

GIS Part

Dev Part

- Schedule: Dev Part:

- | | |
|---|---|
| <ul style="list-style-type: none">• 20.02 Python (JPC)• 27.02 GIS 1 (JCL)• 06.03 Shapely (JPC)• 14.03 GIS 2 (JCL)• 20.03 Pandas (JPC) | <ul style="list-style-type: none">• 27.03 GIS 3 (JCL)• 17.04 PostGIS (JPC)• 24.04 Leaflet + Web GIS (JPC)• 01.05 Web GIS 2 (JPC) |
|---|---|

- Online resources:

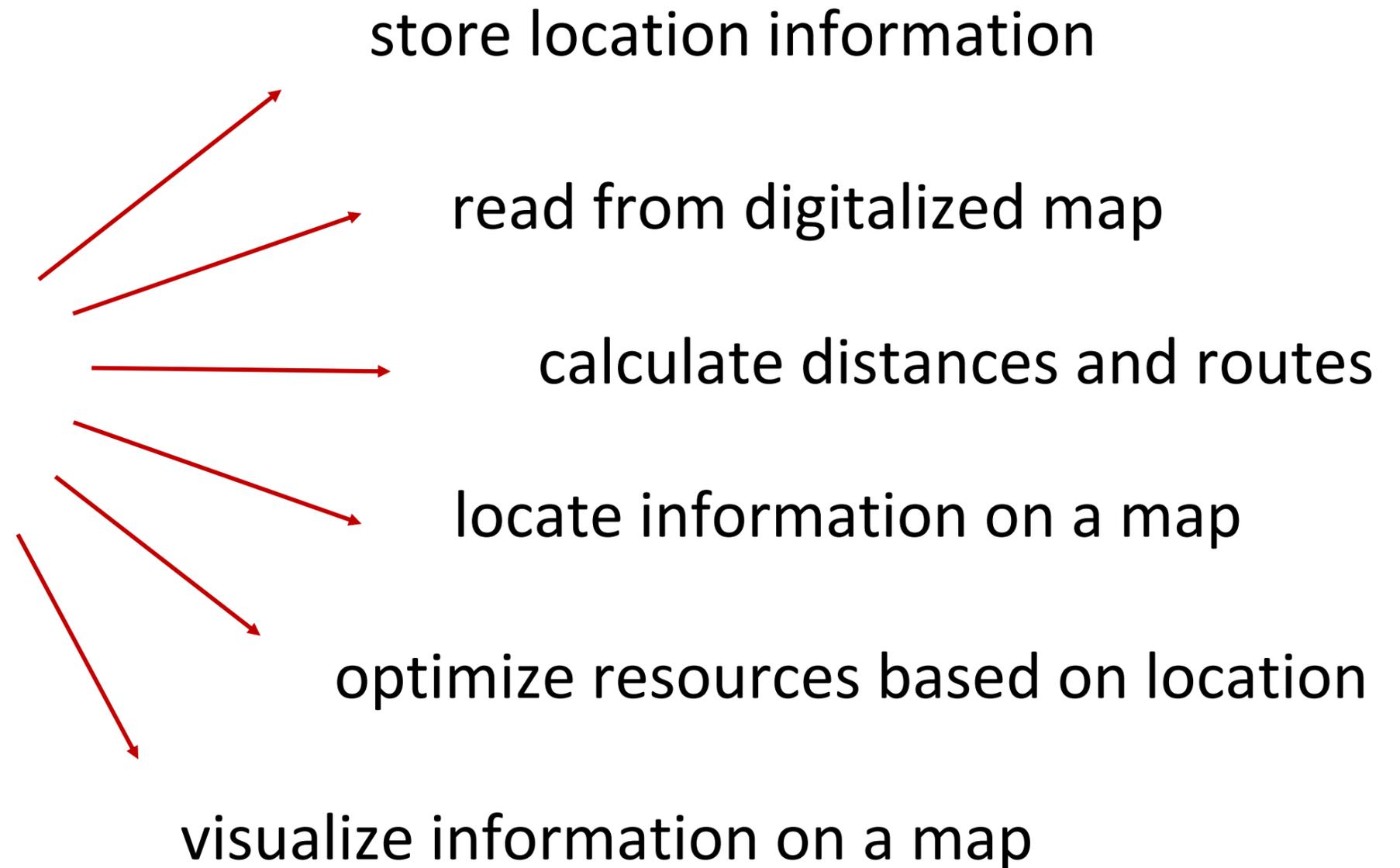


20_HES-SO-VS_GIS PYTHON

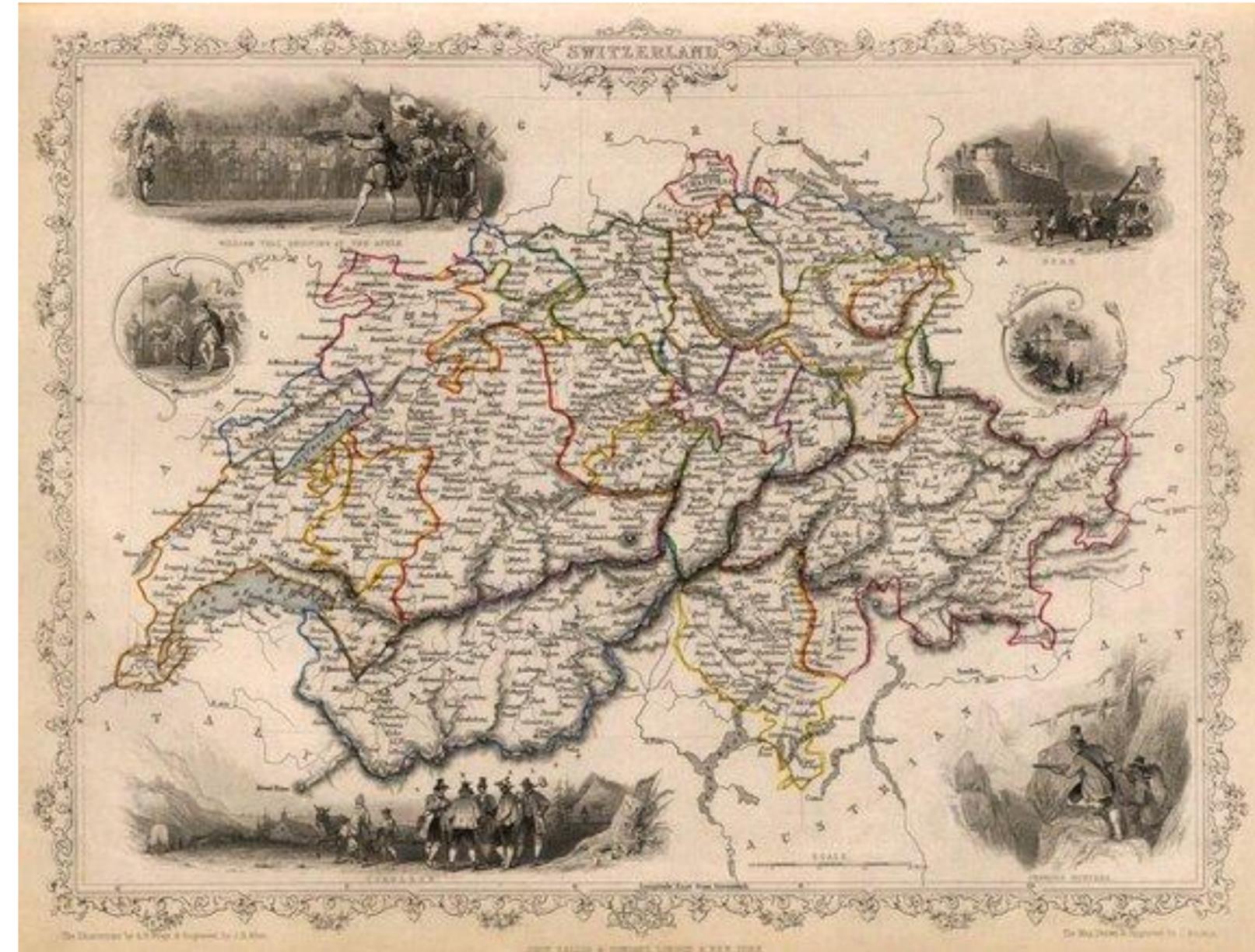
<https://cyberlearn.hes-so.ch/course/view.php?id=15330>

> GIS: Motivation

Why Geospatial data?



➤ GIS: Motivation

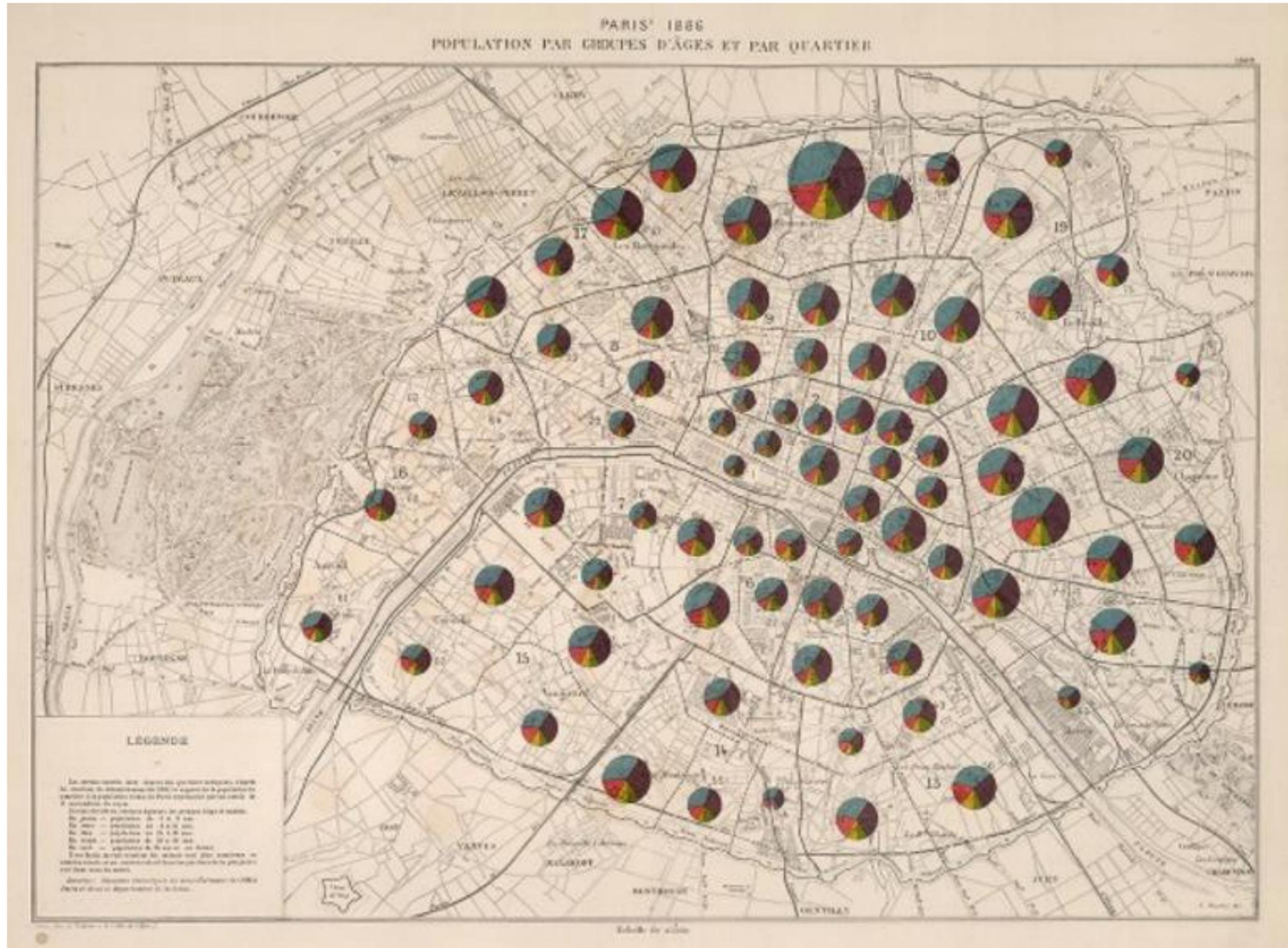


Geospatial information through the ages...

➤ Urban planning



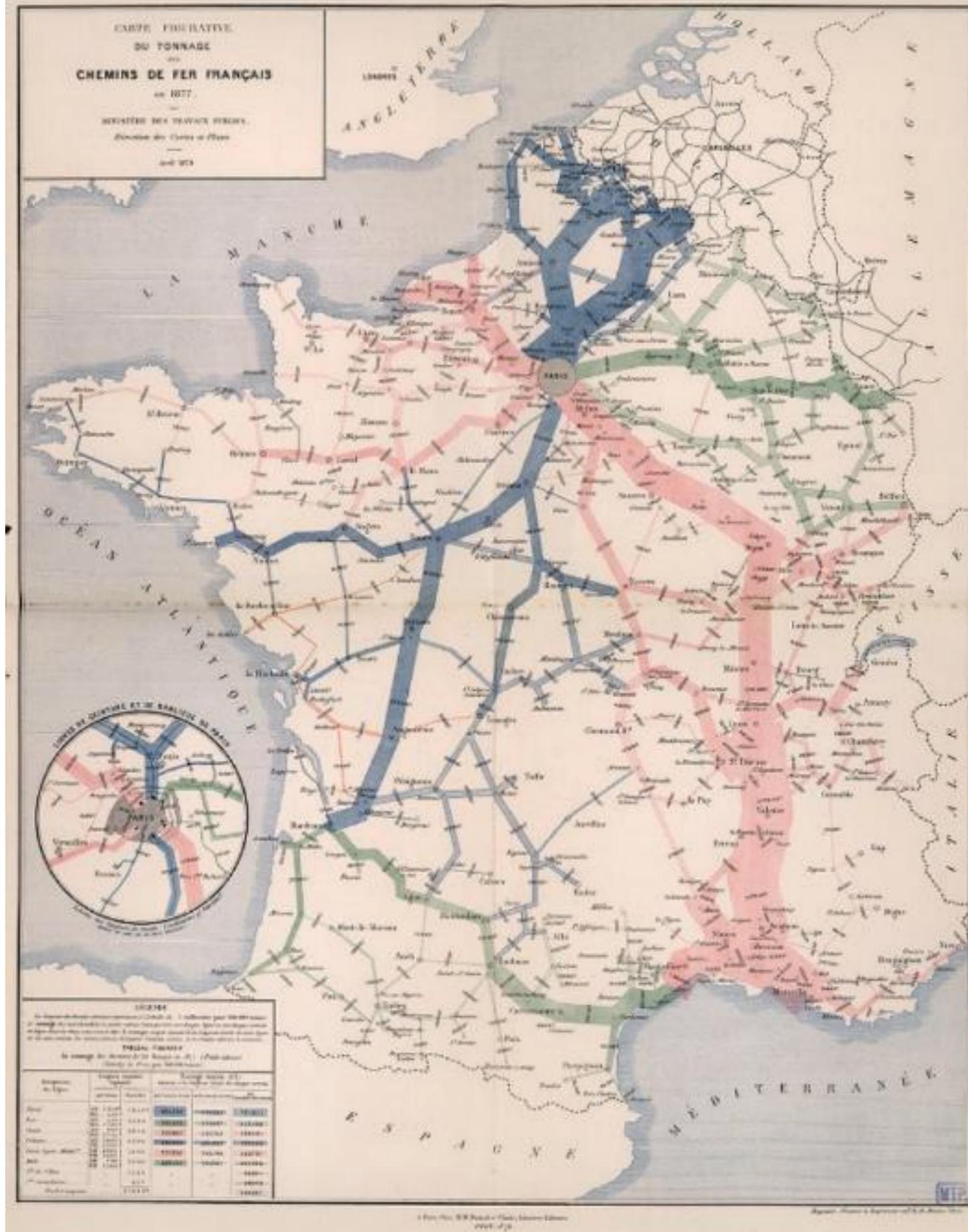
➤ Map visualization



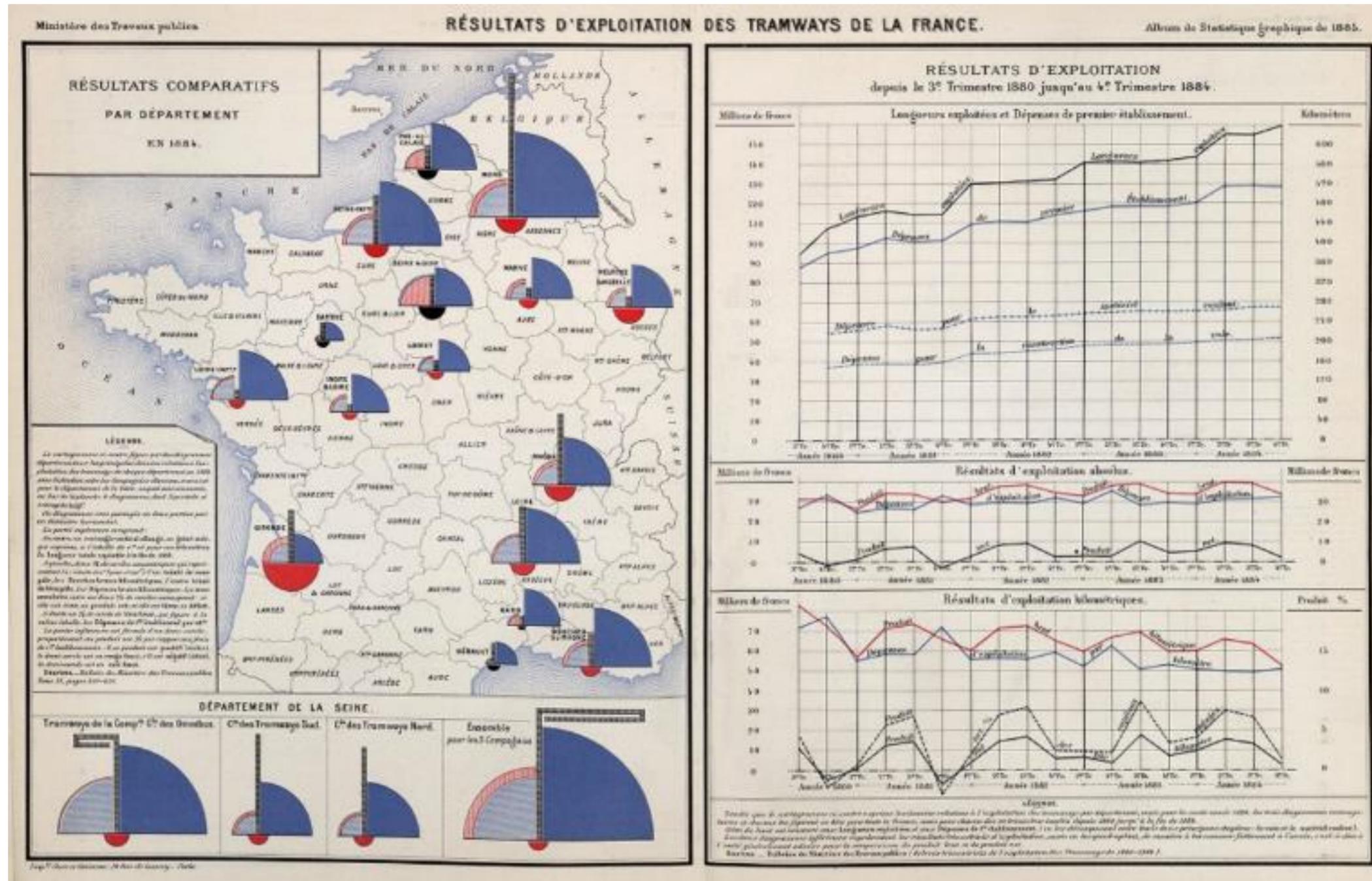
Paris 1886.
Population by age
group

➤ Map visualization

French railroad network. Cargo volumes. 1877

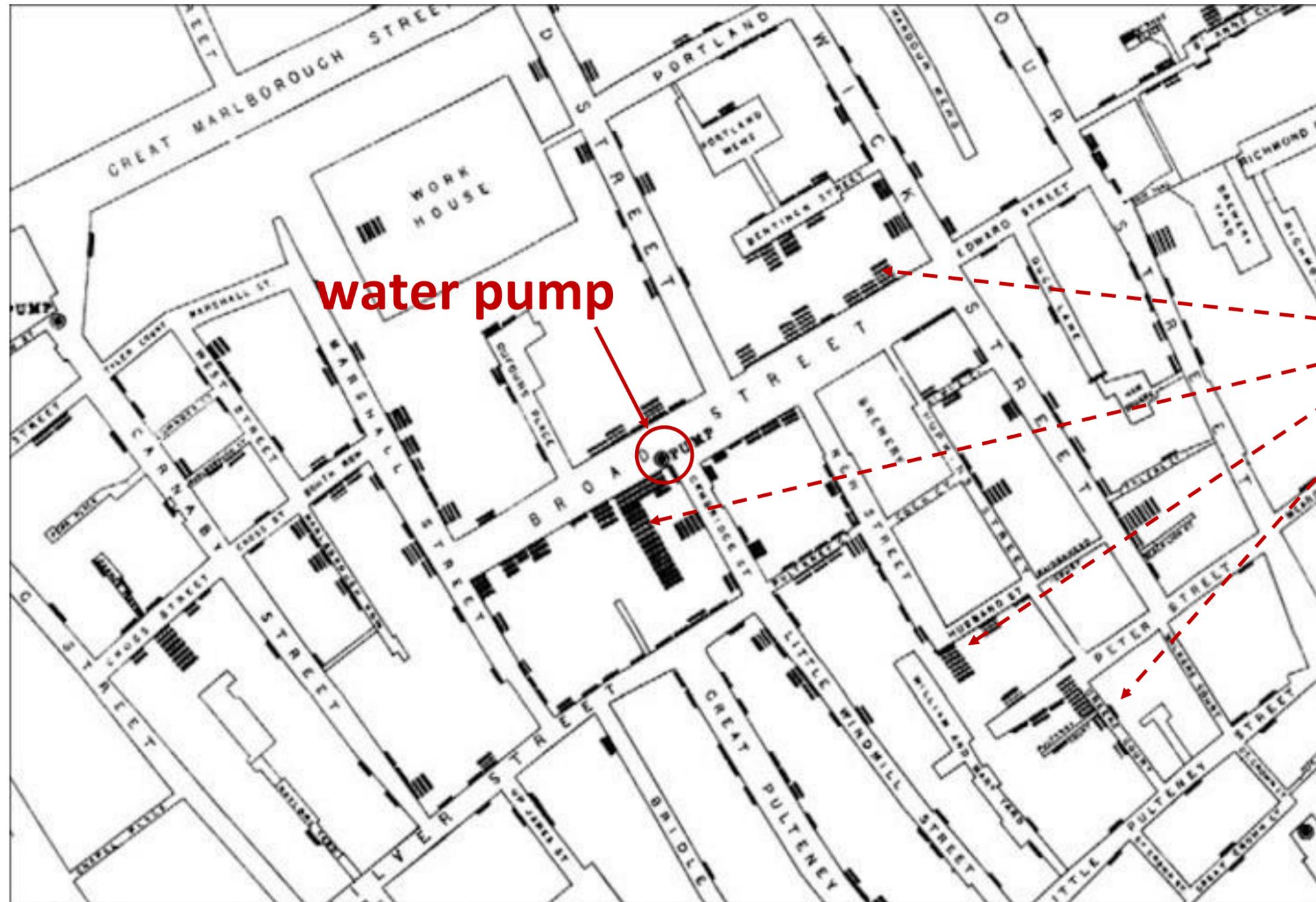


➤ Stats: Map visualization



French tramway
 exploitation
 statistics. 1886

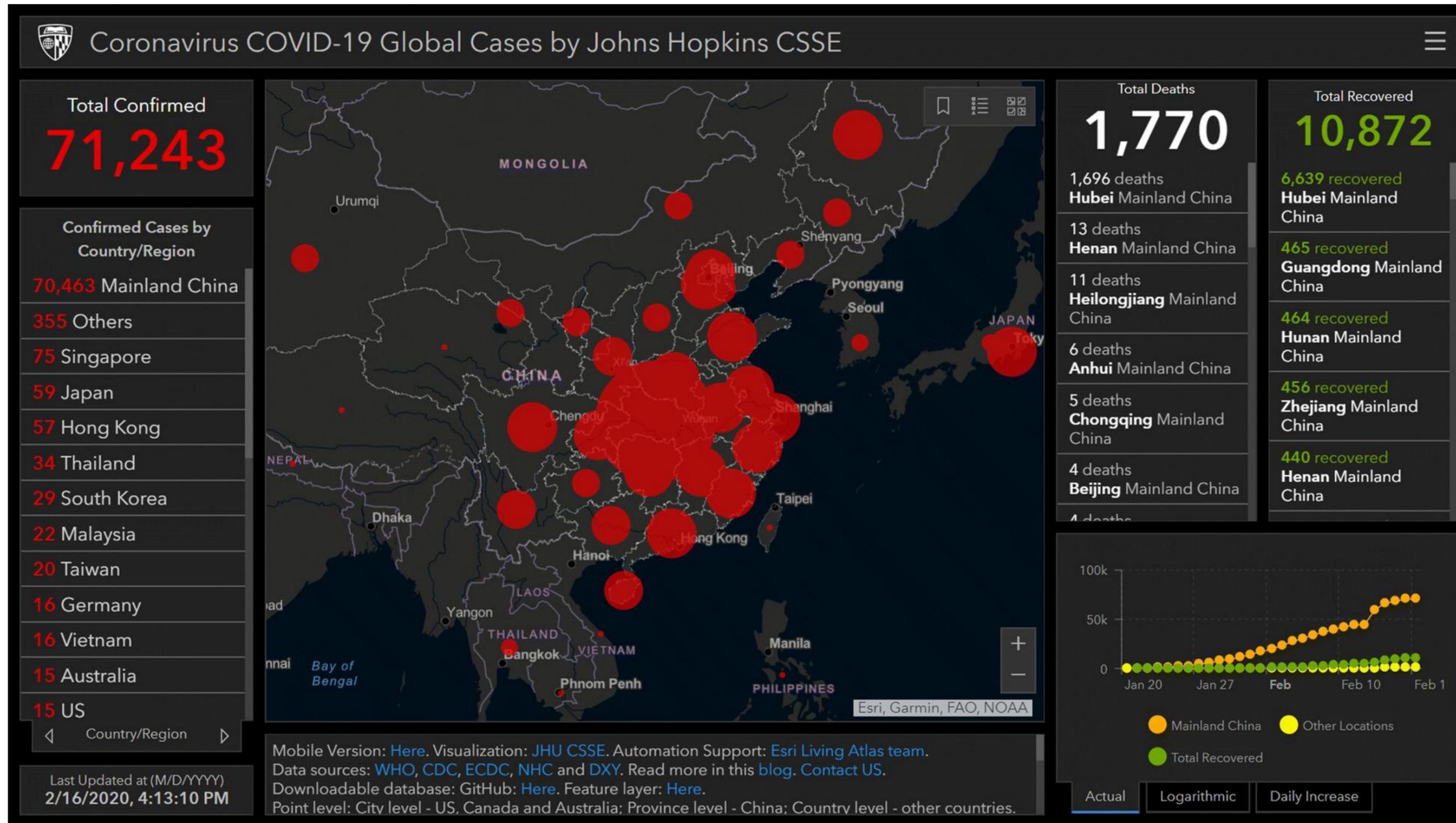
> Spatial Analysis



Geo-located deaths

Cholera deaths
John Snow, 1854

> Spatial Analysis



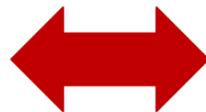
COVID-19,
 Johns Hopkins
 CSSE

> GIS: Geographic Information Systems

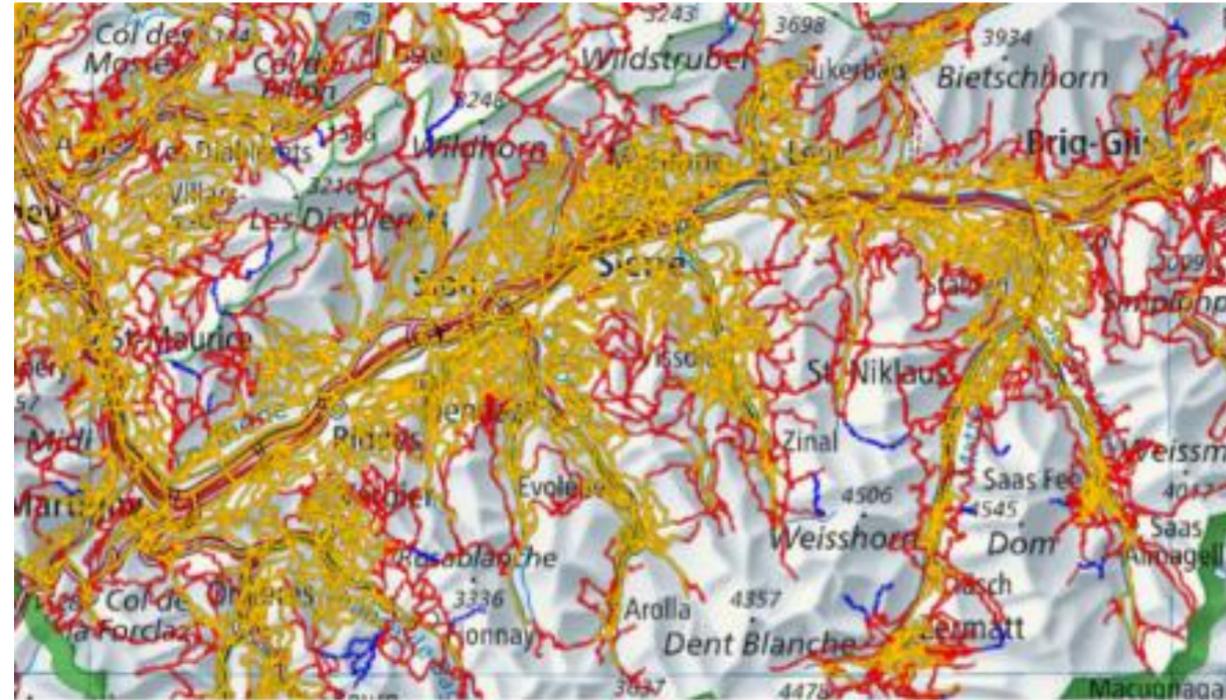


GIS: computer-based tools for **analysis**, **storage**, and **manipulation** of geographic information, usually in a **map**

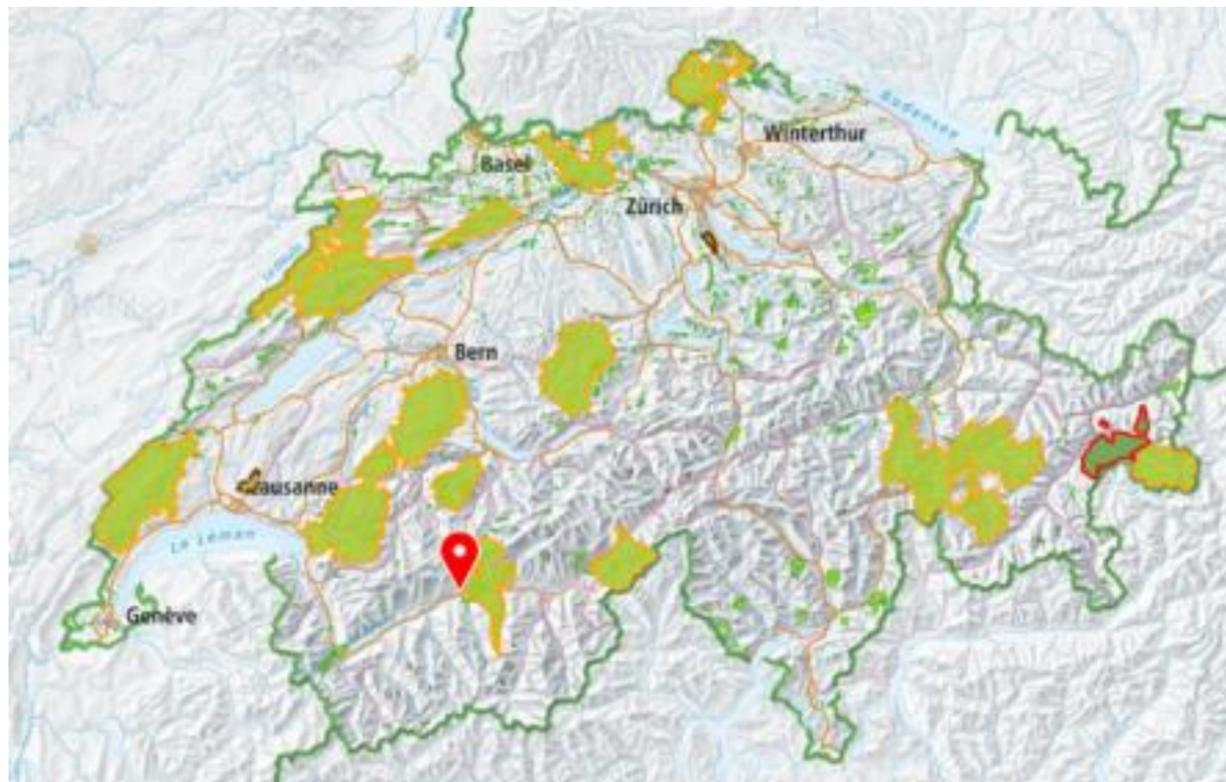
data
what



geography
where



what?
trekking trails



what?
natural parks

> GIS for developers



store/query geodata

- Create geographic data
- Manage geographic data
- Analyze geographic data
- Display geographic data

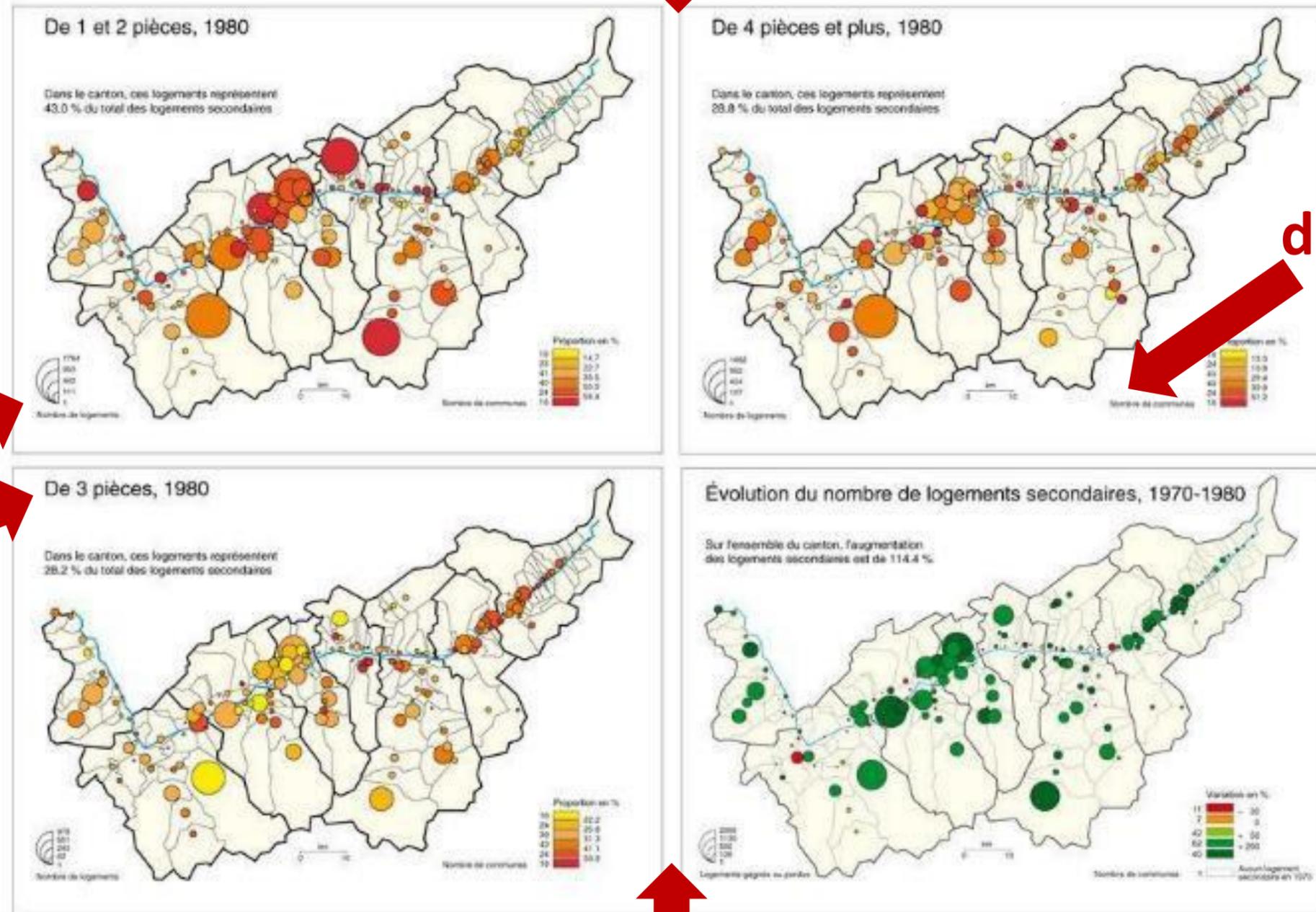
create geodata

create attributive data

create metadata

display maps

La taille des logements secondaires et l'évolution leur nombre



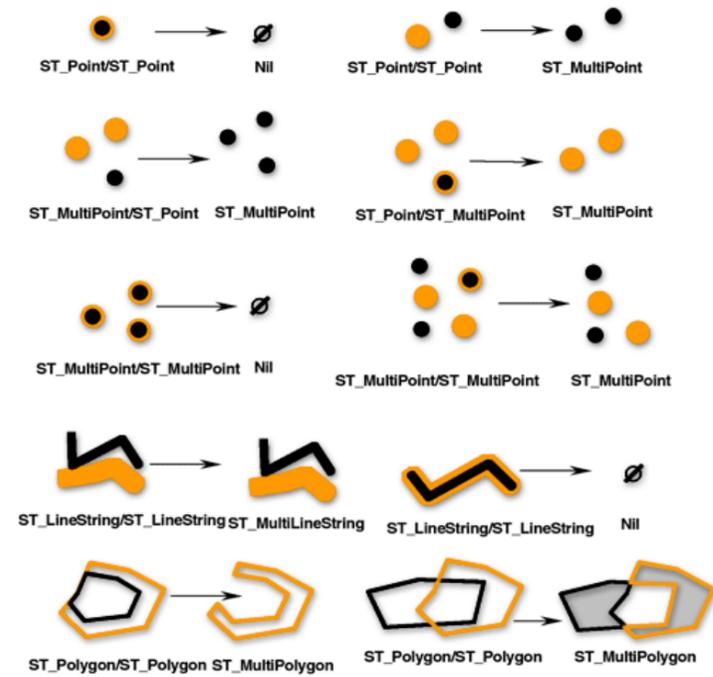
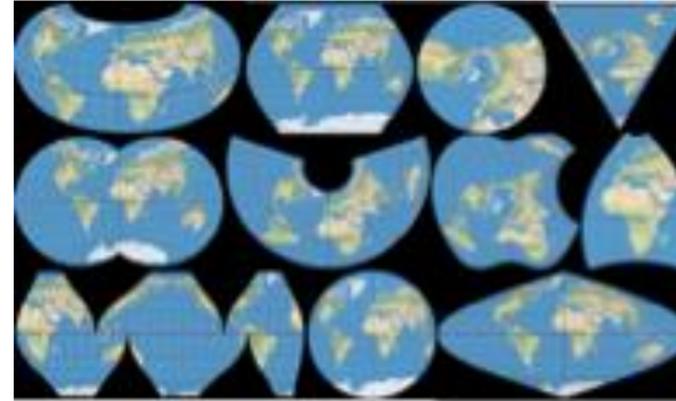
Les tailles des cercles sont comparables entre toutes les cartes de nombre de pièces des habitats secondaires

Recensement fédéral de la population, 1970, 1980

Institut de Géographie, Université de Lausanne

analyze geospatial data

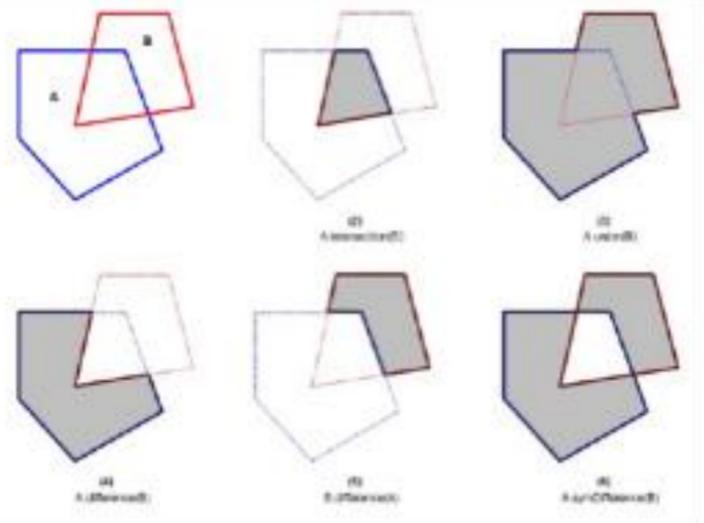
> GIS for developers



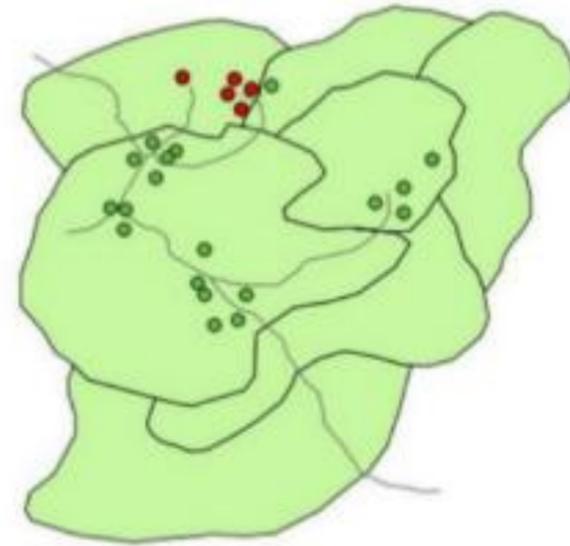
Read/write spatial file formats

Deal with different projections

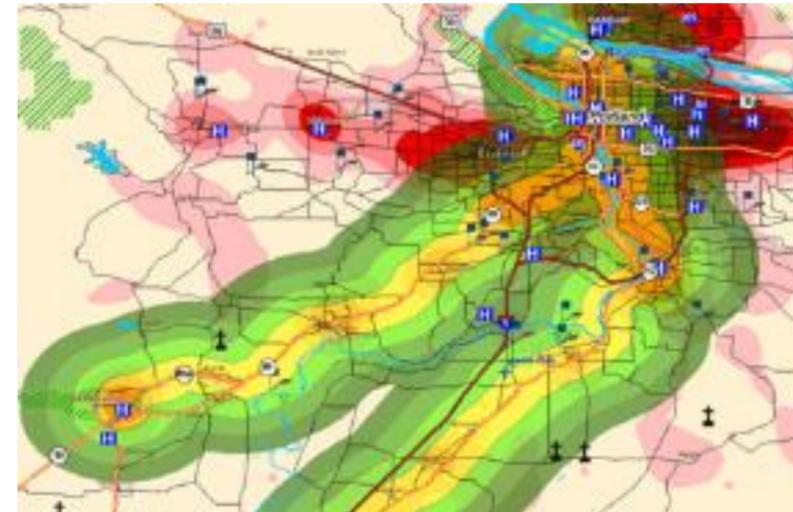
Create geometric objects



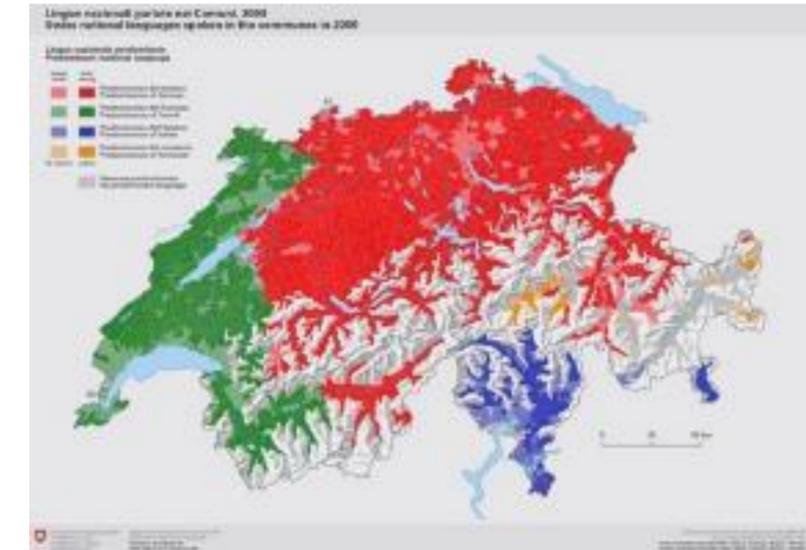
Geometric operations and geocoding



Spatial queries



Spatial analysis

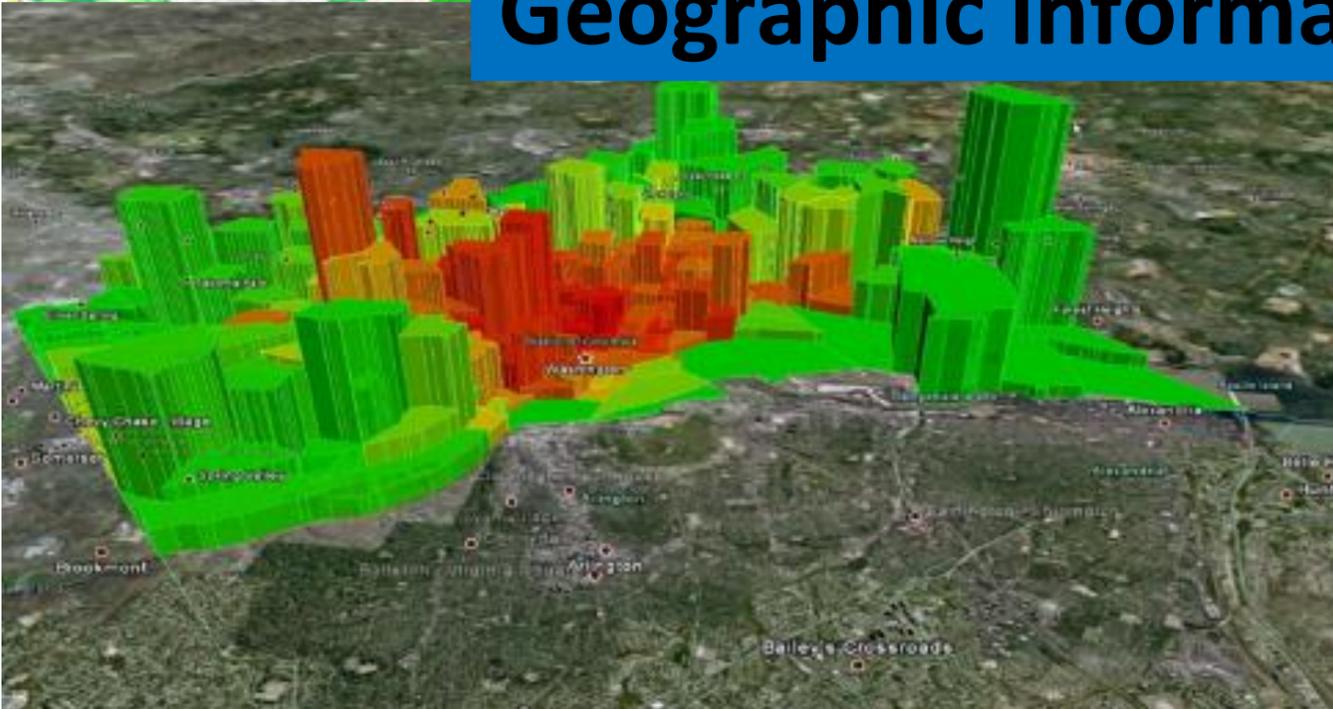


Visualization & maps

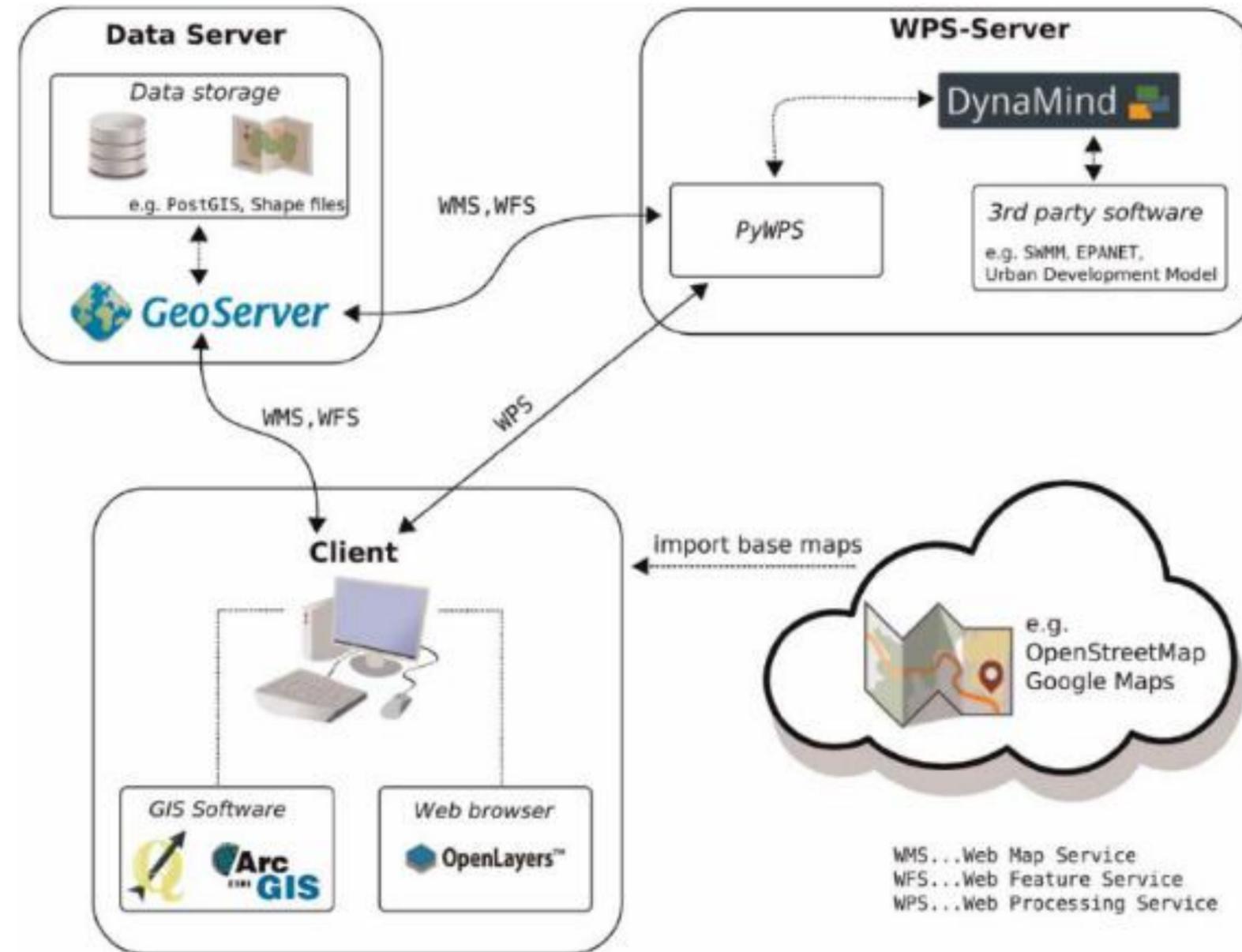
> GIS for developers



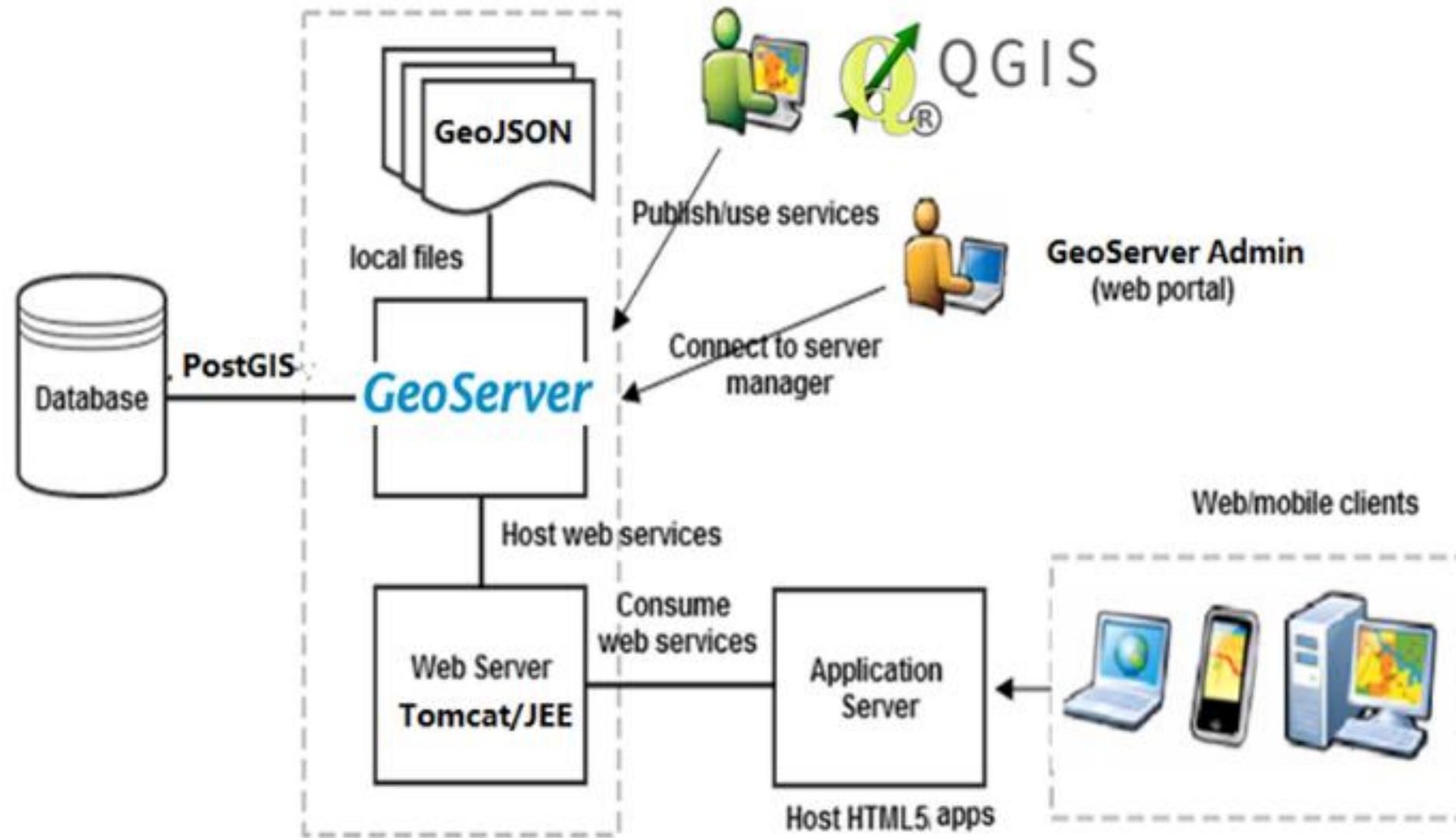
Geographic information products/services



> GIS: Architectures



> GIS: Architectures



> GIS: Tools



Why Python for geo data?

> GIS for developers

Why Python for geodata?



- **Free:** no added costs for licensing
- **For coders:** fully programmable geodata manipulation
- **Modular:** libraries adapted to different use-cases
- **Efficiency:** optimized for Big Data analytics
- **Extensibility:** possibility to extend or reuse multiple libraries
- **Flexibility:** options for lots of formats/standards/approaches
- **Open Source:** code reuse/reproducibility/open science
- **Integration:** supported by other tools as QGIS/ArcGIS etc.

> GIS: Tools



> GIS/Python: Dev Goals

• GIS in Python

- Tools in Python for GIS 
- Fundamentals of geometric objects
- Manipulation of geometries in Shapely

• File management

- input/output geo files 
- Reading and writing shapefiles
- GeoDataFrames, coordinate reference systems

• Operations & Geocoding

- Data geocoding
- Layers and spatial joins
- Basic geo operations

• Geospatial data analysis

- Data classification 
- Geodata aggregation
- Geopandas

• Geospatial databases

- PostGIS and datatypes 
- Queries and spatial analysis

• Web mapping

- Static and interactive maps
- Leaflet/folium 

• GIS integration

- QGIS processing toolbox
- QGIS Python integration PyQGIS 

➤ GIS for developers: examples

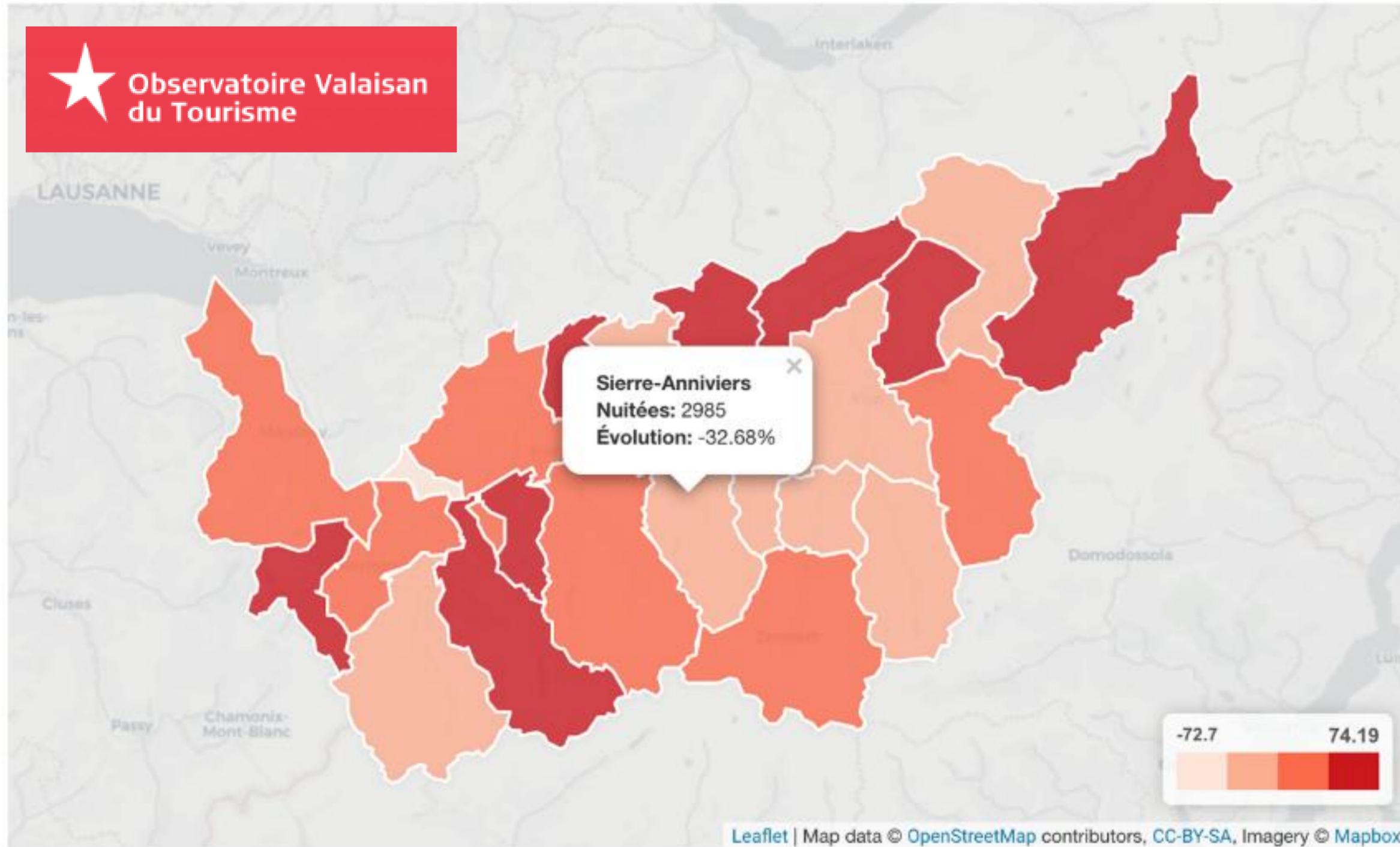
Railway traffic information



CFF/SBB

> GIS for developers: examples

Évolution des nuitées dans les destinations



> GIS for developers: examples



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How it works

Subscriptions

Map

FAQ

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Login

Sion



Google

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Report a problem

Châteauneuf-Furet

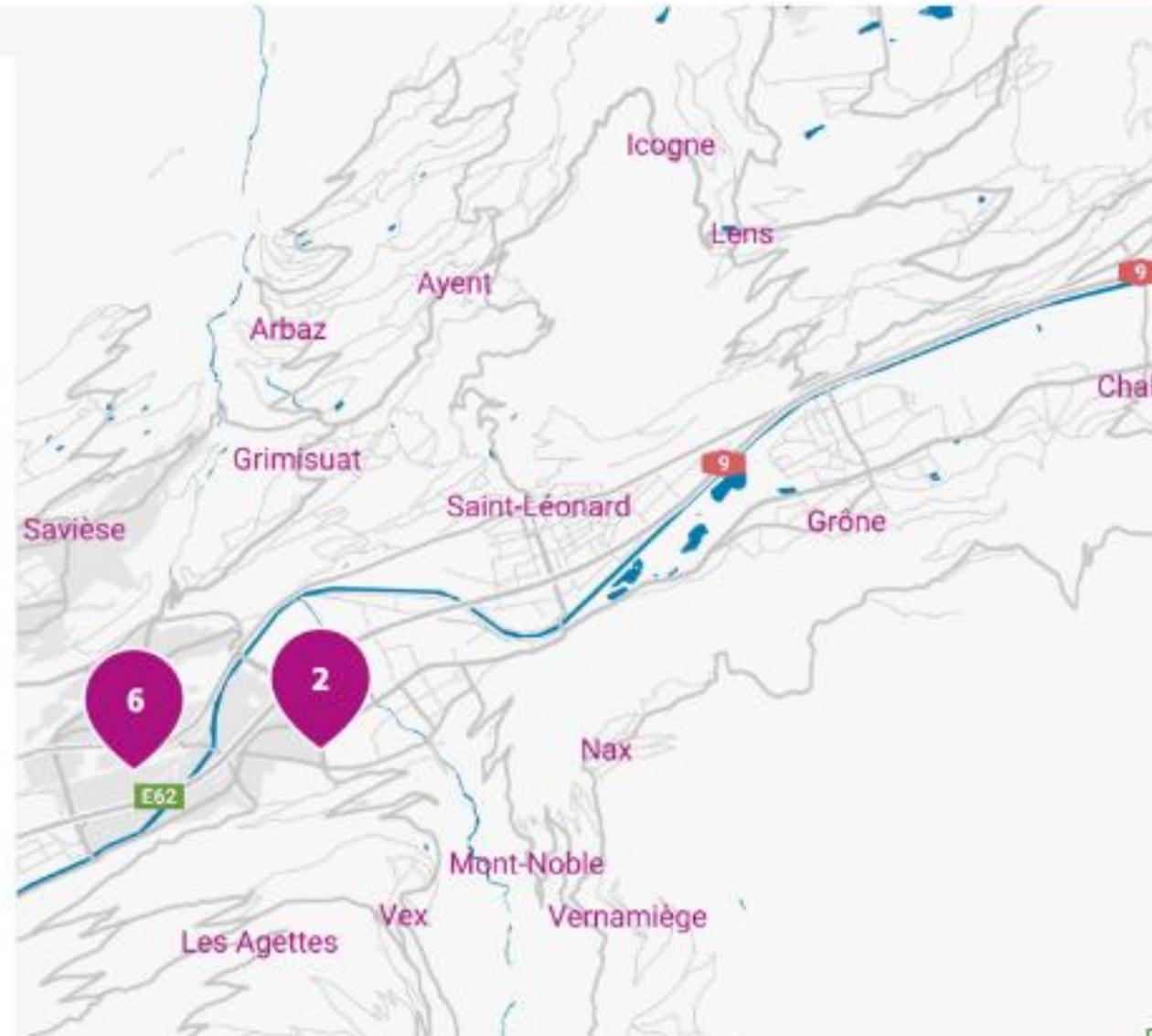
Avenue Maurice-Troillet | 1950 Sion

Bikes

2

E-Bikes

2



➤ GIS for developers: examples



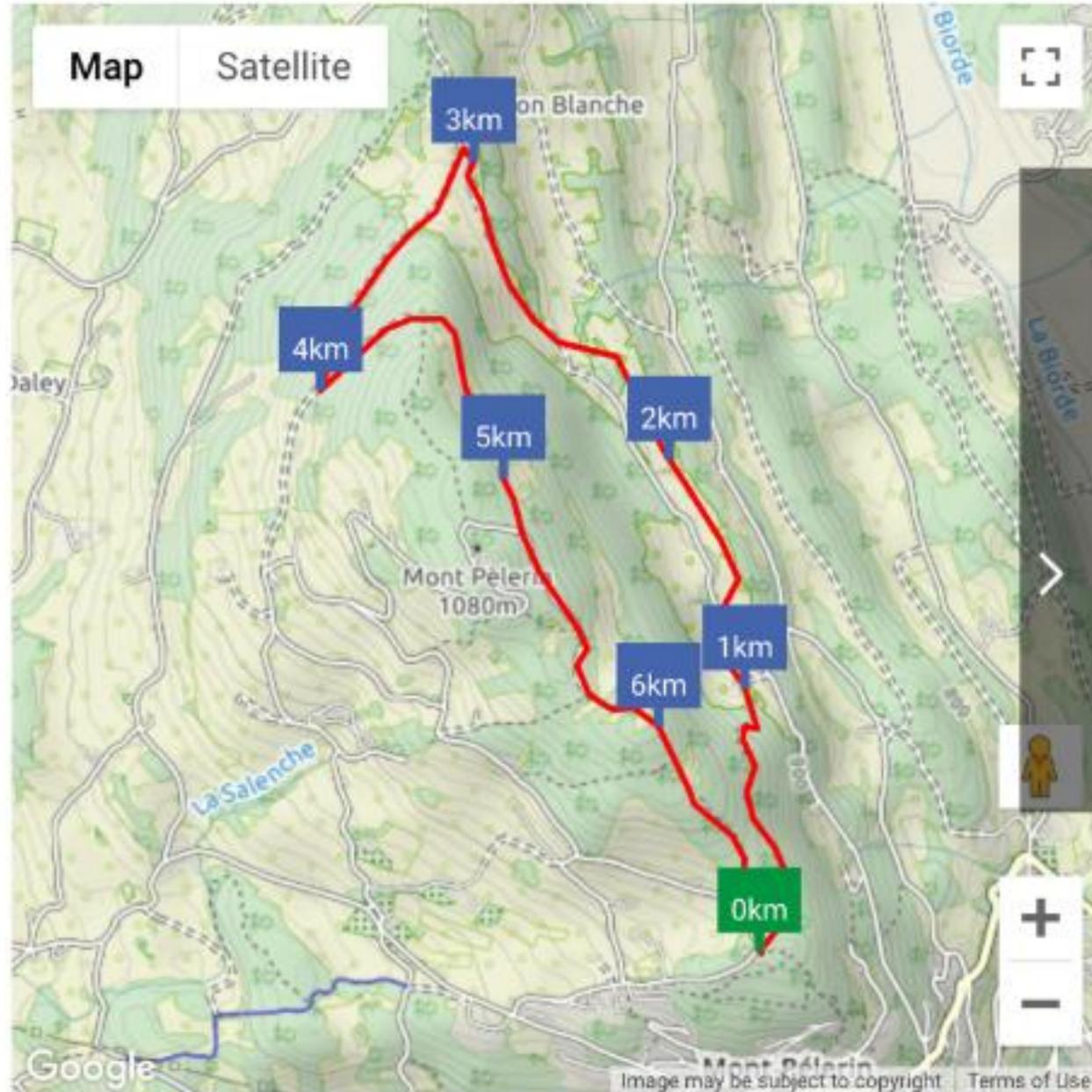
➤ GIS for developers: examples



> GIS for developers: examples

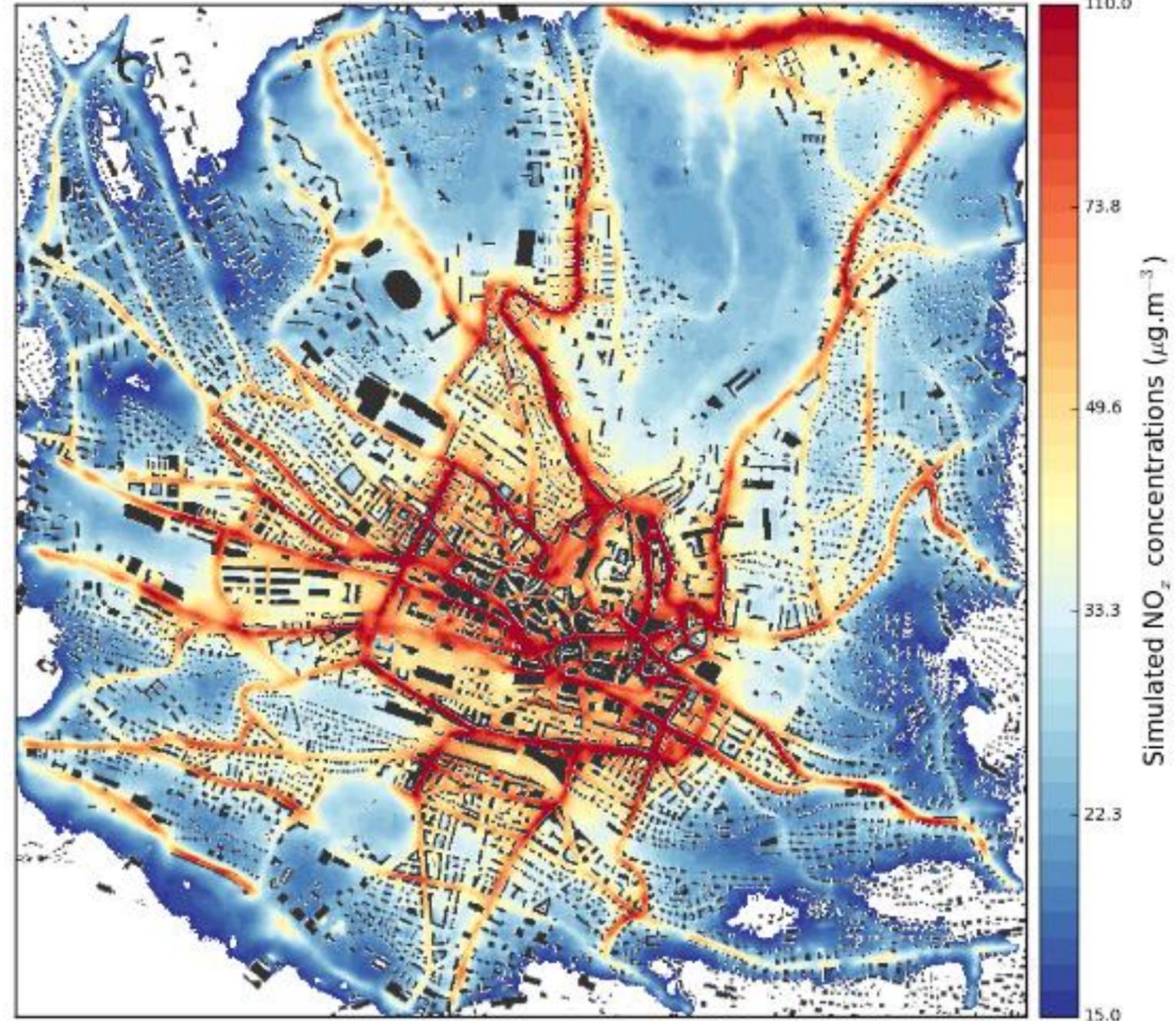
SENTIER RAQUETTES MONT-PÈLERIN

RAQUETTE À NEIGE



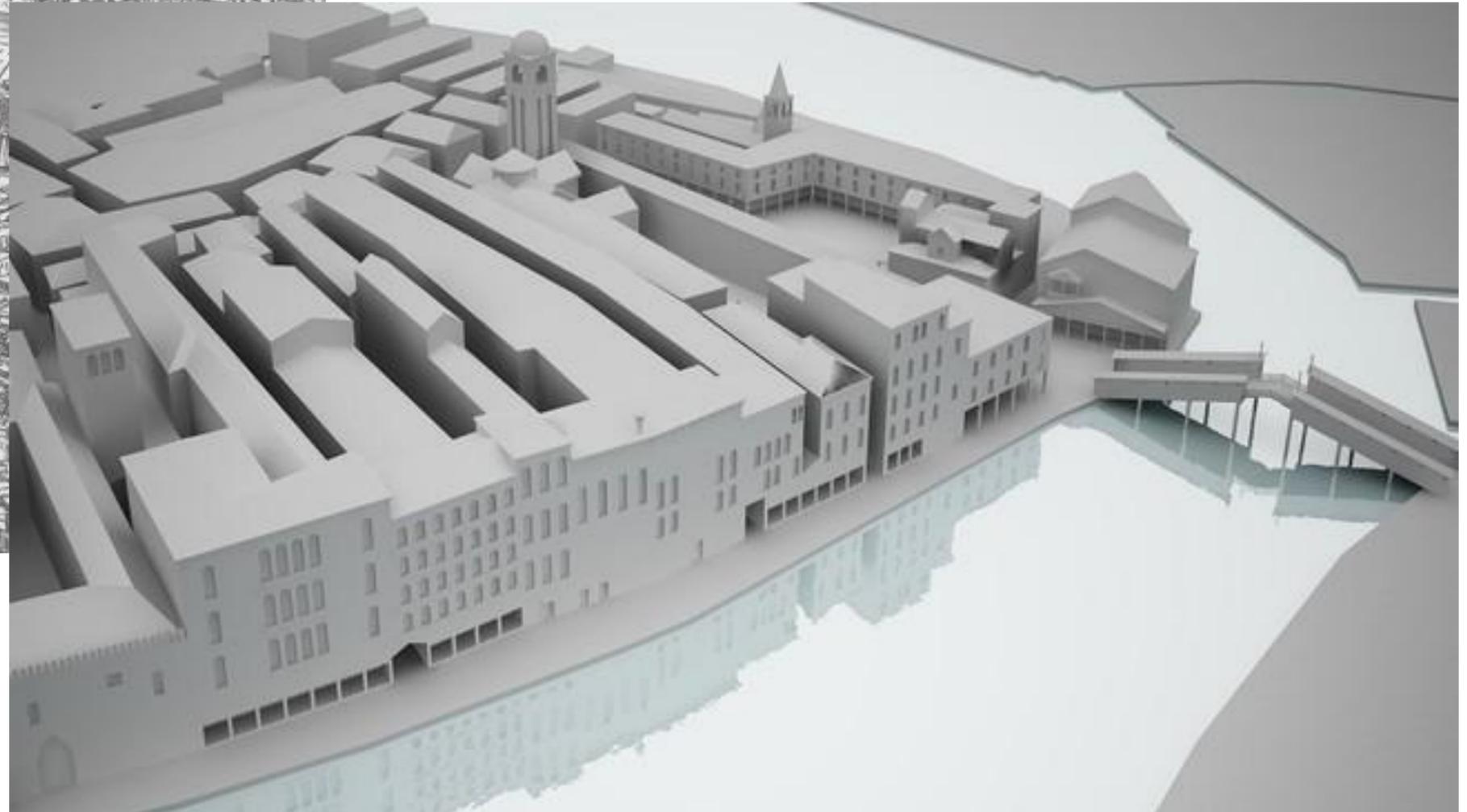
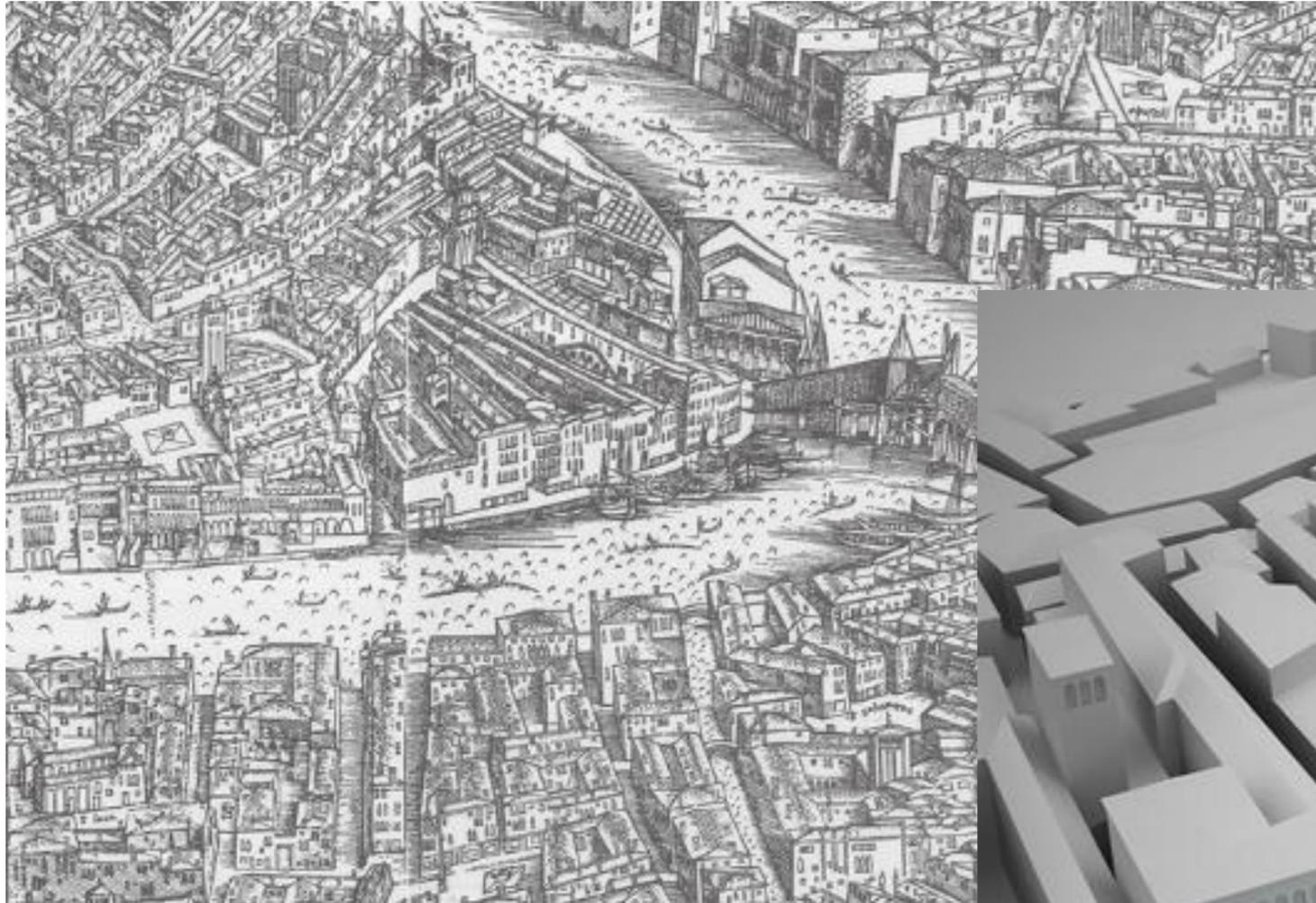
📍	Localité	Montreux
📏	Distance	6.81 km
🕒	Durée	2h30
📈	Dénivelé	310 mètres
🏔️	Difficulté	Moyen

> GIS for developers: examples



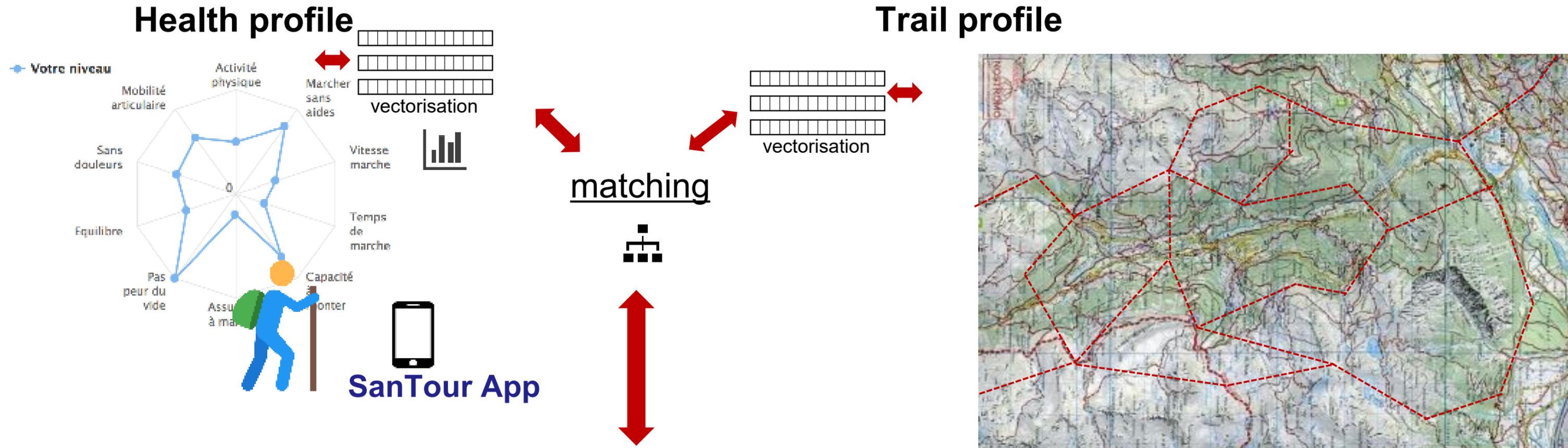
OpenSense: air pollution in Swiss cities

➤ GIS for developers: examples



Venice Time Machine project

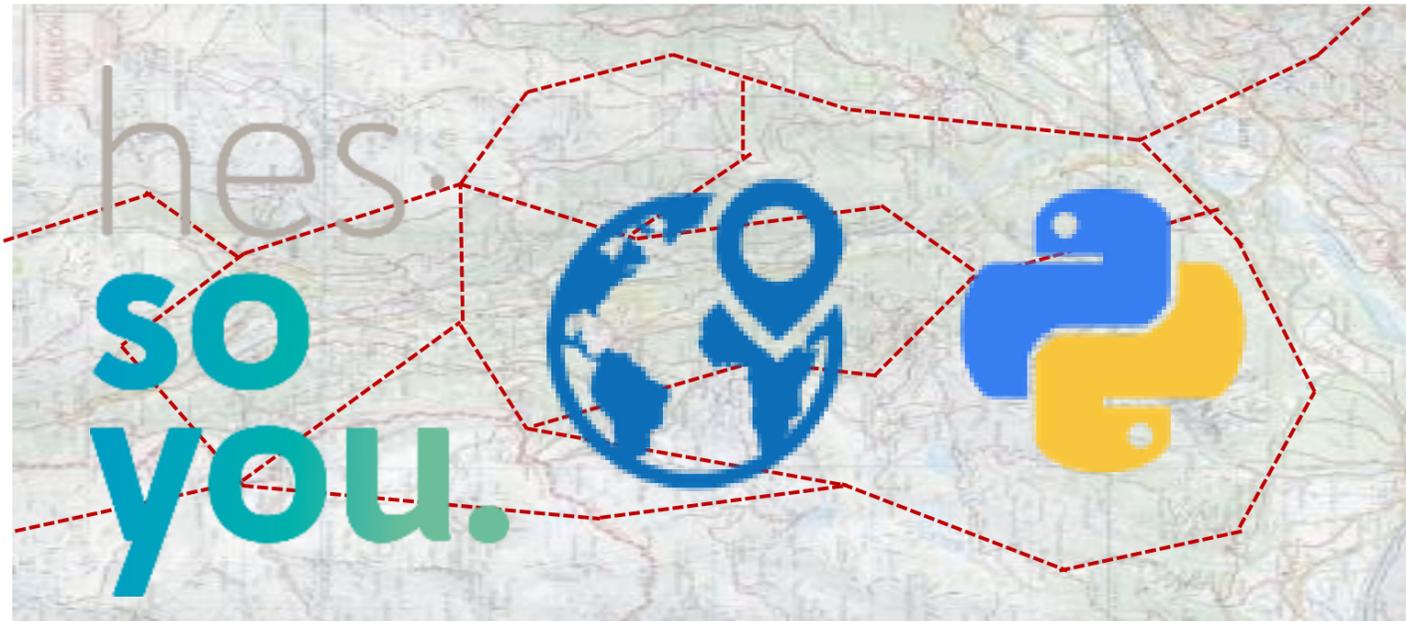
> GIS for developers: examples



Recommendations

parcours	distance	temps	lien	score
Les Clautis	3.55km	1h	Snukr	0.71 score
La Lee ⚠	3.73km	1h	Snukr	0.71 score
Attention si douleurs importantes	6.8km	2.75h	Snukr	0.46 score
Zinal-Petit Mountet chemin d'été ⚠	10.9km	3h	Snukr	0.41 score
Zinal-Petit Mountet Chemin d'hiver	12.6km	3.5h	Snukr	0.29 score

RECOMMANDATION



Thank you for your attention.

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