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

swissuniversities

> 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:**
  - **21.02 Python (JPC)**
  - **28.02 Shapely (JPC)**
  - **07.03 GIS 1 (JCL)**
  - **14.03 Pandas (JPC)**
  - **21.03 GIS 2 (JCL)**
  - **28.03 PostGIS (JPC)**
  - **04.04 Leaflet + Django(JPC)**
  - **11.04 GeoDjango (JPC)**
  - **02.05 GIS 3 (JCL)**
- **Online resources:**

Cyberlearn Hes·so CENTRE E-LEARNING

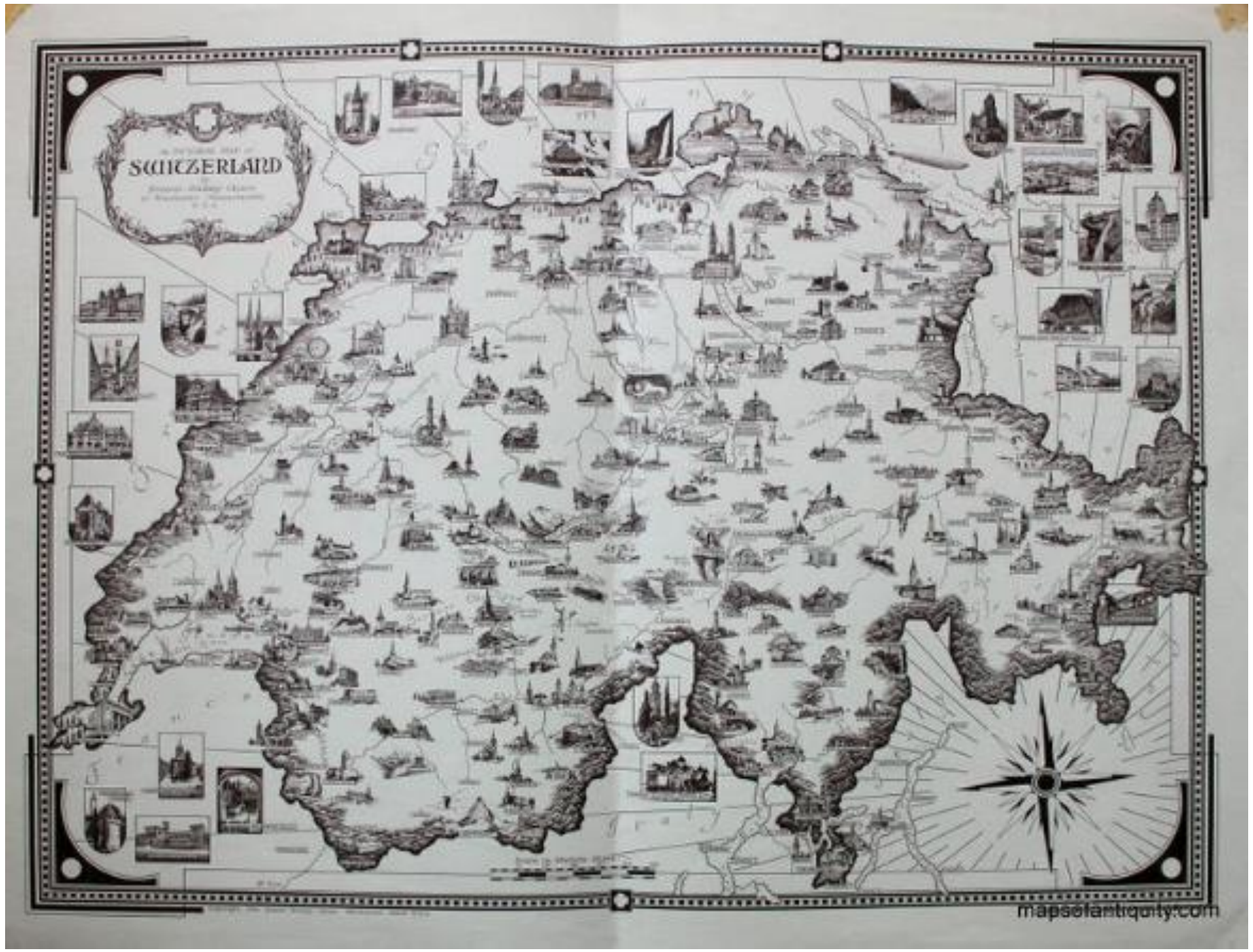
20_HES-SO-VS_GIS PYTHON

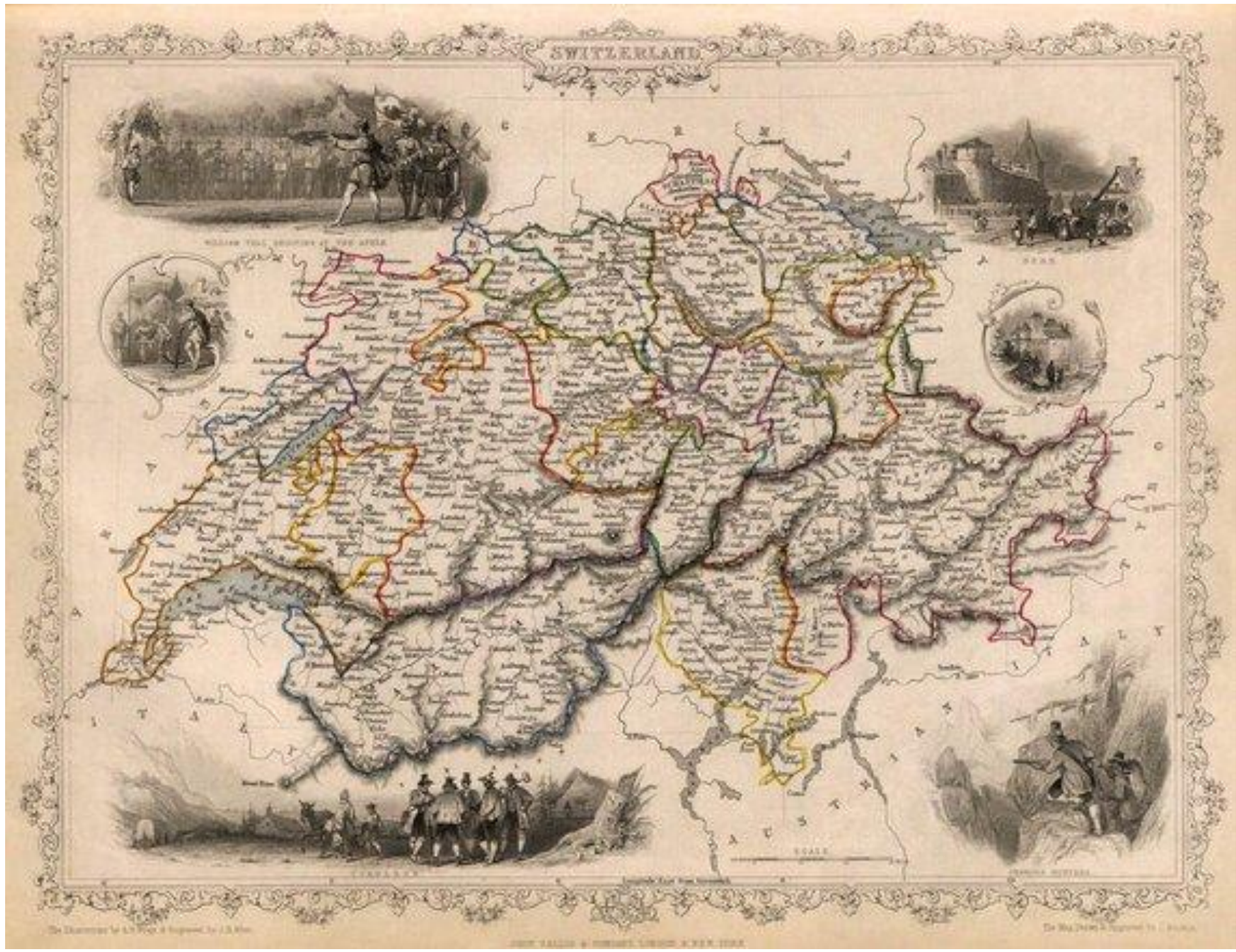
> GIS: Motivation

Why Geospatial data?

- store location information
- read from digitalized map
- calculate distances and routes
- locate information on a map
- optimize resources based on location
- visualize information on a map

> GIS: Motivation

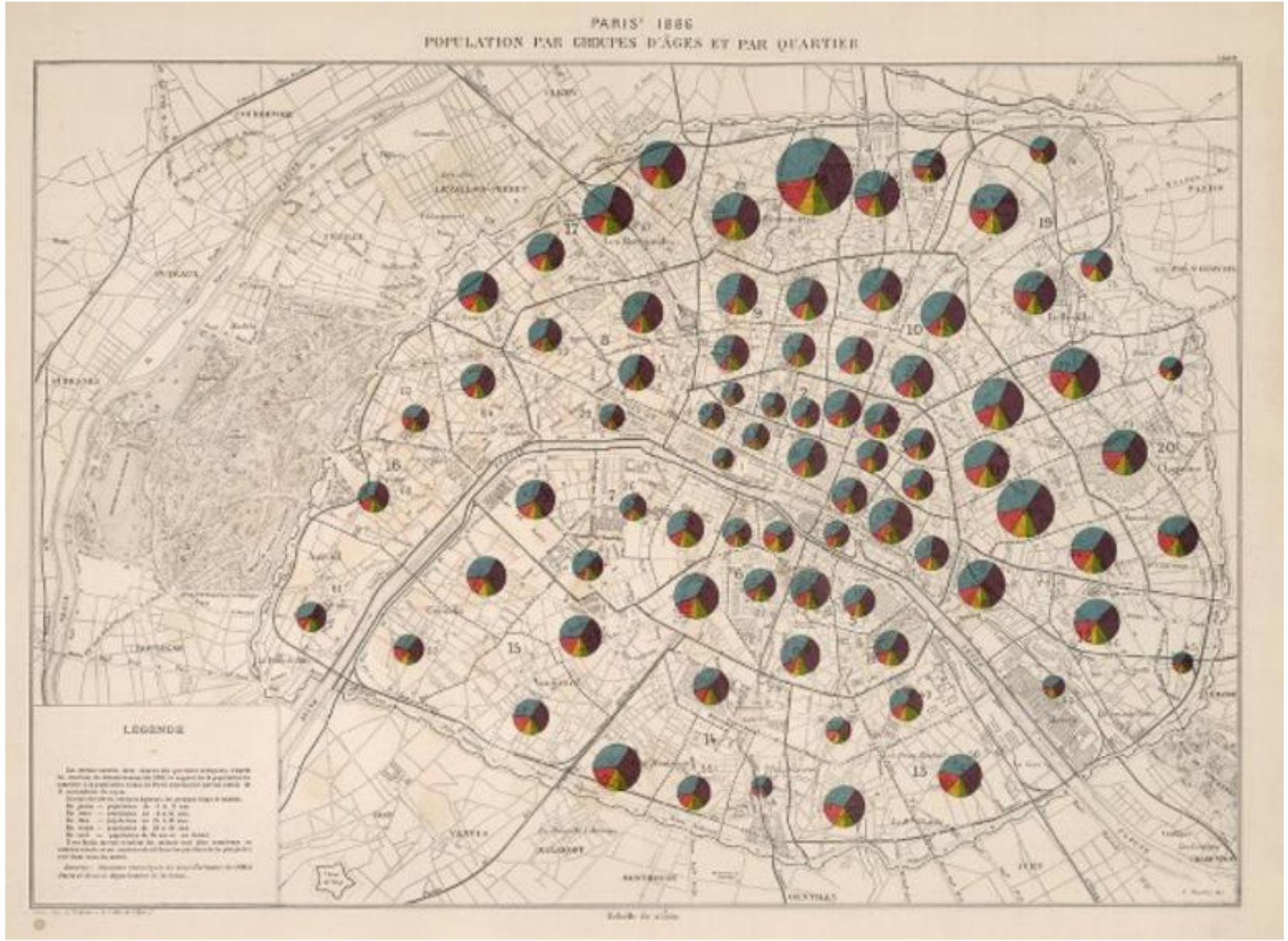




Geospatial information through the ages…

> Urban planning

> Map visualization

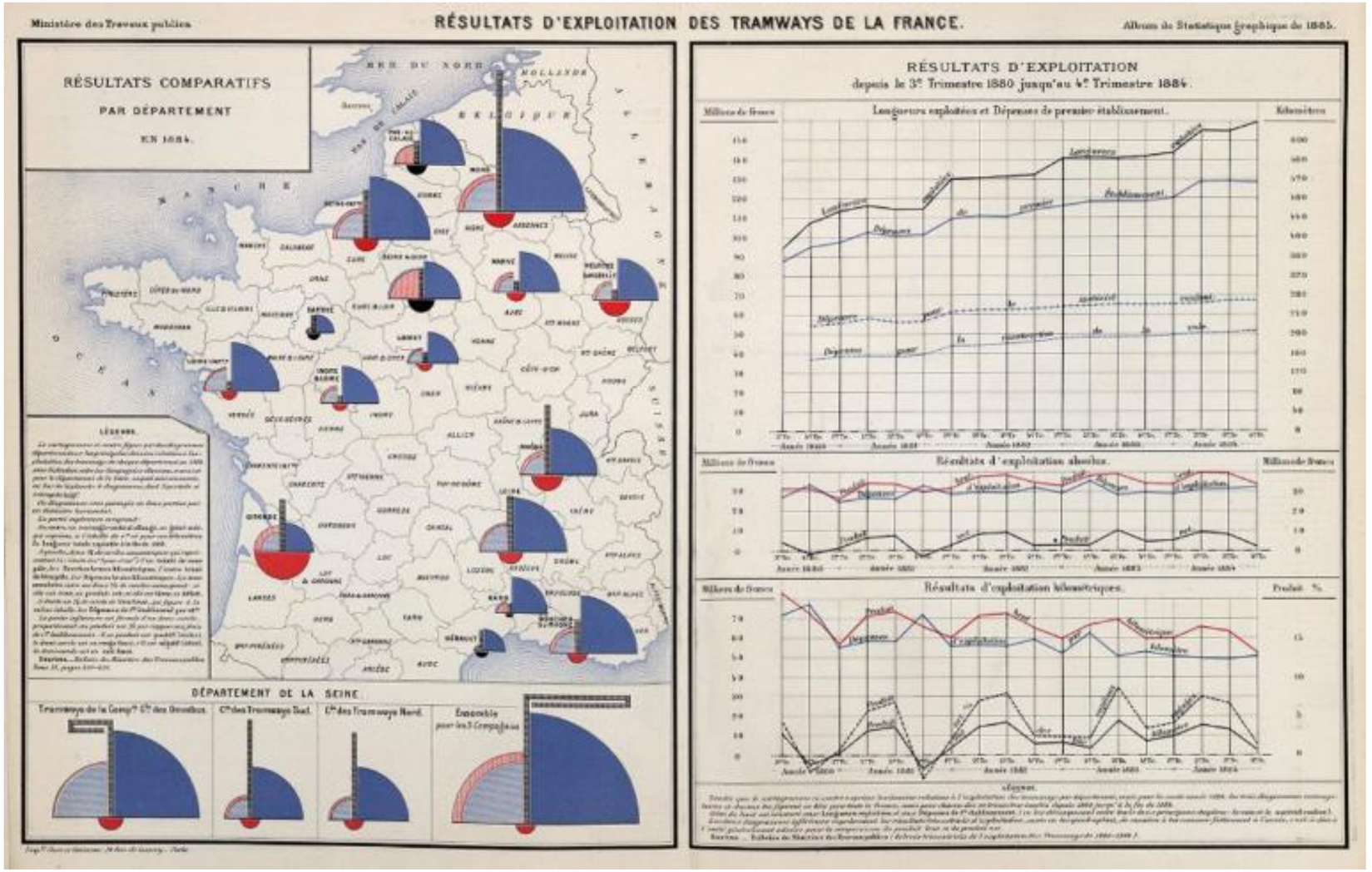


Paris 1886.
Population by age group

> Map visualization

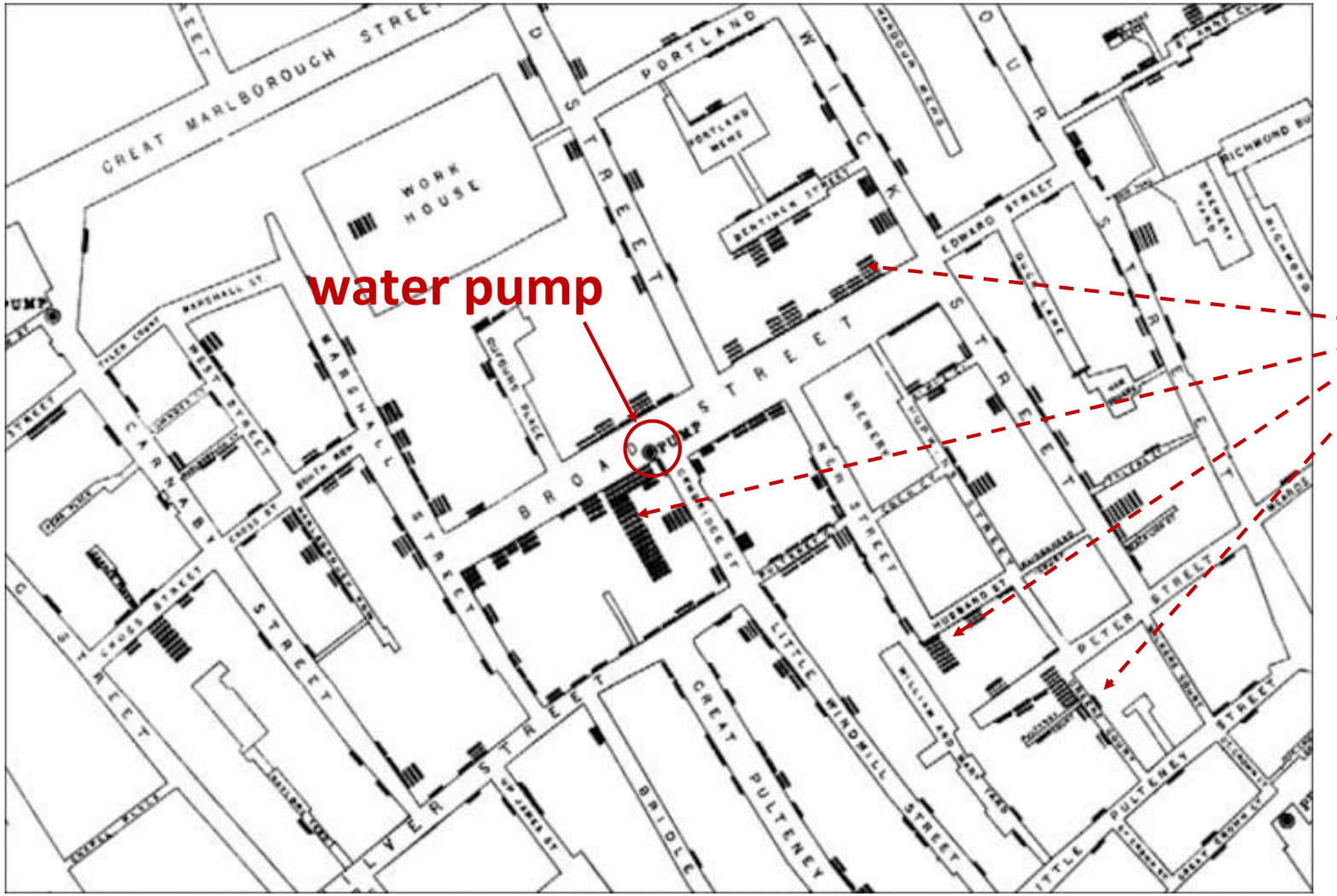
French railroad network. Cargo volumes. 1877

> Stats: Map visualization



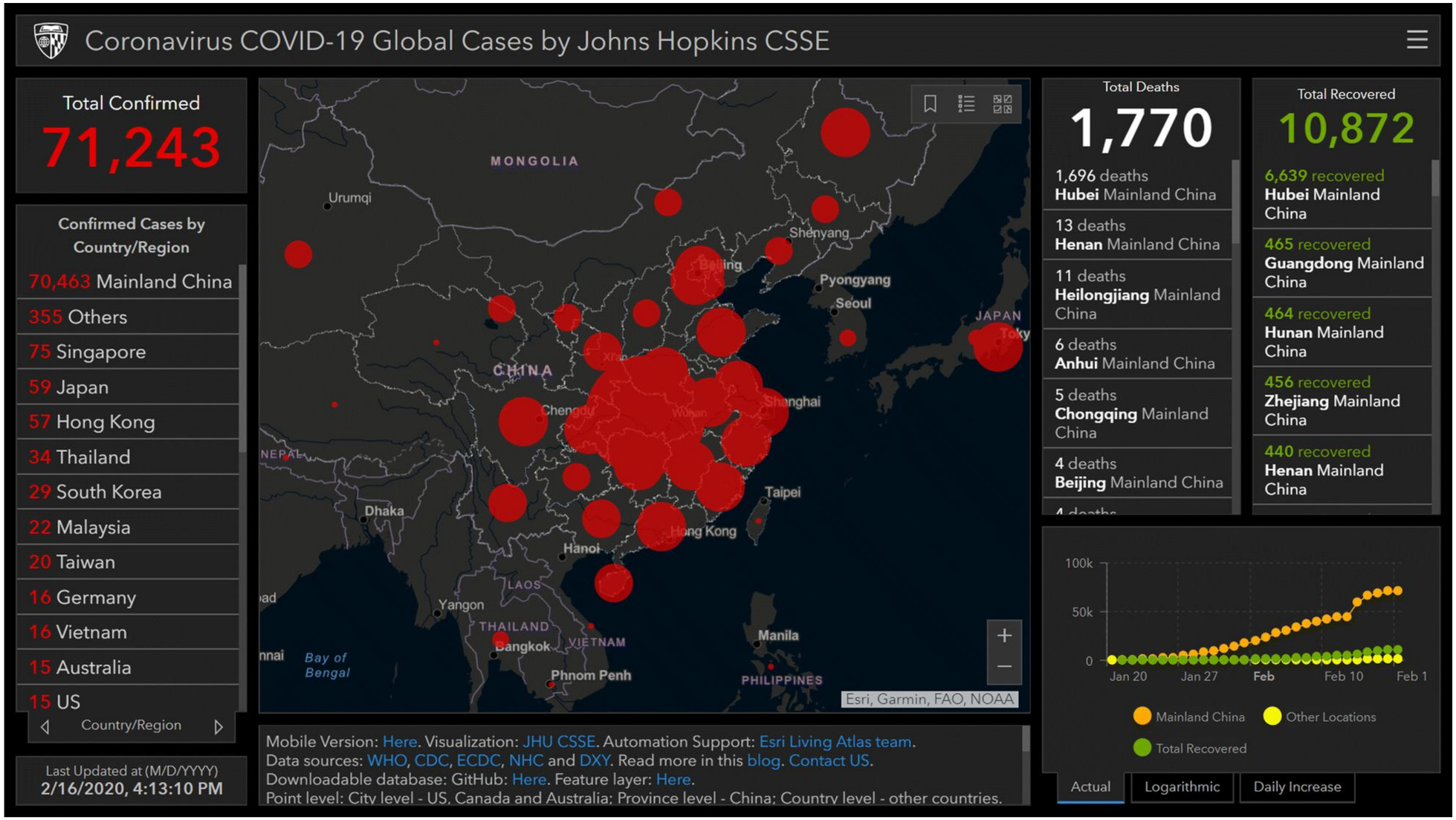
French tramway exploitation statistics. 1886

> Spatial Analysis



Cholera deaths
John Snow, 1854

> Spatial Analysis



COVID-19, Johns Hopkins CSSE

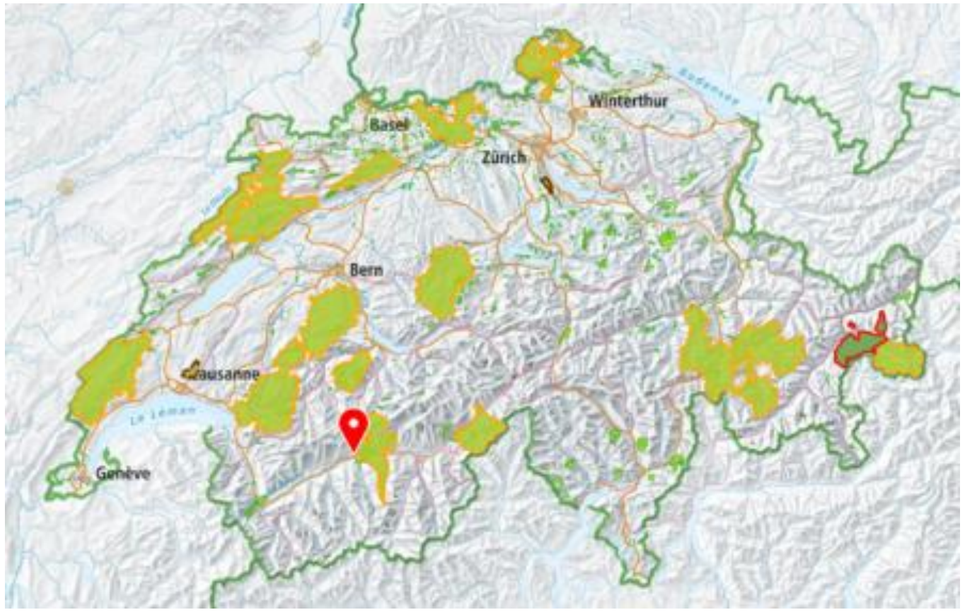
> GIS: Geographic Information Systems

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

data ⟺ geography

what *where*

what?
trekking trails



what?
natural parks

> GIS for developers

Create geographic data

Manage geographic data

Analyze geographic data

Display geographic data

store/query geodata

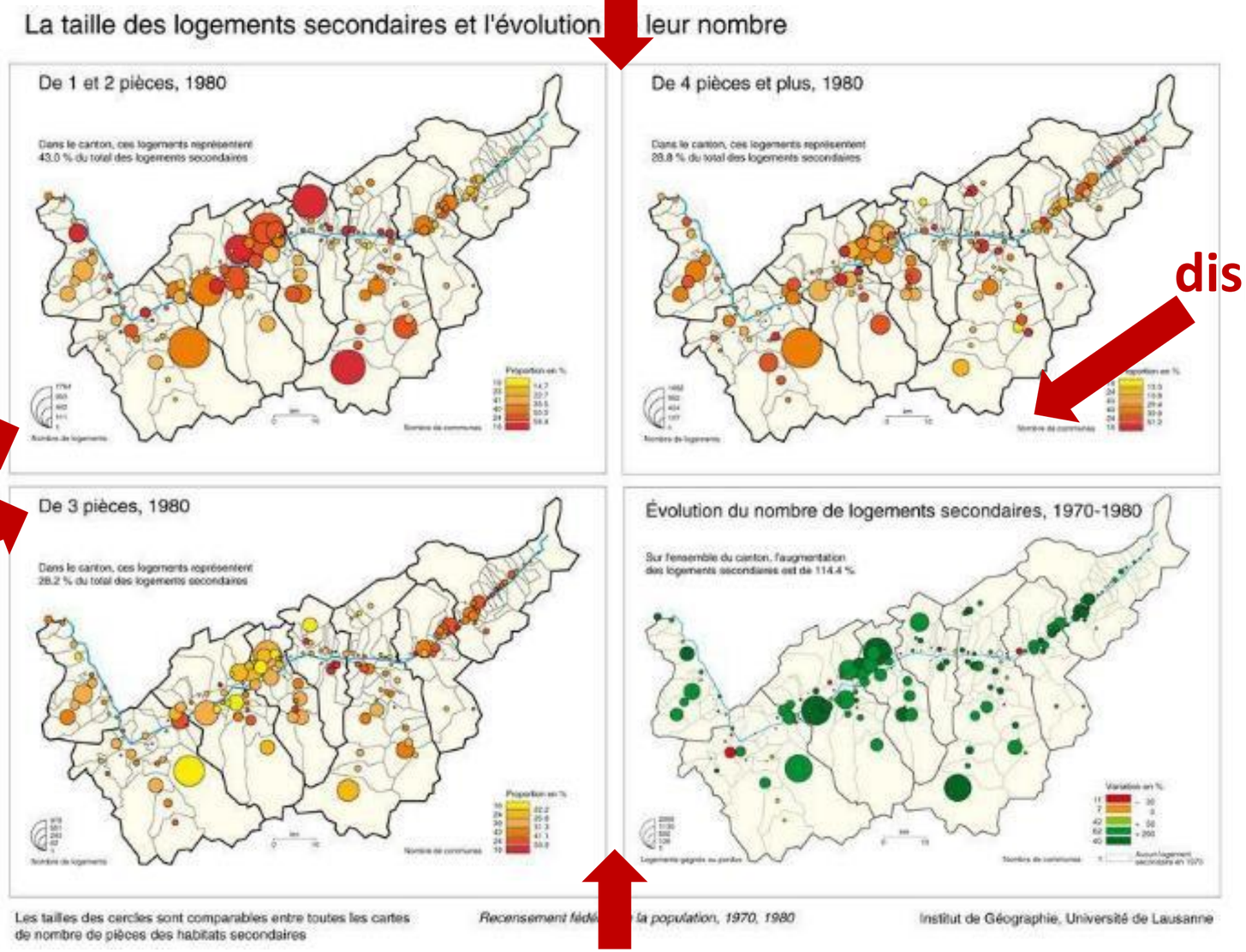
create geodata

create attributive data

create metadata

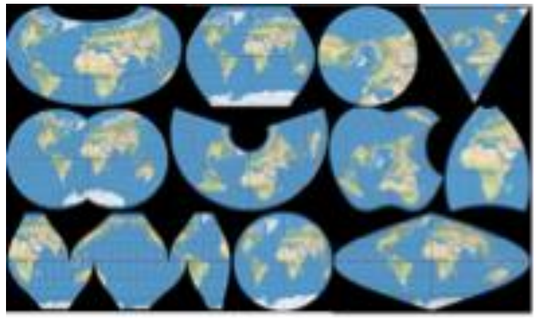
display maps

analyze geospatial data

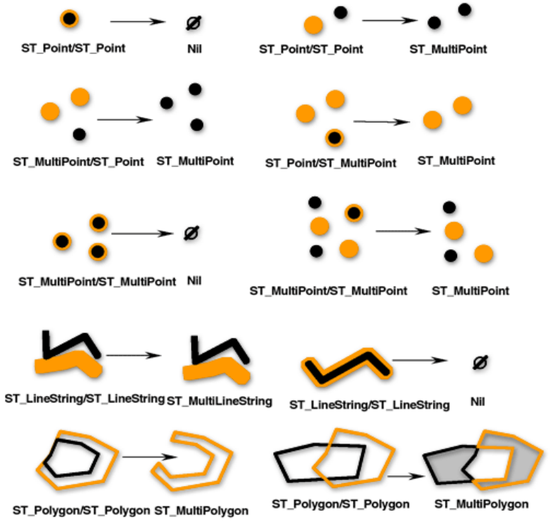


> GIS for developers

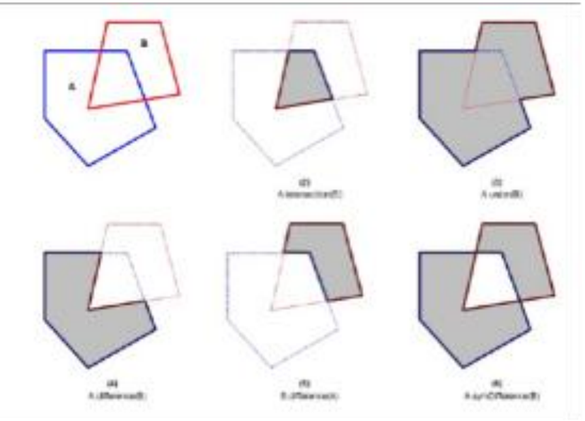
Read/write spatial file formats



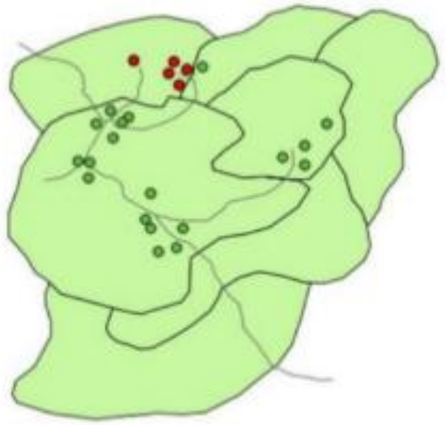
Deal with different projections



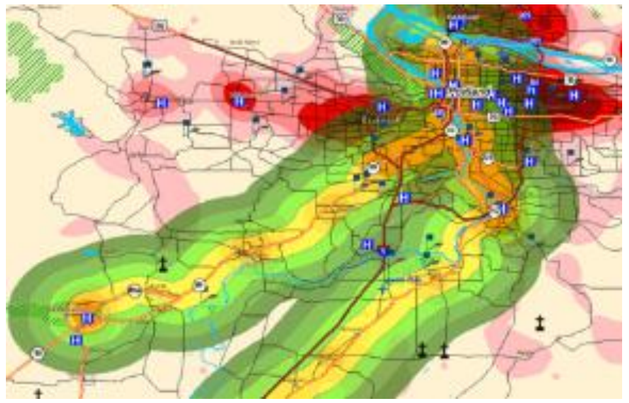
Create geometric objects



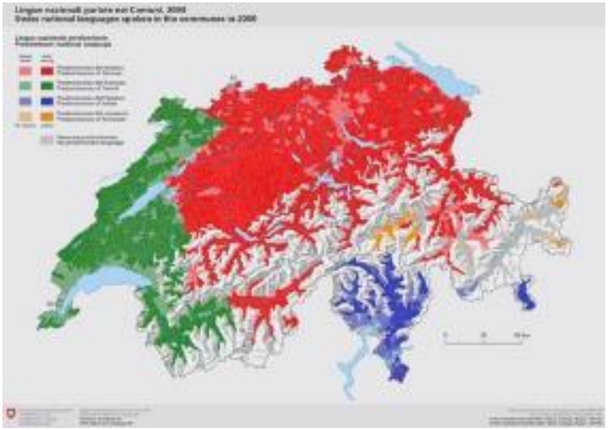
Geometric operations and geocoding



Spatial queries

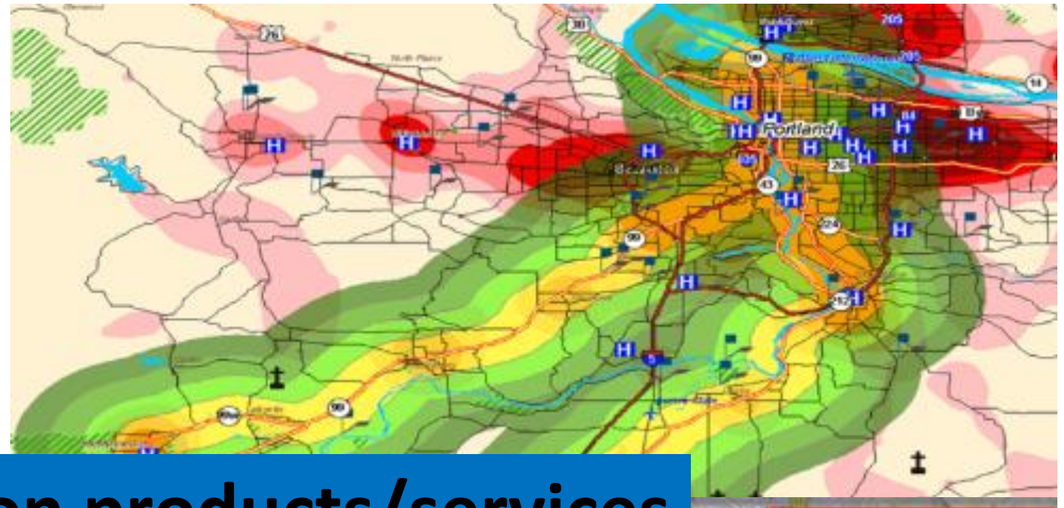


Spatial analysis

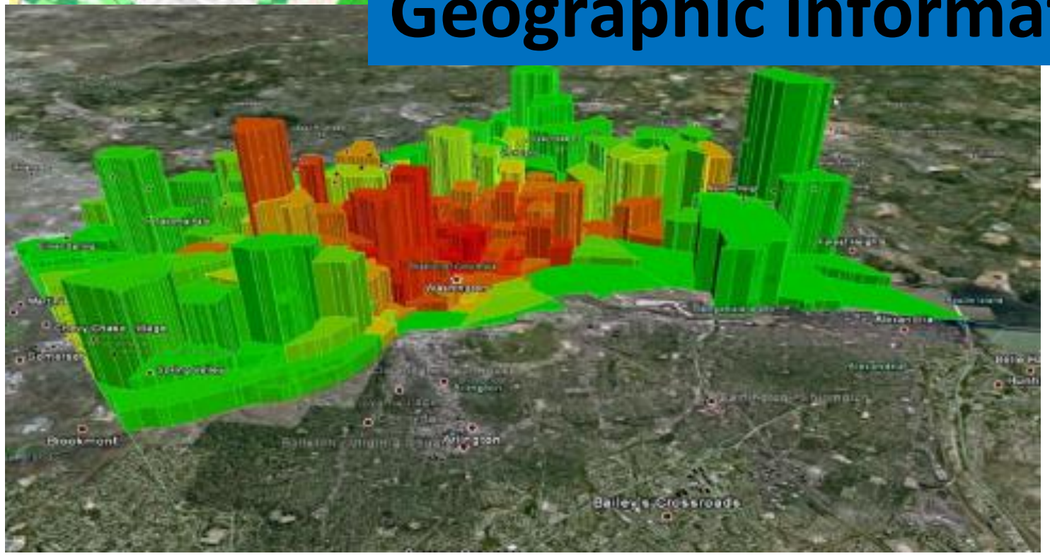


Visualization & maps

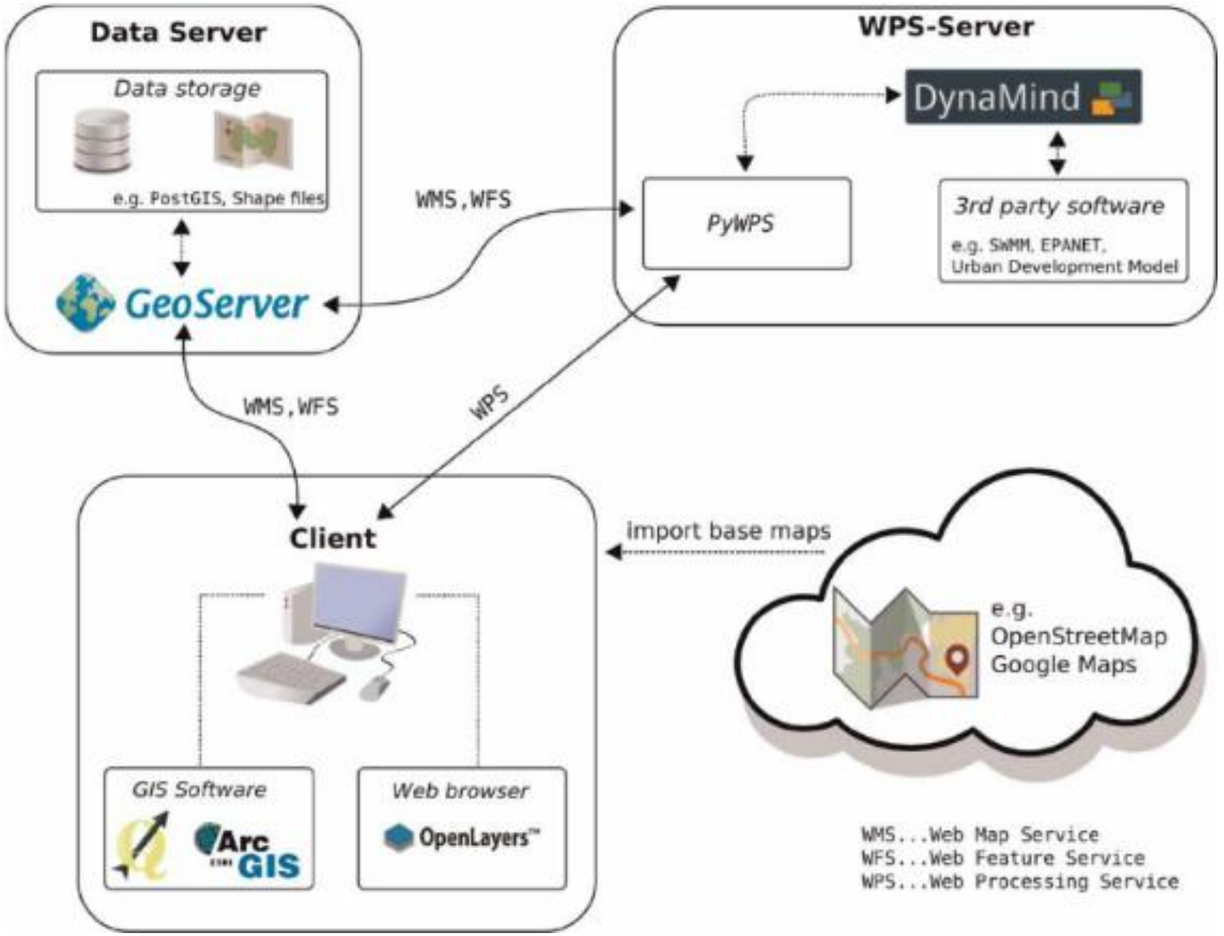
> GIS for developers



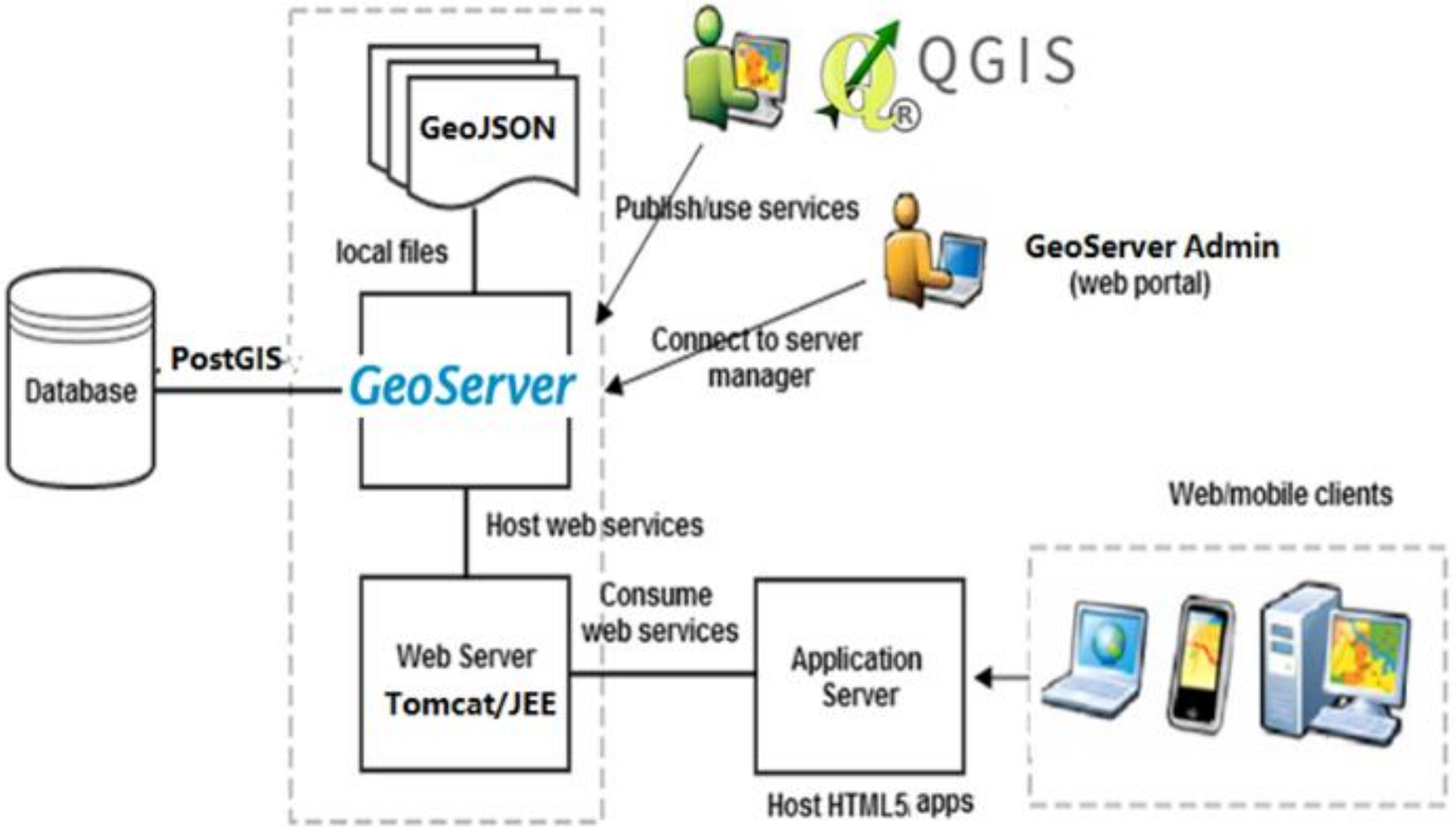
Geographic information products/services



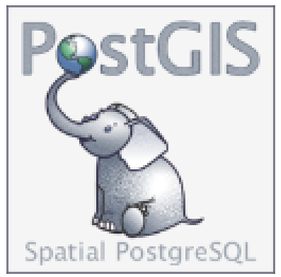
> GIS: Architectures



> GIS: Architectures



> GIS: Tools



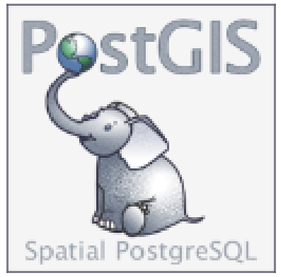
Why Python for geo data?

> 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


PostGIS
Spatial PostgreSQL


Geodjango


pandas


python
django


shapely


Leaflet

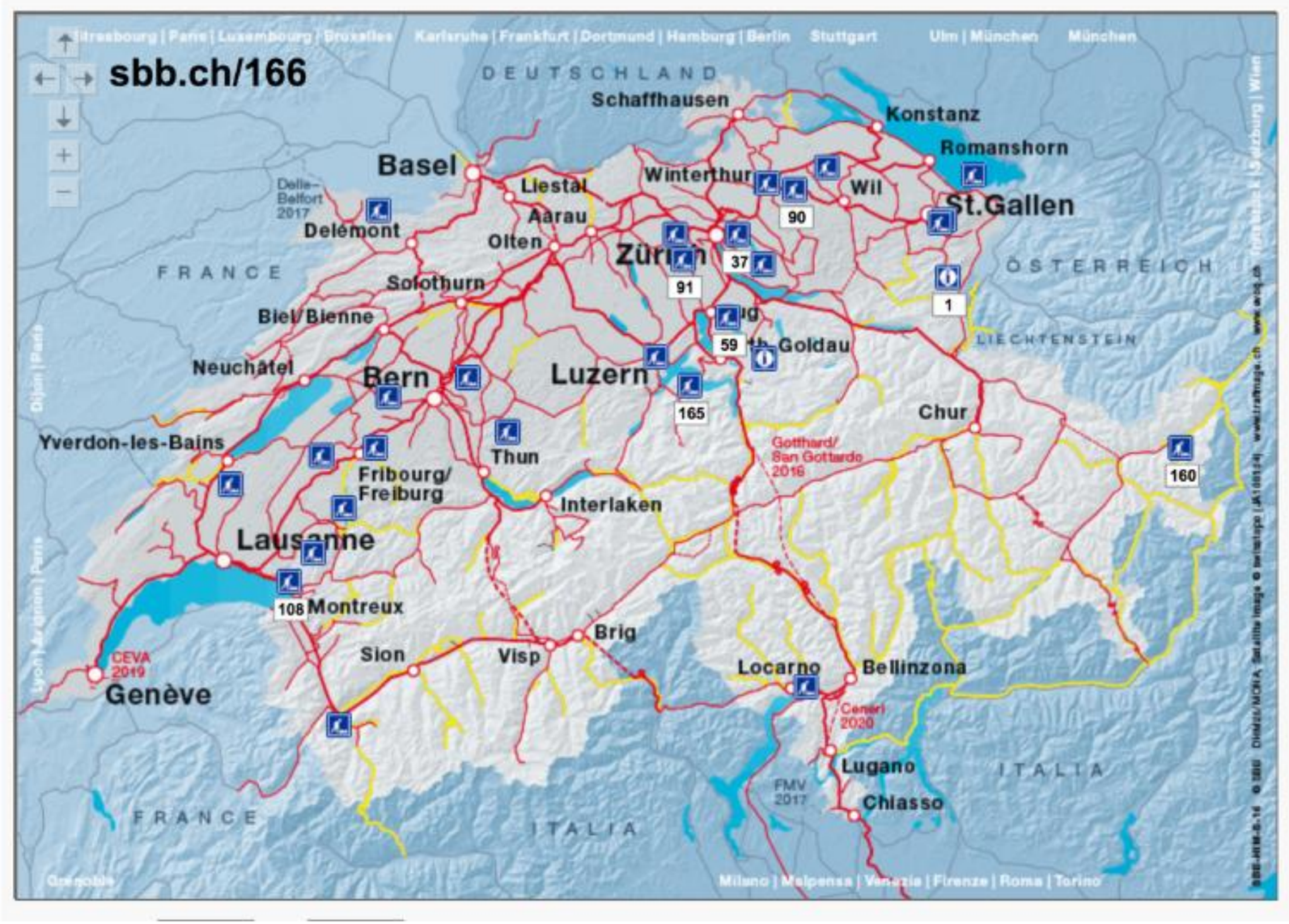
> GIS/Python: Dev Goals

- **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

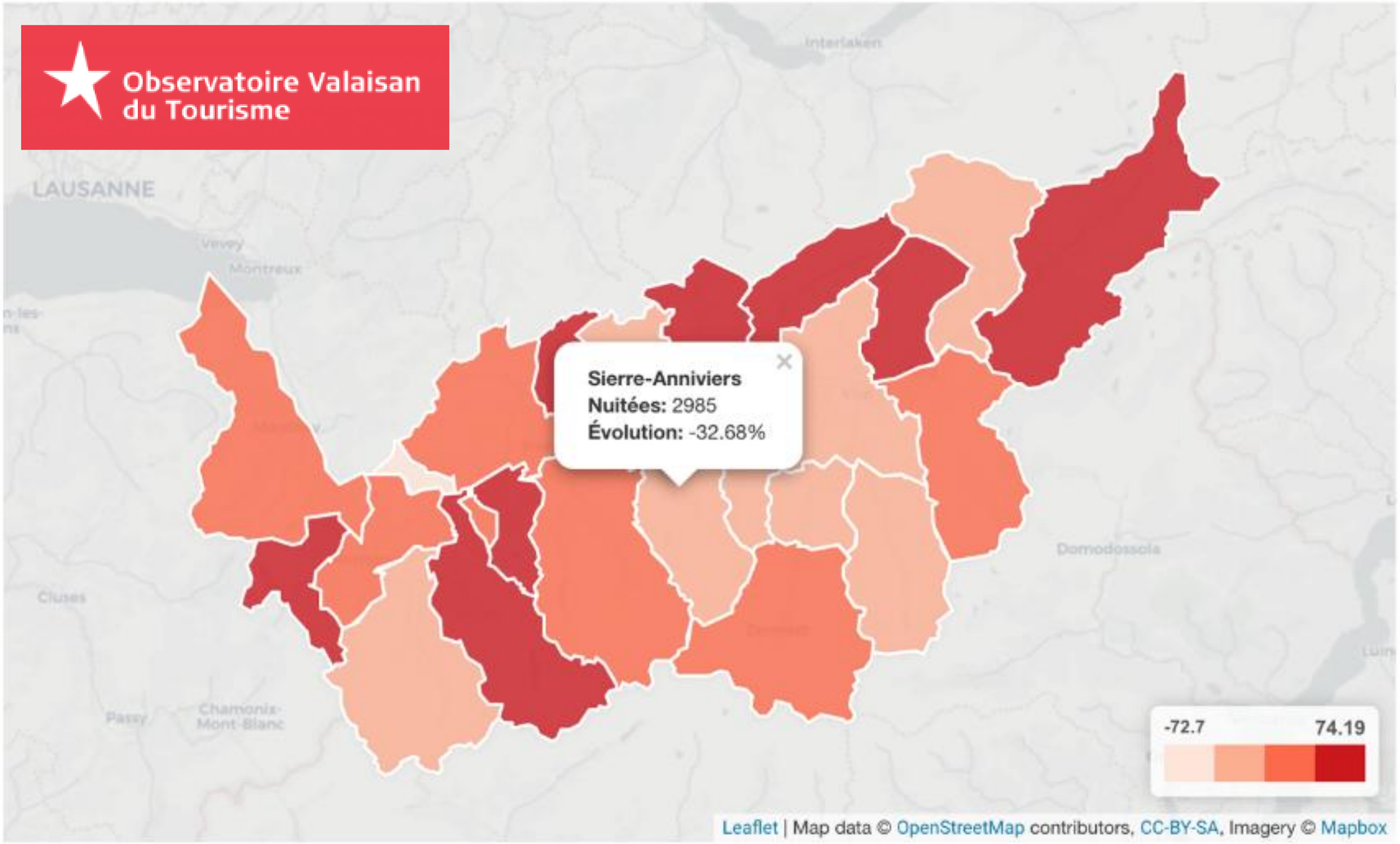
Railway traffic information



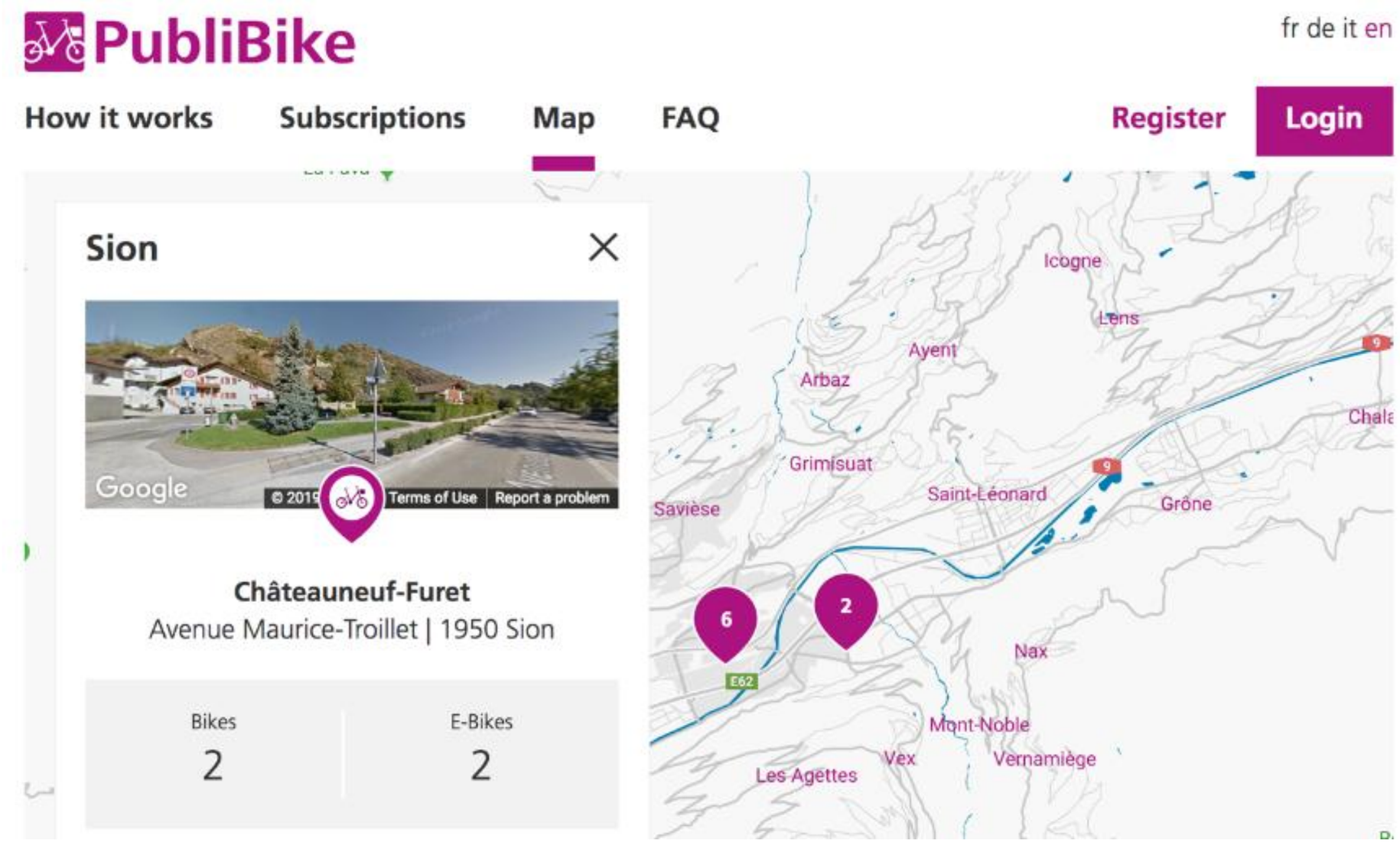
CFF/SBB

> GIS for developers: examples

Évolution des nuitées dans les destinations



> GIS for developers: examples



> GIS for developers: examples

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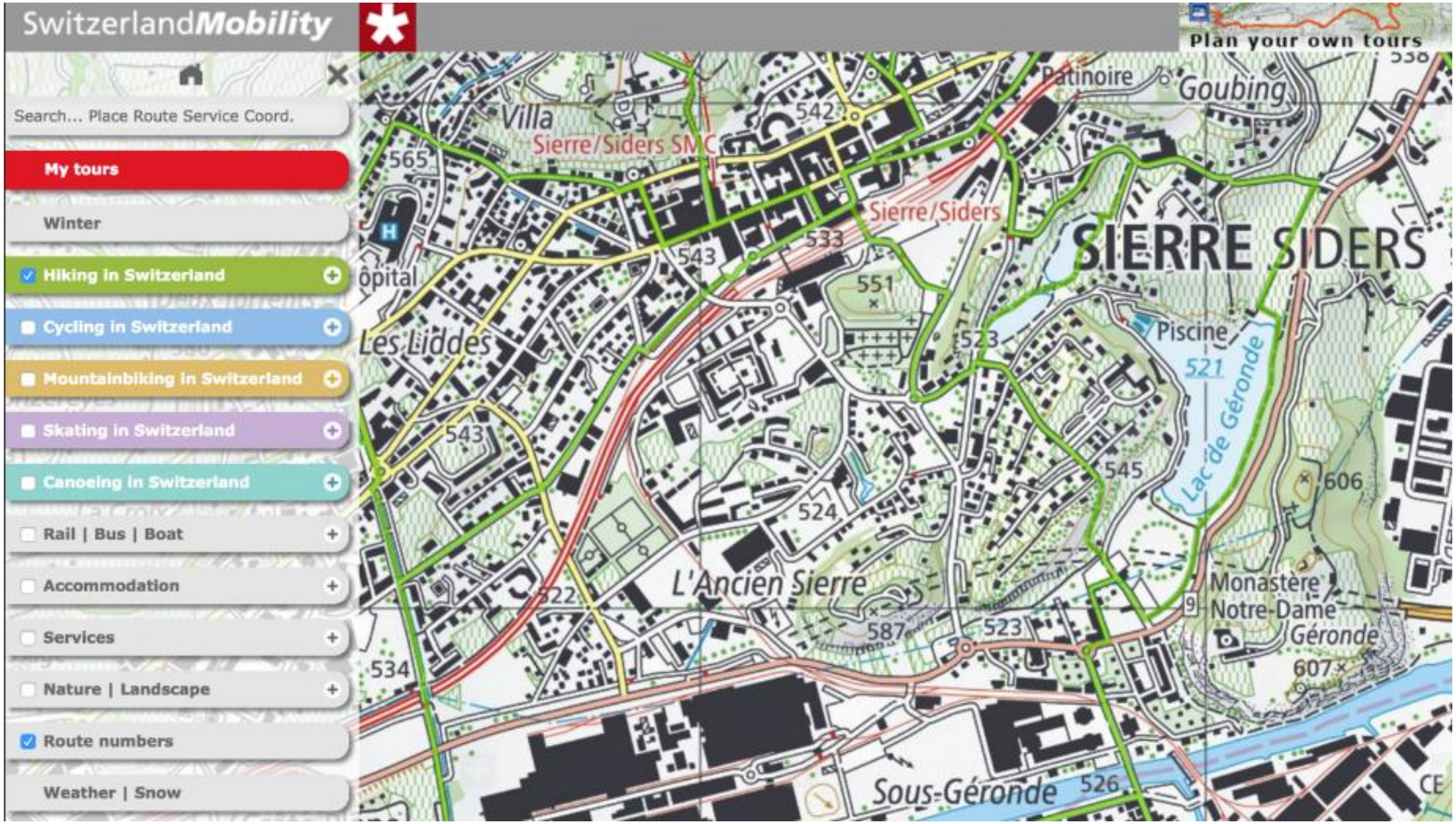
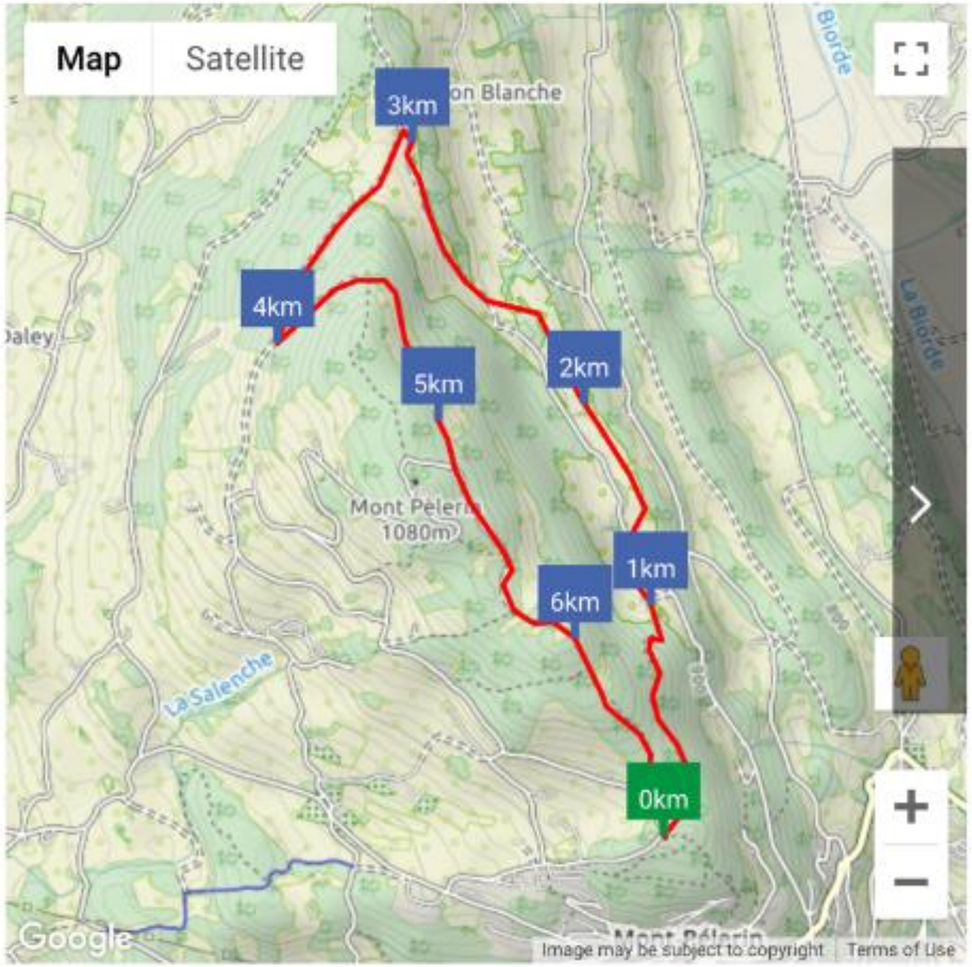


> GIS for developers: examples

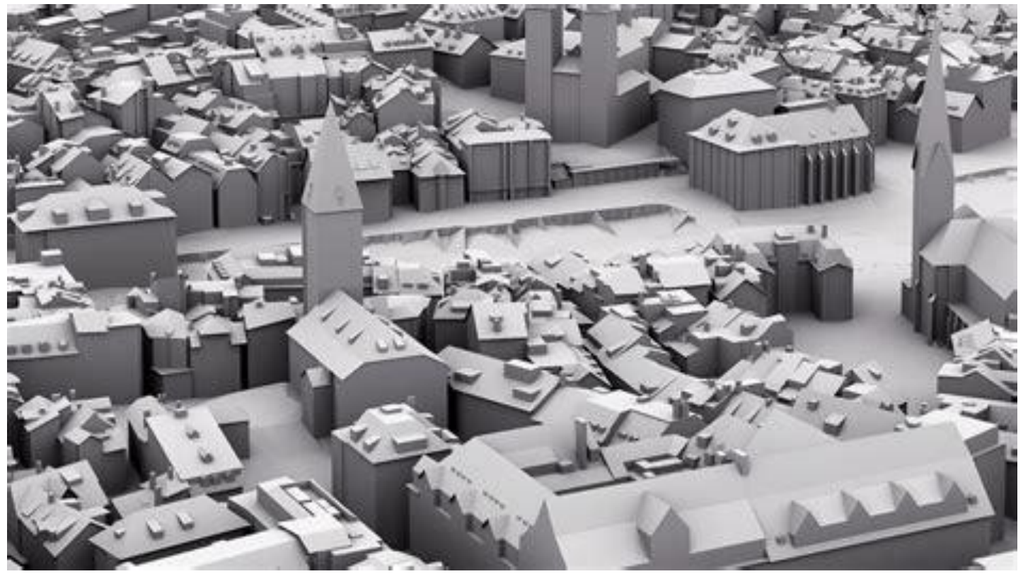
SENTIER RAQUETTES MONT-PÈLERIN

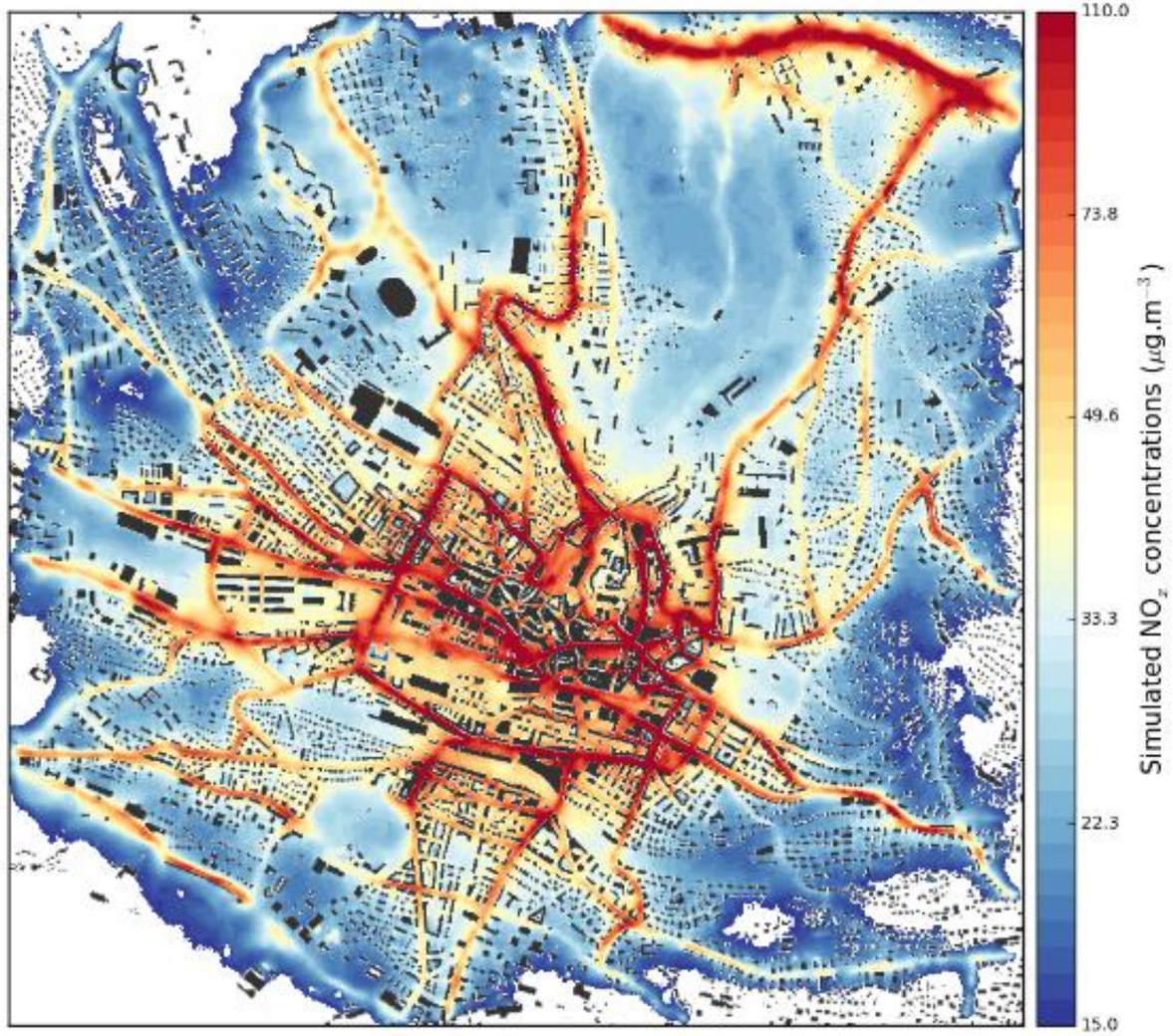
RAQUETTE À NEIGE



Localité	Montreux
Distance	6.81 km
Durée	2h30
Dénivelé	310 mètres
Difficulté	Moyen

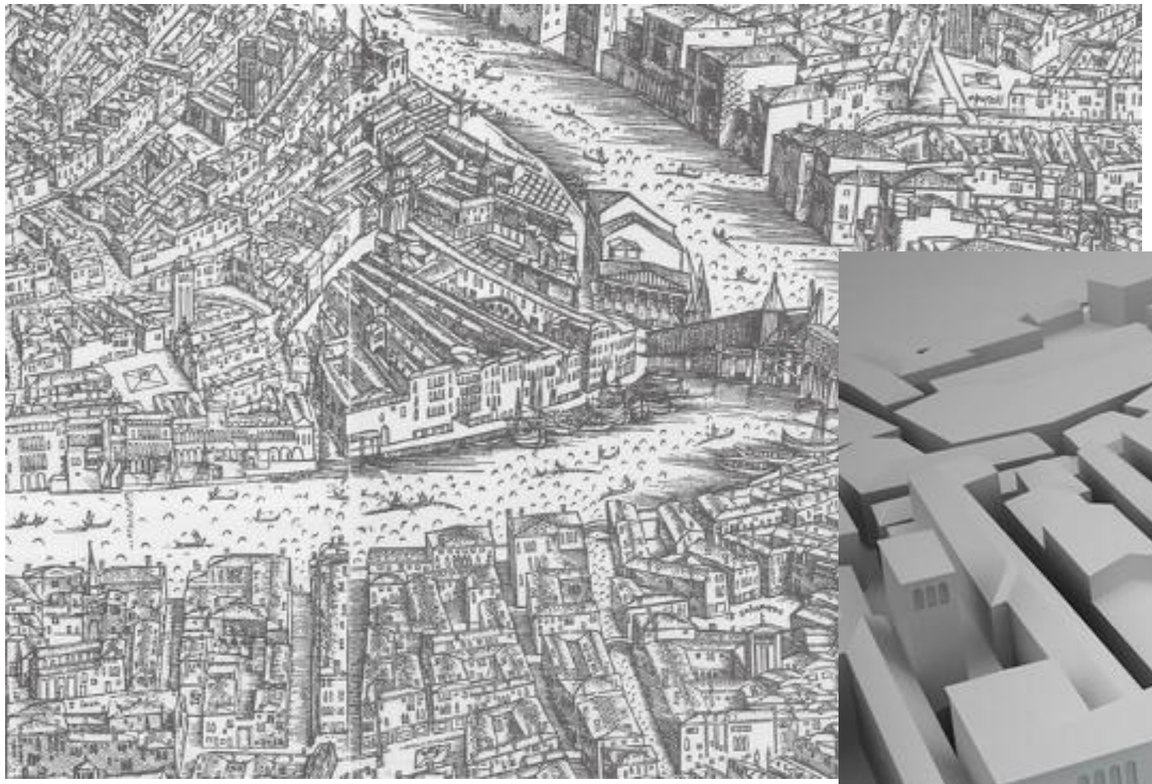
> GIS for developers: examples

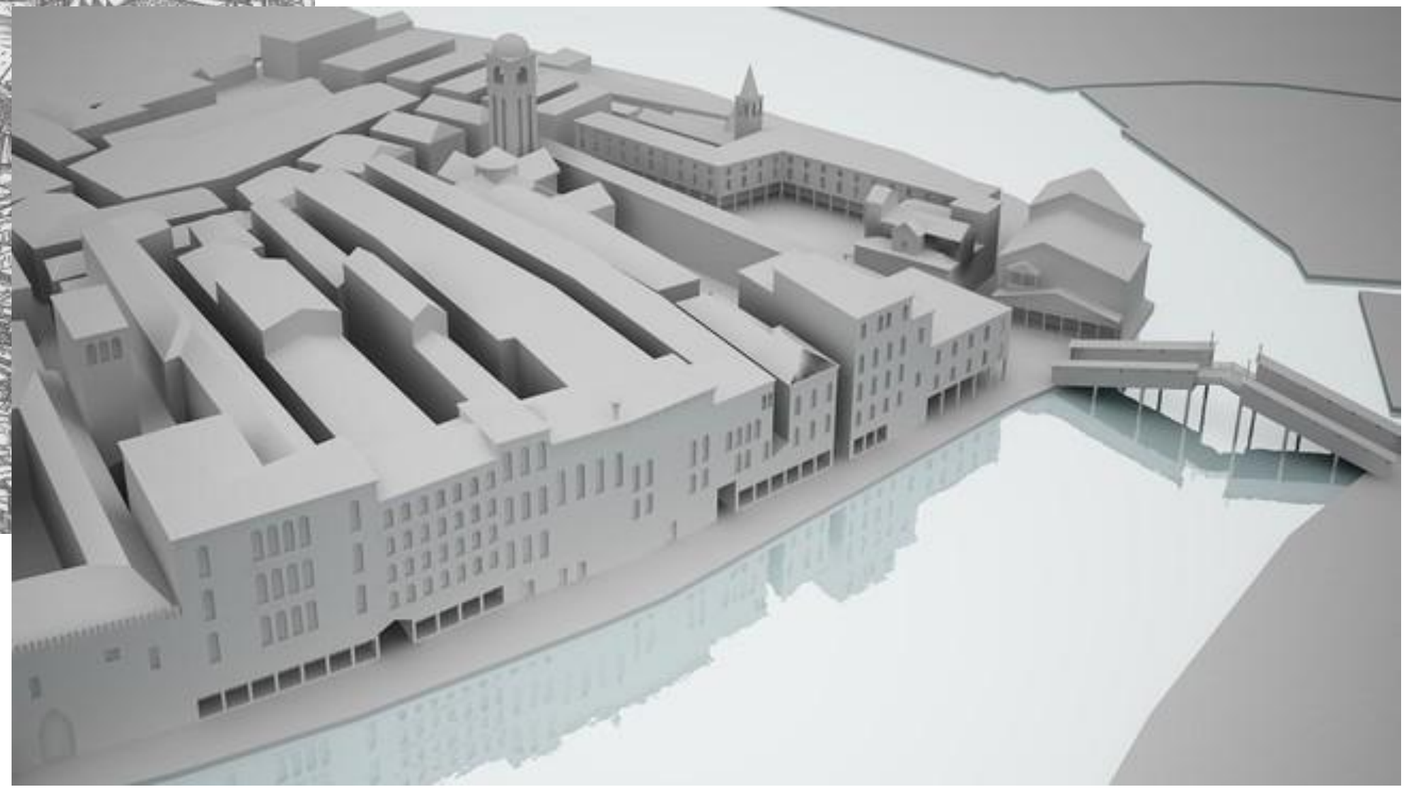




OpenSense: air pollution in Swiss cities

> GIS for developers: examples

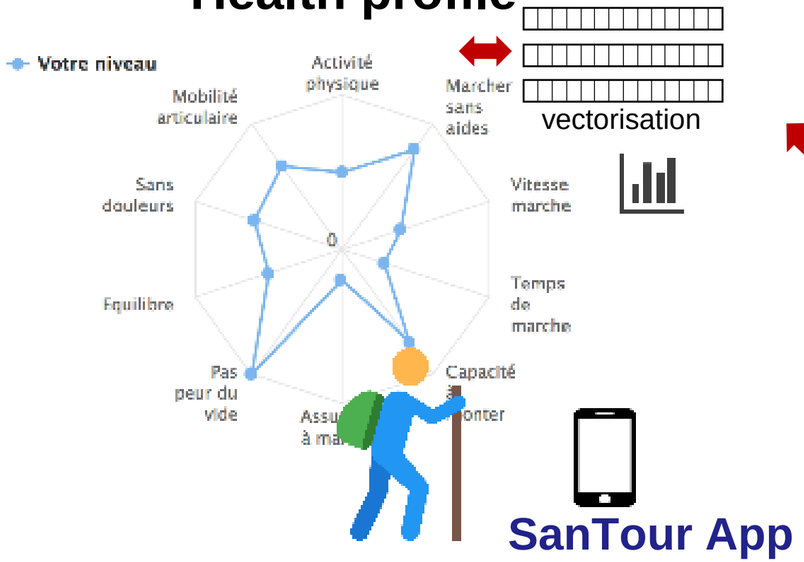




Venice Time Machine project

> GIS for developers: examples

Health profile



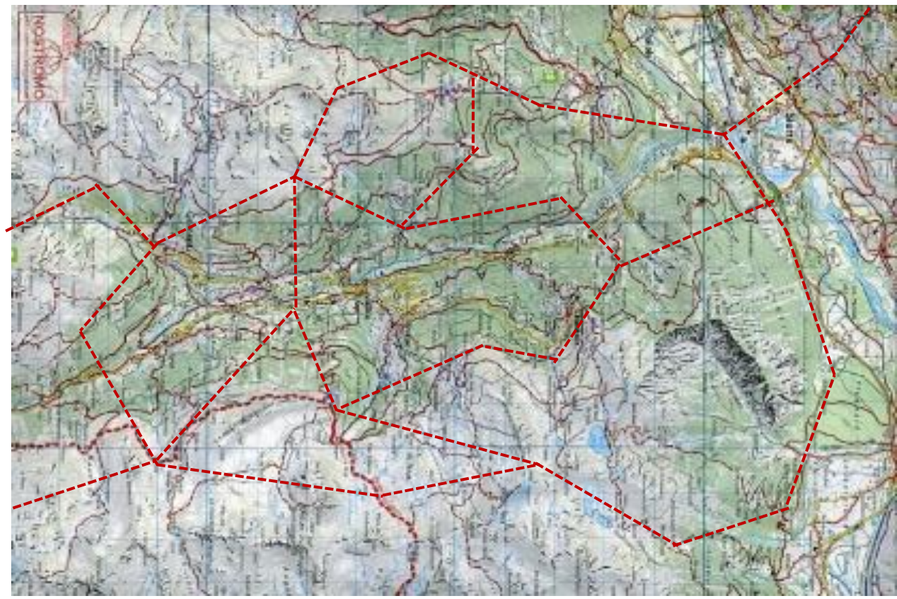
vectorisation

matching

SanTour App

Trail profile

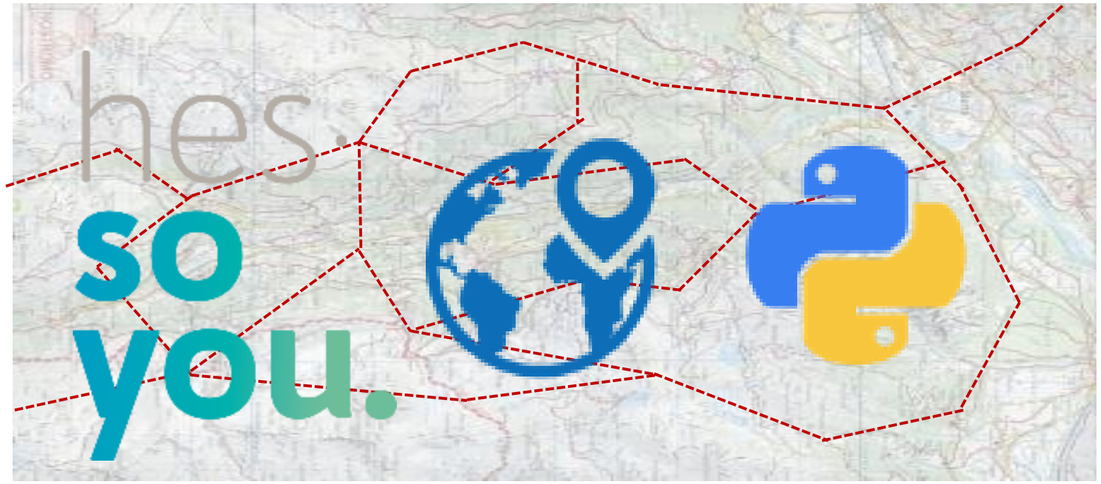
vectorisation



Recommendations

parcours	distance	temps	lien	score
Les Claudis	3.55km	1h	Snukr	0.74 score
La Lee ⚠	3.73km	1h	Snukr	0.71 score
Attention si douleurs importantes	6.0km	2.75h	Snukr	0.46 score
Zinal-Petit Mountet chemin d'été ⚠	10.8km	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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