

Environmental & historical Urban Data Visualization

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Agronomic engineer



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French experimental National University dedicated to cities and urban design: civil engineering, transport systems and infrastructures, urban resilience, geomatics => mix of human, social & computer sciences.

<https://www.univ-gustave-eiffel.fr/en/>

National Institute of Geographic & Forest Information (IGN-F)
French National Mapping Agency, public administrative institute, dedicated to acquisition, processing and mapping of geospatial data, such as the production of geoservices.

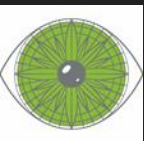
<https://www.ign.fr/institut/identity-card>

- Research in **Geographic Information Sciences**...
.... for a sustainable city and numeric territories.
- Context: Climate Change and the related environmental and social impacts.
- To provide data, knowledge, methods and tools for modeling, analysis, simulation and visualization of the territory and the spatio-temporal phenomena on Earth.
- GI Sciences, Computer Sciences, Remote Sensing, ...

<https://www.umr-lastig.fr/>



- Environmental changes caused by human activities: land uses, pollution, deforestation, urban climatology, water flooding and marine submersions, etc.
- Historical and social changes: past dynamics, massive urbanization, urban planification, mobilities, transportation, etc.
- Understanding of spatialized systems and phenomena...
... and their dynamics on Earth



- Understanding of spatialized systems and phenomena...
.....from the visualization and visual analysis of data, models, evolution scenarios.

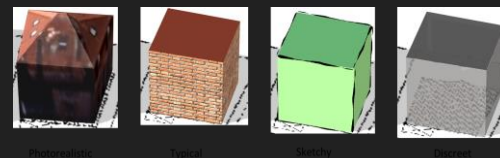
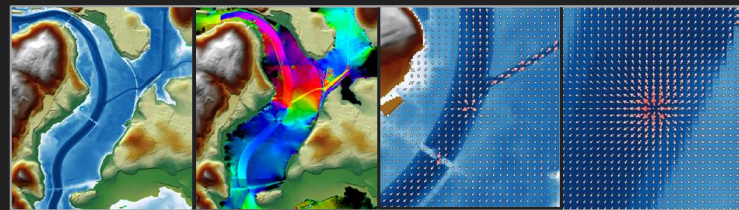
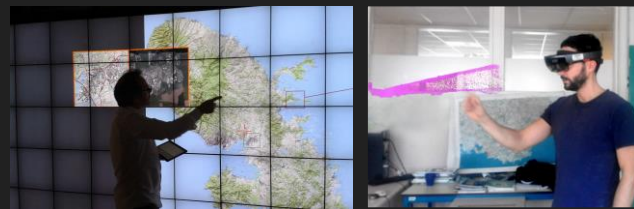
GI Sciences & Human-Computer Interaction & Computer Graphics

Geovisualization, cartography, InfoVis, Datavis,

Graphic representations, Visual Analysis & reasoning

Visual (or not) Perception, Spatial Cognition

Virtual/Augmented/Mixed Reality, Spatial Immersion



IGN-F Applicative Evolution:

- ❑ the automatic map production and on-demand map design on the web. <https://www.umr-lastig.fr/geovis/>
- ❑ the visual analysis of geohistorical & geophysics data, for researchers, experts, and stakeholders.

Stakes

- How to **co-visualize**

- Geographic, spatialized, +/-located ... data
- Heterogeneous, massive, imprecise ...



- To help **the users** in various **use contexts** to :

- **explore** data?
- **design** graphic representations... useful, efficient, usable?
- **visually analyze** spatio-temporal phenomena on Earth?
- **take decisions** on geographic spaces?



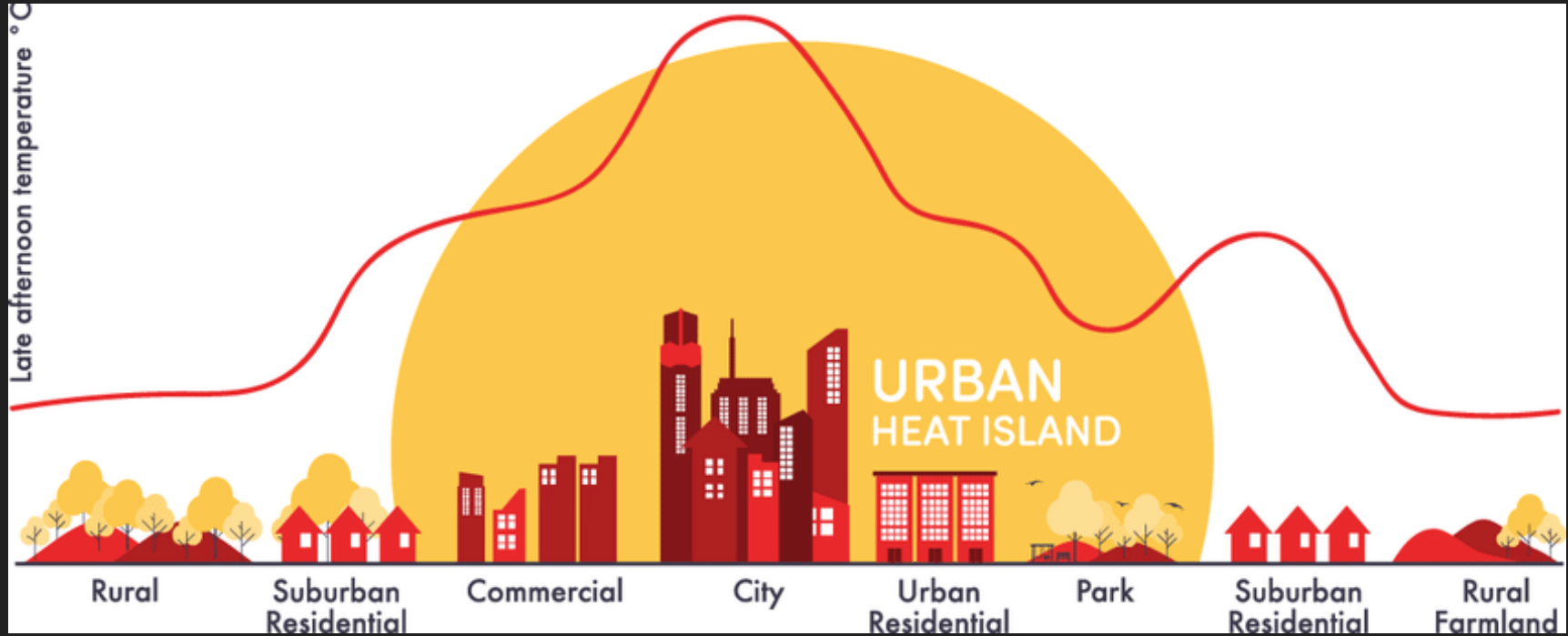
- According to various **visual, perceptive, cognitive abilities**...

- **Multi-dimensional exploration of the territory**

Some research works...

About climate data

ERA4CS URCLIM Advance on Urban Climate Services JPI CLIMATE (2017-2021)



<https://www.urclim.eu/>

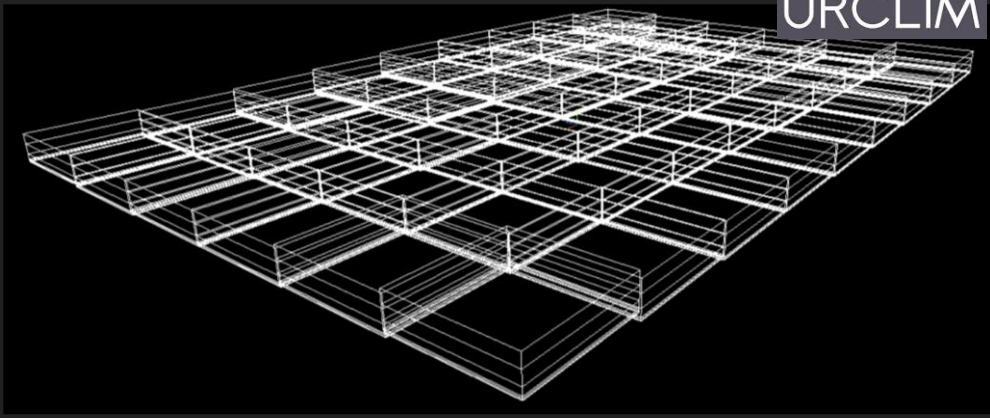
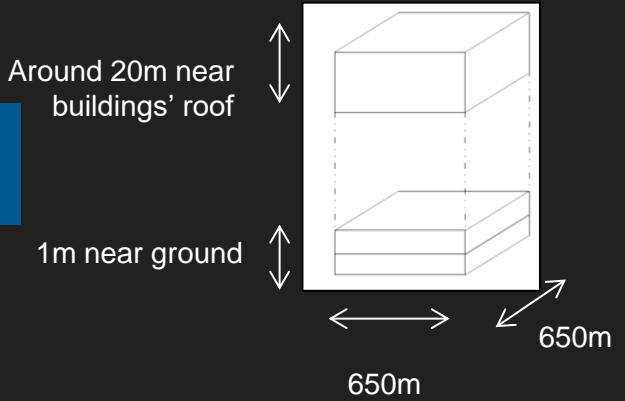


Co-visualization of temperature and urban data



- Simulated air temperature data

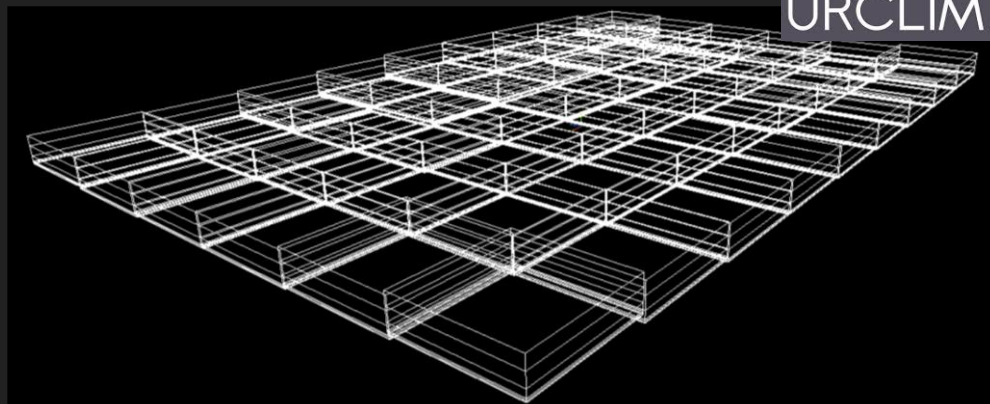
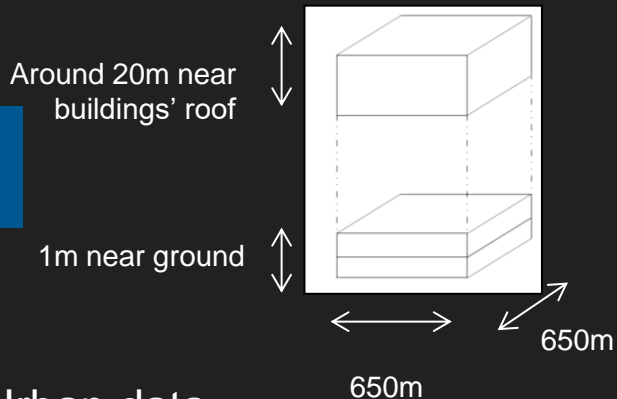
- Irregular 3D grid



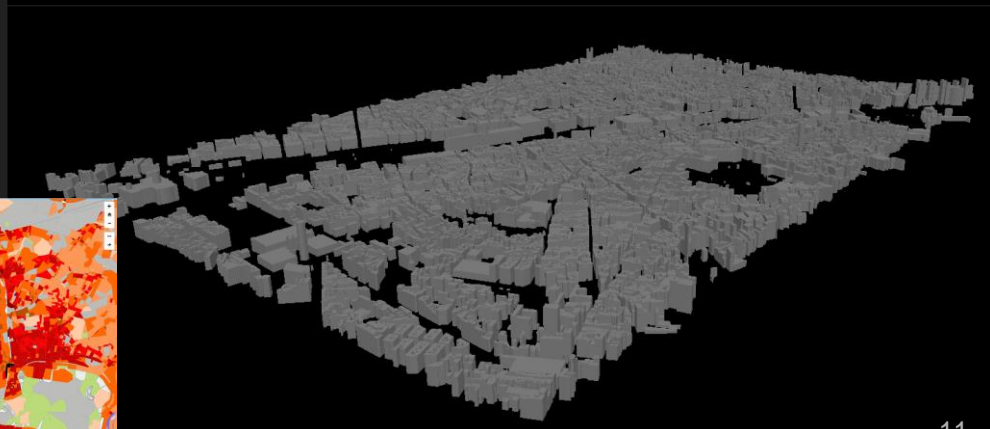
Co-visualization of temperature and urban data



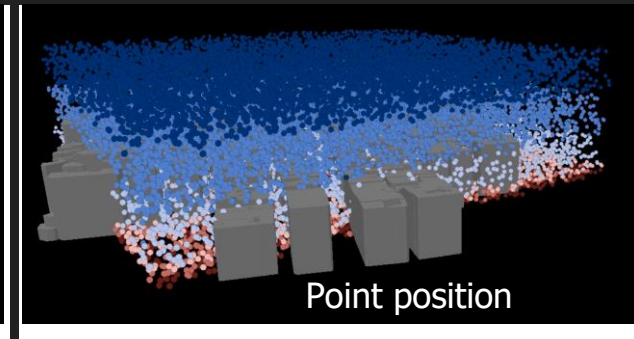
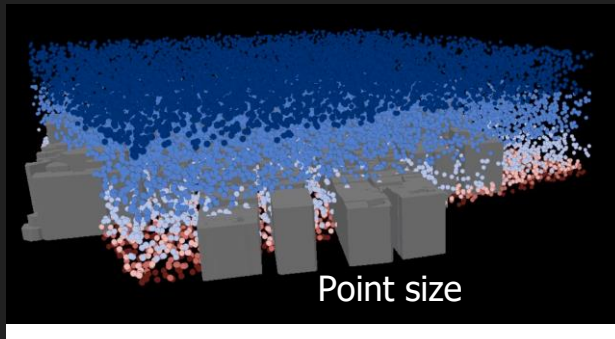
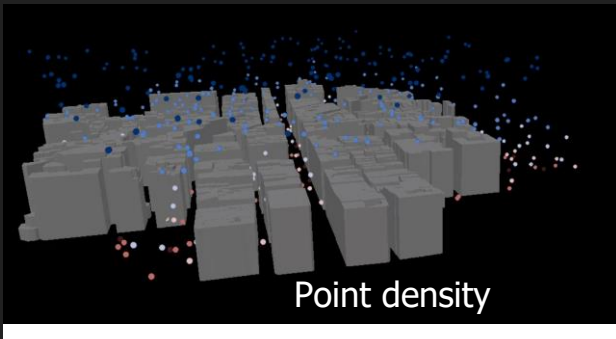
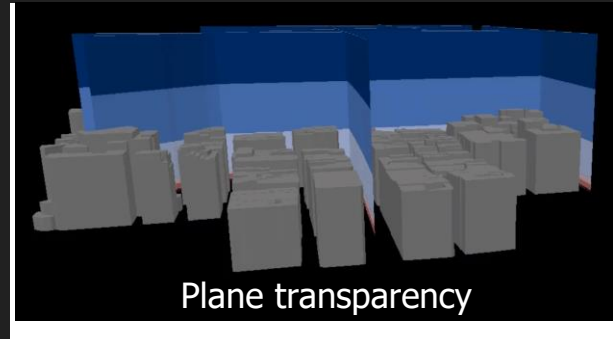
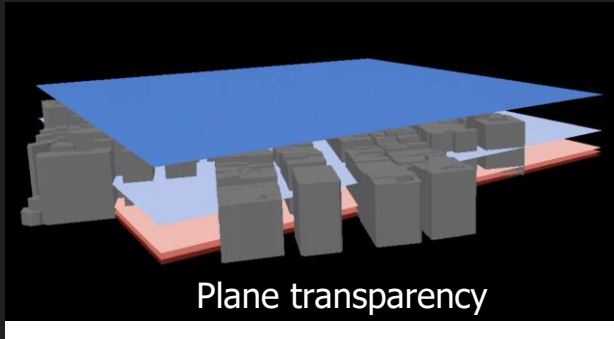
- Simulated air temperature data
 - Irregular 3D grid



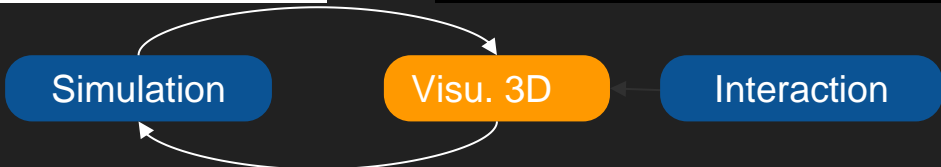
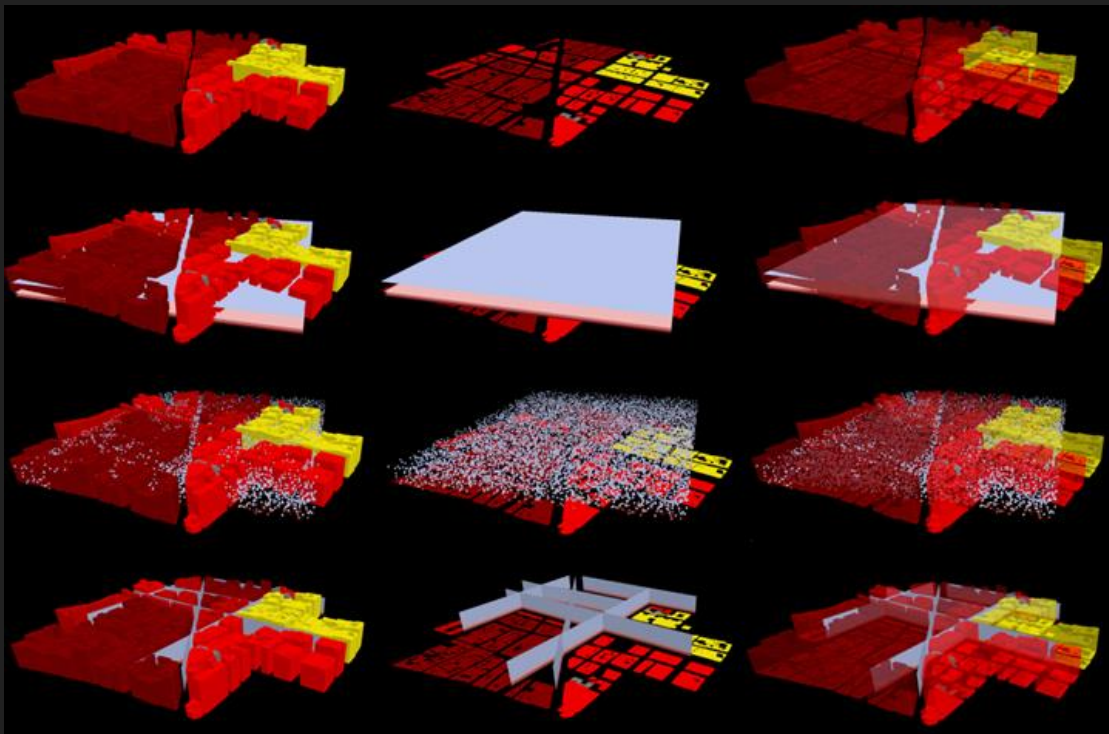
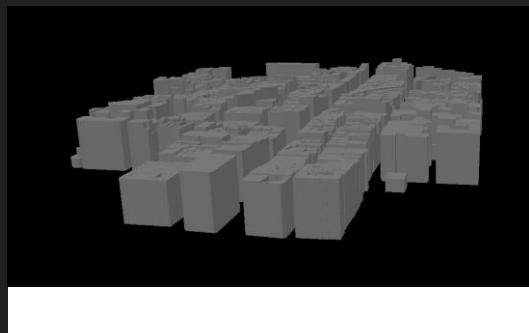
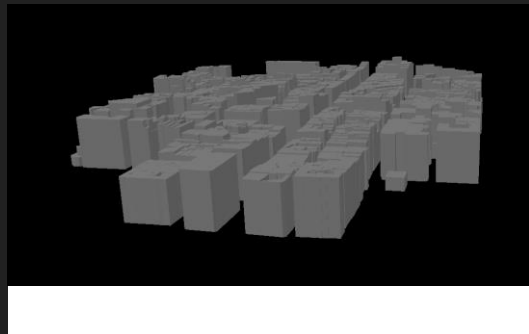
- Urban data
 - 3D urban model
Metric resolution
 - Morphological indicators
City Block scale



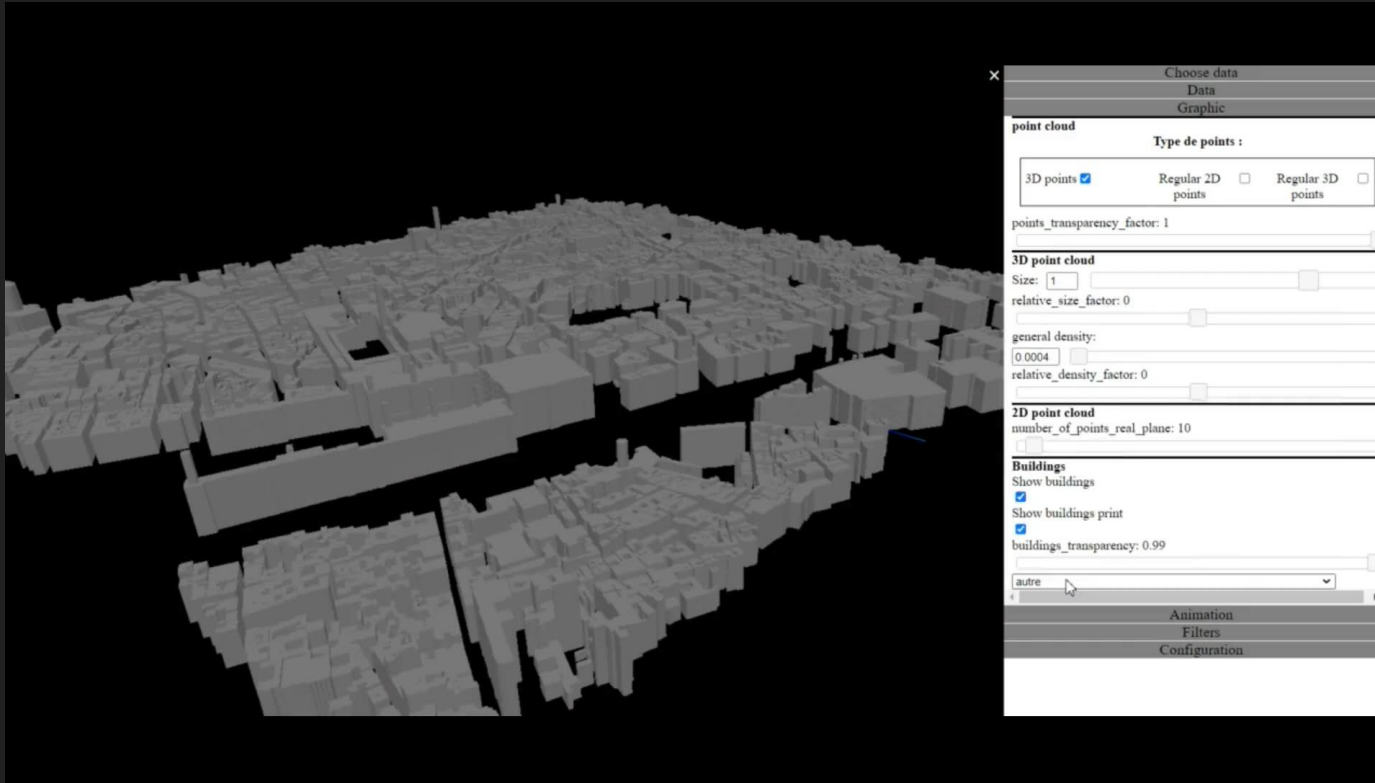
Exploration of geometries & styles to represent simulated temperature



Co-visualization of information?



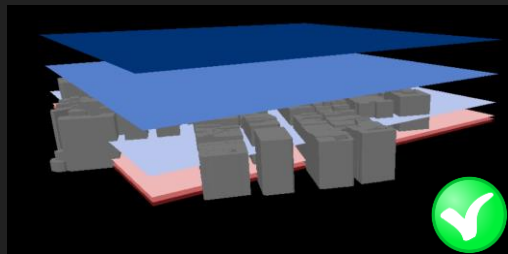
Visual analysis of the simulated air temperature distribution



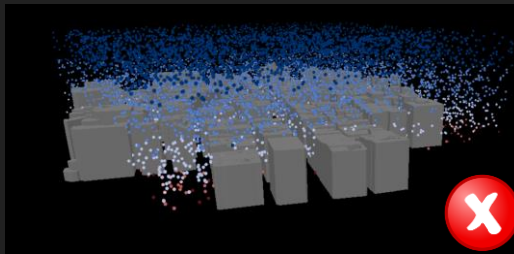
Expert evaluation



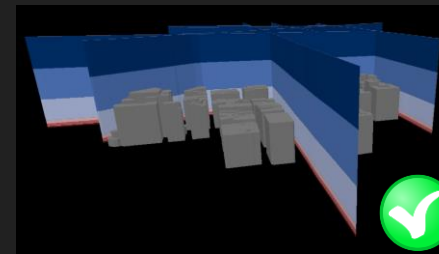
- Open discussion with meteorological experts



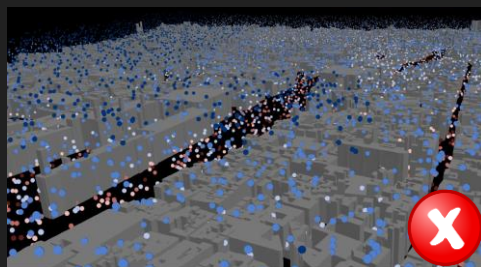
Horizontal planes



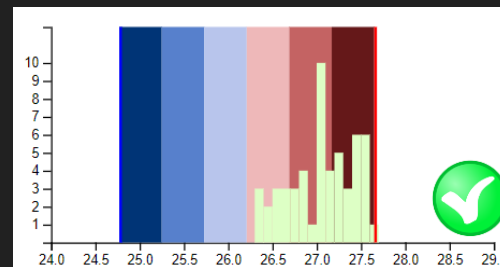
3D point cloud



Vertical planes



Animated filtering

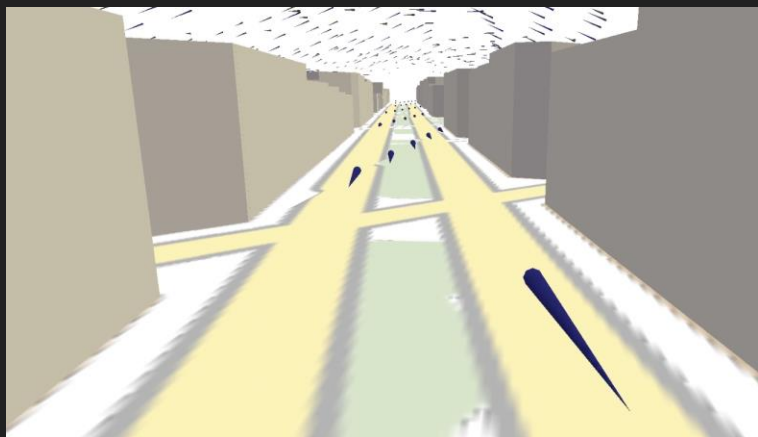


Interactive diagram

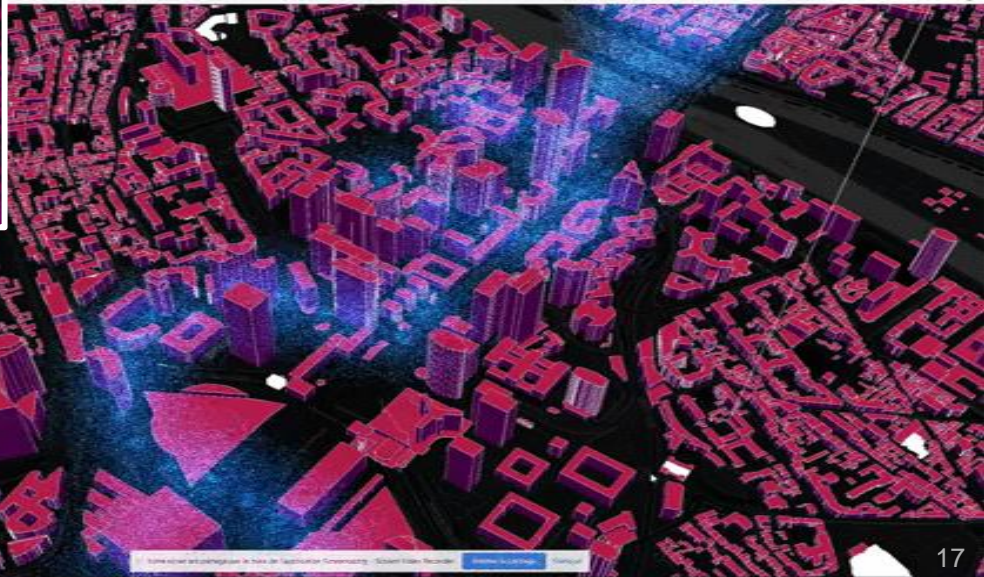
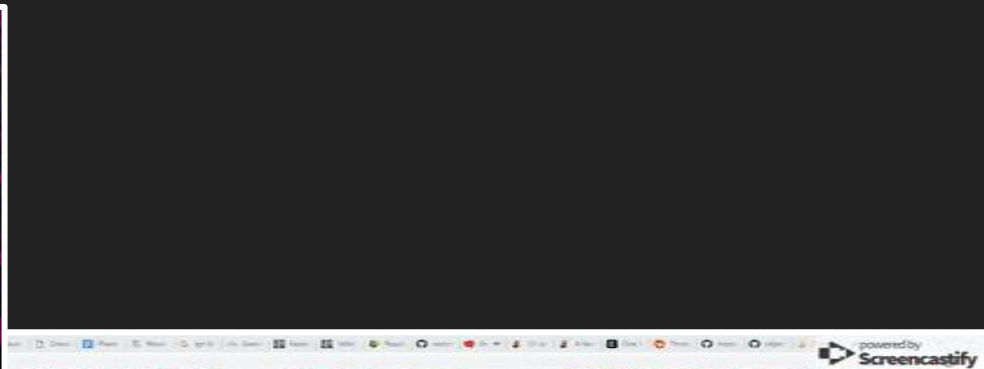
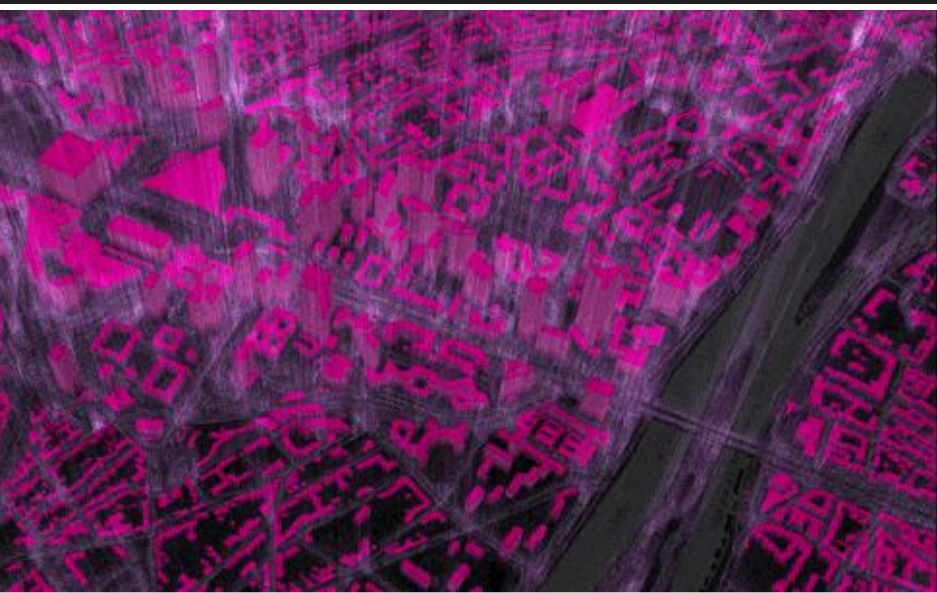


**METEO
FRANCE**

Wind visualization => VR/AR



Co-visualization of 'simulated' data / rendering



About hydro data

- PLAN
- COUCHES
- OUTILS
- MODÈLE 3D DE THALES
- DIAGNOSTIC PMR
- GEOVELO
- MODÈLES 3D
- REGLAGES
 - EFFETS
 - Activer effets
 - Activer climat
 - Variation
 - Eau
 - Niveau
 - Netfilé: Krone Mapping
 - Saturation
 - Teinte
 - Contraste
 - Luminance
 - 3D Glasses switch rendering
 - Base
 - CUBEMap
 - Project lecture on pointcloud
- COMPTE

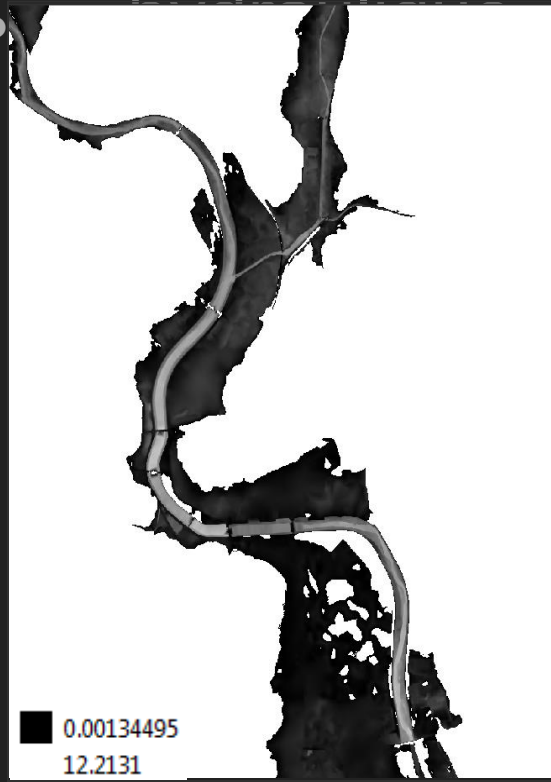


Flooding scenarios Visualization

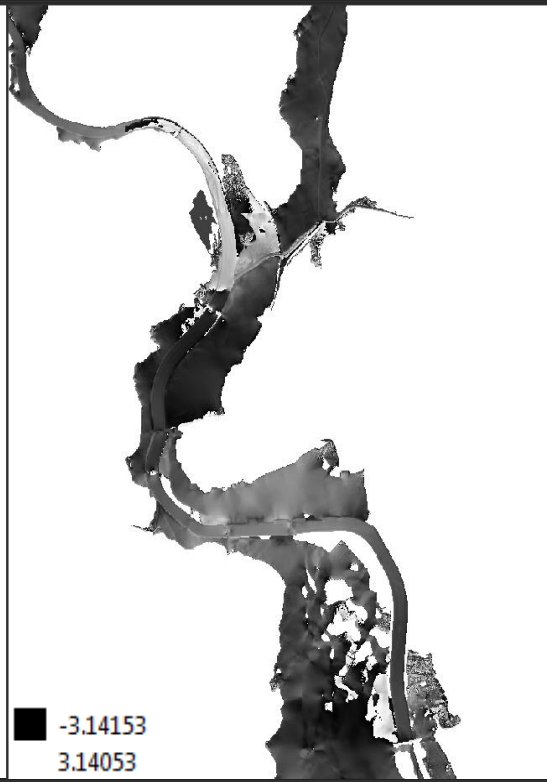


Multi-scale Visualization of simulated hydro data

Hauteurs d'eau:



Directions:

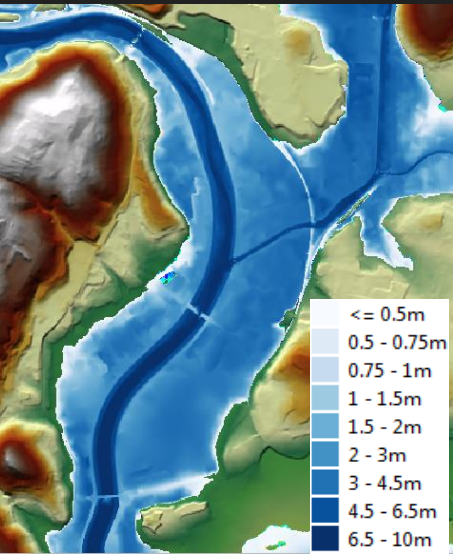


Vitesses:



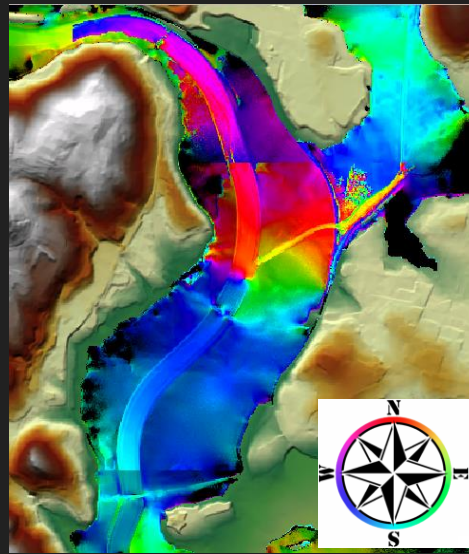
Multi-scale Visualization of simulated hydro data

Water heights

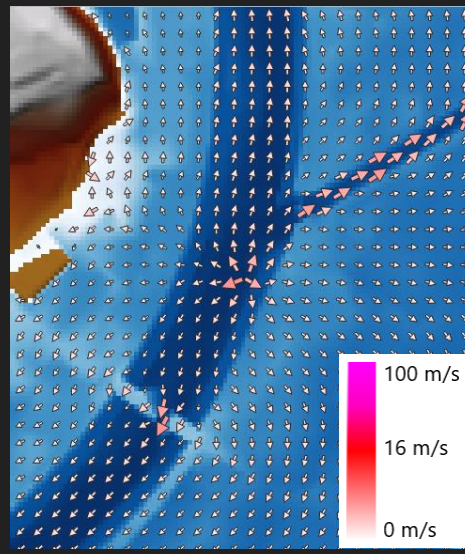


1/16000

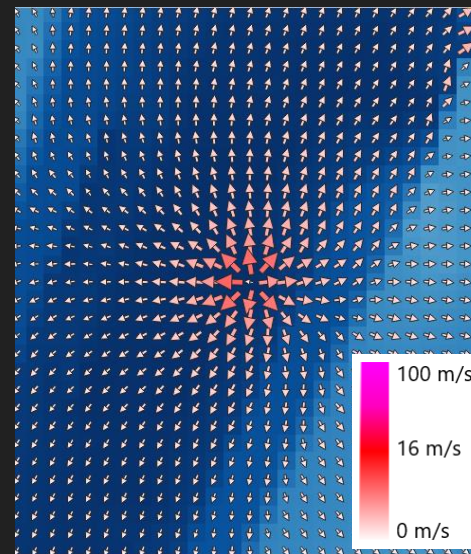
Speeds & directions



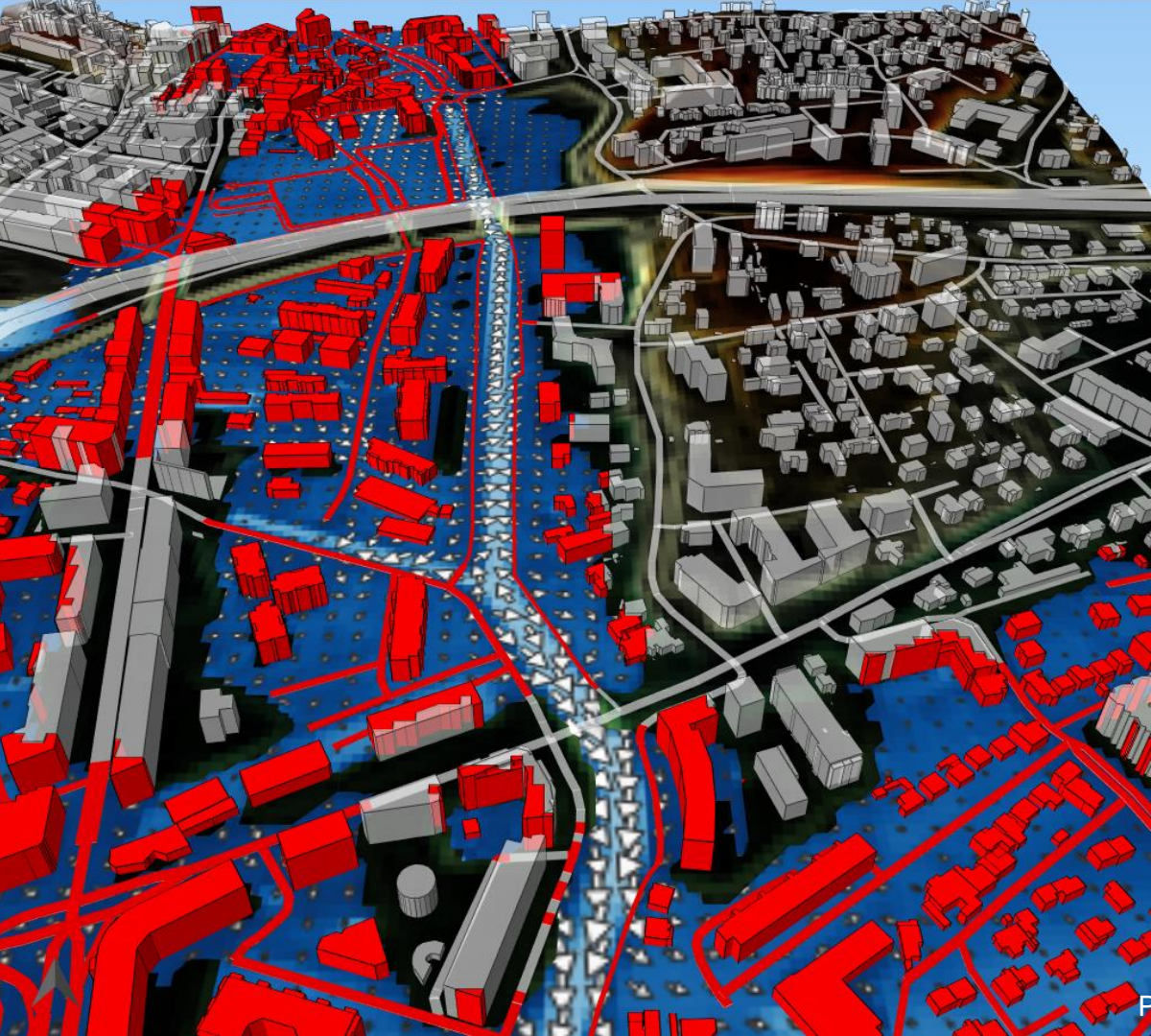
1/16000



1/4000



1/1000



Current:

- 0 - 0,75 m/s
- ◊ 0,75 - 1,5 m/s
- ↑ 1,5 - 3 m/s
- ↑ 3 - 6 m/s
- ↑ 6 - 10 m/s

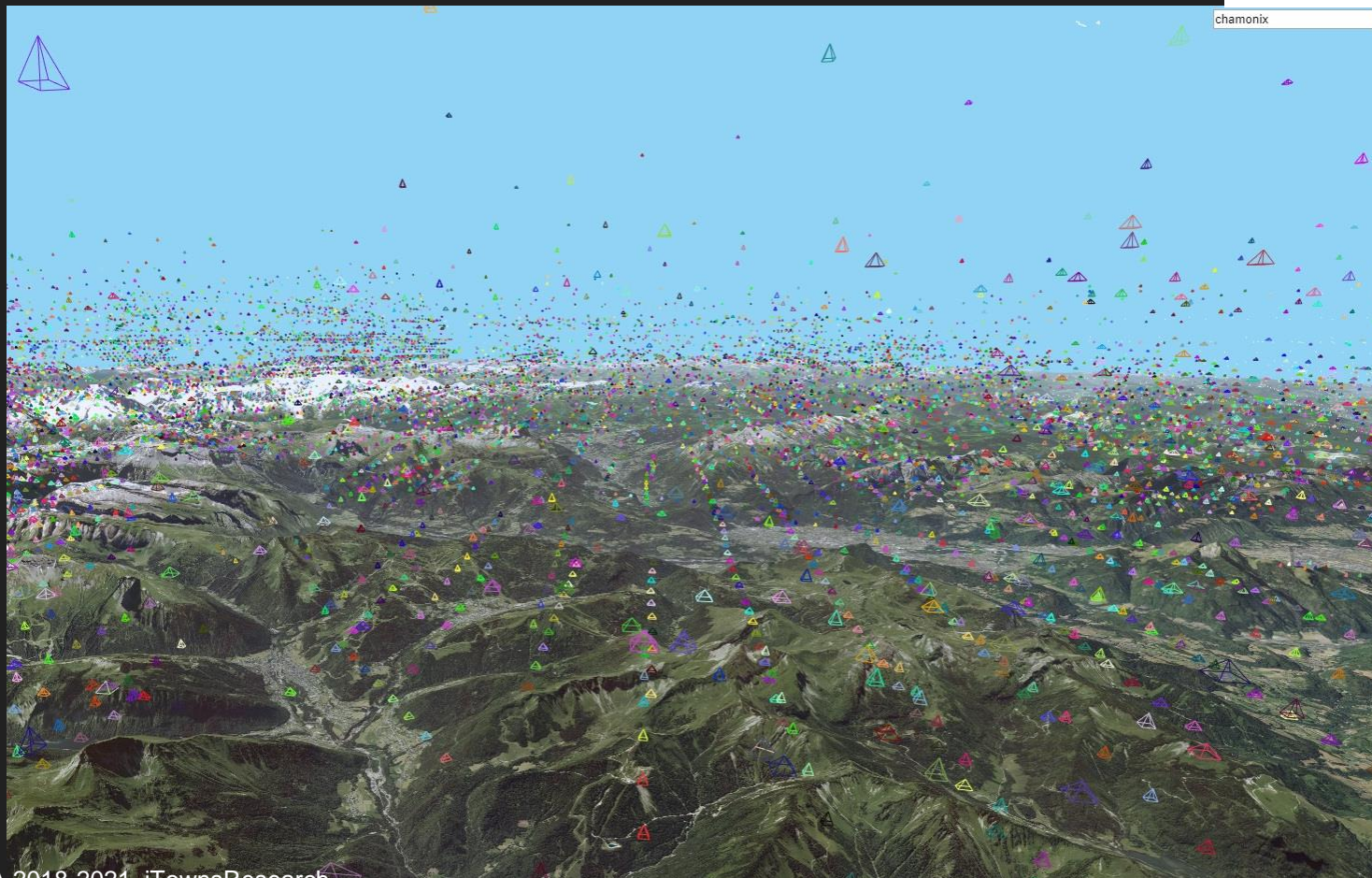
- Routes et bâtiments saufs
- Routes et bâtiments inondés

About historical data

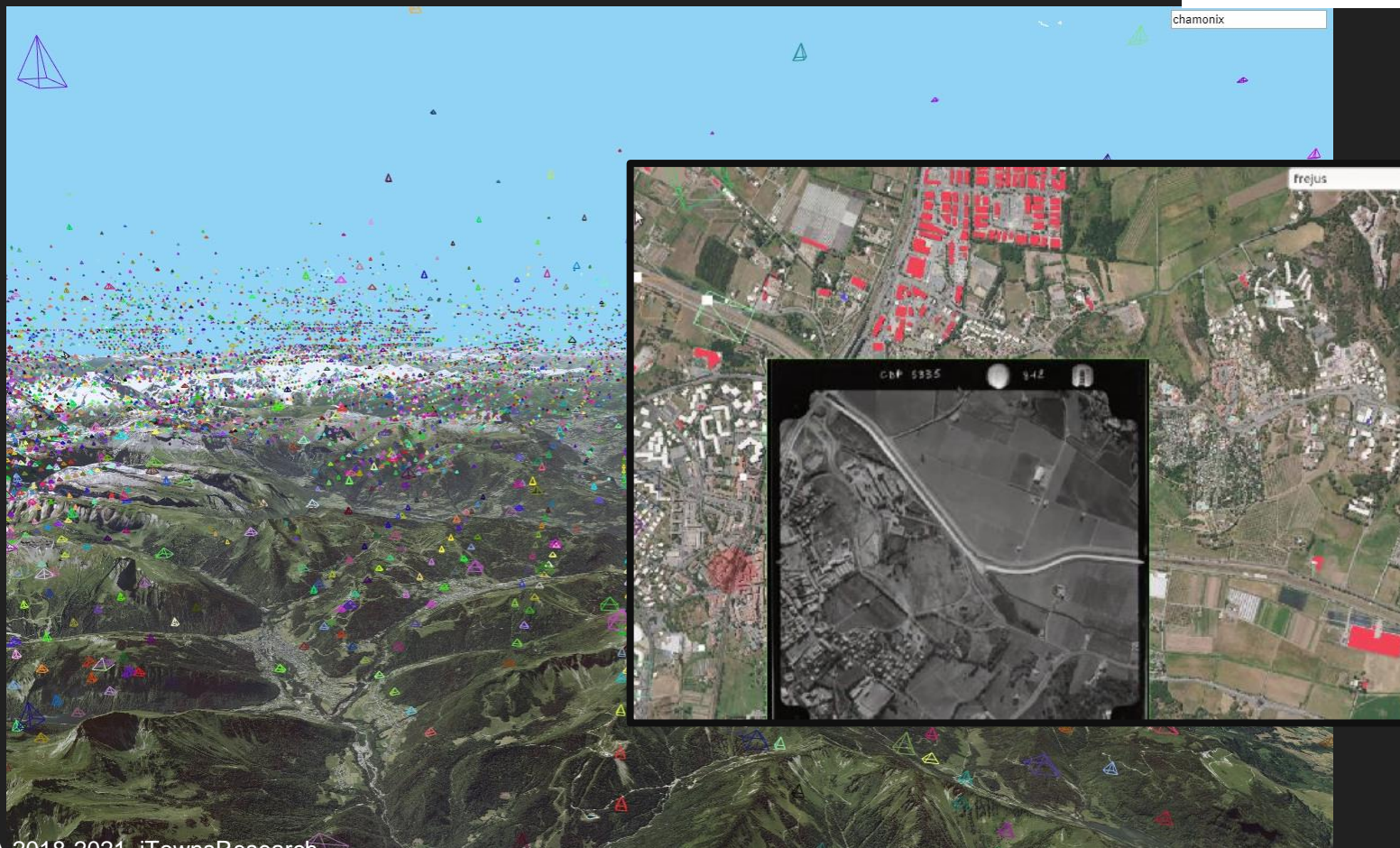
Cultural Heritage & geohistorical data



Historical massive data visualization



Historical massive data visualization



Navigating into Historical massive data

Content

Home

Image Collections ▾

Sample

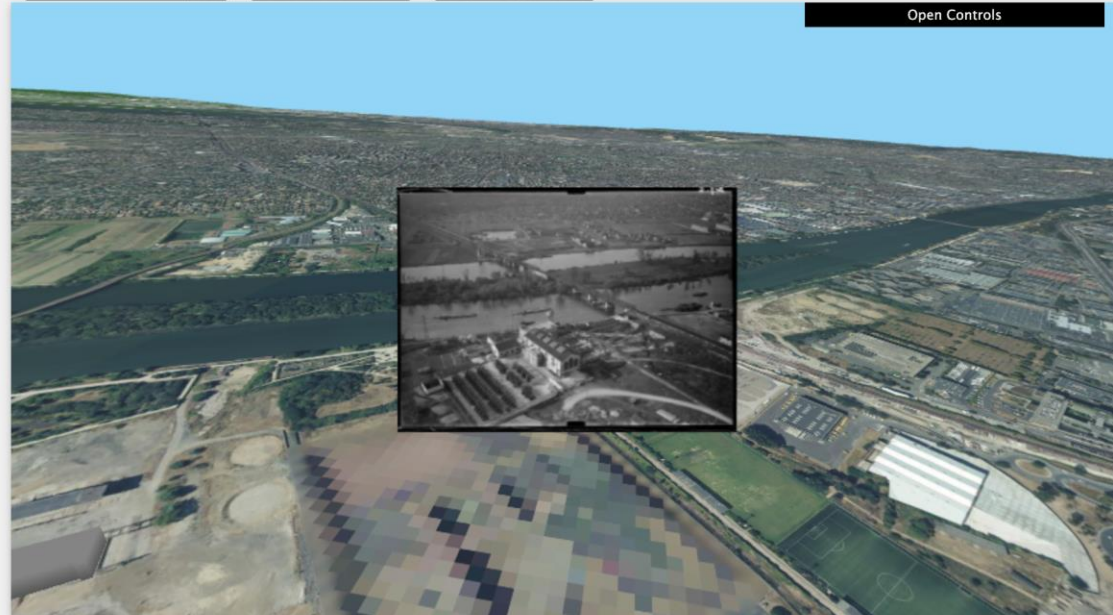
Maurepas

Viabon

Niepce

Nanterre

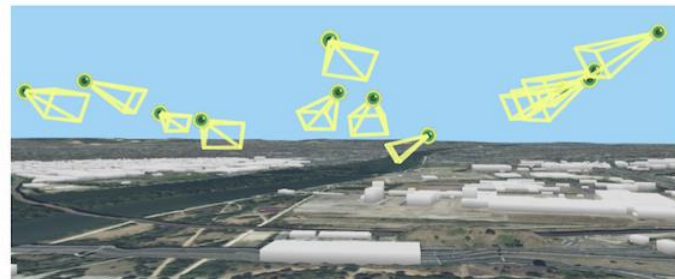
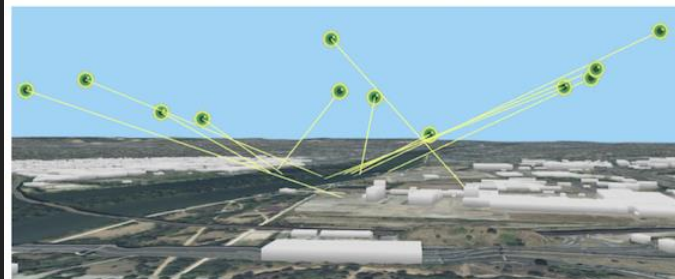
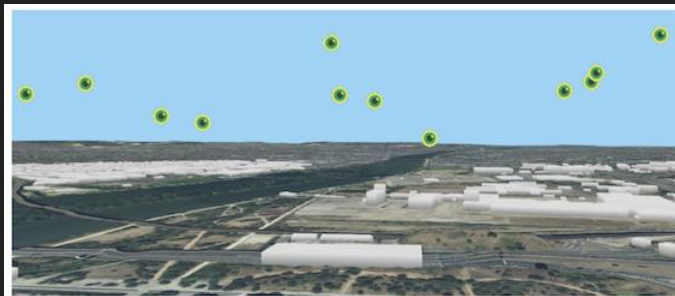
Menu Visualization ▾



PHD Thesis Evelyn Paiz-Reyes

Functionality 1: Interacting with the Photos

placing view-point
markers in the scene



Functionality 1: Interacting with the Photos

using spatialized
thumbnails

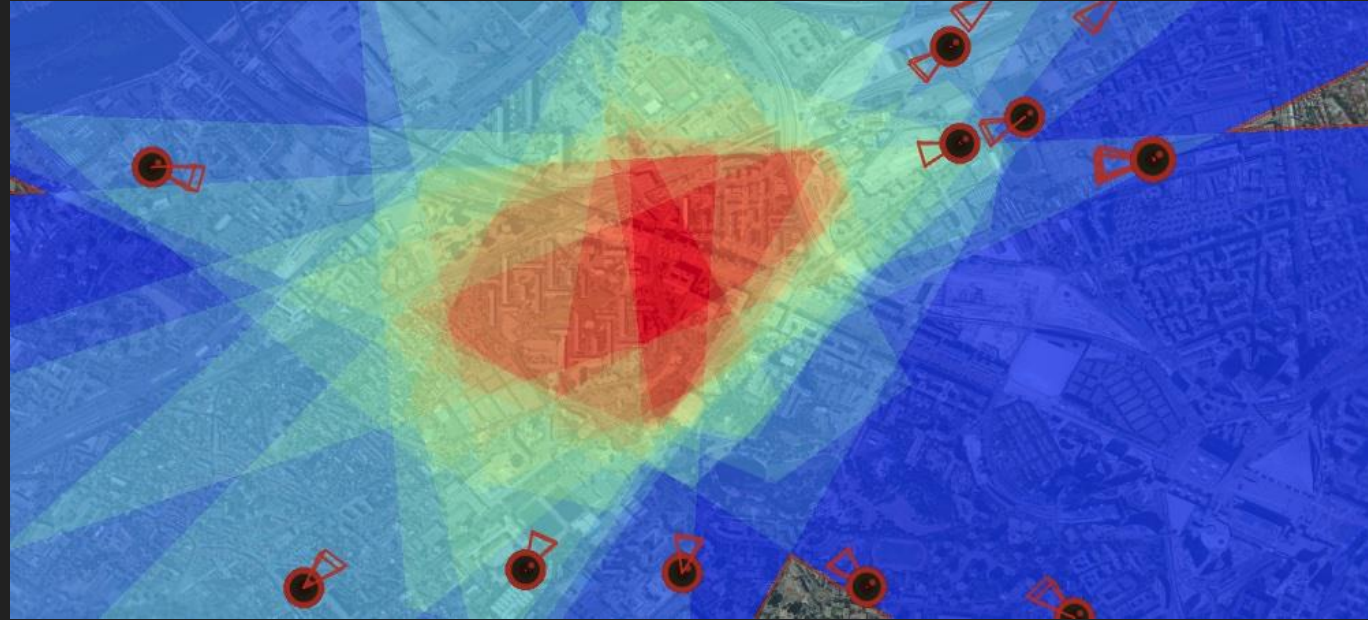


Functionality 1: Interacting with the Photos

visualizing the
photograph through the
historical camera

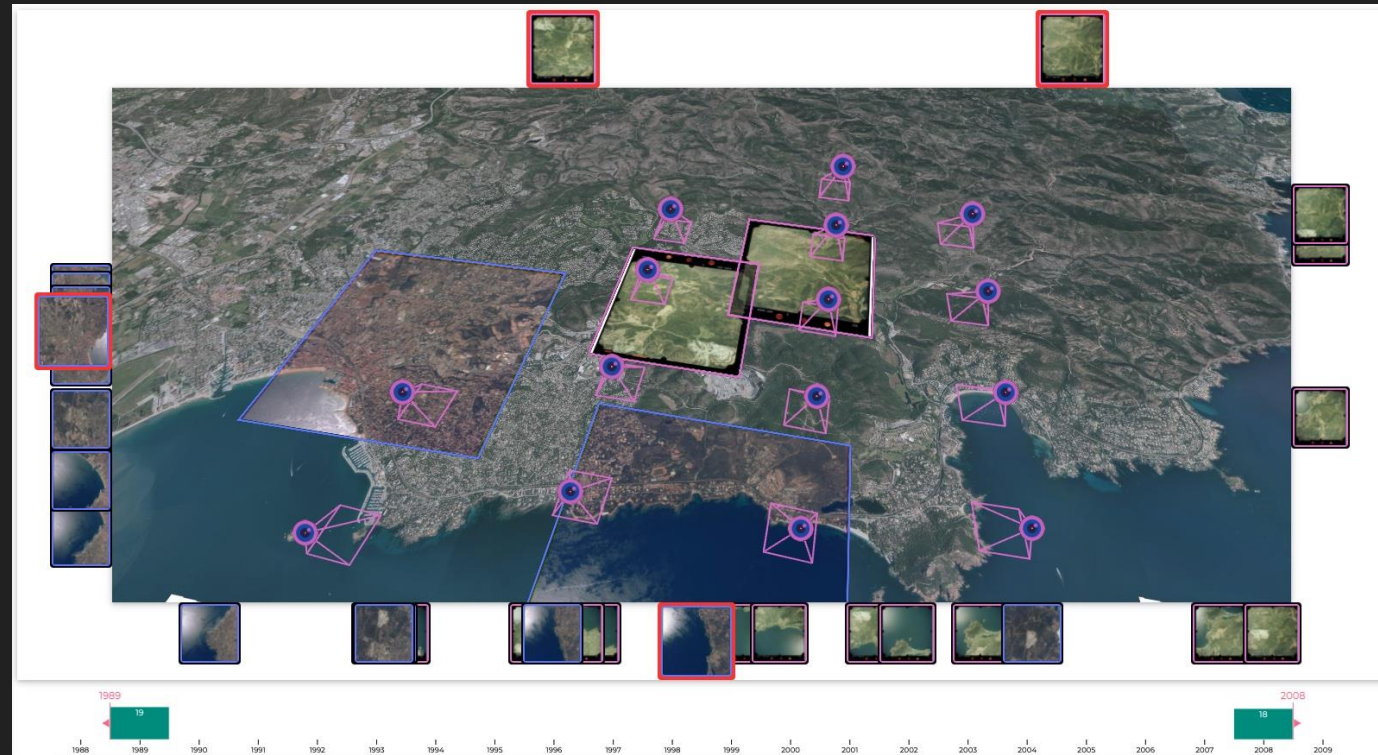


Functionality 2: Adding Saliency on Elements using a visibility heatmap to identify areas of interest



Functionality 3: Exploring through Space and Time

filtering the photos
using a timeline

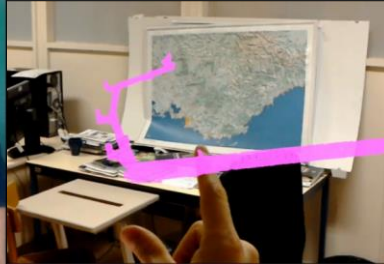


About existing & up-coming urban data

Augmented Reality (AR)



Augmented Reality (AR)

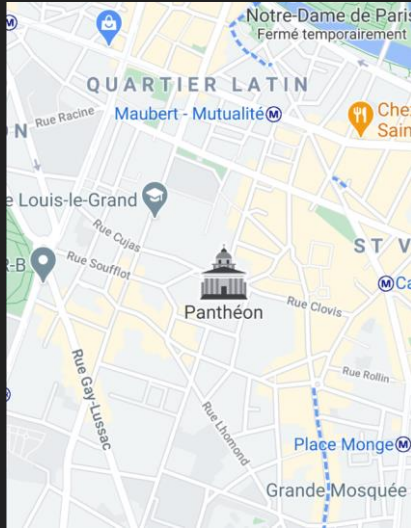


Real/Virtual hybridation / Holograms

Interactive transitions between representations

María Jesús Lobo - GEOVIS team – projet GeoFLY

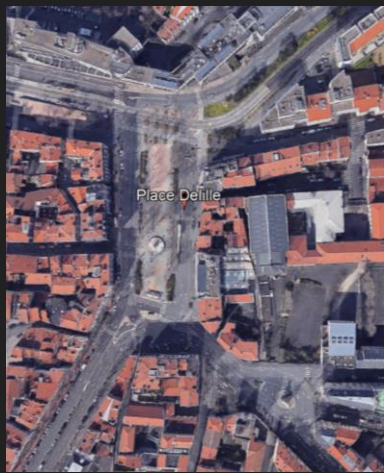
How to help users relate a 2D map view with an immersive view?



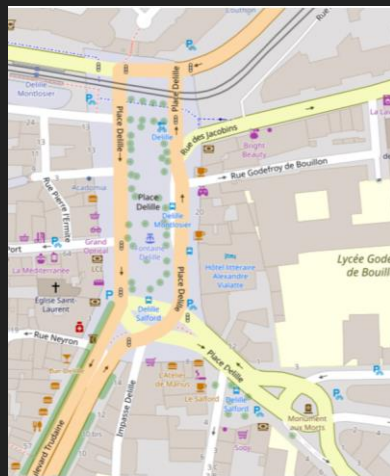
Mapping Road Crossings for Visually Impaired People



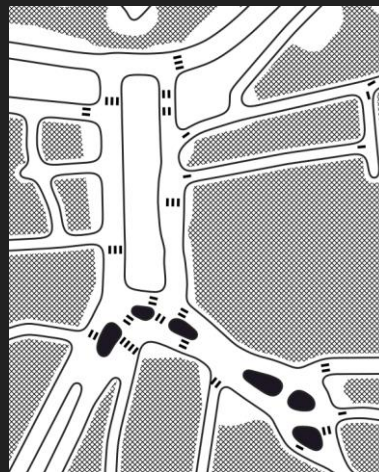
“reality”



data



map

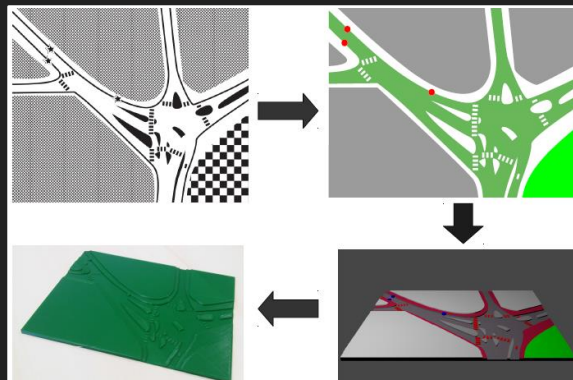


Yuhao (Markie) Jiang, 1st year PhD student

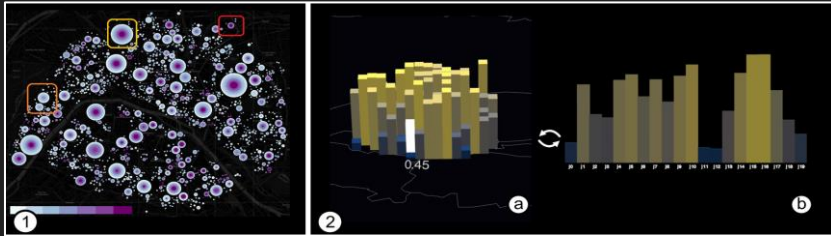
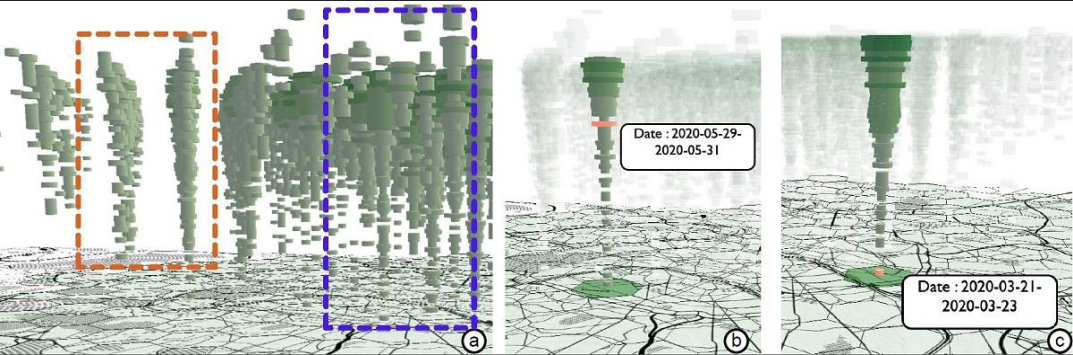
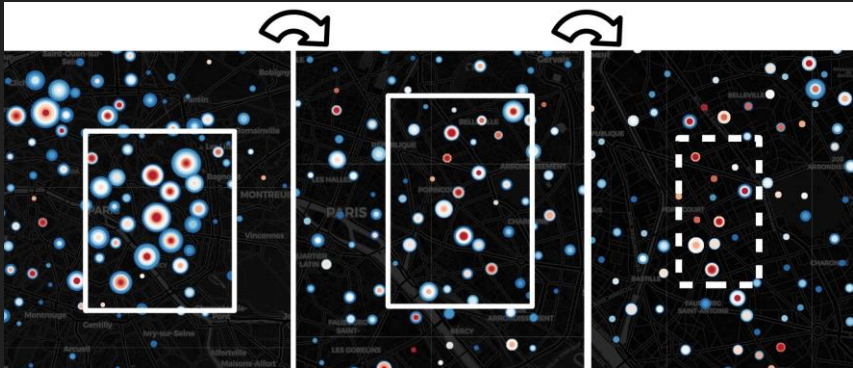
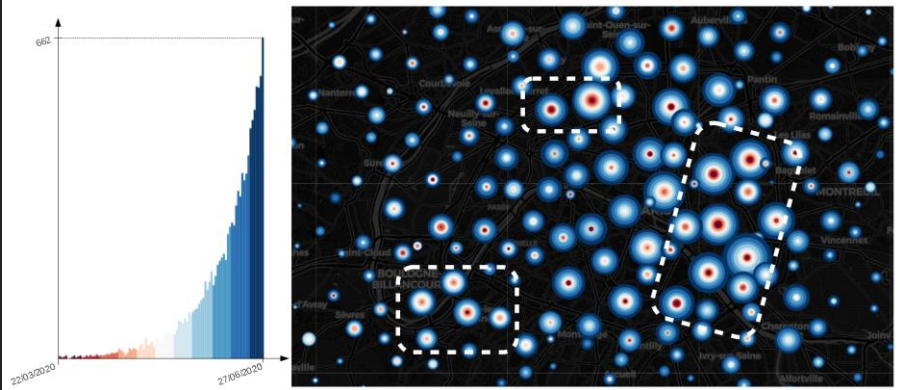
Supervisors: Sidonie Christophe, Maria-Jesus Lobo (GeoVIS)

Christophe Jouffrais (IRIT)

Jiang, Lobo, Christophe, Jouffrais, ICC2021



Spatio-temporal clusters of COVID data visualization

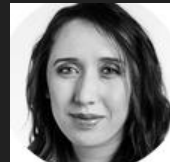
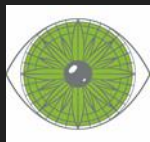


Open issues

Heterogeneous (3-4D) data to visually integrate to support visual analytics and interpretability of their relationship

=> geometry, topology, semantics issues / GI Sciences.

- Resolution & scales & dimensions: multi-perspectives on the data
- Visual complexity & graphic semiology, from the designer point of view
- ST Phenomenon complexity & (non-)visual complexity, from the user point of view
- Well-known issue of finding a balance between complexities!
- Let the users interact, analyze and interpret / user-centered design and user perspectives.



Thank you!

For any questions...
feel free to write!

sidonie.christophe@ign.fr
[@SidoChristophe](#)