

Environmental & historical Urban Data Visualization

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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.

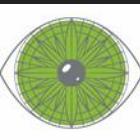
<https://www.ign.fr/institut/identity-card>

- 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/>



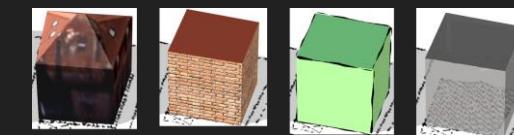
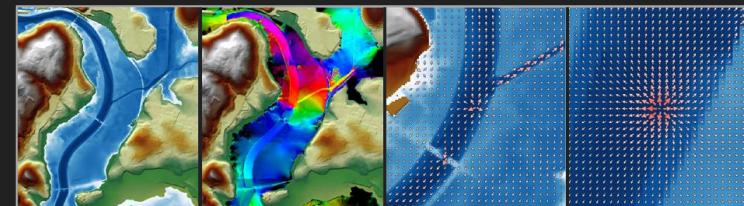
- Environmental changes caused by human activities: land uses, pollution, deforestation, urban climatology, water flooding and marine submersions, etc.
- Historical and social changes: past dynamics, massive urbanization, urban planification, mobilities, transportation, etc.
- Understanding of spatialized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

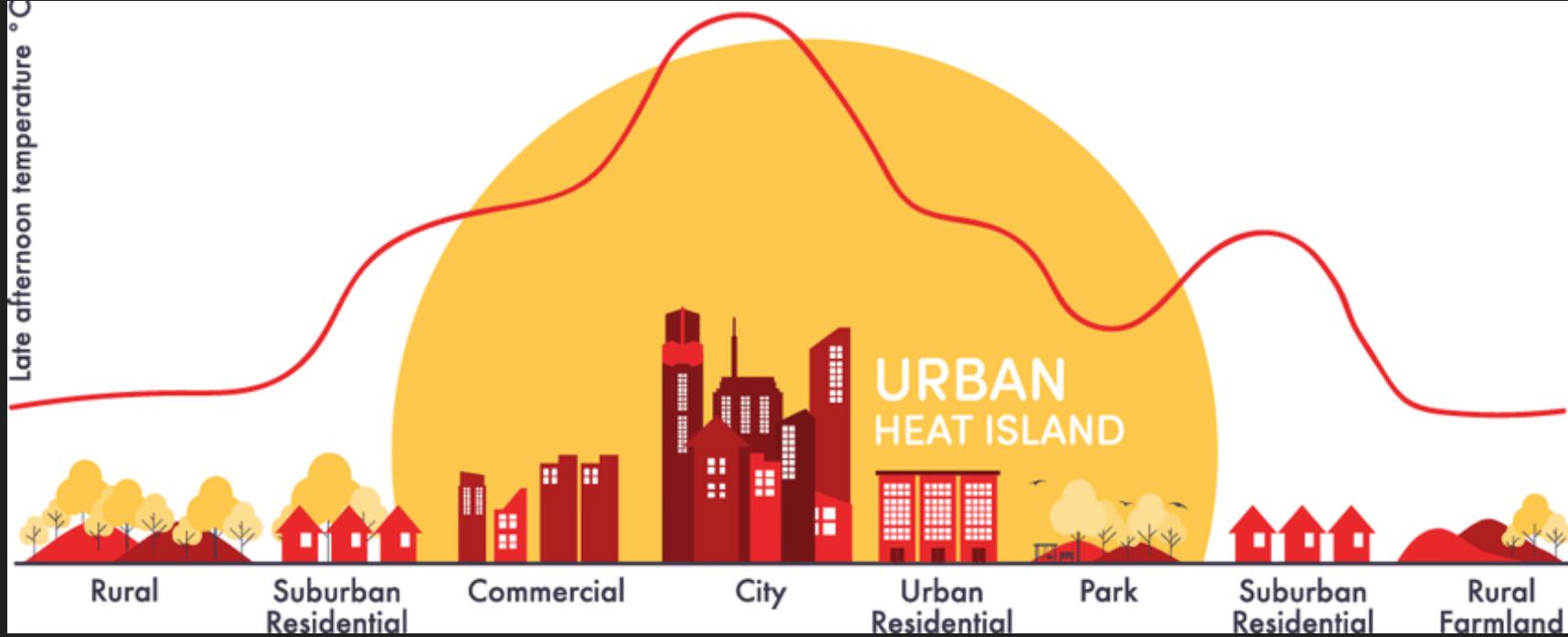
- How to **co-visualize**
 - Geographic, spatialized, +/-located ... data
 - Heterogeneous, massive, imprecise ...
 - To help **the users** in various use contexts to :
 - **explore** data?
 - **design** graphic representations... useful, efficient, usable?
 - **visually analyze** spatio-temporal phenomena 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/>

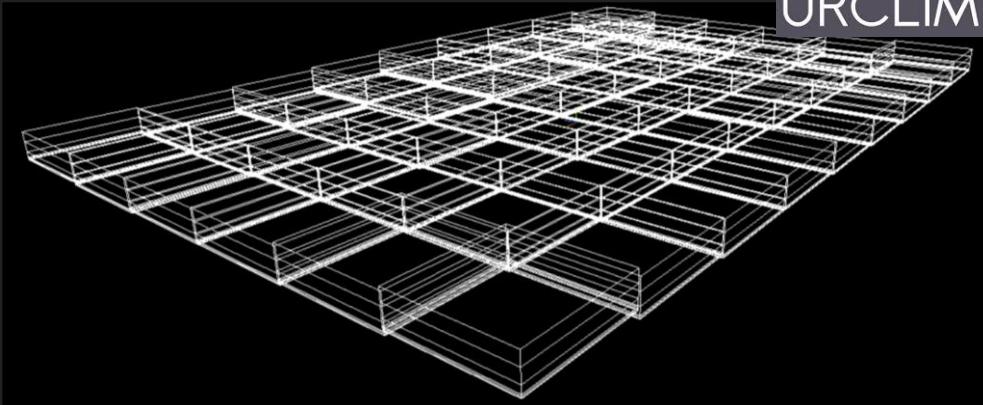
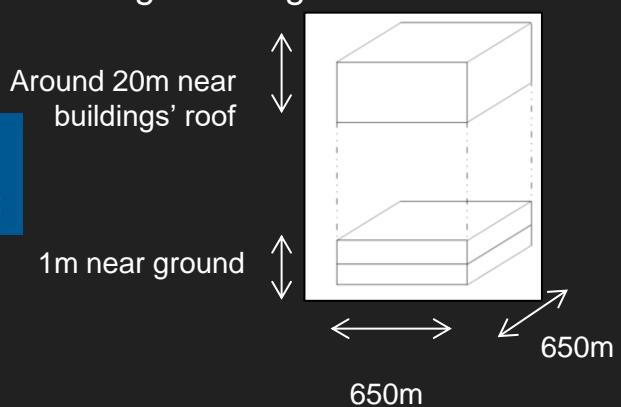


Koninklijk Nederlands
Meteorologisch Instituut
Ministerie van Infrastructuur en Milieu



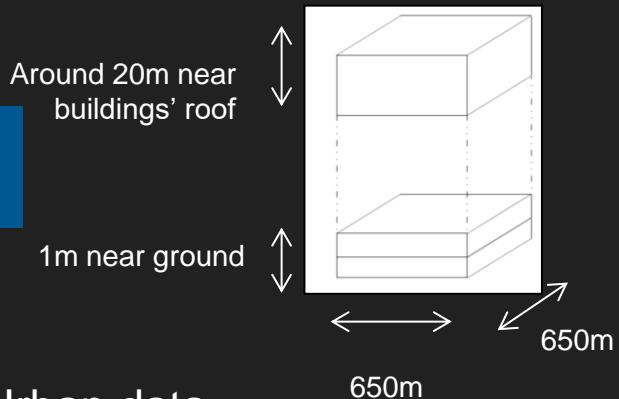
Co-visualization of temperature and urban data

- Simulated air temperature data
 - Irregular 3D grid

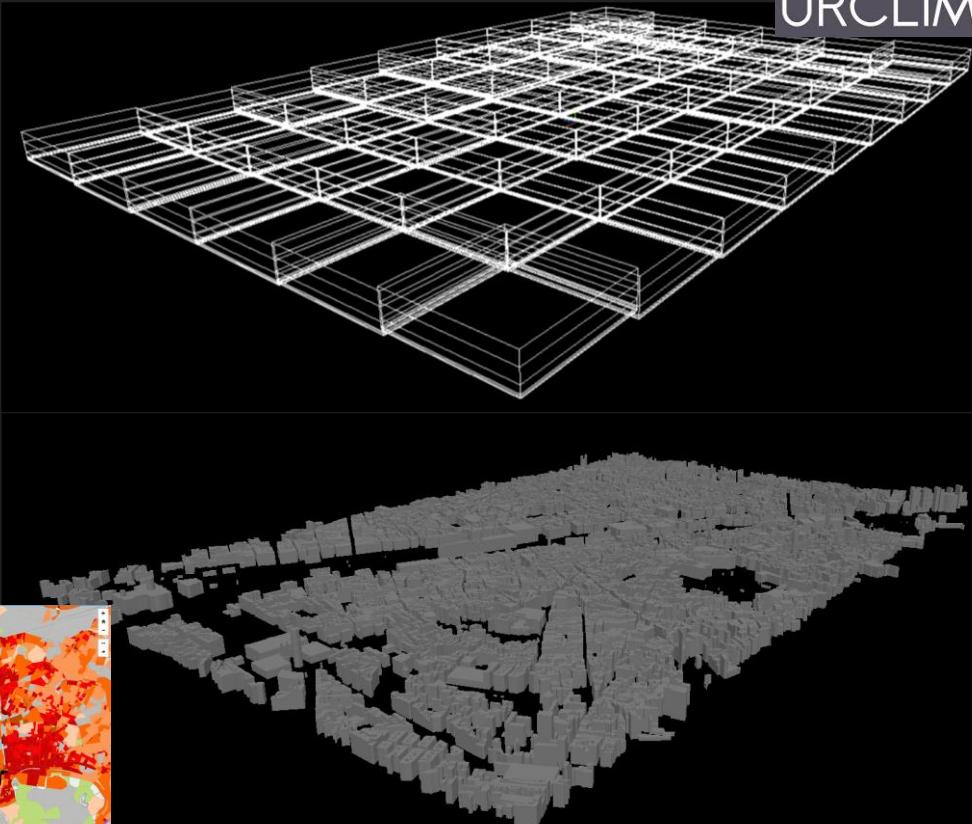
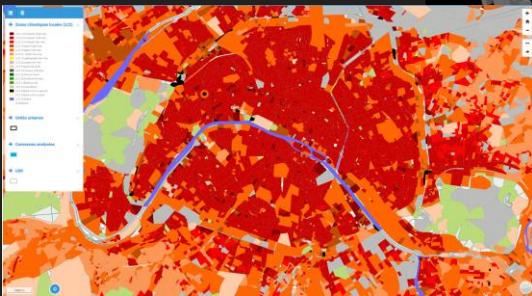


Co-visualization of temperature and urban data

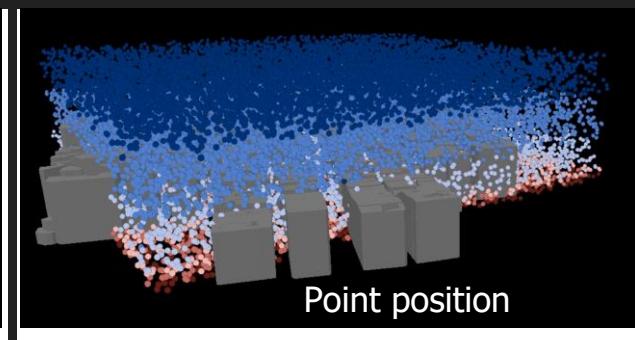
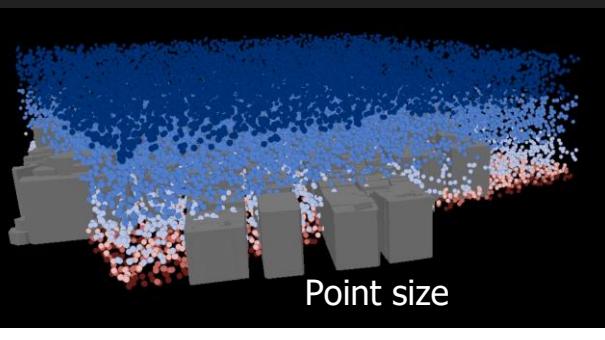
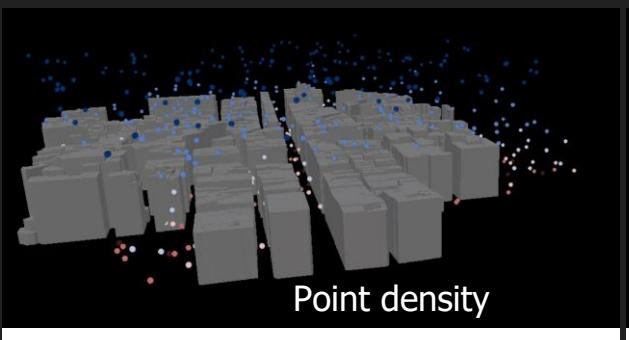
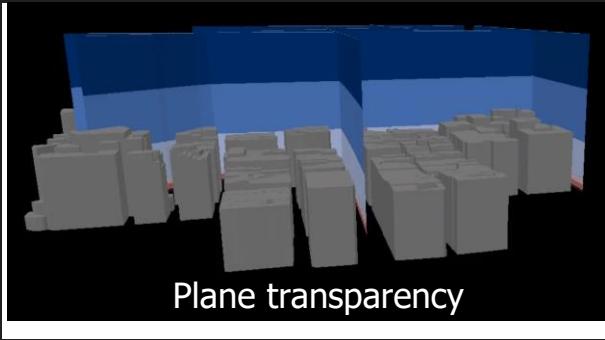
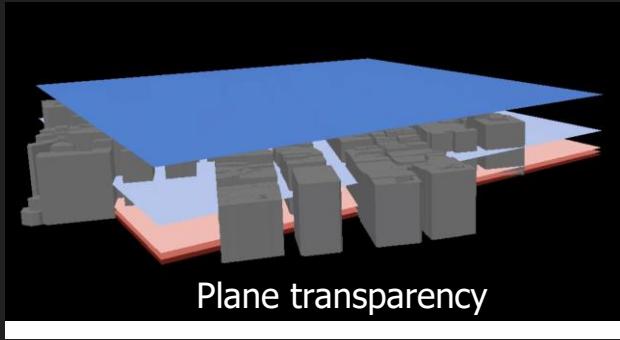
- Simulated air temperature data
 - Irregular 3D grid



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



Exploration of geometries & styles to represent simulated temperature

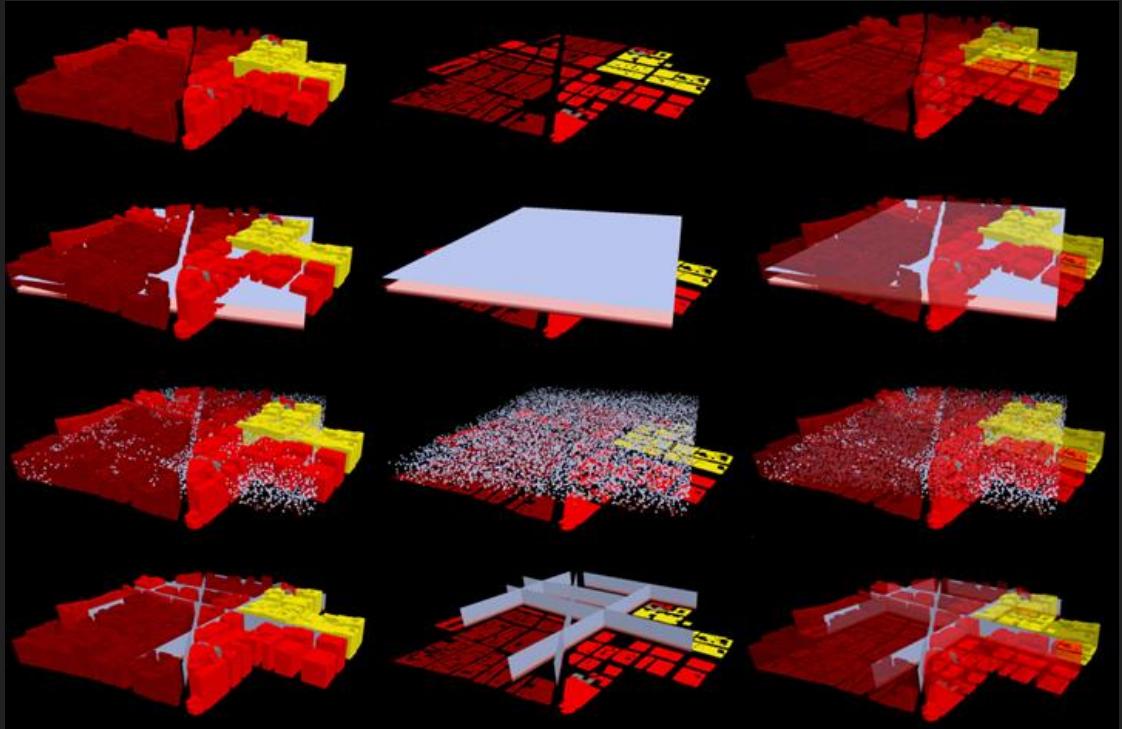
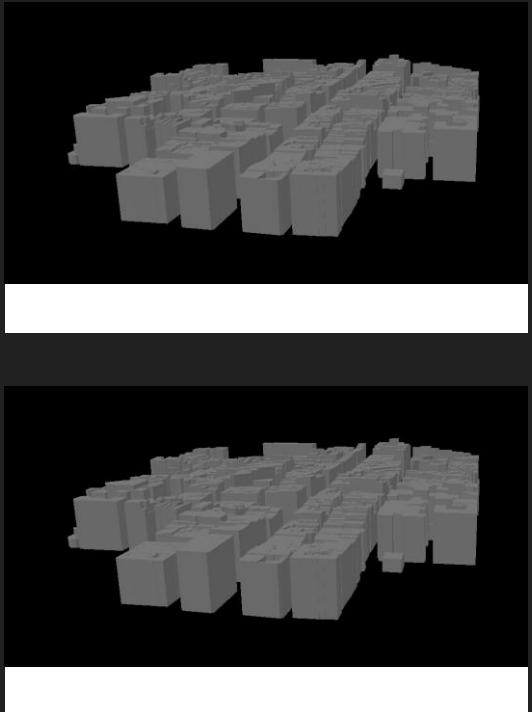


Simulation

Visu. 3D

Interaction

Co-visualization of information?

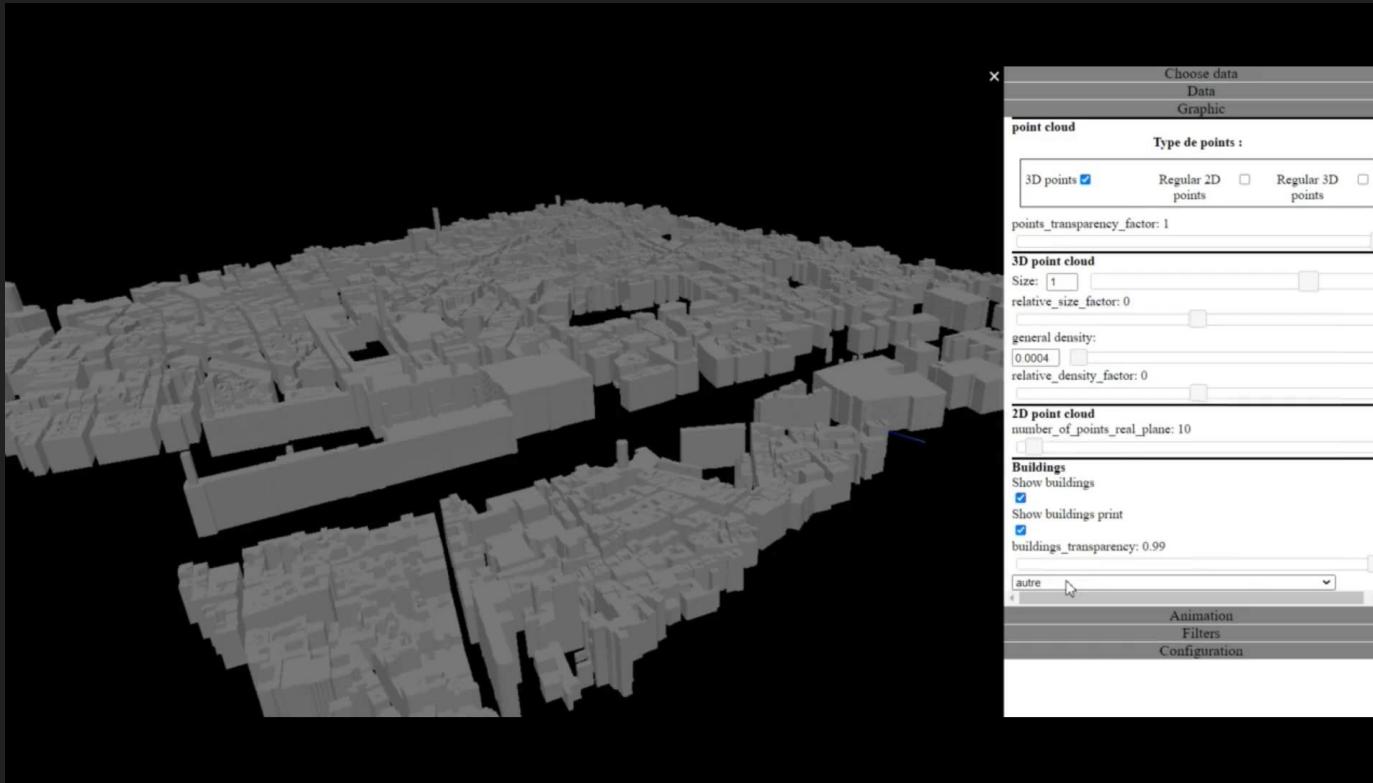


Simulation

Visu. 3D

Interaction

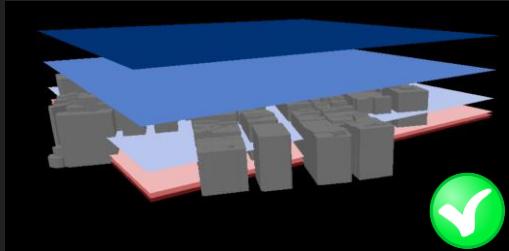
Visual analysis of the simulated air temperature distribution



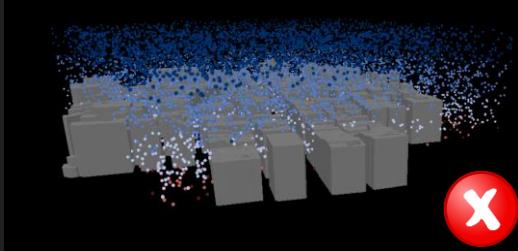
Expert evaluation



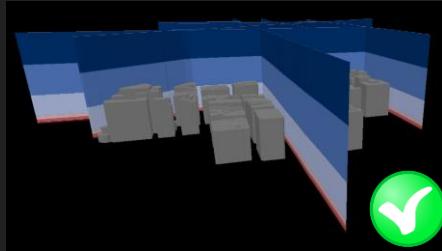
- Open discussion with meteorological experts



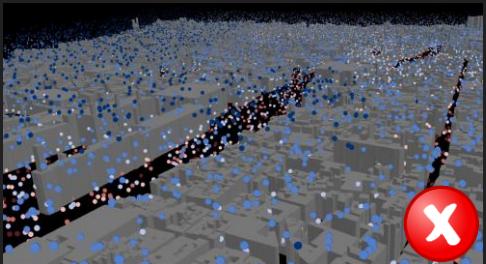
Horizontal planes



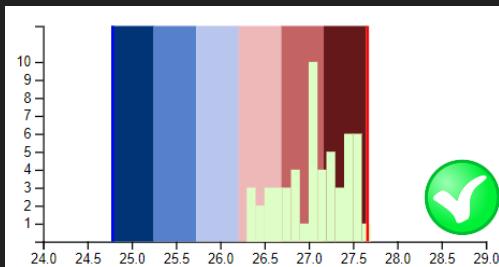
3D point cloud



Vertical planes



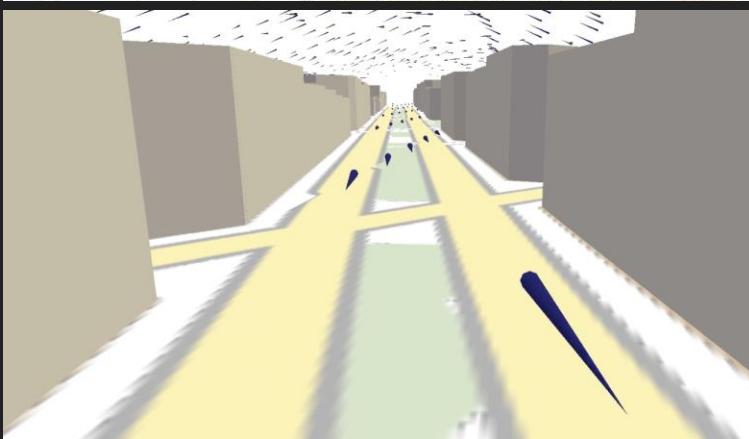
Animated filtering



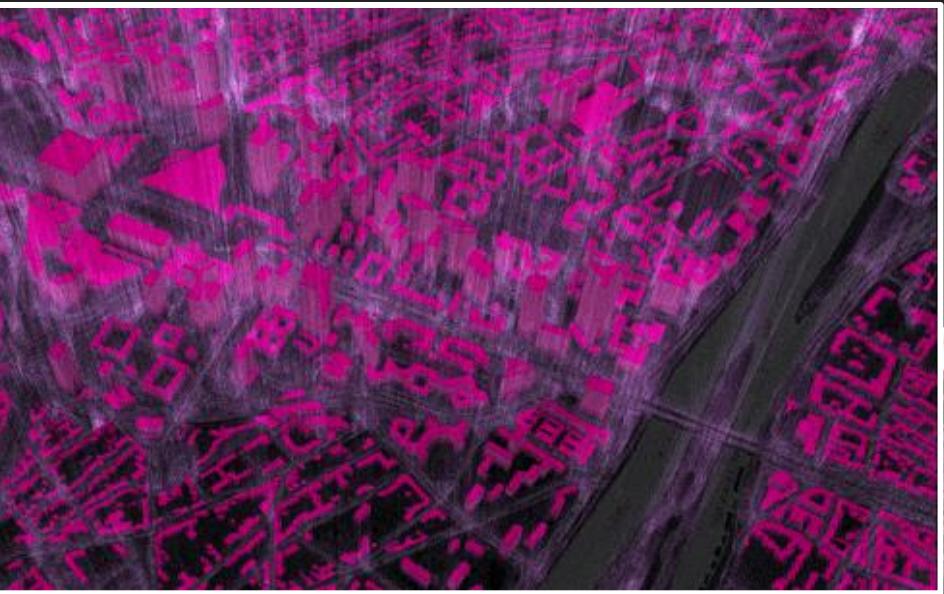
Interactive diagram



Wind visualization => VR/AR



Co-visualization of ‘simulated’ data / rendering



(iTowns project, A; Devaux, 2019)

About hydro data

PLAN

COUCHES

Outils

MODÈLE 3D DE THALES

DIAGNOSTIC PMR

GEOVELO

MODÈLES 3D

RÉGLAGES

EFFETS

 Activer effets Activer climat

Variation



Eau

Niveau

 Nettoyé Zone Mapping

Saturation

Teneur

Contraste

Luminance

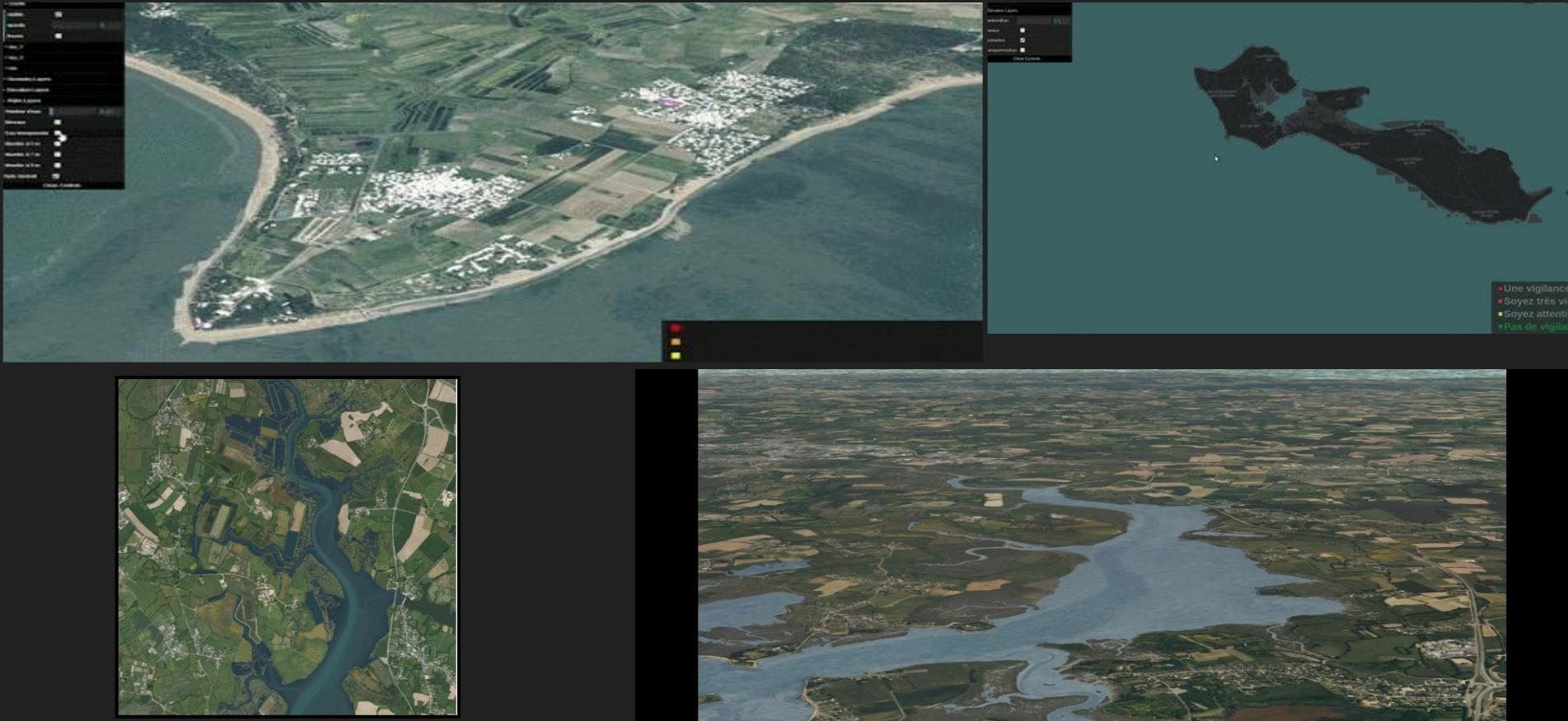
 3D Glasses switch rendering

Base

 CubeMap Project texture on pointcloud

COMPTÉ

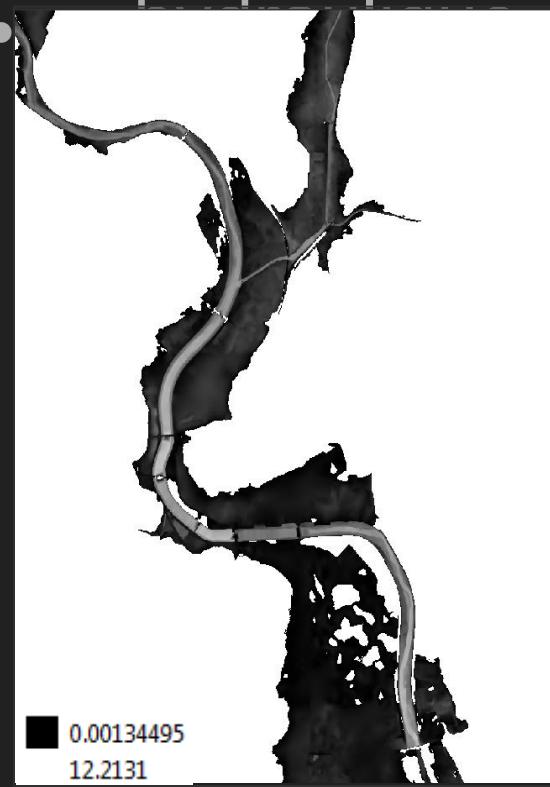
Flooding scenarios Visualization



Multi-scale Visualization of simulated hydro data

Urba Risk Lab

Hauteurs d'eau:



Directions:



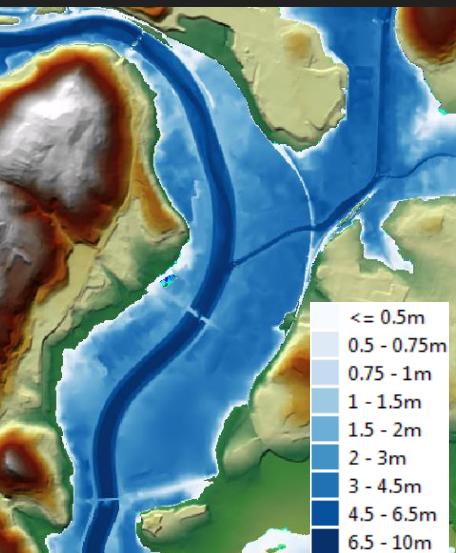
Vitesses:



Multi-scale Visualization of simulated hydro data

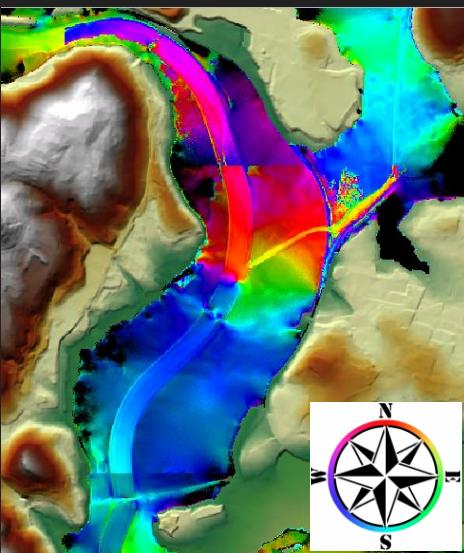
Urba Risk Lab

Water heights

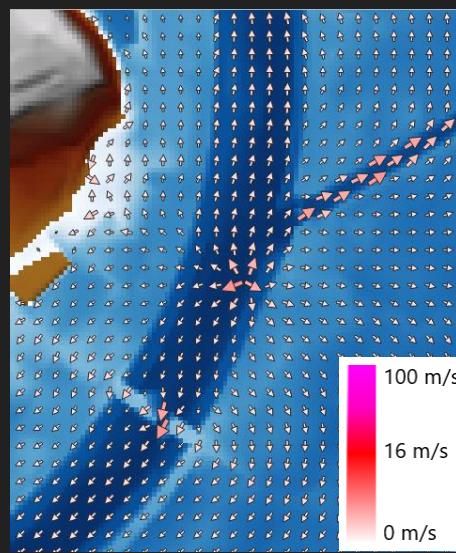


1/16000

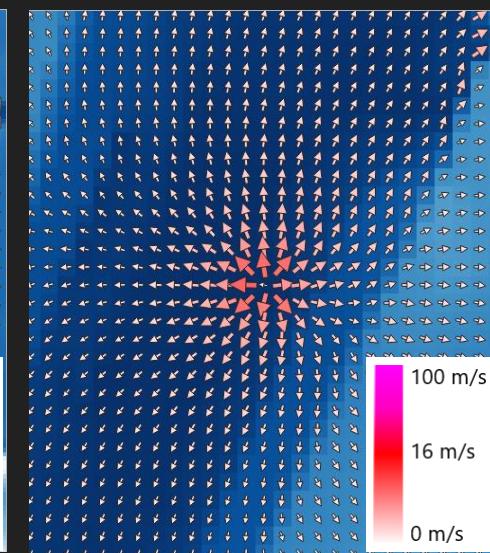
Speeds & directions

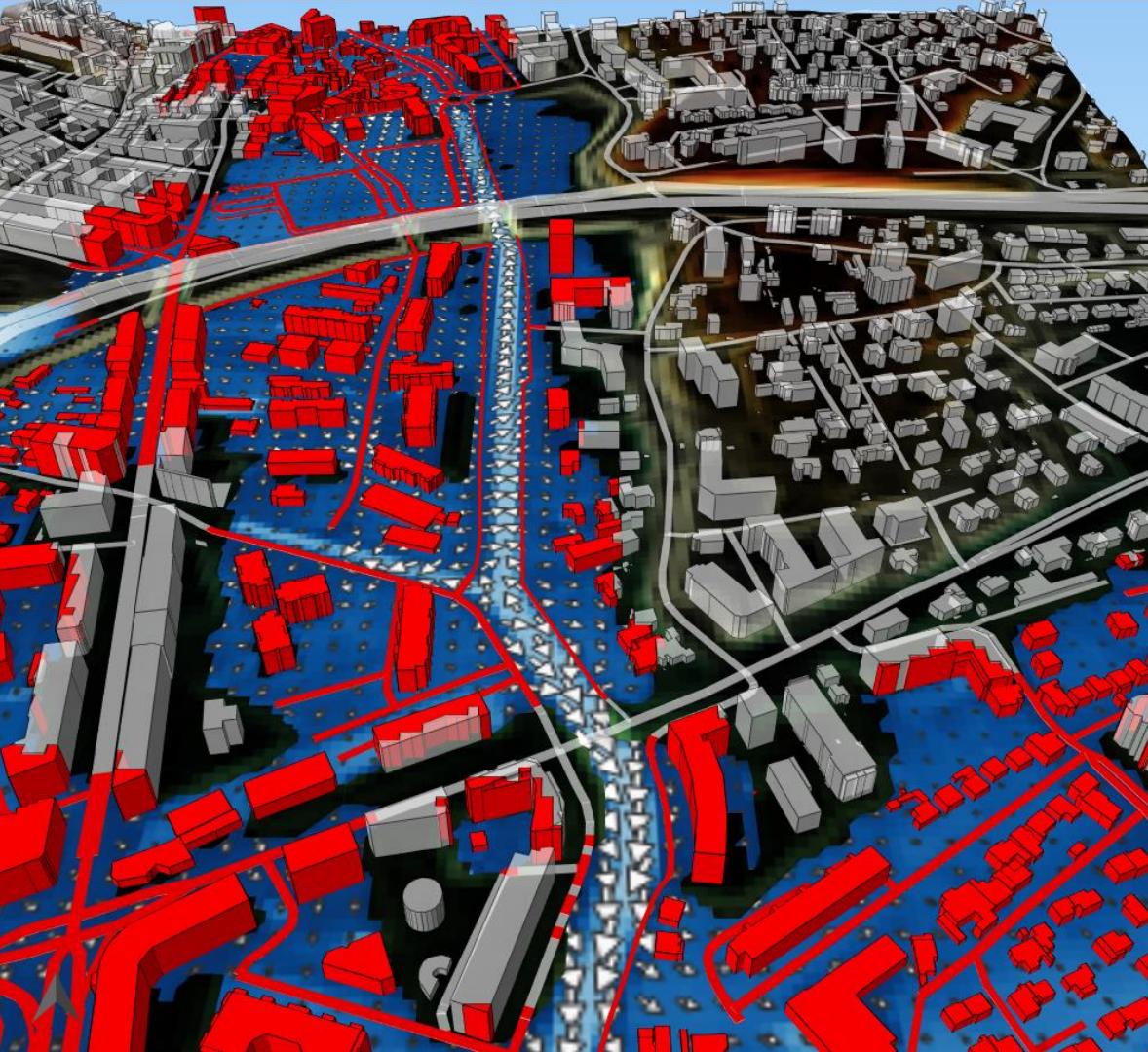


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1/4000





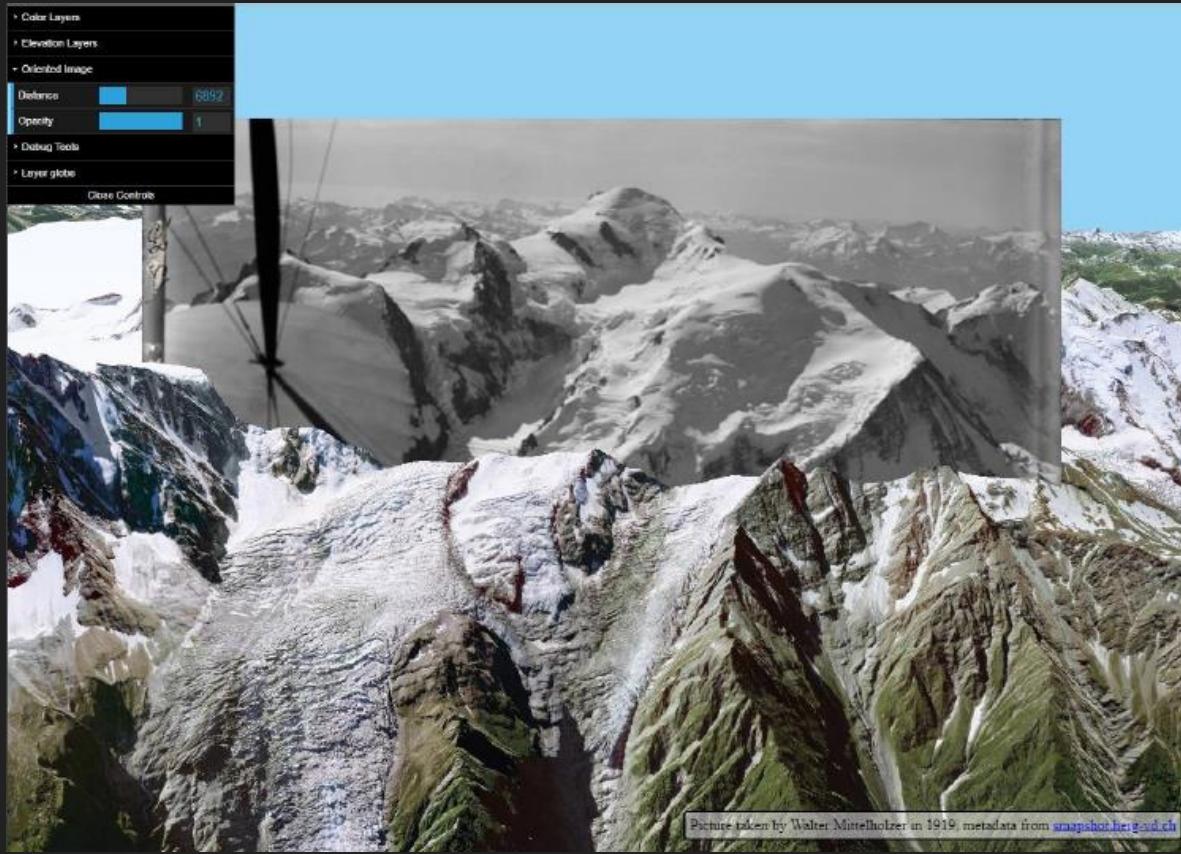
Current:

- 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

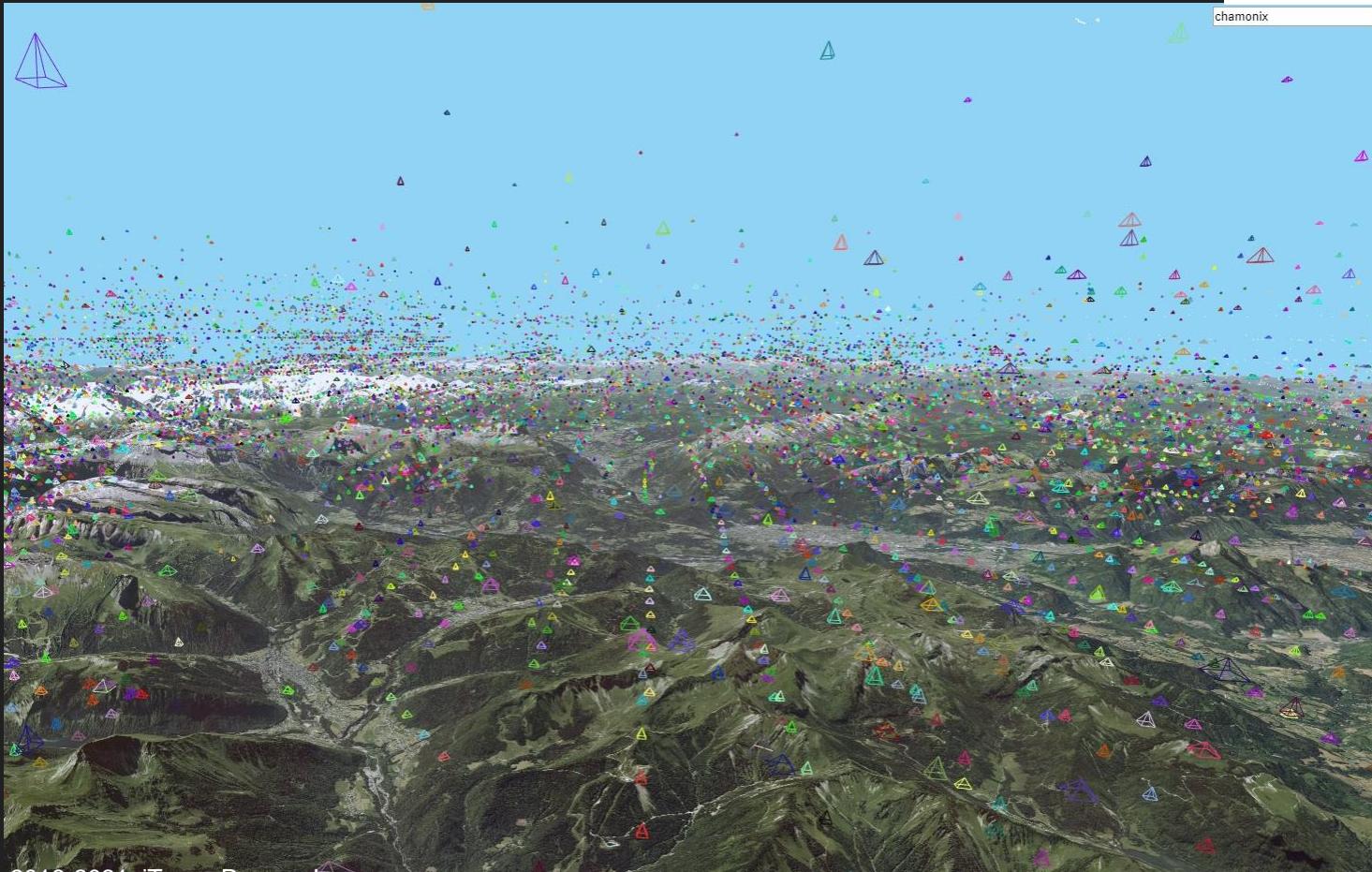


Picture taken by Walter Mittelholzer in 1919, metadata from snapshot.hrgg.ch

Cultural Heritage & geohistorical data



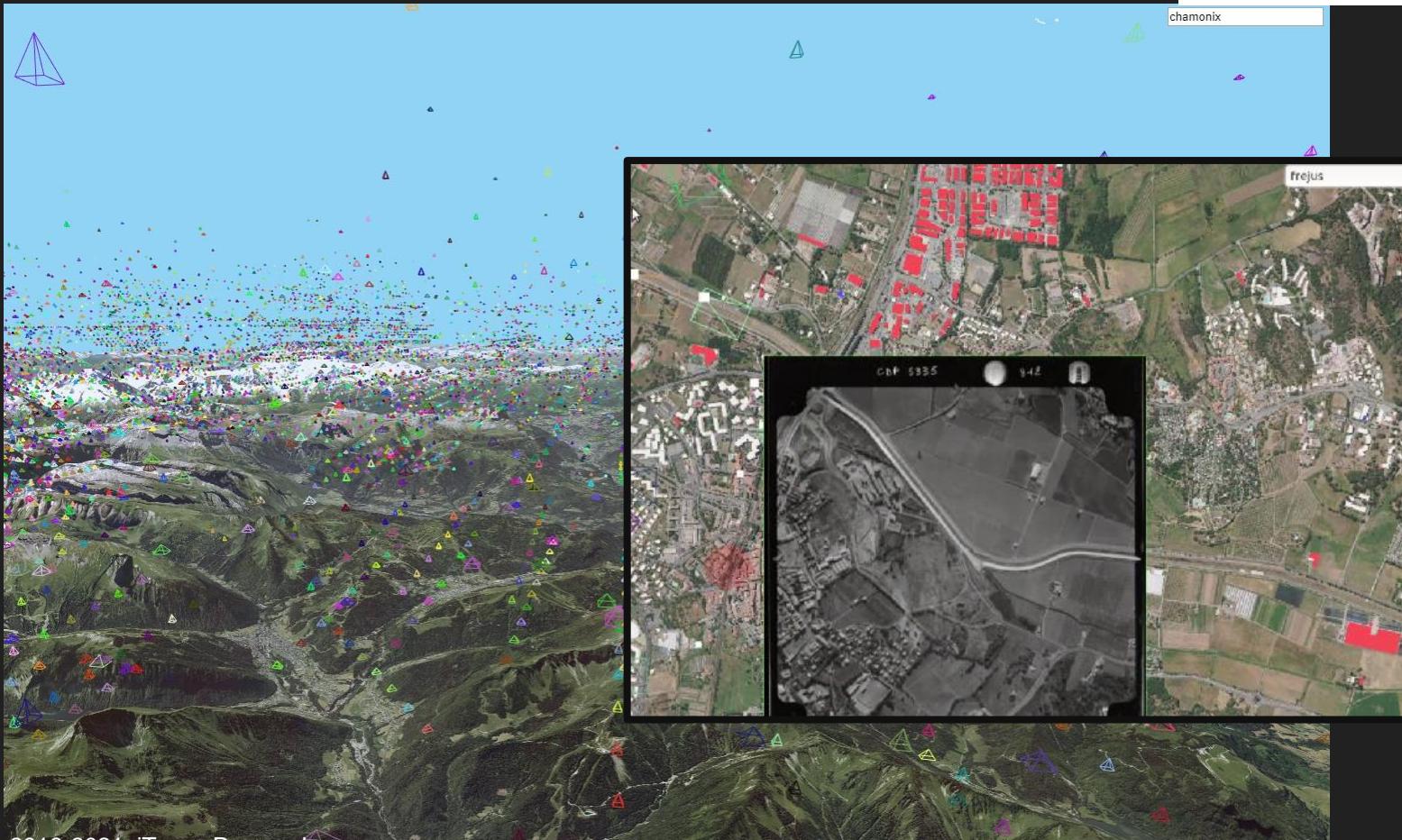
Historical massive data visualization



Historical massive data visualization



Historical massive data visualization



Navigating into Historical massive data

Content x

Home

Image Collections ▾

Sample

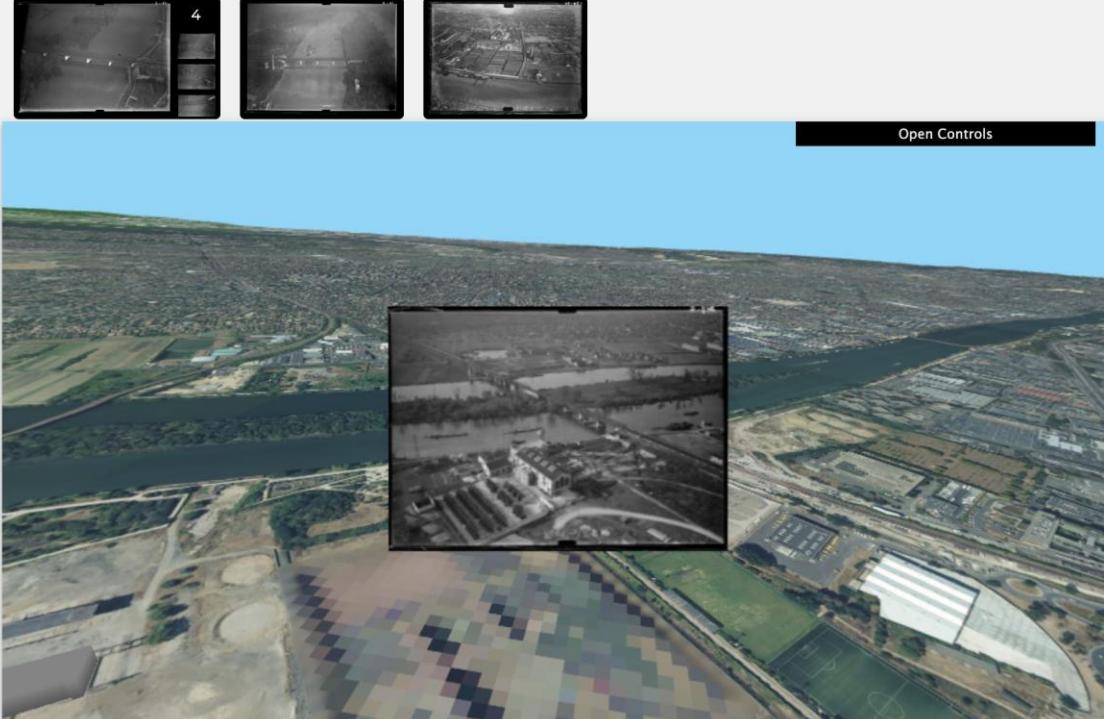
Maurepas

Viabon

Niepce

Nanterre

Menu Visualization ▾



An aerial view of a city, likely Paris, showing a river and various urban areas. A large black rectangular box highlights a specific industrial or port area in the center-right. In the top left corner of the main view, there is a smaller inset image showing a different perspective or zoom level of the same area. The top right corner features a 'Open Controls' button, and the bottom right corner has a vertical stack of four smaller thumbnail images showing different parts of the city.

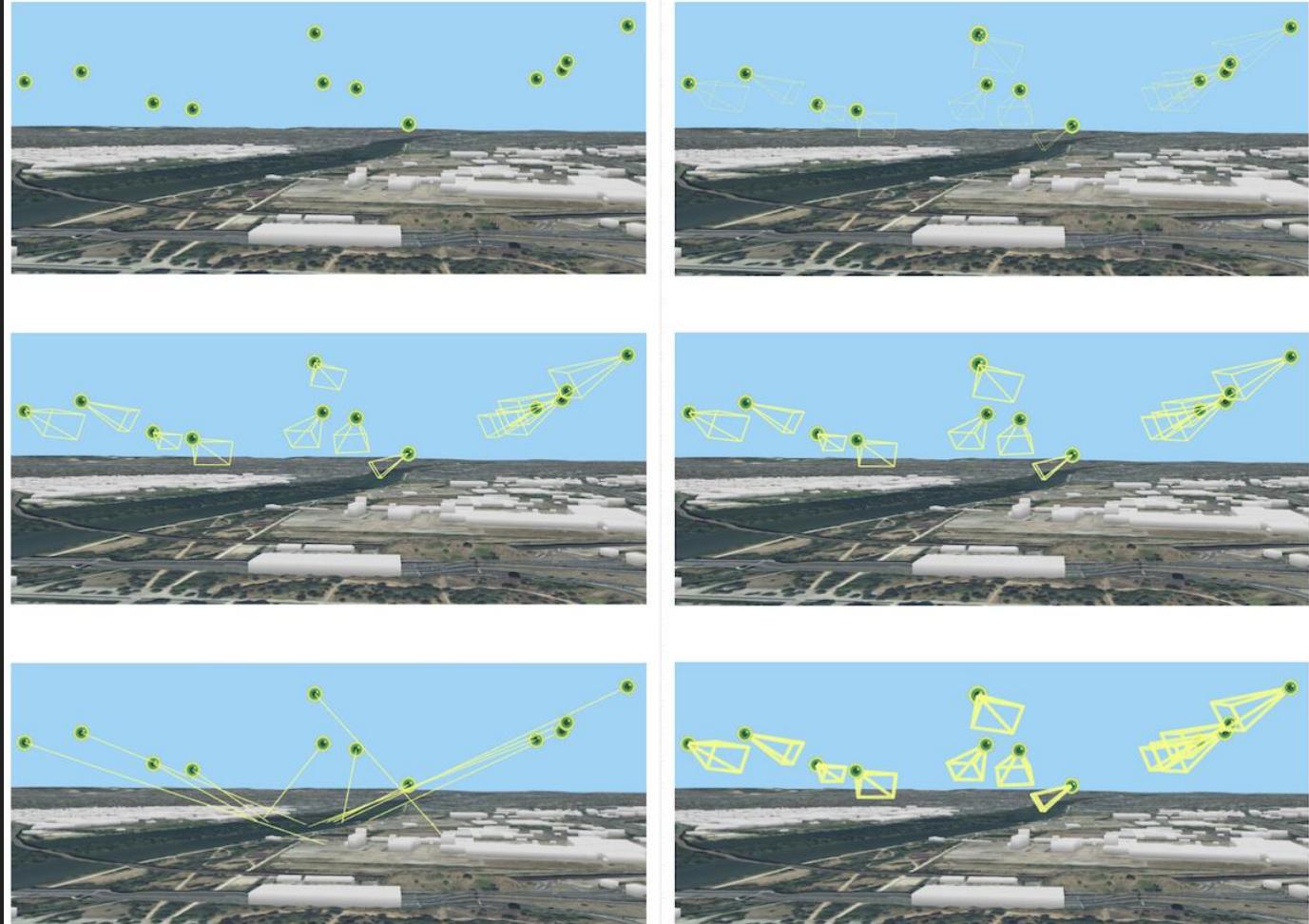
4

Open Controls

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

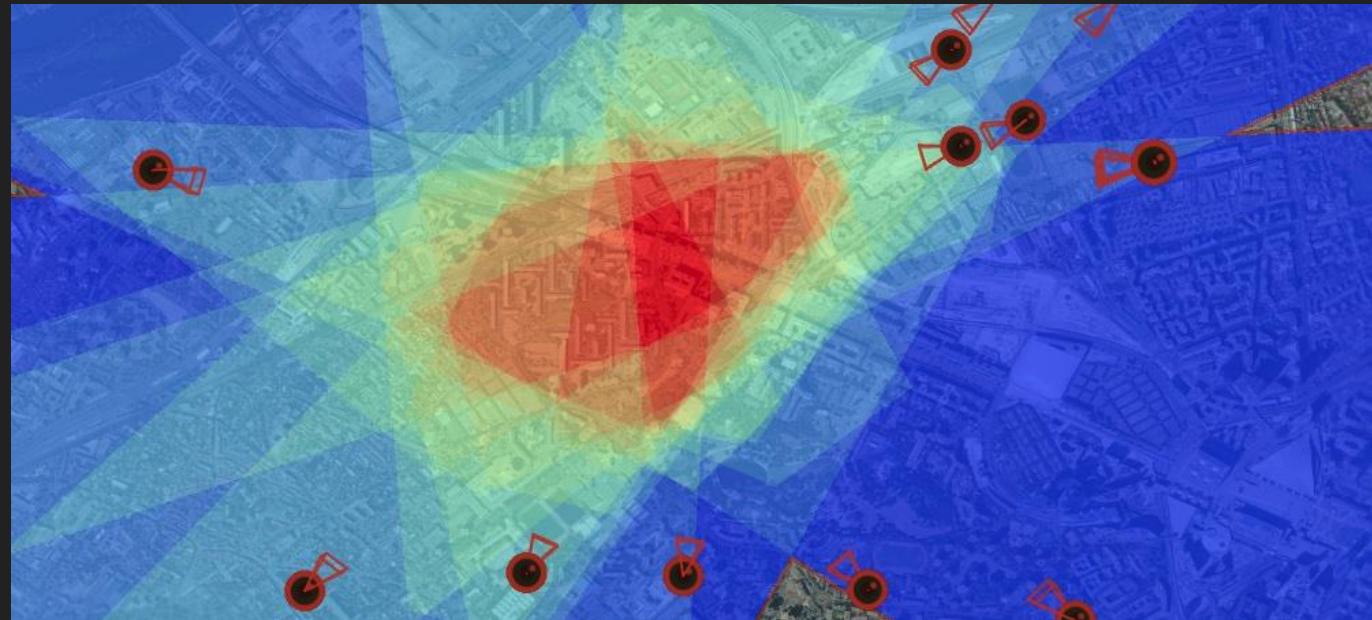


Functionality 1: Interacting with the Photos

visualizing the
photograph through the
historical camera

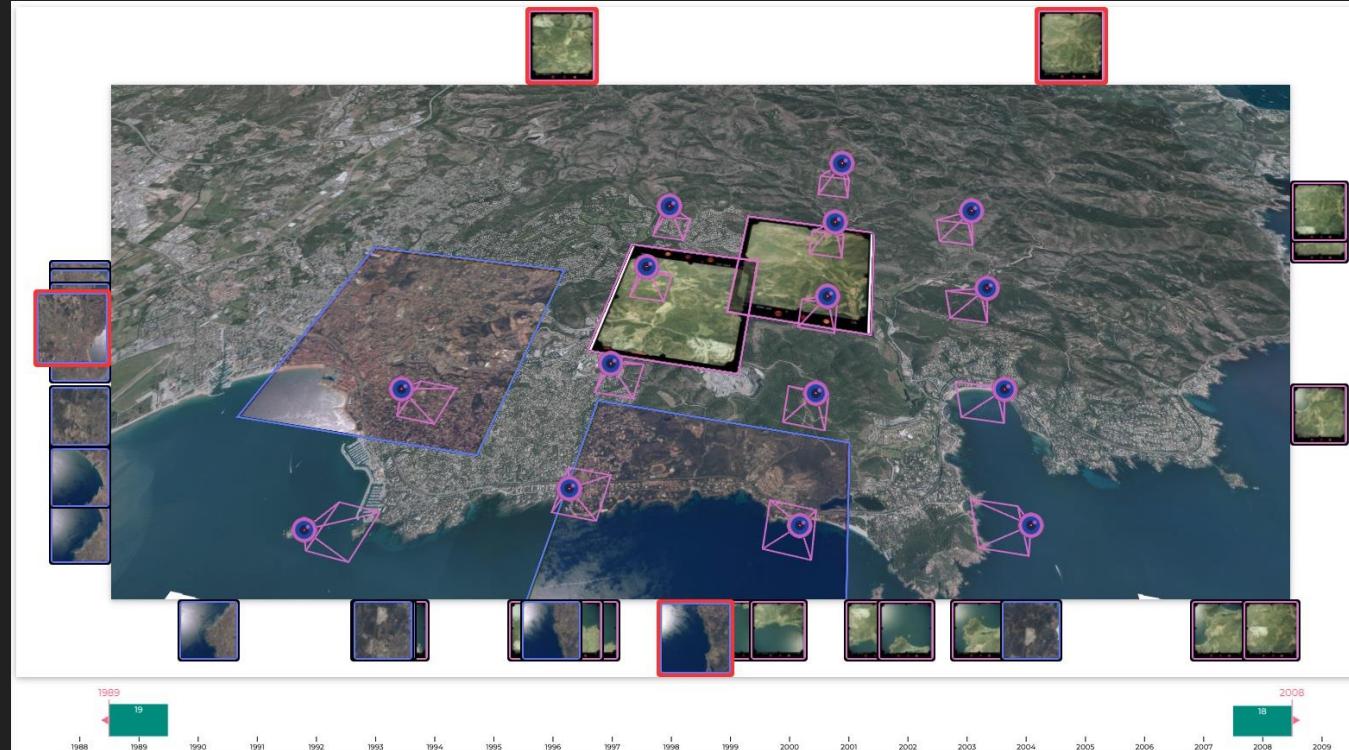


Functionality 2: Adding Saliency on Elements using a visibility heatmat to identify areas of interest



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 / Hololens

Interactive transitions between representations

María Jesús Lobo - GEOVIS team – projet GeoFLY

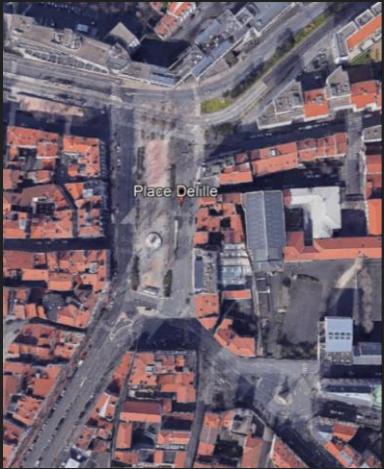
How to help users relate a 2D map view with an immersive view?



Mapping Road Crossings for Visually Impaired People



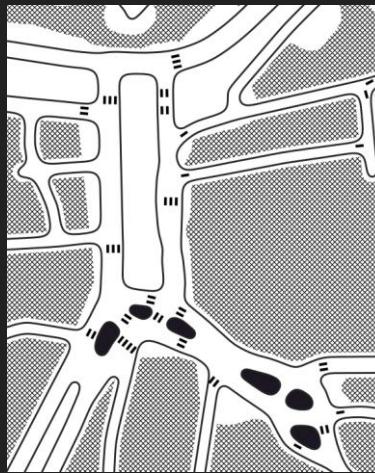
“reality”



data

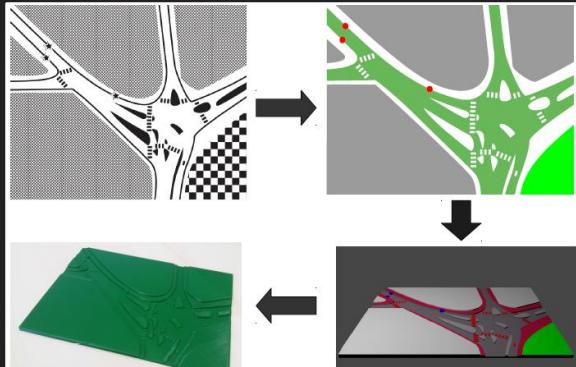


map

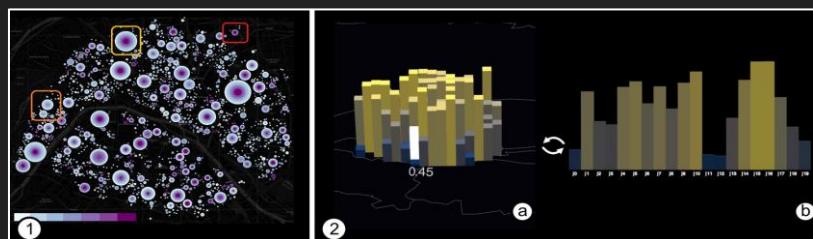
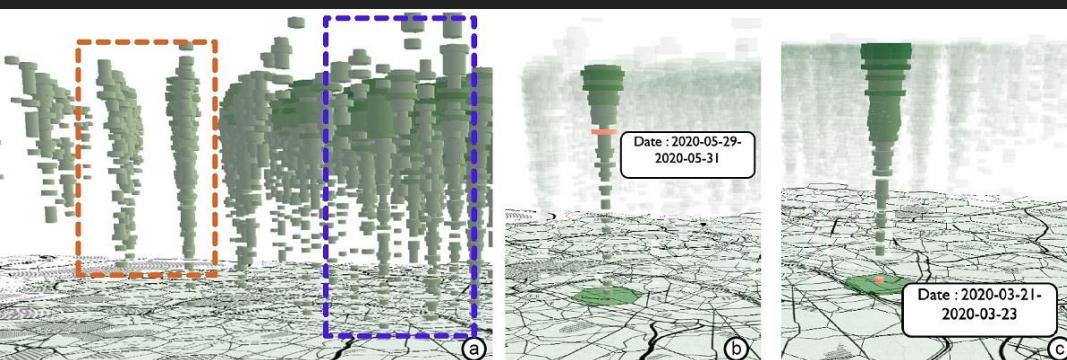
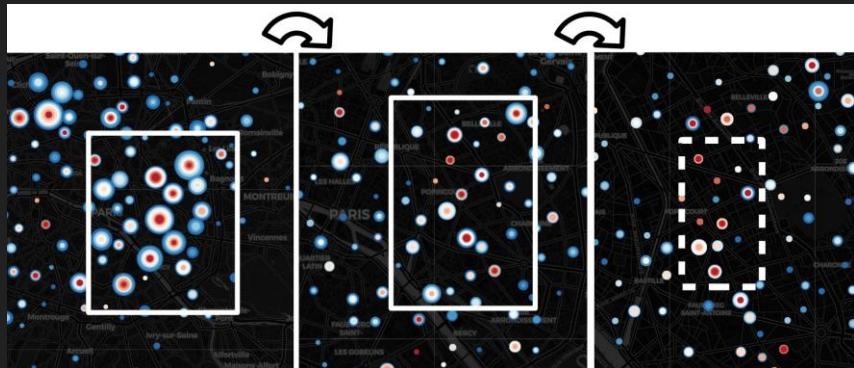
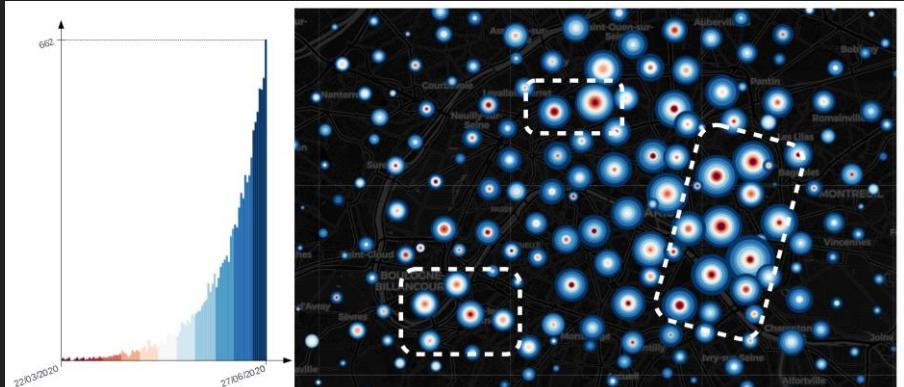


Yuhao (Markie) Jiang, 1st year PhD student

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



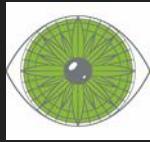
Spatio-temporal clusters of COVID data visualization



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!

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