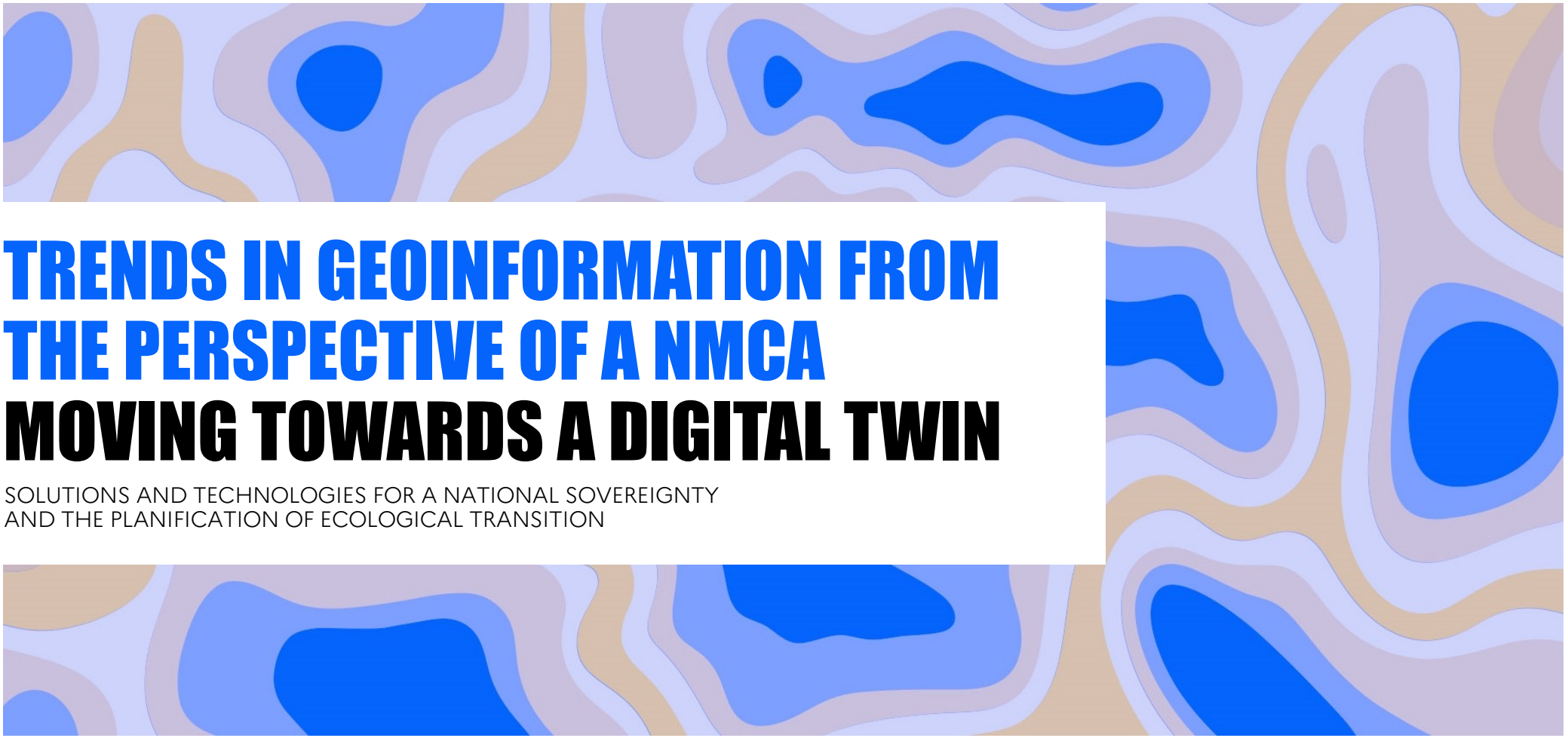
RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

IGN
INSTITUT NATIONAL DE L'INFORMATION GÉOGRAPHIQUE ET FORESTIÈRE

CHANGER D'ÉCHELLE



TRENDS IN GEOINFORMATION FROM THE PERSPECTIVE OF A NMCA

MOVING TOWARDS A DIGITAL TWIN

SOLUTIONS AND TECHNOLOGIES FOR A NATIONAL SOVEREIGNTY
AND THE PLANIFICATION OF ECOLOGICAL TRANSITION

A DETAILED KNOWLEDGE OF OUR TERRITORIES IS MORE THAN EVEN CRUCIAL

8 MAJOR ANTHROPOCENE CHALLENGES

URBANIZATION

RISKS

FORESTS

BIODIVERSITY

AGRICULTURE

COASTLINE

WATER

ENERGY

Before / after the Alex tempest, Alpes-Maritimes

A need for a higher frequency monitoring

A strong need for multi-source

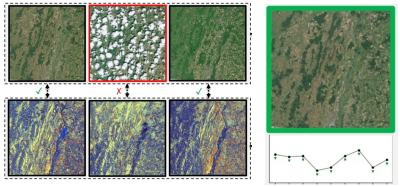
An urgent need for automation

ACQUIRING MULTI-SOURCE IMAGERY AT A NATIONAL SCALE

Satellite imagery at medium (SENTINEL), HR (PLEIADES) VHR (PNEO, CO3D)

Yearly production of a SPOT6&7 orthoimage enriched with Pleiades imagery at 0.7 m

Successfull experimentation using Pleiades Neo for generating LULC map with both aerial and satellite

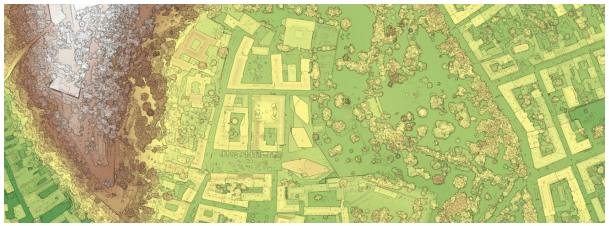


Detection of agricultural events with time series of Sentinel Optical&SAR

High revisit capacity and quick coverage.

World coverage capacity

National photogrammetric coverage program 20 cm (3 years cycle), 5 cm (PCRS) – 75% of France

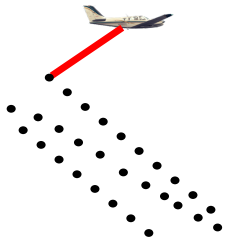


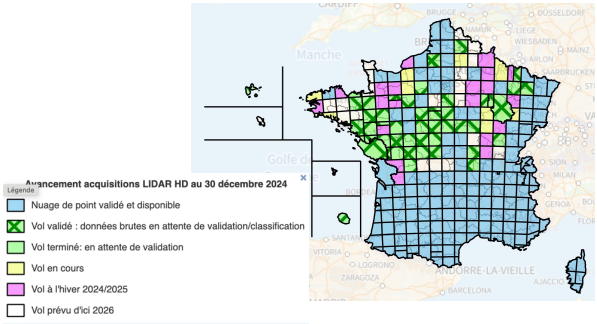
Orthoimages, 3D urban DSMs,

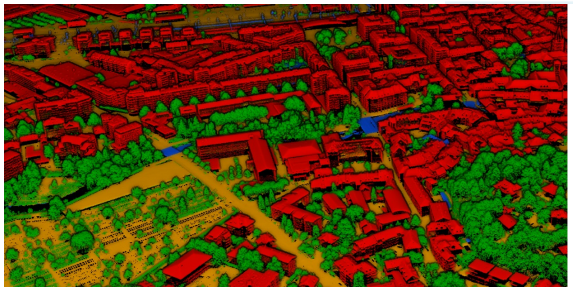
3D city models, forest canopy

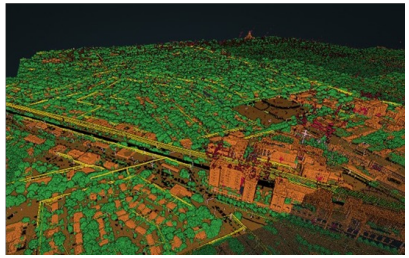
ACQUIRING MULTI-SOURCE IMAGERY AT A NATIONAL SCALE

National LIDAR HD program 2021-2026, 10-20 pts/m2





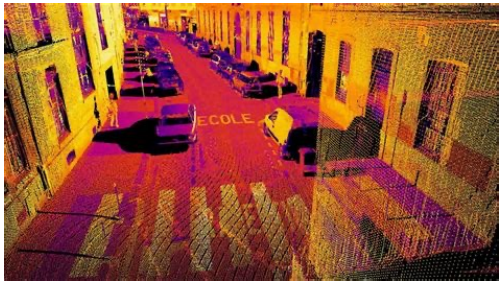




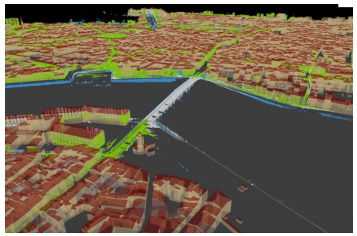
3D, DTM, forest, floodable areas, coast-line

Strong expertise on mobile mapping systems

Mobile mapping system Stereopolis 3.0.



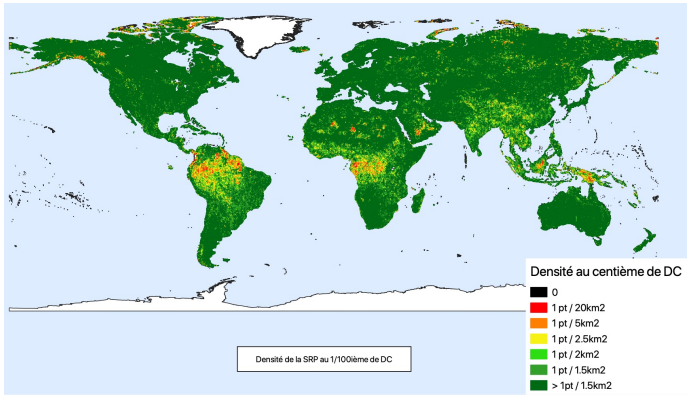
3D point cloud color with backscatter intensity

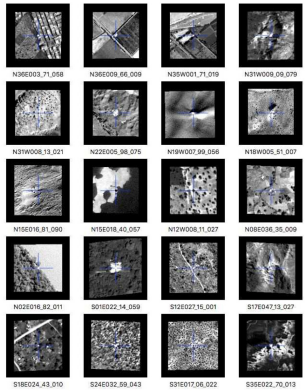


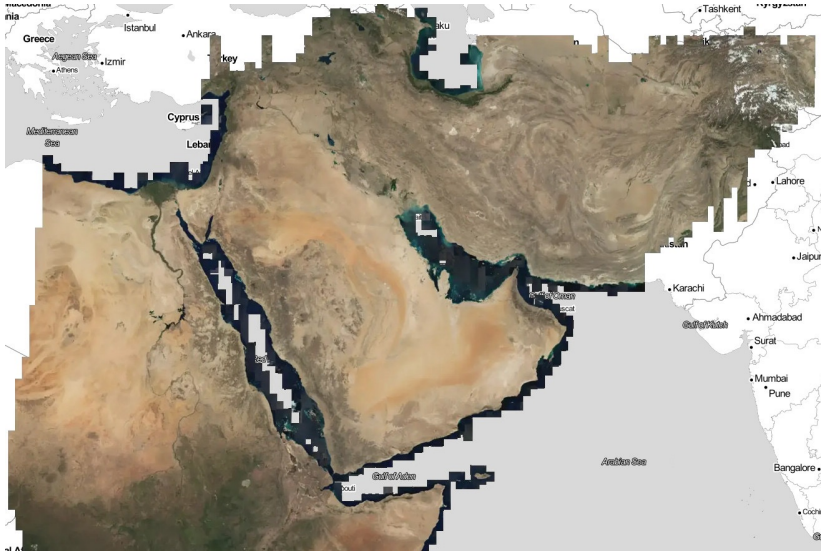
3D registration of mobile mapping data on the 3D city model

Façades, public spaces, pavements, roadmarks, street furniture, obstacles

GEOREFERENCING AND ASSEMBLING GEOSPATIAL IMAGERY WITH THE 3D SPACE REFERENCE POINTS (SRP) PRODUCT

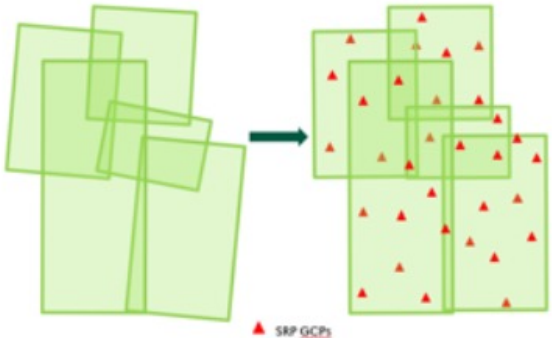






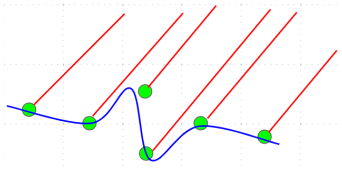
<3m horizontal accuracy

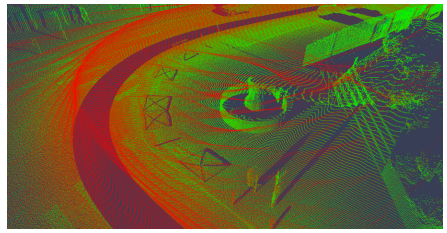
1 GCP per 2 km2 in average



Automatic bundle adjustment of many images to produce mosaics at large scale

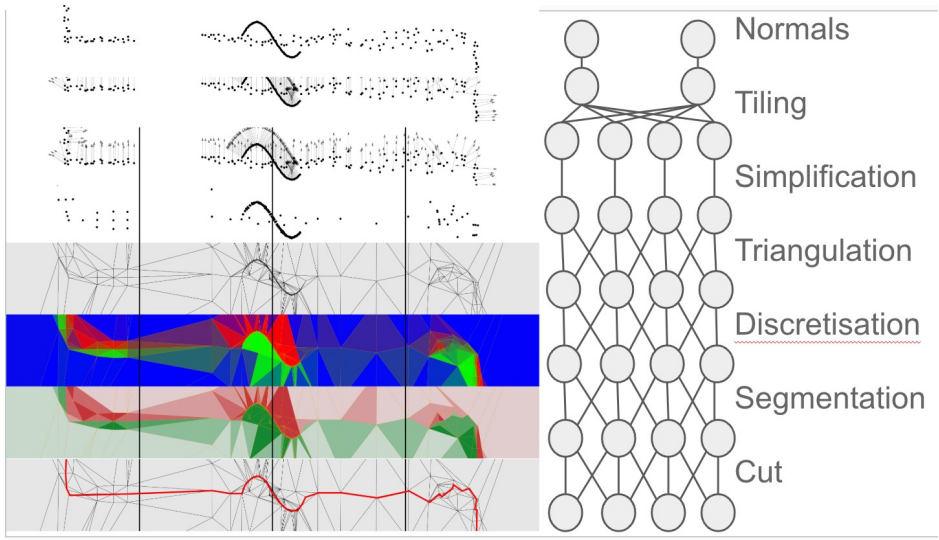
VOLUMETRIC 3D SURFACE RECONSTRUCTION WITH WASURE TECHNOLOGY

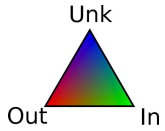


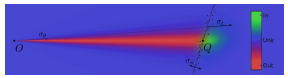


L. Caraffa, Y. Marchand, M. Brédif and B. Vallet, "Efficiently Distributed Watertight Surface Reconstruction," *2021 International Conference on 3D Vision (3DV)*, London, United Kingdom, 2021, pp. 1432-1441,

Brédif, M., Caraffa, L., Yirci, M., and Memari, P.: PROVABLY CONSISTENT DISTRIBUTED DELAUNAY TRIANGULATION, ISPRS Annals, V-2-2020, 195–202, 2020.

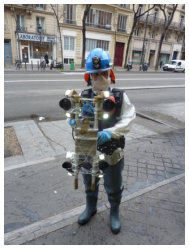


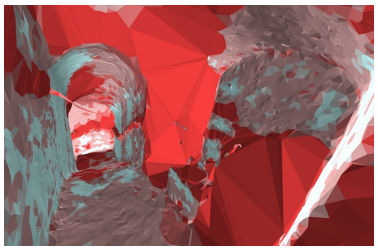


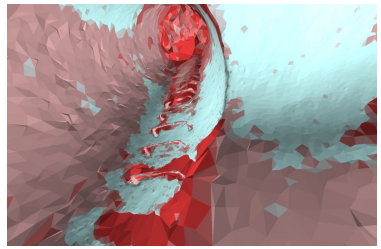


Uncertainty management

Enrichement by fusion/integration of aerial and mobile mapping lidar data sets following a registration of the two data sets.

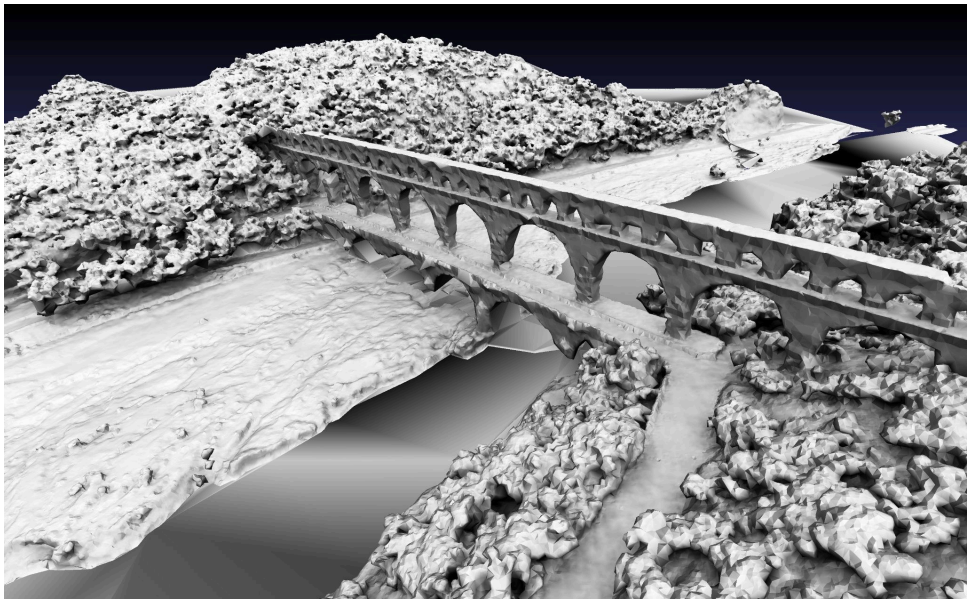




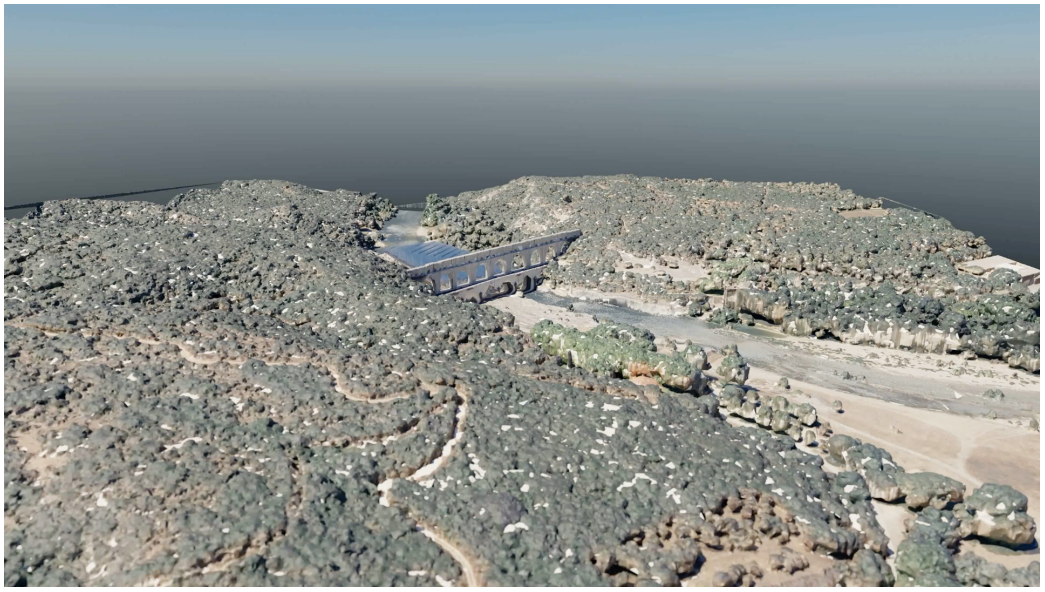


Fusion of optical point clouds acquired by a multi-stero-rig in the Paris sewerage system

VOLUMETRIC 3D SURFACE RECONSTRUCTION WITH WASURE TECHNOLOGY



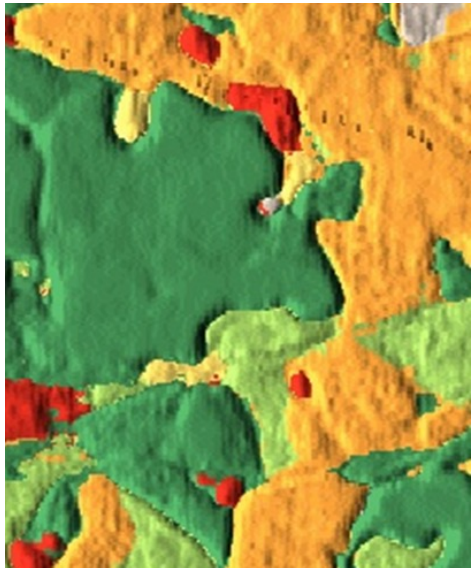
3D reconstruction of Pont du Gard



Water spreading on the watertight surface

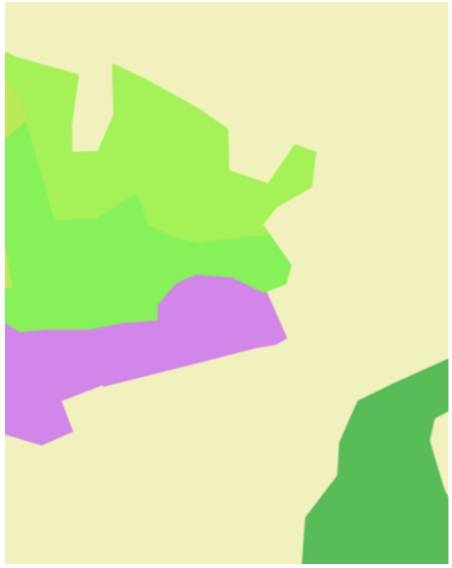
MONITORING LAND ARTIFICIALISATION AN URBAN SPREADING (ONLY) 0.04%/YEAR LANDSCAPE CHANGES !

LAW « Zéro Artificialisation Net » - 20 juillet 2023



GOOGLE

Update: 5 days
Resolution: 10 m
Number of classes: 9



CORINE LAND AND COVER

Update: 6 years
Resolution : 10 m
Number of classes : 44

OCS GE (IGN)

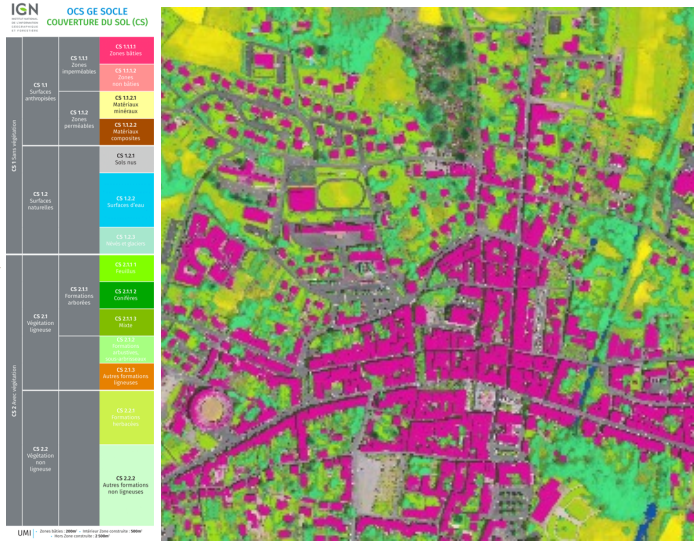
Update: 3 years (1 year possible)
Resolution : 20 cm
Number of classes : 17

USING DEEP GEO-AI FOR VHR LAND COVER AND GEOSPATIAL POST-PROCESSING AND AUTHORITY SOURCING CORRECTIONS

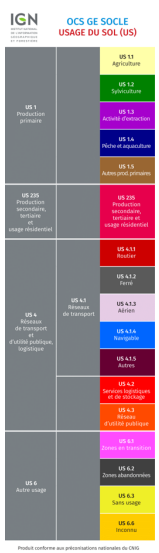
LAW « Zéro Artificialisation Net »
20 juillet 2023

Producing two complete national LULC maps at 3 years interval with 20 cm GSD

Annotations on aerial imagery

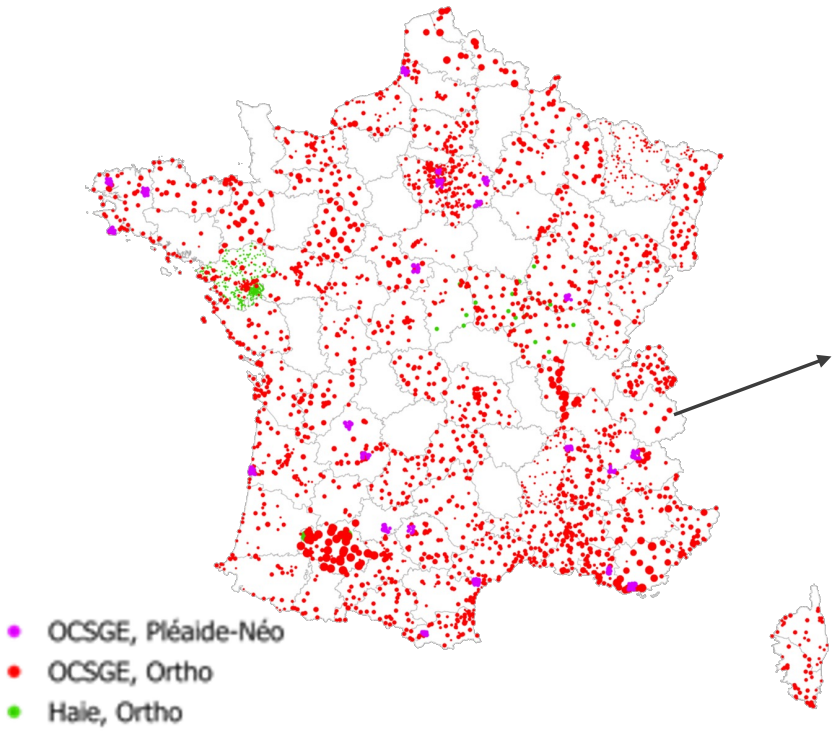


Heat map of the deep learning classification



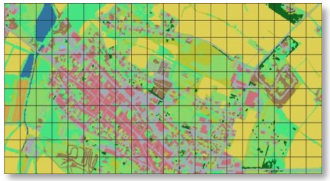
Final regularised map with anciliary DBs and community sourcing

LABELLING A LARGE DATASET REPRESENTATIVE OF THE DIVERSITY FRENCH LANDSCAPES MAKING THIS DATA OPEN AND ORGANISING BENCHMARKS TO STIMULATE INNOVATION AND COPE WITH FAST TECHNOLOGICAL ADVANCES



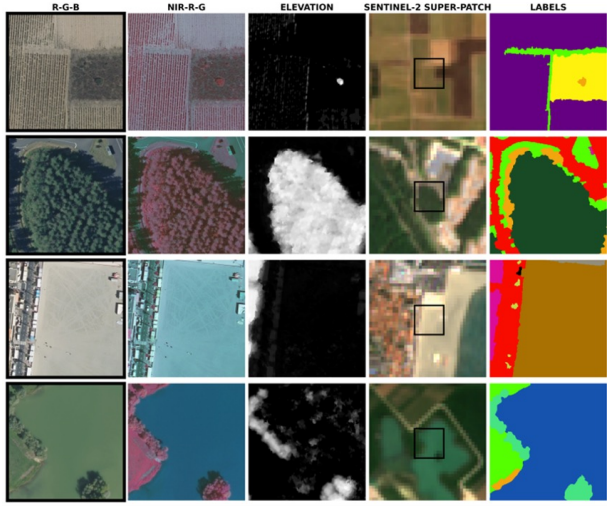
AI data in open data :

- Annotations (60 billion pixels)
- Formatted data for AI
- AI Models
- AI predictions

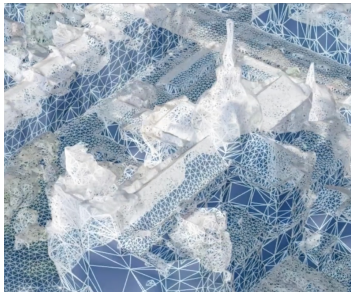


Work with technical communities, researchers, users, to :

- improve models,
- allow users to generate prediction models
- enrich annotations in a collaborative way

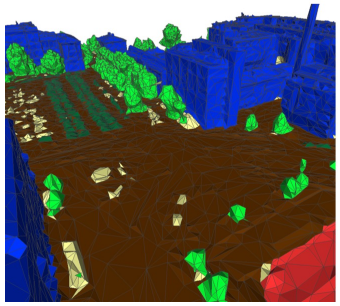


MESHES, 3D MODELS OF CITIES AND TERRITORIES AT THE NATION SCALE



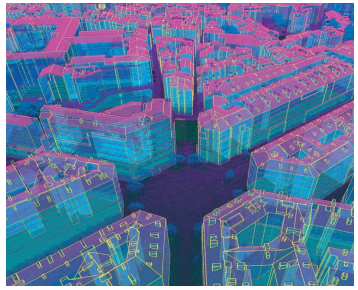
3D textured mesh
with WAZURE technology

[Caraffa & al 2021]



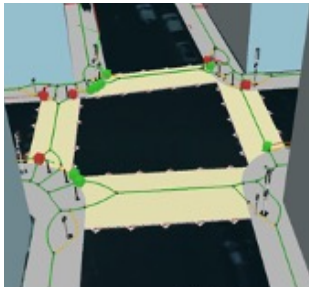
3D semantic segmented
and simplified mesh

[Grzeczkowicz & Vallet 2023]



3D models with
Geoflow or Simplicity

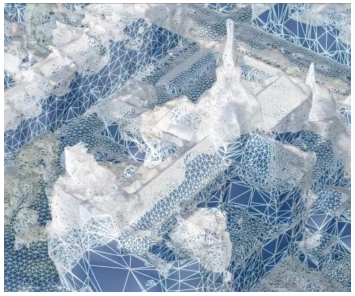
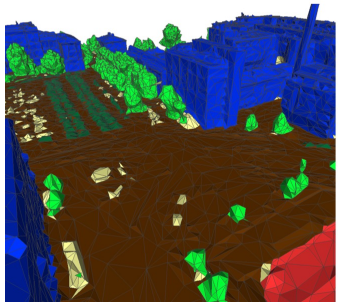
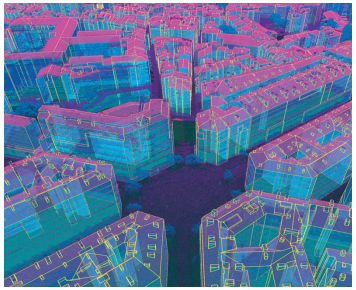
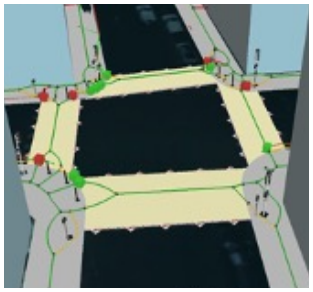
[Peters & al 2022]
[Bauchet & al 2024]



3D modelling of public spaces
for accessibility/mobility
calculation services .....

[Yirci & al 2013]

MESHES, 3D MODELS OF CITIES AND TERRITORIES AT THE NATION SCALE

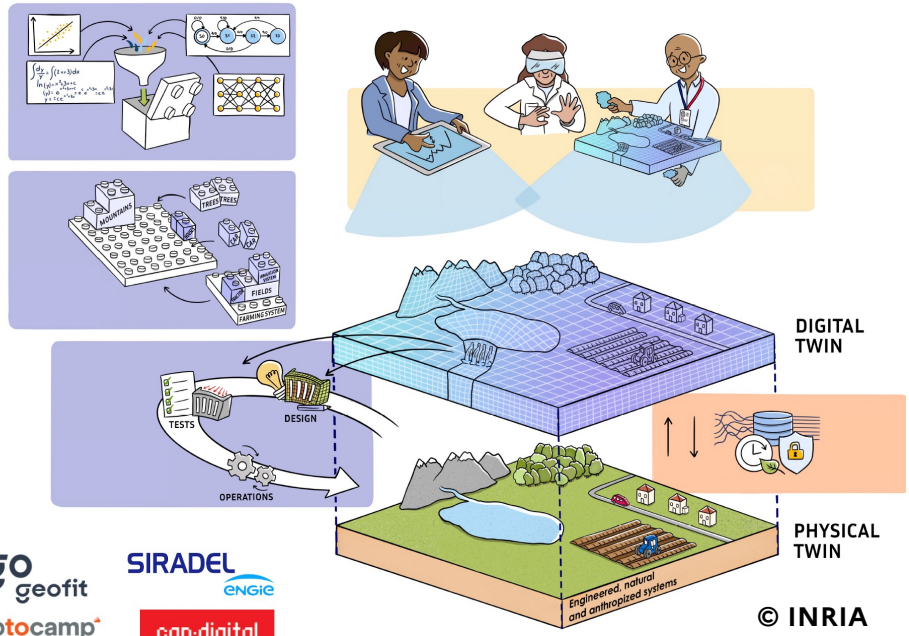
Aiming at by mid-2028

- → Generation of semantic mesh on whole of France from lidar and photos
- → Automatic integration of mesh changes in new lidar or photogrammetric acquisitions
- → Delivery of all 3D model of buildings 100% automatic (thus with errors)
- → First inverse procedural correction plotting tools for community sourcing

Still research

- → 3D automatic modelling of public space from aerial and/or mobile mapping
- → Self diagnosis of generated models to guide human corrections
- → A need for smart inverse procedural modeling plotting tools to correct the data
- → Propagation modification tools to ensure the coherence between mesh, LULC, and all vector maps
- → Analysis of veracity of new contributions (smartphone, etc.)

BUILDING A GEO DIGITAL TWIN AT THE NATIONAL LEVEL/SCALE
A PUBLIC-PRIVATE PLATFORM AND GEOCOMMON WITH AN OPEN FOUNDATION

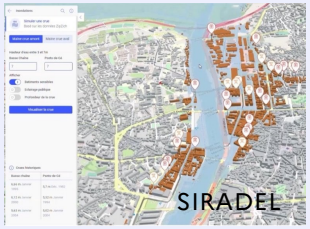


- → A high fidelity dynamic replica at a national scale connected to a layer of simulation algorithms to answer to complex questions
- → Bridging the gap between geoinformation and geo-objectivated decisions
- → An intermediate between BIM & smart cities and digital earth based digital twins and inyteroiparbale with them
- → A Science and market place at the same time
- → Enabling researchers, start-ups & companies to scale up their successfull experiments
- → Making geoinformation as a core of the developpement of an innovation ecosystem

BUILDING A DIGITAL TWIN PLATFORM OF FRANCE :

AN PUBLIC-PRIVATE OPEN FOUNDATION

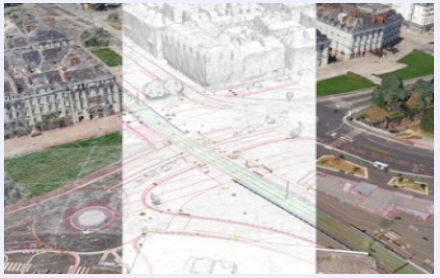
SIMULATIONS & PREDICTIONS
Modeling and coupling natural and social phenomena

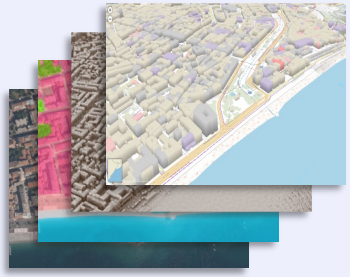


VISUALISATION & INTERACTIONS
To launch, understand, choose, and convince

AI-HPC Factory
Automation and acceleration

GEOPLATFORM & 3D GIS
Geodata and geoinformation warehouses and geoservices
Generalisation on the fly





GEODATA & GEOINFORMATION
topographic, thematic, real-time, open or closed

AMÉNAGEMENT URBAIN
AMENAGER DURABLEMENT MA VILLE

PLANIFICATION ÉCOLOGIQUE
AIDE AU CHOIX DES IMPLANTATIONS DE ZAER DE MON TERRITOIRE

RISQUES
RENDRE MON TERRITOIRE RÉSILIENT FACE AUX RISQUES NATURELS

RESSOURCES
OPTIMISER LES USAGES DE LA RESSOURCE EN EAU

ENVIRONNEMENT
ADAPTER LA FORÊT ET SA FILIÈRE AU RÉCHAUFFEMENT CLIMATIQUE

SANTÉ
LUTTER EFFICACEMENT CONTRE LES ÉPIDÉMIES

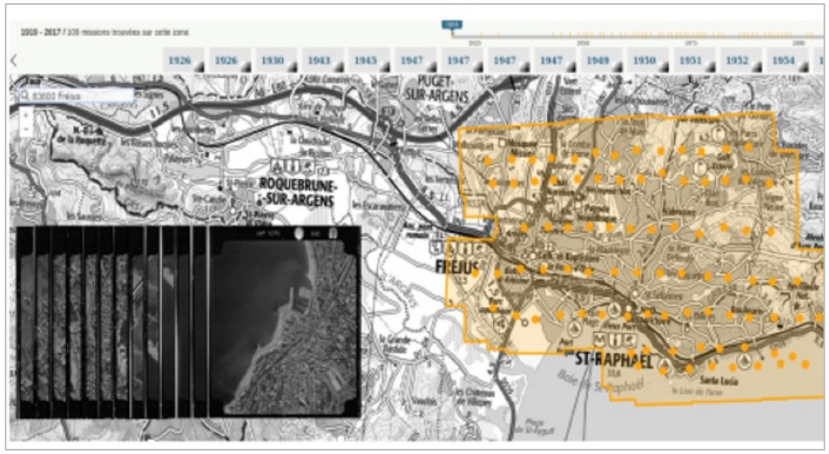
MOBILITÉS
CONCEVOIR ET OPTIMISER MON OFFRE DE MOBILITÉ À L'ÉCHELLE DE MON TERRITOIRE

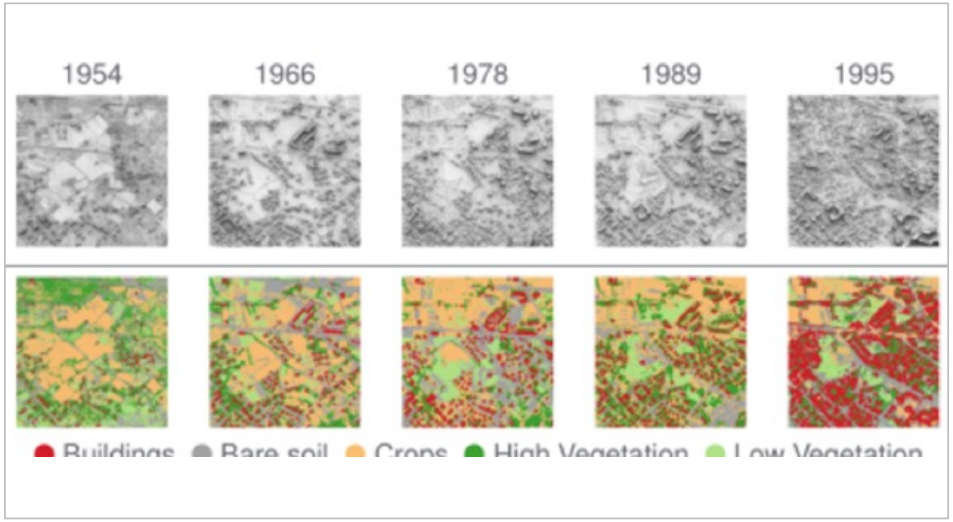
AUTRES CAS EN LIEN AVEC LA RECHERCHE OU PROSPECTIFS

TECHNOLOGIES FOR USE CASES ALREADY IN PROGRESS TO MODEL THE PAST EVOLUTION OF THE TERRITORY AND FORECAST POSSIBLE FUTURES

Arnaud Le Bris. Using historical aerial photogrammetric campaigns to retrieve the evolution of territories, HIATUS. EuroSDR Workshop on "Historical and time stamped data for SDGs", EuroSDR, 2024, Zagreb, Croatia.

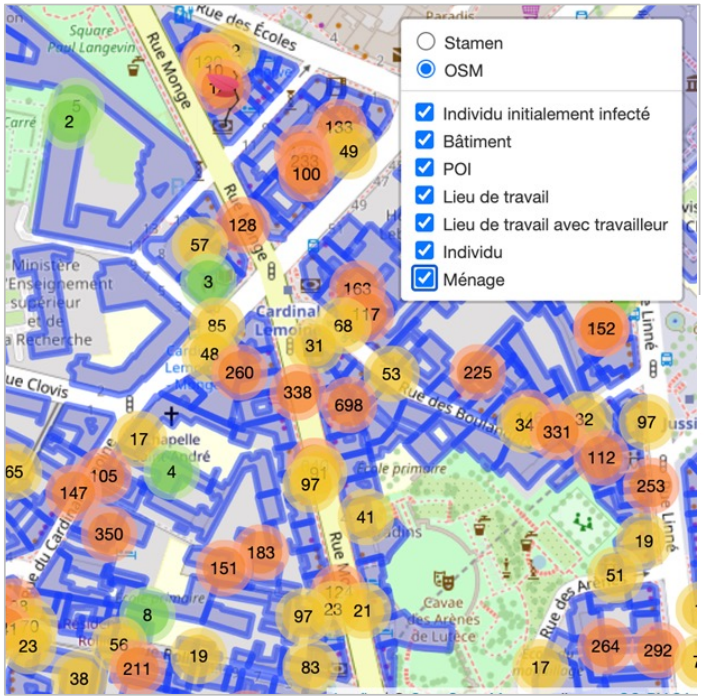
Arnaud Le Bris, Sébastien Giordano, Clément Mallet. CNN semantic segmentation to retrieve past land cover out of historical orthoimages and DSM: first experiments. ISPRS Annals, 2020, Nice, France.

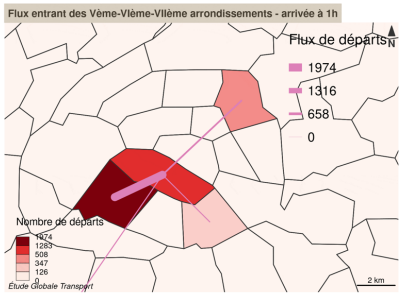


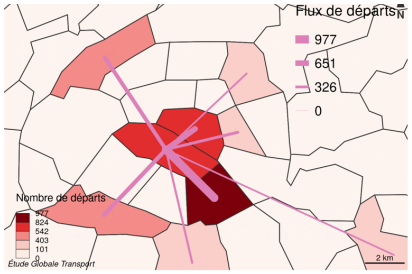


Automatic multi-date registration/bundle of multi-quality historical surveys and semantic segmentation of some land cover classes (HIATUS project - LASTIG)

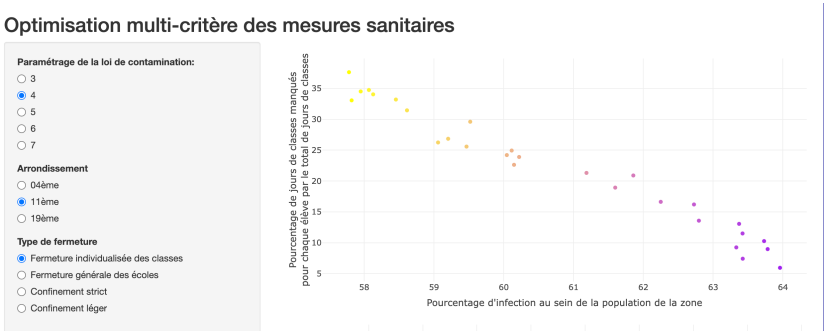
WHEN GEOPATIAL MEETS STATISTICS FOR SPATIALISED ANALYSIS AND SIMULATIONS FOR DECISION MAKING IN PUBLIC HEALTH POLICIES







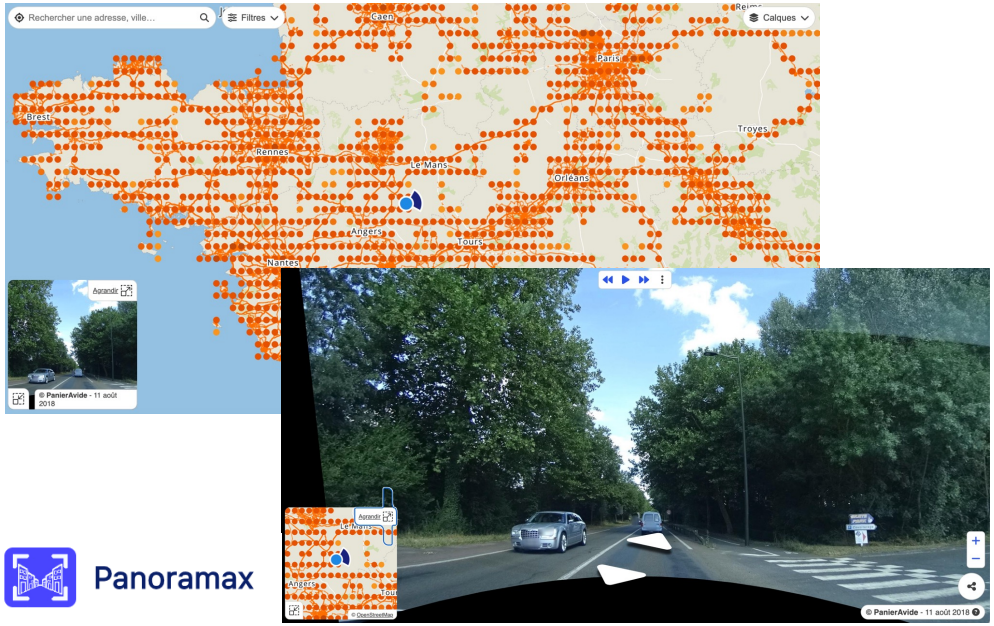
https://ici.saclay.inria.fr/



Simulator of epidemic propagation (project ICI / INRIA-IGN - LASTIG)

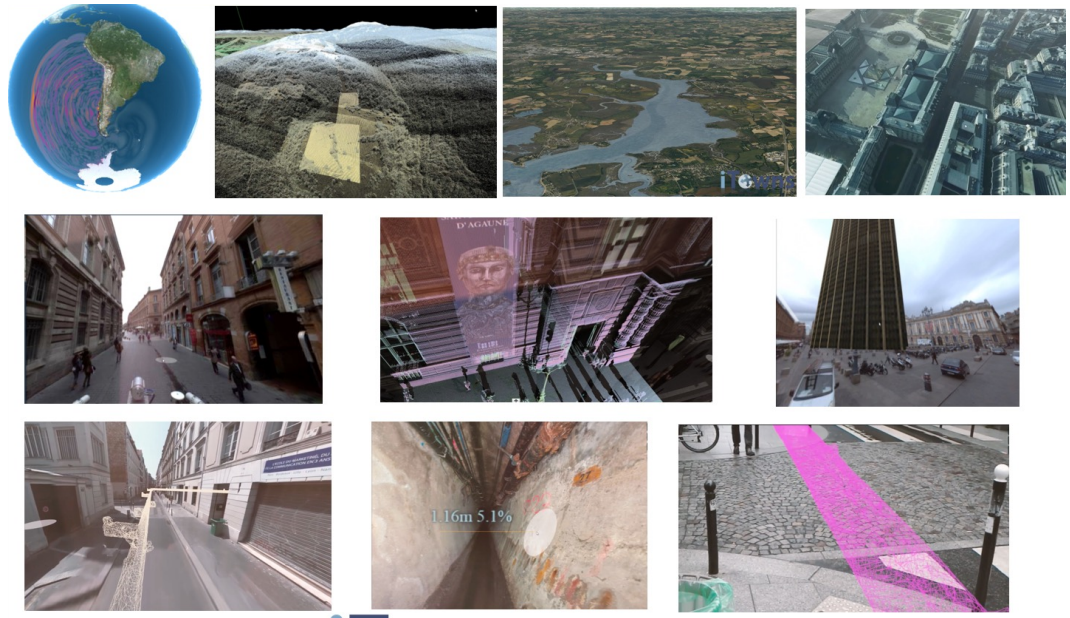
TO FACE THE CHALLENGES, WE NEED COMMUNITIES TO BUILD AND DEVELOPP GEOCOMMONS TOGETHER (PLATFORMS, DATA, LIBRARIES, TOOLS, ETC.)

EXAMPLES: PANORAMAX, ITOWNS



Panoramax

is an OpenData project



iTowns is an open-source project

IGN

45 millions photos, 368808 km, 666 contributors

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