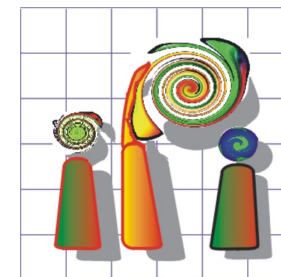


# IGN

INSTITUT NATIONAL  
DE L'INFORMATION  
GÉOGRAPHIQUE  
ET FORESTIÈRE

## CHANGER D'ÉCHELLE



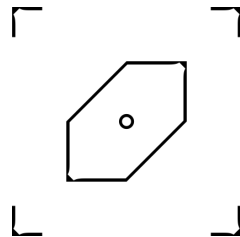
1 1  
1 0 2  
1 0 0 4

Leibniz  
Universität  
Hannover

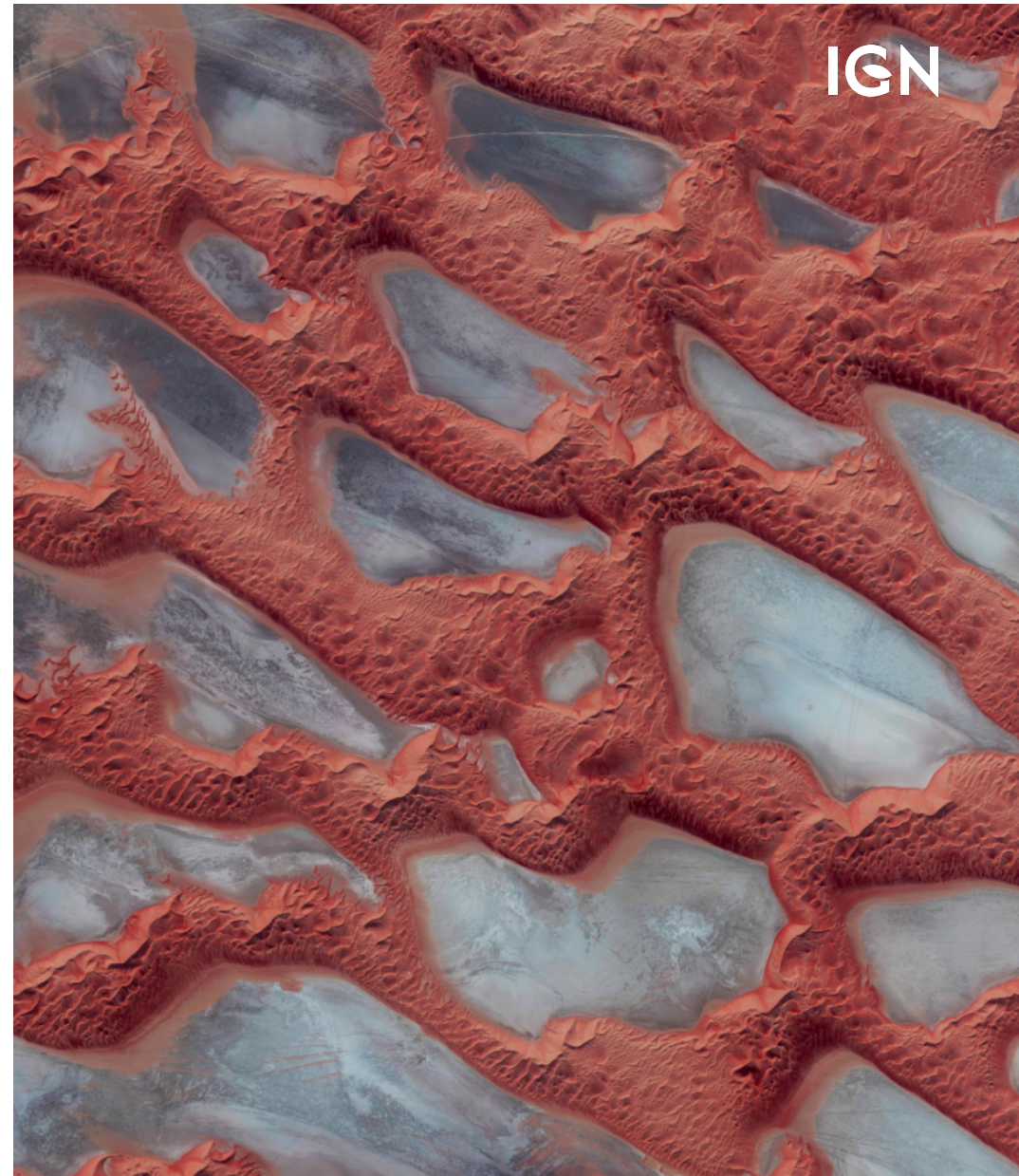
# TRENDS IN GEOINFORMATION SYSTEMS FROM AN NMCA's POINT OF VIEW

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FOR SOVEREIGNTY, RESILIENT  
TERRITORIES AND SMOOTH  
GREEN TRANSITION



Institut national de l'information géographique et forestière



**KNOWLEDGE  
OF THE TERRITORY  
HAS NEVER BEEN  
MORE NECESSARY**

**Our planet faces rapid and violent upheavals**  
Before and after the « Alex » Storm, French Alps



# MONITORING CONTINUOUSLY OUR TERRITORY

IGN

## 8 MAJOR CHALLENGES OF THE ANTHROPOCENE

URBANIZATION

RISKS

FORESTS

BIODIVERSITY

AGRICULTURE

COASTLINE

WATER

ENERGY



### LITTORAL

ANTICIPER LE RECU  
DU TRAIT DE CÔTE  
POUR ADAPTER LE TERRITOIRE

—> des cartes et des représentations  
pour visualiser et simuler

### EAU

MESURER LES RESSOURCES  
POUR MIEUX LES PARTAGER

—> des données entretenues  
en mode collaboratif

### ÉNERGIE

LOCALISER LES CONTRAINTES  
ET LES POTENTIELS  
POUR DÉVELOPPER  
LES ÉNERGIES RENOUVELABLES

—> donner une vision d'ensemble

### RISQUE

PRÉVOIR ET INNOVER  
POUR ANTICIPER LA CRISE

—> décrire précisément le territoire en 3D  
pour mesurer les aléas et prévenir les risques  
—> contribuer à la gestion de crise

### BIODIVERSITÉ

DÉCRIRE LA BIODIVERSITÉ  
ET SES HABITATS  
POUR MIEUX LES PRÉSERVER

—> des expertises croisées

### FORÊT

OBSERVER LA FORÊT  
D'UN ŒIL NEUTRE  
POUR LA PILOTER

—> des décennies d'expertise et de données  
—> modélisation et nouvelles données

### AGRICULTURE

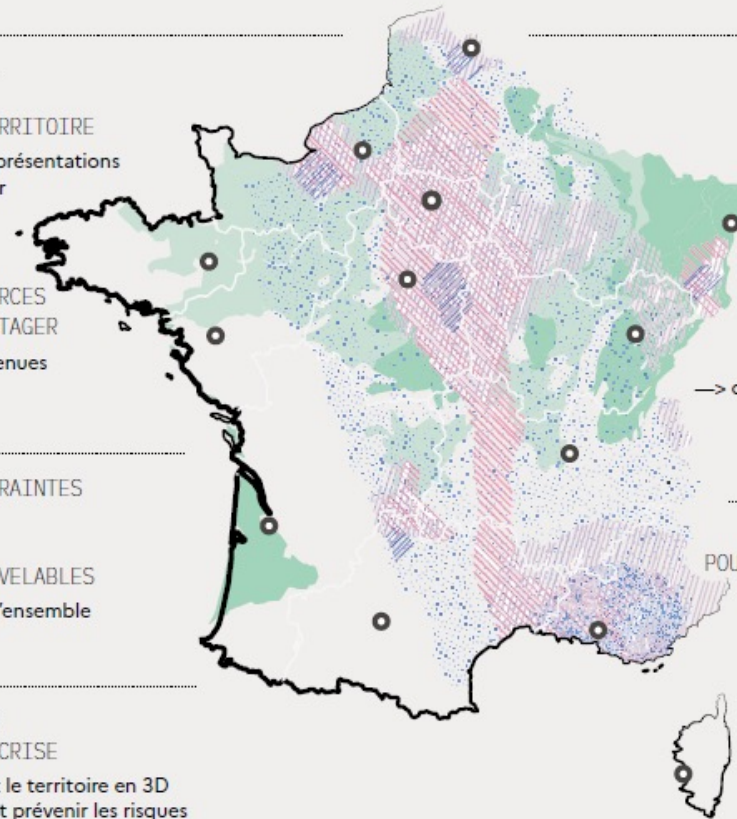
MIEUX CONNAÎTRE LES CULTURES  
POUR UNE AGRICULTURE PLUS DURABLE

—> des données et de l'IA  
pour accélérer le traitement

### URBANISATION

SUIVRE L'OCCUPATION  
ET L'USAGE DES SOLS  
POUR RÉGULER  
L'ARTIFICIALISATION

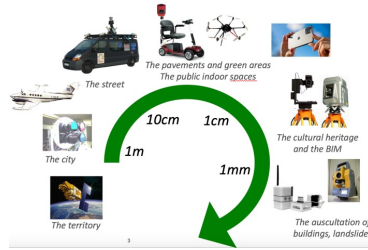
—> déchiffrer le territoire



# MULTI-SOURCE ACQUISITION AND PROCESSING



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



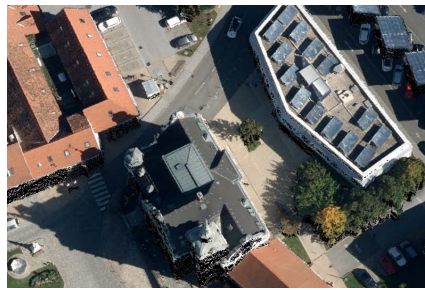
Satellite imagery at medium (SENTINEL), high (PLEIADES) Very high resolution (PNEO, CO3D)

High revisit capacity and quick coverage. World coverage capacity

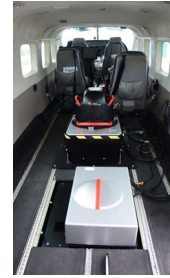
National photogrammetric coverage program

20 cm (3 years cycle)

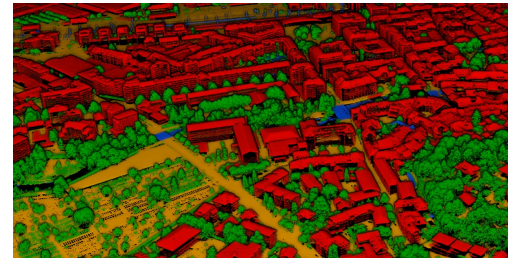
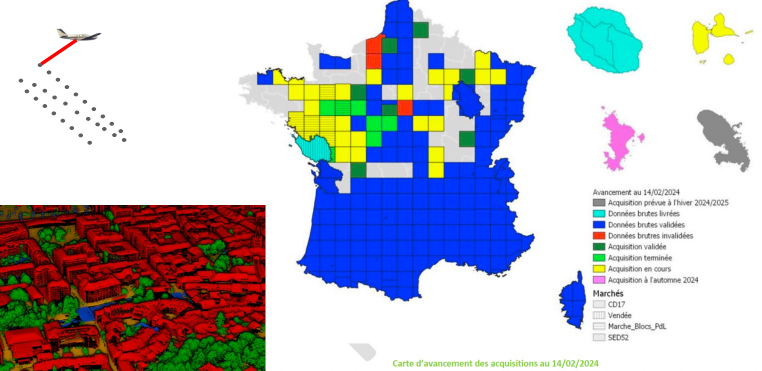
5 cm (PCRS)  
Partnership with regions  
66% coverage



Orthoimages, 3D urban, 3D city models, forest canopy



National coverage program LIDAR HD  
2021-2025, 10-20 pts/m<sup>2</sup>

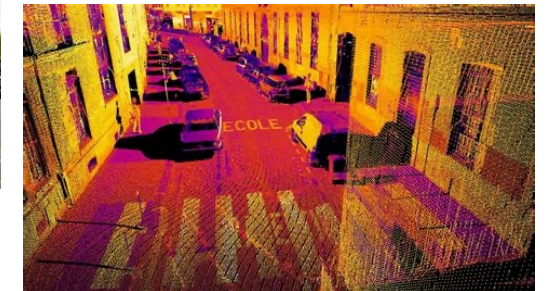


3D, DTM, forest, floodable areas, coast-line

Strong expertise on mobile mapping systems



Mobile mapping system  
Stereopolis 3.0. IGN ©



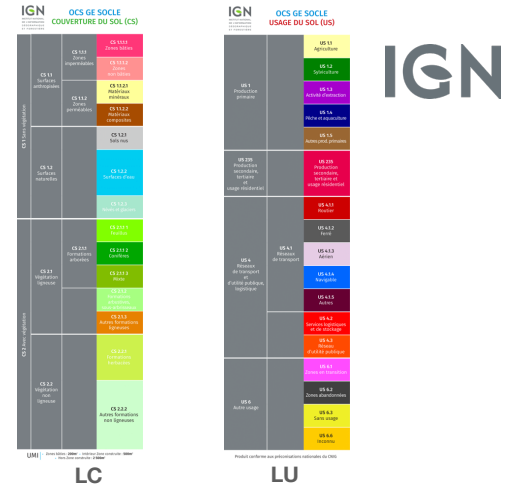
3D point cloud color with  
backscatter intensity

Façades, public spaces, pavements, roads/streets, urban/road furniture

Large scale land cover/land use product

# USING ARTIFICIAL INTELLIGENCE FOR AUTOMATED INFORMATION EXTRACTION

## ARTIFICIALISATION MONITORING WITH LULC FOR AN ENVIRONMENTAL POLICY



Annotations on aerial imagery



Heat map of the deep learning classification



Final vector product regularised using vector data and collaborative sourcing

**Goal:** producing two complete LULC at 3 years interval over France's territory (20 cm GSD)

**Trend:** integrating the Lidar HD data for the classification

*30 engineers specialised in AI  
in the IGN operational teams*



## AI DATA ARE OPEN TO GO FURTHER WITH COMMUNITIES

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

# TOWARDS REAL MULTI-SOURCE GEODATA PROCESSING

A 3 years cycle for the observation of our territory is not sufficient anymore



Pleiades Neo © AIRBUS DS 2022 © IGN

To meet the current challenges, we need authoritative and more frequent data adapted to the dynamics of the phenomena to follow

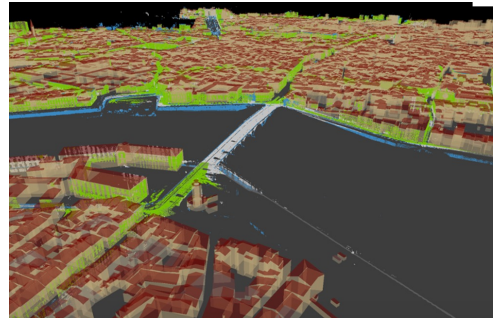
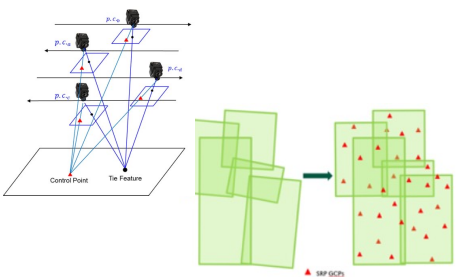
Space together with aerial imagery therefore occupies a growing place within the technological mix of the IGN

Many optical satellites and constellations at 30 cm are on the market

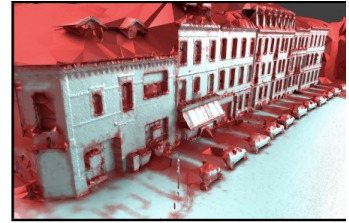
Currently working on the definition and production of a hybrid yearly orthoimage with 20 cm aerial imagery and PNEO satellite imagery at 30 cm

Producing a LULC map every three years from a mix of satellite and aerial imagery using also lidar HD





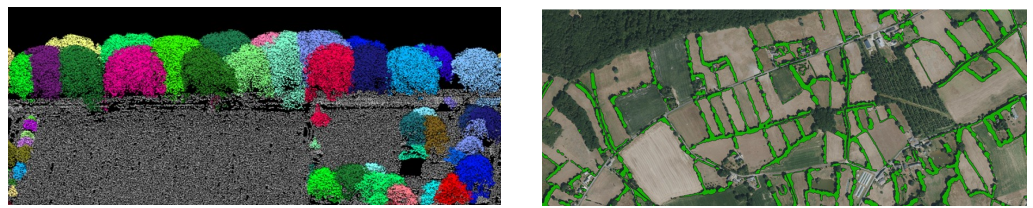
Integrating data in the same geometric reference frame  
 Space-triangulation and aerial-triangulation (left)  
 Registration of mobile mapping lidar on 3D city data (right)



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

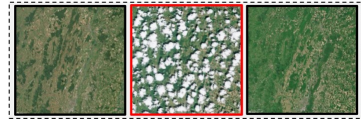


Land use and land cover classification. OCS-GE

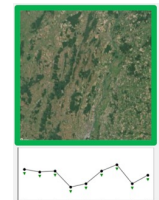
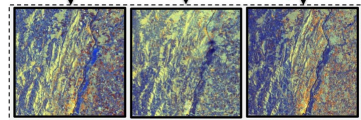


Extraction of hedgerows

Sentinel-Optical



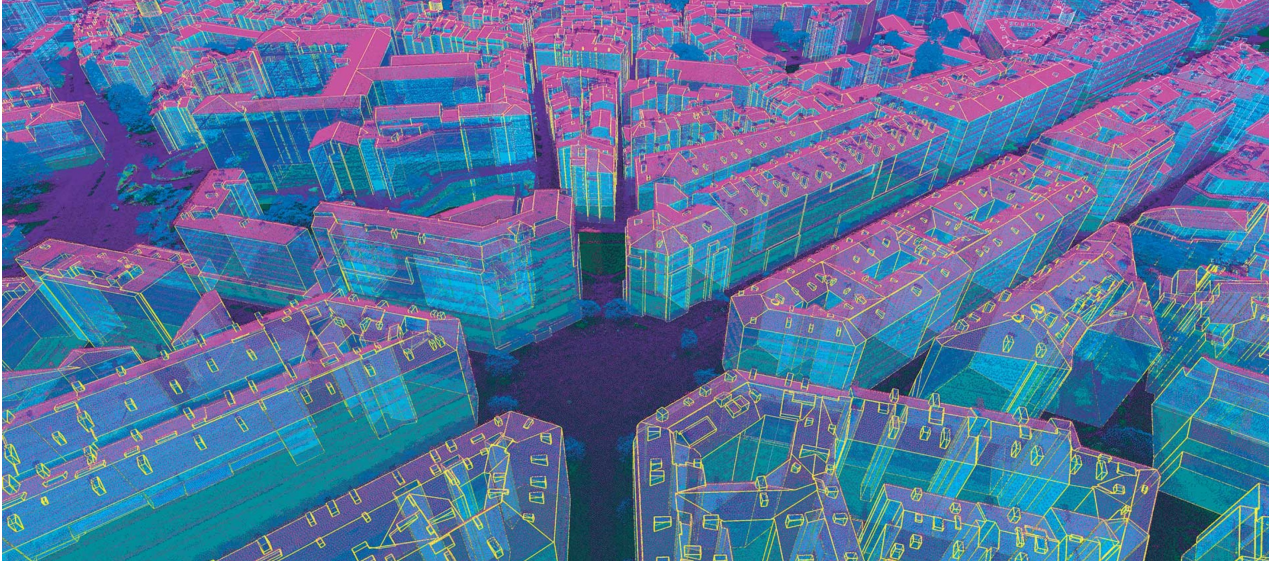
Sentinel-SAR



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

# SCALABLE MULTI-SOURCE GEOINFORMATION PROCESSING TECHNOLOGIES

# 3D CITY AND TERRITORY MODELS AT A NATIONAL LEVEL



Simplicity. Luxcarta ©

Significant progresses in 3D reconstruction with very high scale data and lidar

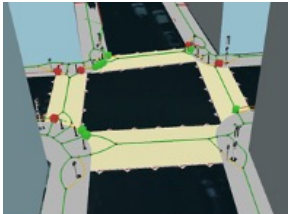
Nevertheless, need for not just buildings but also 3D addresses, roads and pavements, underground, building block limits, addresses, furniture, trees, zebra-crossings... and all of that should be coherent

3D city and territory models are useful only if continuously updated in a 3D GIS repository

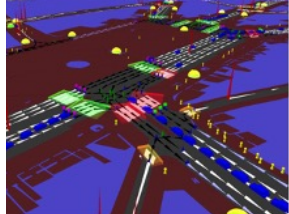
NMAs are going towards full automatic production and management of the 3D repository at a national level.

The “last meter” for the local authorities. A need for 3D smart procedural editing tools to correct and update the 3D models

A need for automatic change detection and self-diagnosis of reconstruction quality to guide human interaction.



Elyx3D. 1Spatial ©



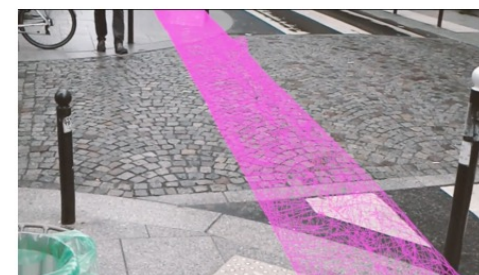
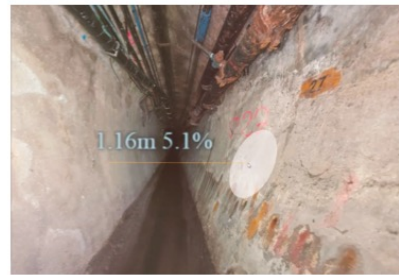
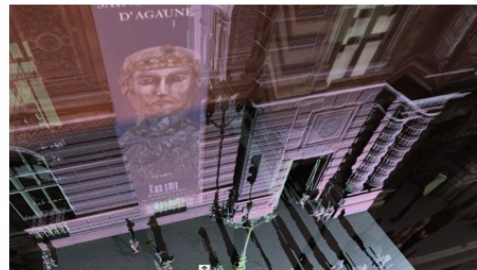
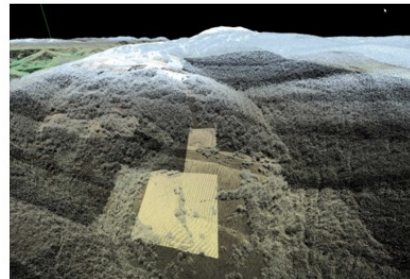
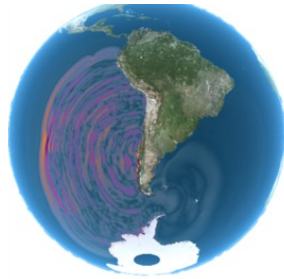
Thales TS ©



Irisa ©

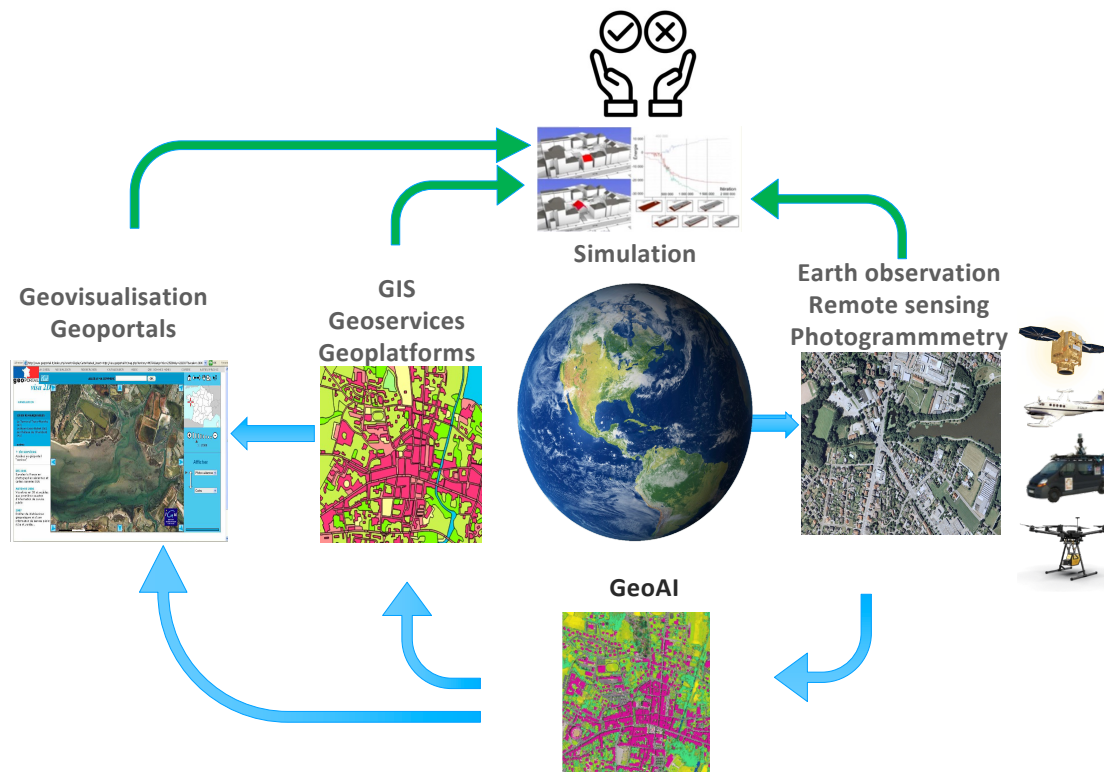
# BUILDING GEOCOMMONS : IMMERSIVE GEOVISUALISATION, INTERACTION AND PLOTTING TECHNOLOGY

IGN



**iTowns** is an open-source project IGN

iTowns is a technology allowing to navigate seamlessly and immersively in all NMCA data (images, lidar, 3D models, etc.), to measure, to plot in 3D, to annotate, to augment with projects and simulations, to interact with data/objects



# BUILDING A GEO DIGITAL TWIN A COMMON COVERING FRANCE

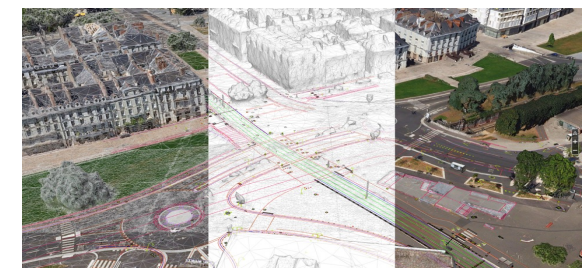
REDUCING THE GAP BETWEEN GEOINFORMATION AND DECISION MAKING  
FOR PUBLICS POLICIES, LOCAL AUTHORITIES, AND PRIVATE SECTOR  
TOGETHER WITH PUBLIC AND PRIVATE SECTOR

An Open Science  
and Open Innovation  
Integrated platform

A Science and market place hosting  
algorithms, services, applications and  
solutions both open and privately owned

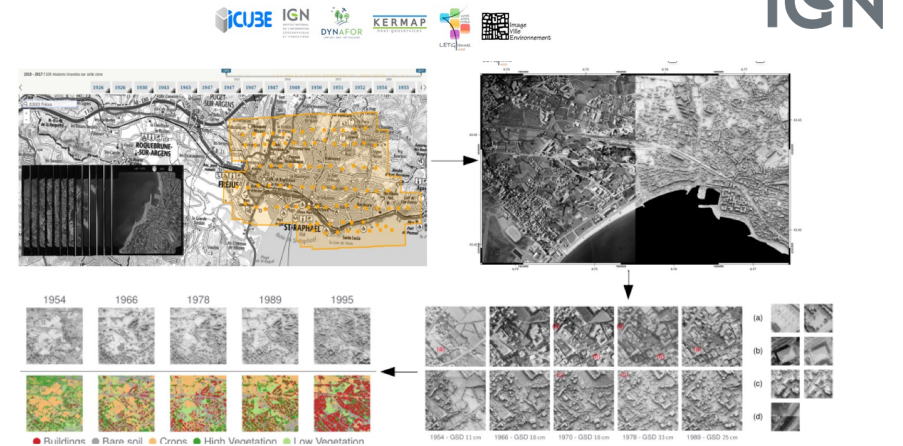


A millefeuille of data interoperable with data of other  
specific digital twins and sensor networks

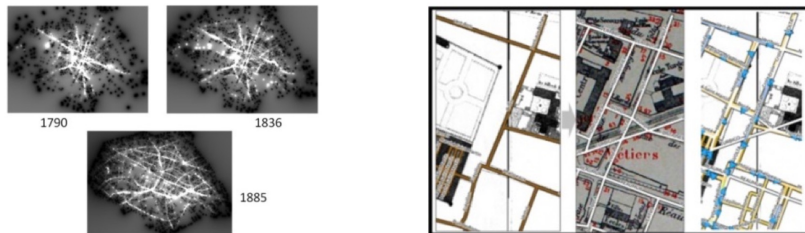


Spatially accurately coherent data layers

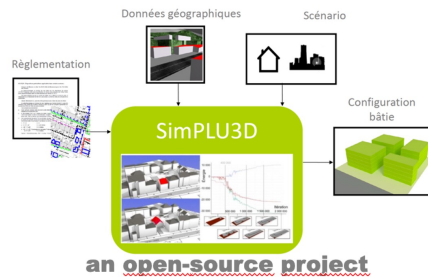
# SOME TECHNOLOGIES AND USE CASES OF THE DIGITAL TWIN TO MODELIZE THE PAST AND FORECAST POSSIBLE EVOLUTIONS



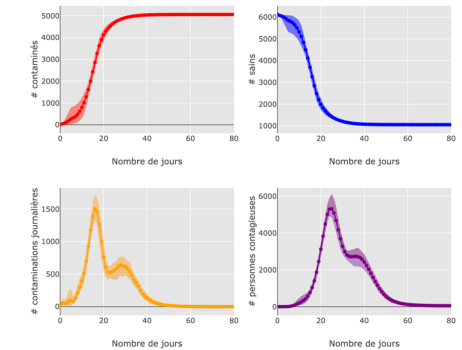
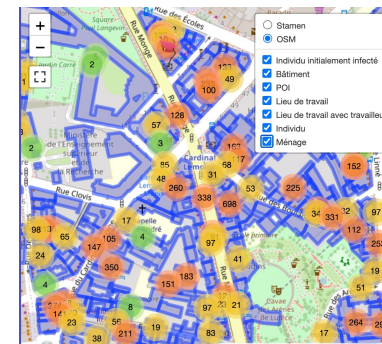
Multi-date aerial triangulation, DSM generation, and landcover classification of historical aerial surveys. Project HIATUS (LASTIG)



Capturing and modeling the evolution of the Paris road network. Project GeoHistoricalData.



Simulator of the evolution of urban patterns. Project SIMPLU (LASTIG)



Simulator of epidemic propagation to help decisions and the definition of public health policies Project ICI. INRIA-IGN ©





**RÉPUBLIQUE  
FRANÇAISE**

*Liberté  
Égalité  
Fraternité*

**IGN**

INSTITUT NATIONAL  
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GÉOGRAPHIQUE  
ET FORESTIÈRE

**CHANGER  
D'ÉCHELLE**



# SOME CONCLUSIVE IDEAS/REMARKS/TRENDS

- The challenges are so big that we need to build geocommons together at a european and international level
- A need for a national governance of Geoinformation integrating local authorities and all stakeholders
- Moving from geoinformation to geodecisions using geomodels to give a strategic and economical value to data/information and make it more frequently used to answer societal challenges
- A need to integrate geospatial data with statistical data and phenomenon dynamics
- A need for interoperability between the digital twin of territories, sensor networks, and specialized domain twins: building/bridge, road ....

- Killing Orthoimages. Computer graphics, computer vision, NERF can render all view points in real time
- A need for time series
- Serving digital twin data on-demand in real-time for 6D geolocalisation of mobile phones, for mixed reality navigation, maintenance, metaverse, and as a counterpart enrich the digital twin with the captured contents
- Geoinformation production lines should become agnostic with respect to information sources
- A convergence and a rationalization of production lines which are in silos and too specific.
- A need for a full holistic coherence by design of the Geoinformation millefeuille and dependencies between the layers
- Generative AI to transform a natural language request to an automated sequence of processes in the digital twin