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CHANGER D'ÉCHELLE

GEOSPATIAL AI FOR LAND COVER AND AGRICULTURAL LAND MONITORING

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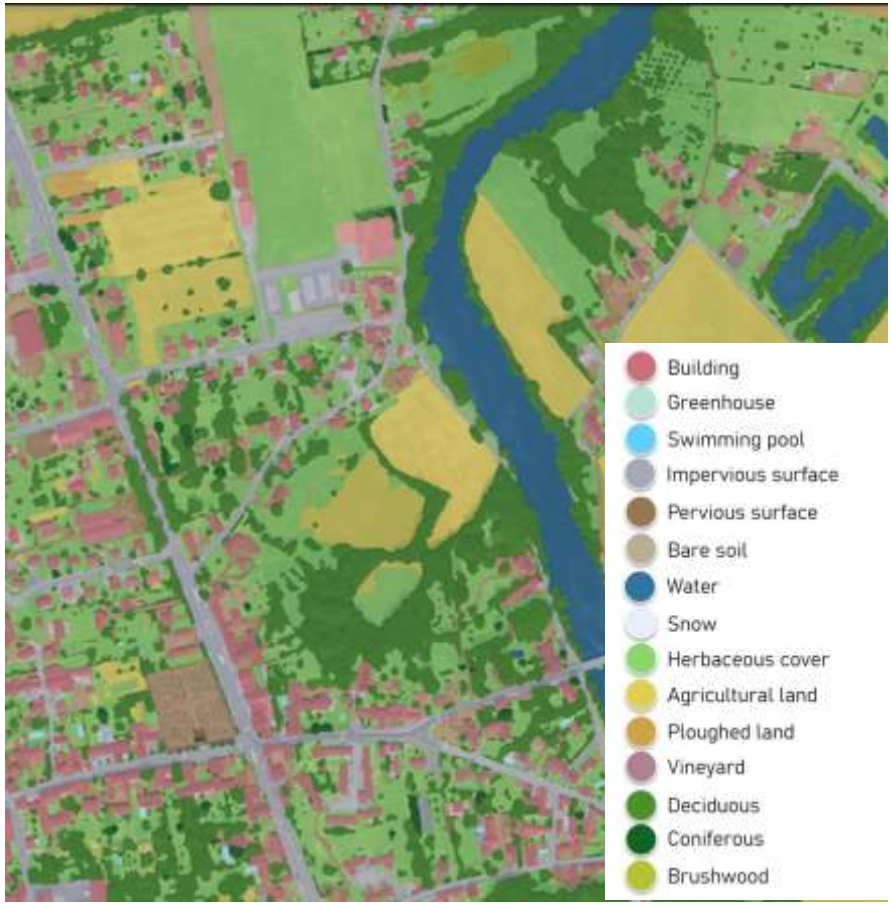
COSIA: LARGE-SCALE AI PRODUCT FOR LAND COVER

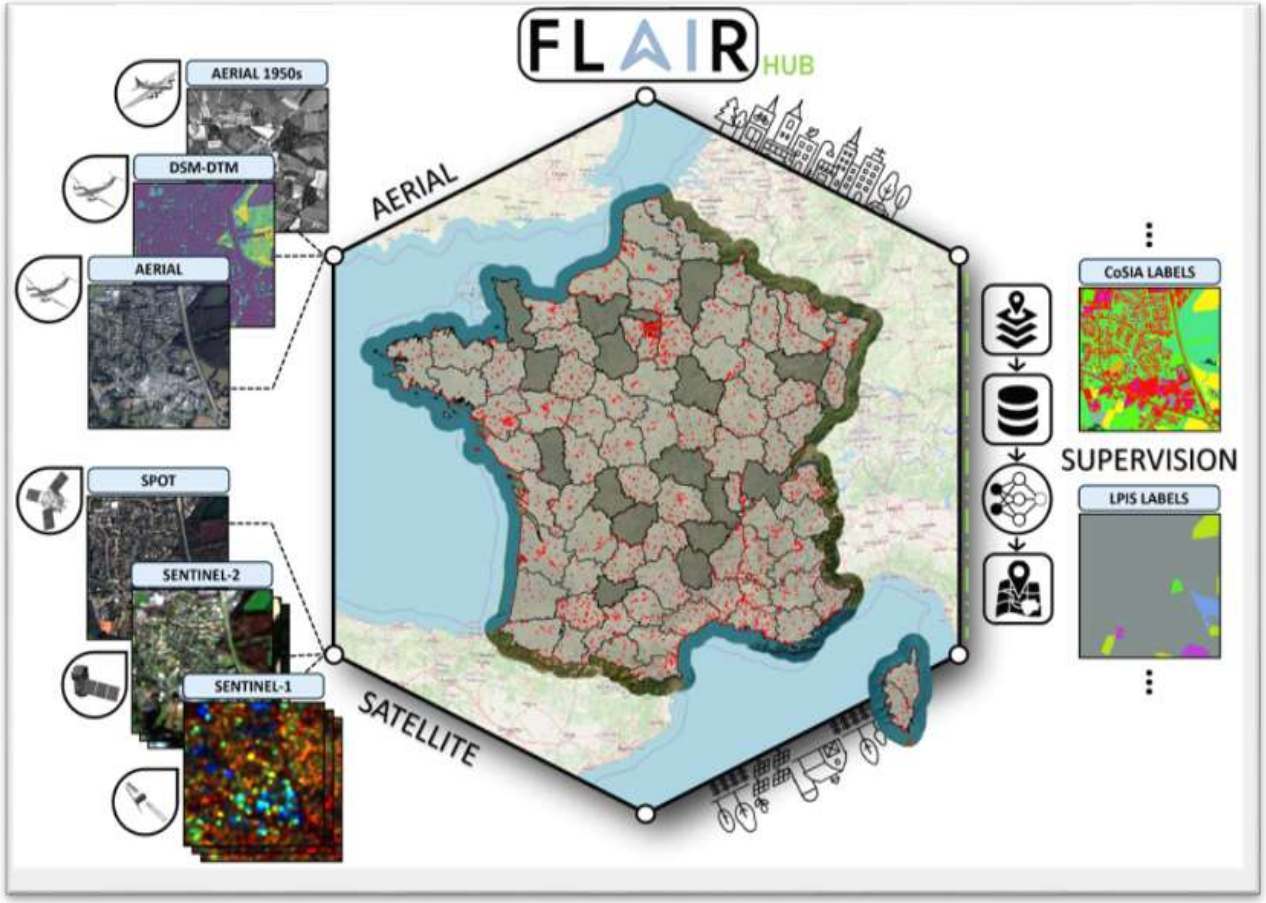
- **In-house AI models** based on state-of-the-art AI architecture: **Swin-Large+UPerNet**
- **Countrywide pixel-wise predictions**: updated every 3 years
- Main application: monitoring **land artificialization** *(e.g., loss of agricultural land)*
- Predictions distributed as data streams via https://cartes.gouv.fr/, and models/datasets on https://huggingface.co/IGNF

CoSIA Experimental Demonstrator

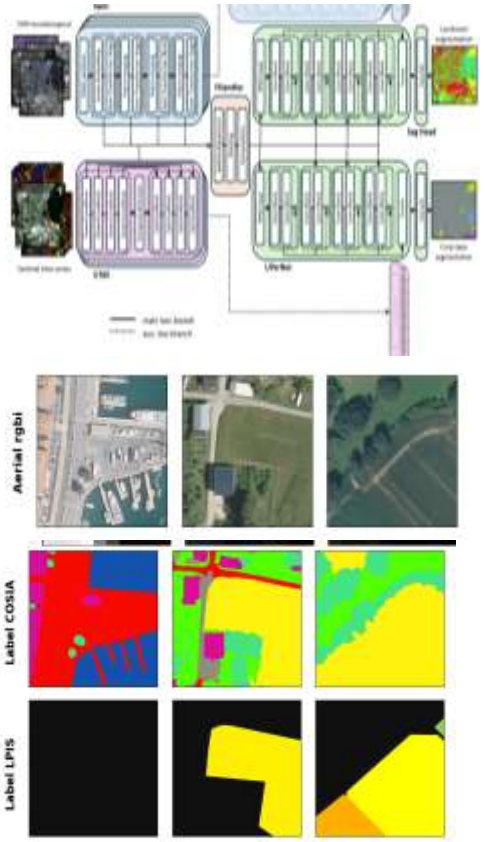


FLAIR-HUB: Large-Scale Multimodal Dataset and Models for Land Cover and Crop Mapping

- **Large-scale dataset**: 63.2 B annotated pixels at 0.20 m resolution
- Semantic labels: **land cover** (15 classes) and **crop type** (23/31/46 classes)
- **6 aligned modalities**: aerial imagery, Sentinel-1/2 time series, SPOT, topography, ...
- **Advanced multimodal architecture:** UPerFuse combining Swin Transformer and UTAE

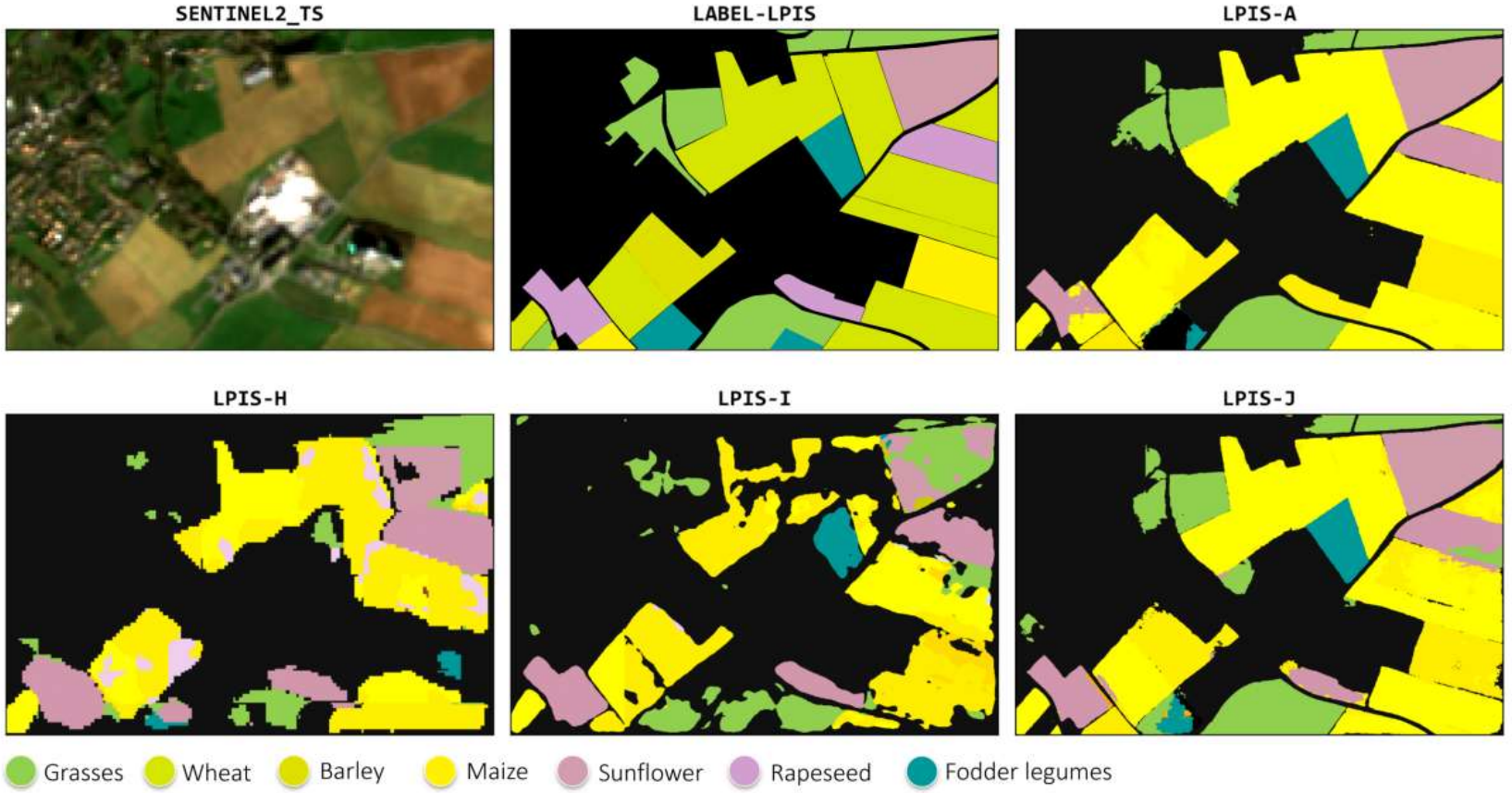


FLAIR-HUB information page



FOSTERING MULTIMODAL AI MODELS FOR CROP TYPE PREDICTION WITH FLAIR-HUB

- **LPIS-A:** Aerial
- **LPIS-H:** Sentinel-1 TS + Sentinel-2 TS
- **LPIS-I:** SPOT + Sentinel-1 TS + Sentinel-2 TS
- **LPIS-J:** Aerial + SPOT + Sentinel-1 TS + Sentinel-2 TS

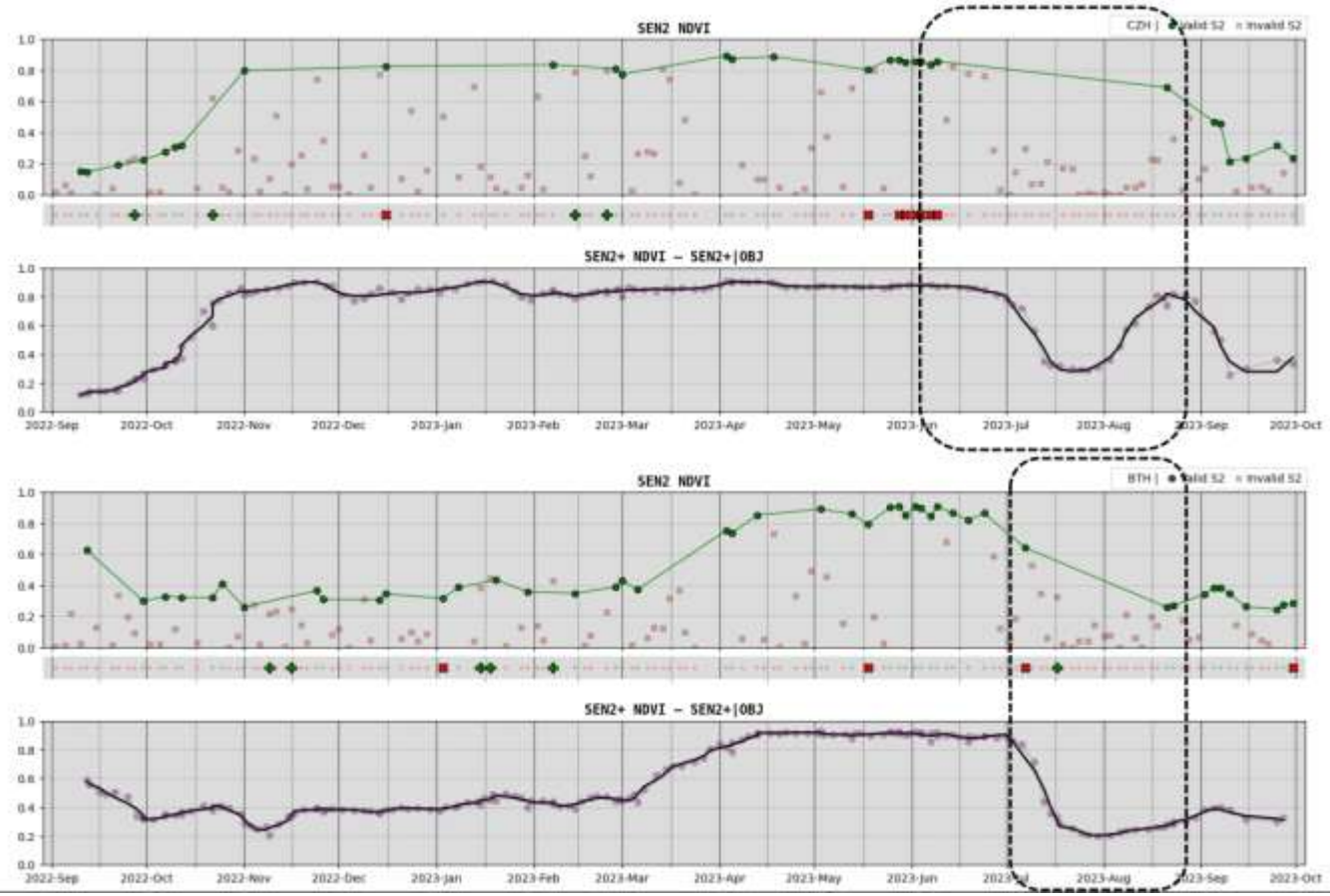


FLAIR-HUB: Large-scale Multimodal Dataset for Land Cover and Crop Mapping

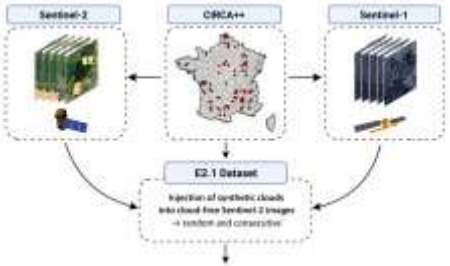
EXPERIMENTS FOR THE REAL-TIME AGRICULTURAL PARCEL MONITORING SYSTEM (3STR)

Delivering proof-of-concepts for the French CAP paying agency (ASP France), concerning the **real-time agricultural parcel monitoring system (3STR)** :

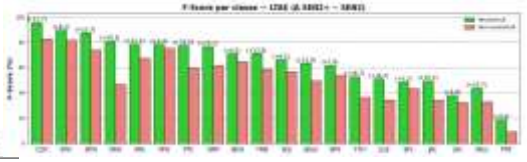
- Axis 1: Detecting heterogeneous agricultural parcels
- **Axis 2: Densifying Sentinel-2 time series through cloud removal**
- Axis 3: Detecting agricultural practices (mowing, ploughing, harvesting, ...)



Axis 2 : How ? **Building an AI model for SAR-to-Optical Translation**

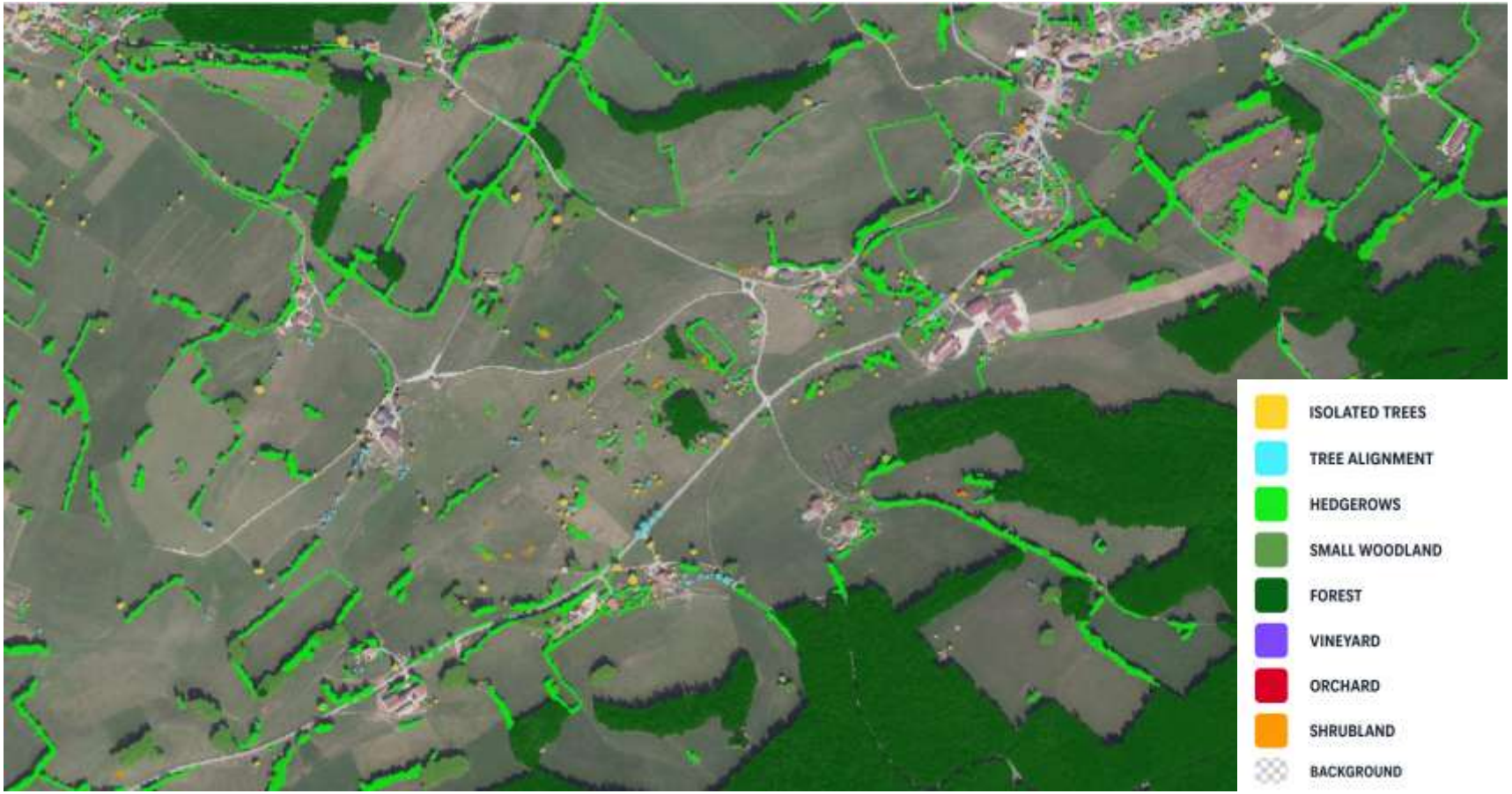


and improving crop classification metrics using reconstructed inputs.



MONITORING VEGETATION MORPHOLOGY FOR GOOD AGRICULTURAL AND ENVIRONNEMENTAL CONDITIONS

- **Fine-tuning** the CoSIA semantic segmentation model (transfer learning)
- by creating a new annotated dataset (~10% of FLAIR-HUB)
- with a target taxonomy capturing **vegetation morphology (hedgerows, isolated trees, …)**
- Ongoing countrywide production for the “**Hedgerows Observatory**" database



CHANGE DETECTION MODELS FOR NON-AGRICULTURAL AREAS

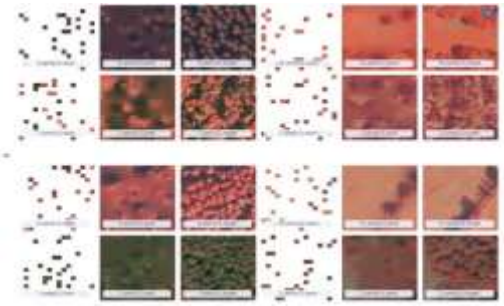
- Creation of a **500 km² bi-temporal aerial dataset** (25% of FLAIR-HUB), featuring **5-band imagery** and **39 annotated classes** (track, reservoir, ditch, photovoltaic panel …) for change detection tasks.
- Use of **siamese AI architectures** to handle bi-temporal data and predict changes.
- Training these models to achieve particularly strong **no-change prediction**, for use in **interactive update workflows**.

Reference / Prediction

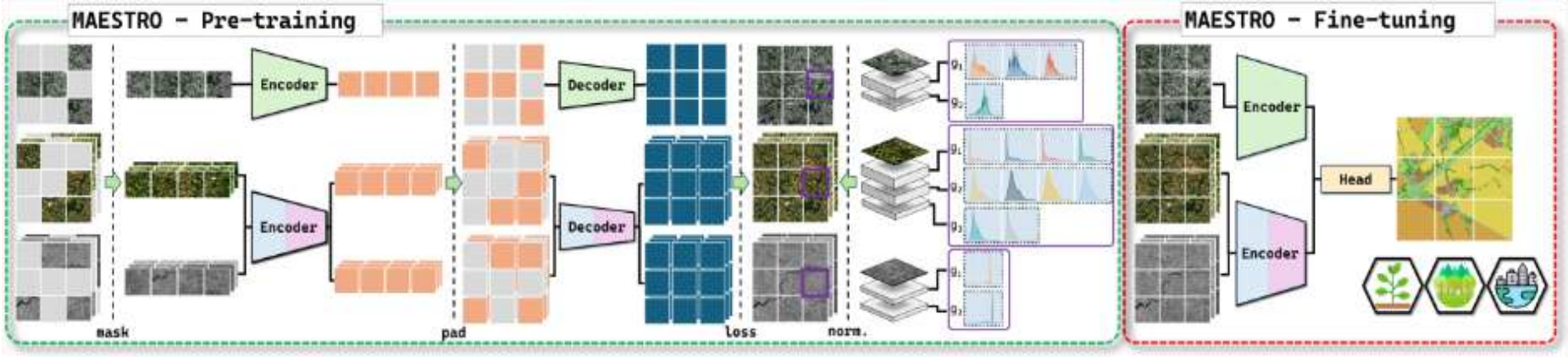
Reference / Prediction

MAESTRO : IN-HOUSE FONDATION MODELS AT IGN

- **Adapting foundation models to remote sensing specificities** (multimodality, multi-temporality, spectral information) → strong value of in-house models at IGN
- SSL with Masked Autoencoders (MAE) and Vision Transformers (ViTs)
- **+5%** performance gain for **forest species** prediction vs. DINOv2
- Currently leveraged for cloud removal and low-annotation tasks (*e.g. agricultural practice detection*)



MAESTRO: Masked AutoEncoders for Multimodal, Multitemporal, and Multispectral Earth Observation Data



Optimized Fusion strategies for multimodal and multitemporal data


THANK YOU FOR YOUR ATTENTION