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Session on:  
Korea Carbon Project: Hybrid MRV for actionable  
data of national carbon sequestration

# An innovative hybrid approach for soil carbon farming MRV

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Antonenko V., Geraud A. , Ihasusta A.

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# Carbon Dioxide Removal

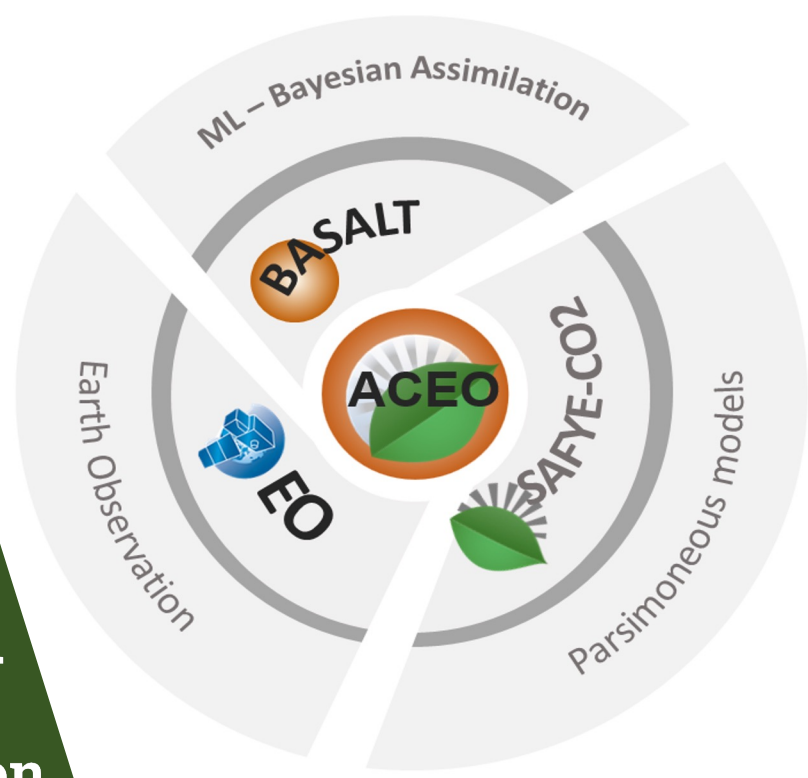
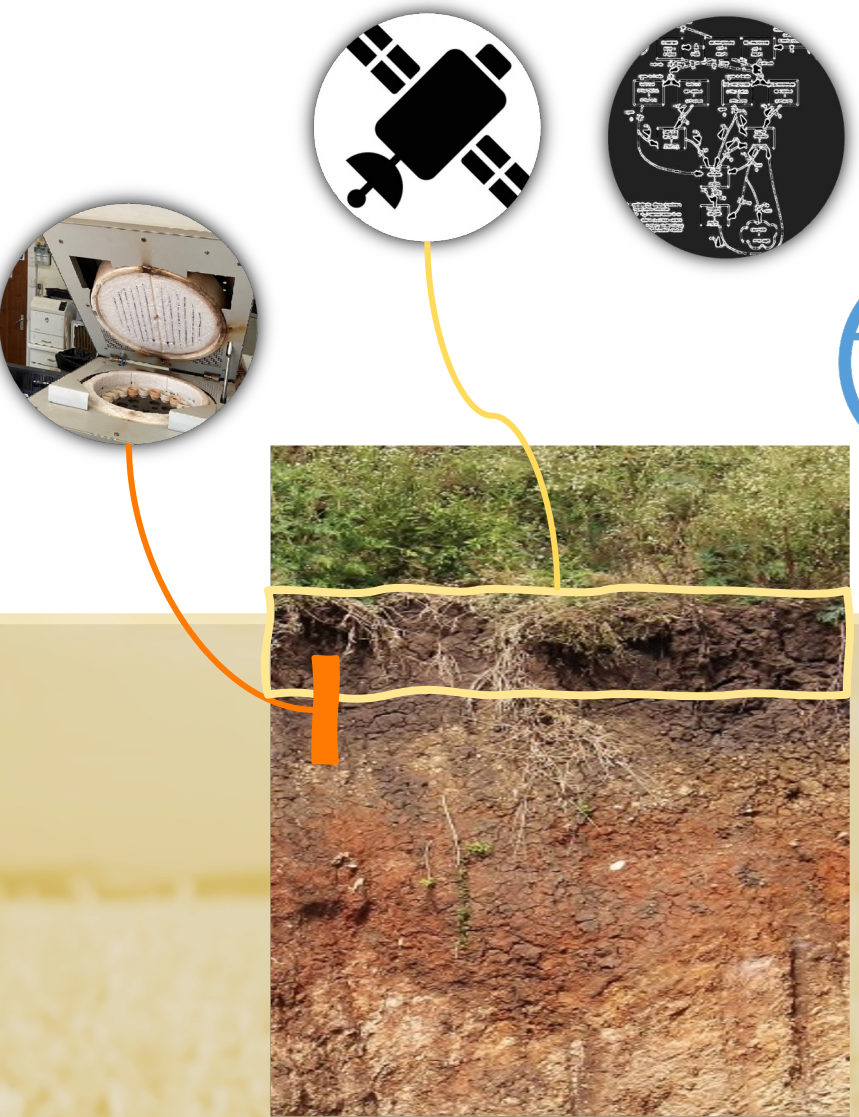
Technology	Afforestation and reforestation	Soil carbon sequestration	Biochar	Bioenergy with carbon capture & storage	Direct air carbon capture and storage	Enhanced weathering	Peatland and coastal wetland restoration	Blue carbon management	Ocean alkalinity enhancement	Ocean fertilization
Capture mechanism	Land-based biological	Land-based biological	Land-based biological	Land-based biological	Chemical	Geochemical	Land-based biological	Ocean-based biological	Geochemical	Ocean-based biological
Feasibility/readiness	●	●	●	●	●	●	●	●	●	●
Scalability	●	●	●	●	●	●	●	●	●	●
Ease of MRV*	●	●	●	●	●	●	●	●	●	●
Potential consequences	●	●	●	●	●	●	●	●	●	●
Public perception	●	●	●	●	●	●	●	●	●	●
Cost (US\$/tCO <sub>2</sub> )	< 100	< 100	100–500	100–500	> 800	100–500	< 100	< 100	Too early to quantify	
Storage medium	Buildings, vegetation, soils and sediments			Geological reservoirs		Minerals	Vegetation, soils and sediments		Minerals	Marine lime/nis

Sources: UNEP - Emissions Gap Report (2023), Adapted from Geden et al. (2022) and Pisciotta, Davids and Wilcox (2022).

Offsetting  
in-setting  
Inventories



# Monitoring soil carbon



**AgriCarbon-EO**  
A hybrid MRV approach that combines:  
modeling, remote sensing, and assimilation.

<https://www.cesbio.cnrs.fr/agricarboneo/agricarbon-eo/>



# AgriCarbon-EO

Is also a processing chain that process the data from end-to-end.

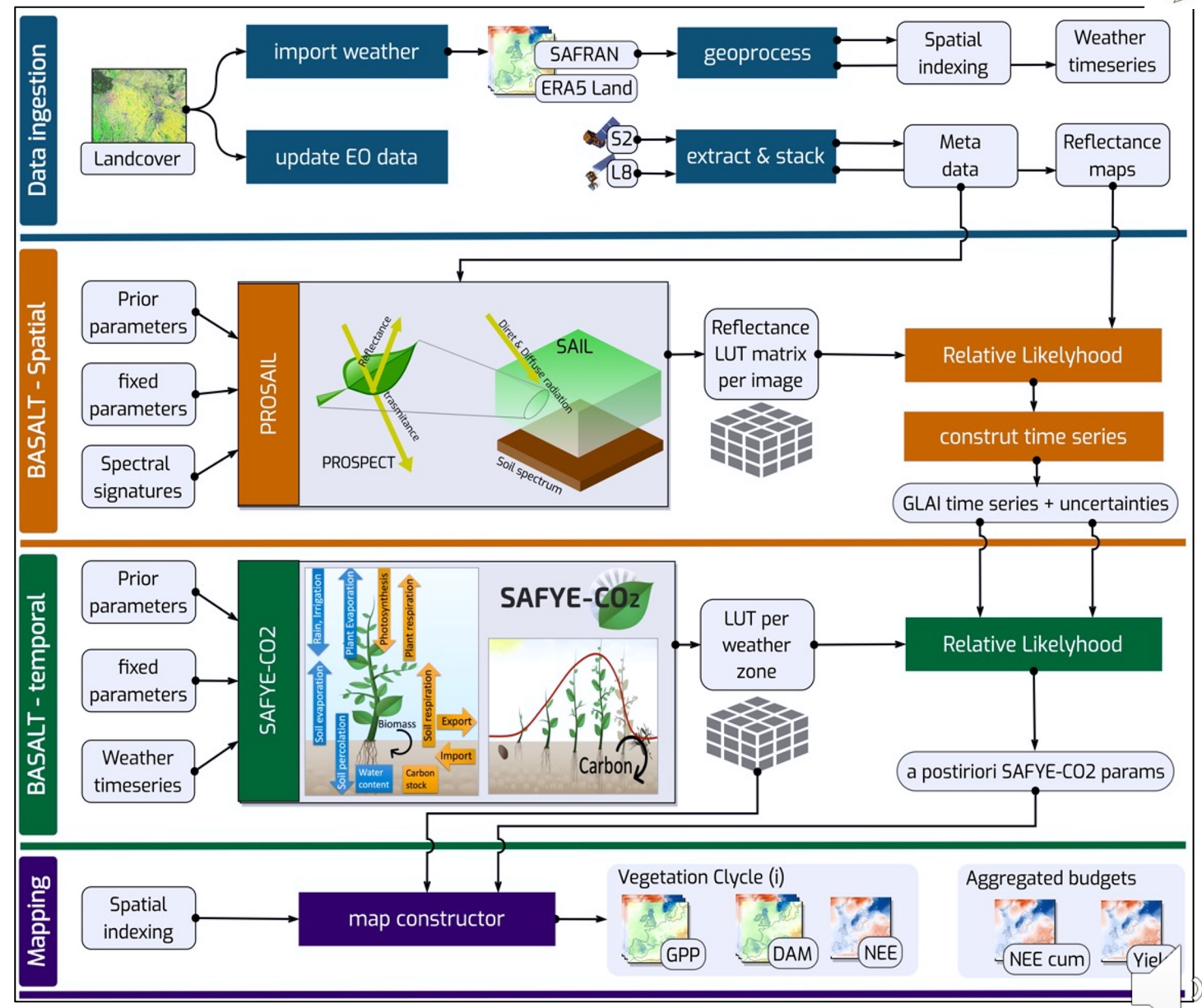


**Geoscientific Model Development**

AgriCarbon-EO: v1.0.1: Large Scale and High Resolution Simulation of Carbon Fluxes by Assimilation of Sentinel-2 and Landsat-8 Reflectances using a Bayesian approach

Taeken Wijmer, Ahmad Al Bitar, Ludovic Arnaud, Rémy Fieuzal, and Eric Ceschia

**Agri sector:**





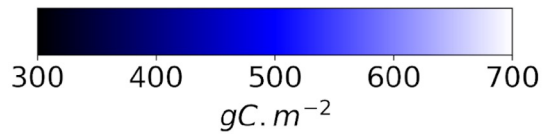
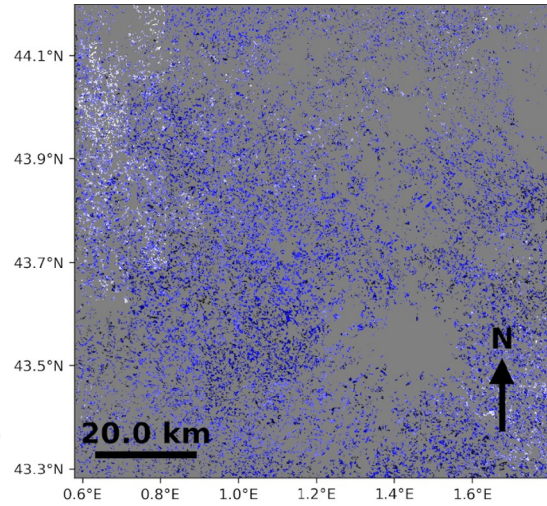
# Carbon budget components



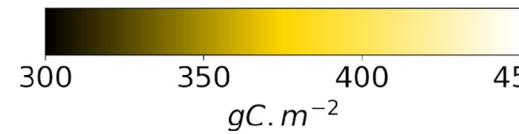
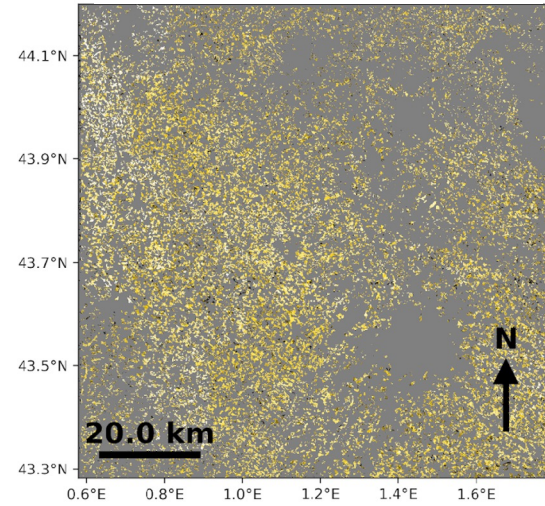
$$\Delta\text{carbon} = \text{Net flux} + C_{\text{import}} - C_{\text{export}}$$



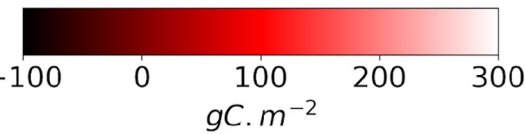
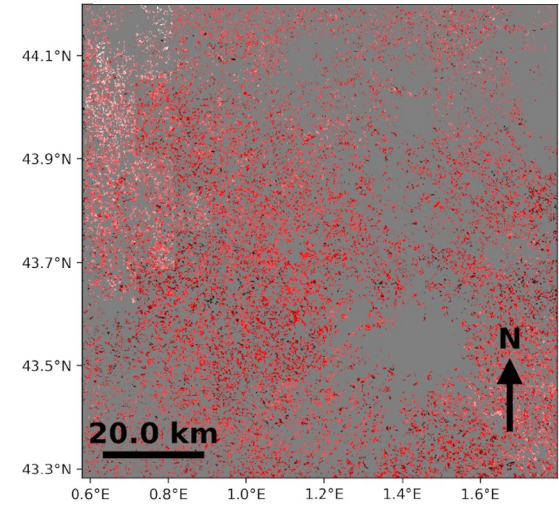
Net annual CO<sub>2</sub> flux (NEP)



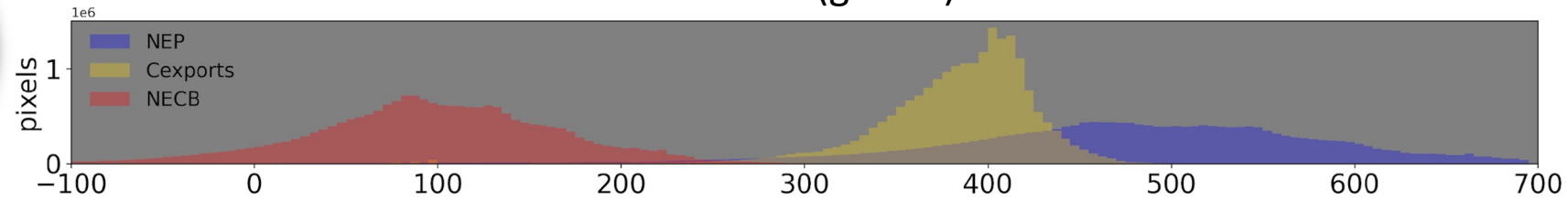
C exported at harvest



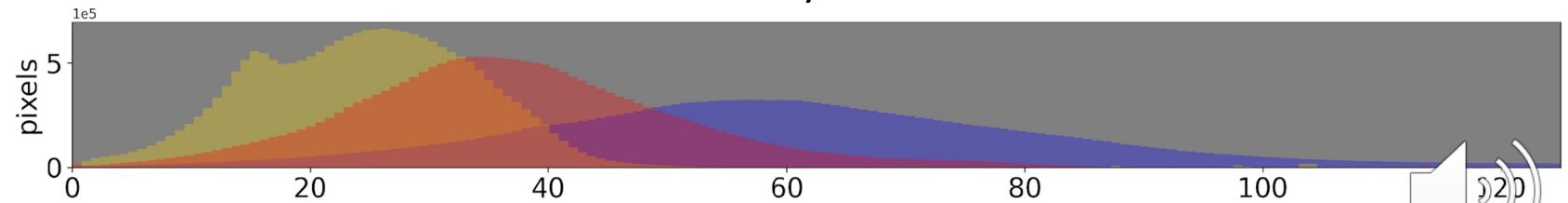
Annual C budget (NECB)



Mean value (gC.m<sup>-2</sup>)



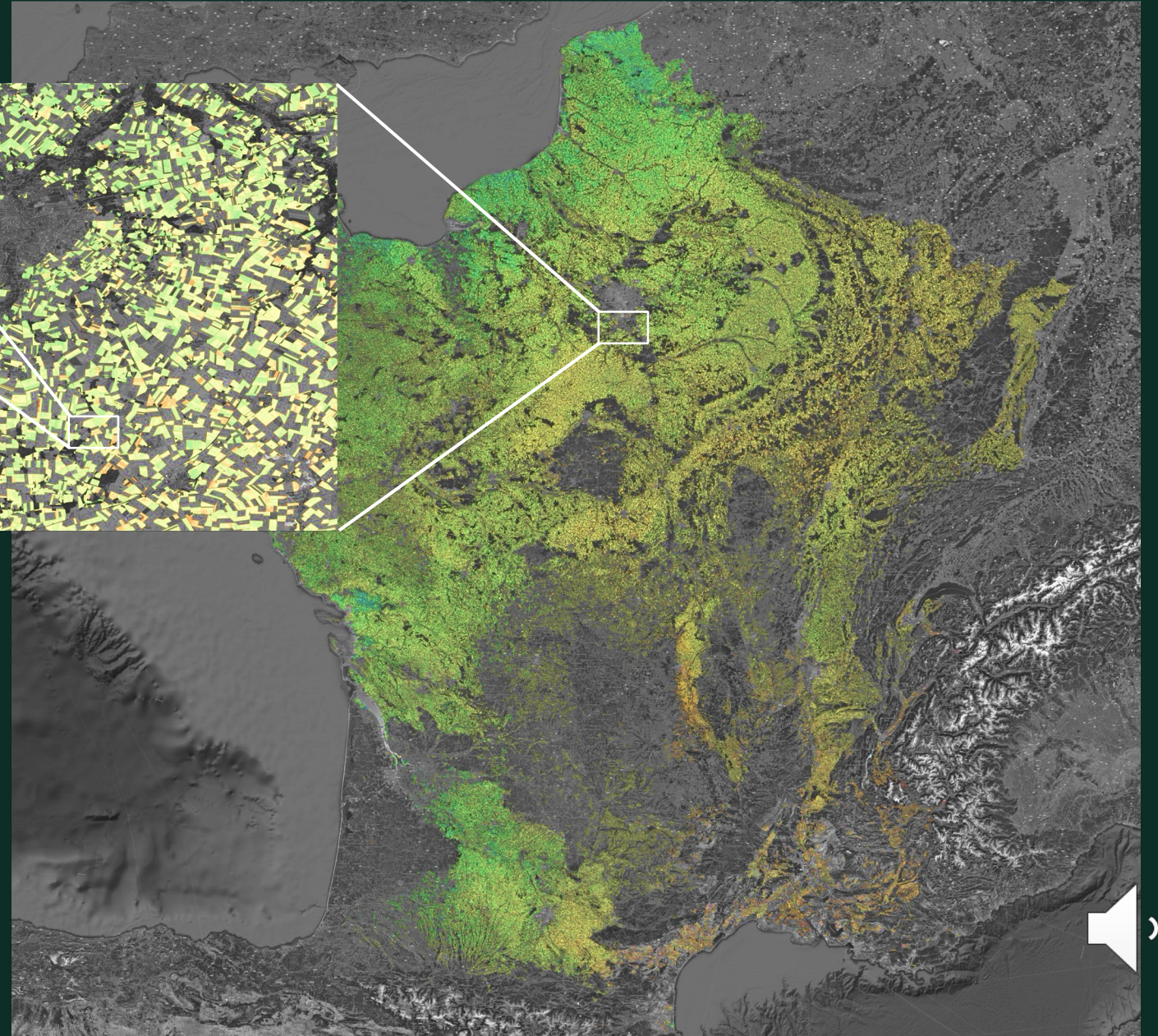
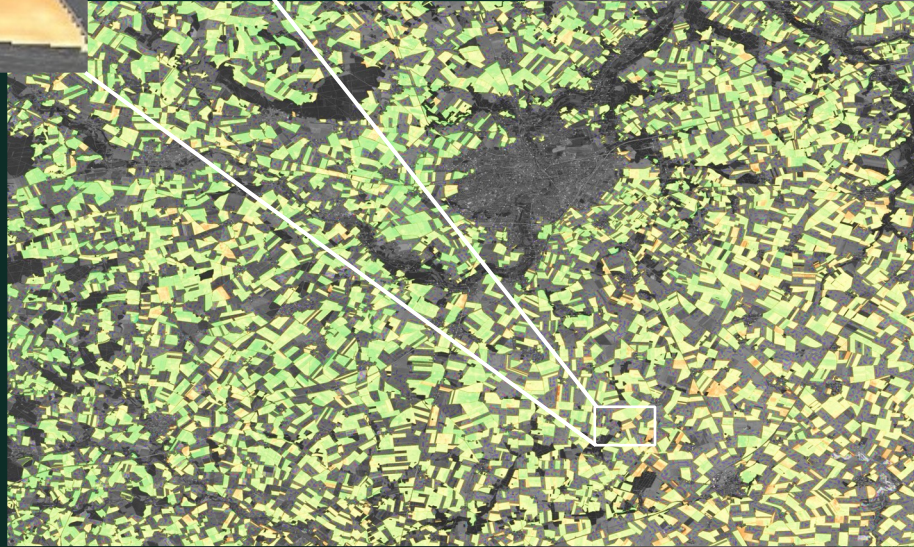
Uncertainty estimates





# Scaling-up

Capturing changes from intra-field to national scale



Dry above ground biomass  
Winter wheat 2019 in France

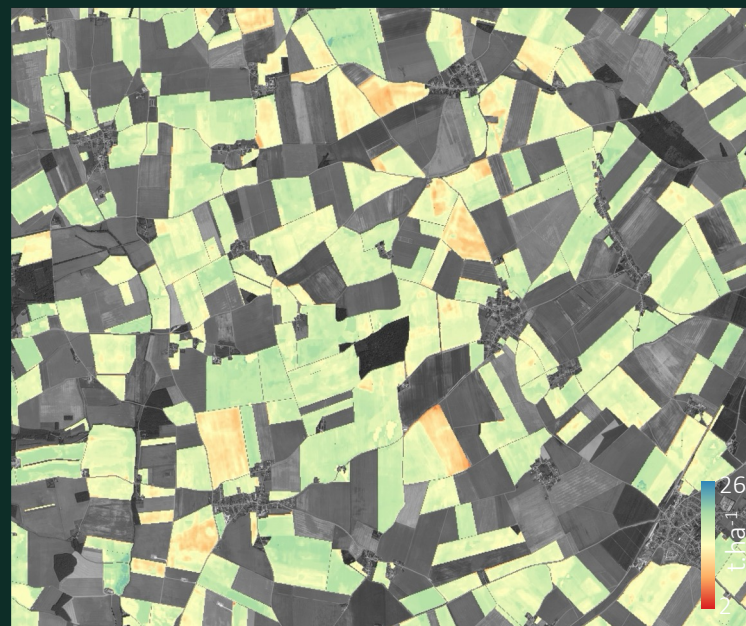
10m resolution  
0.6 billion pixels  
Daily estimates



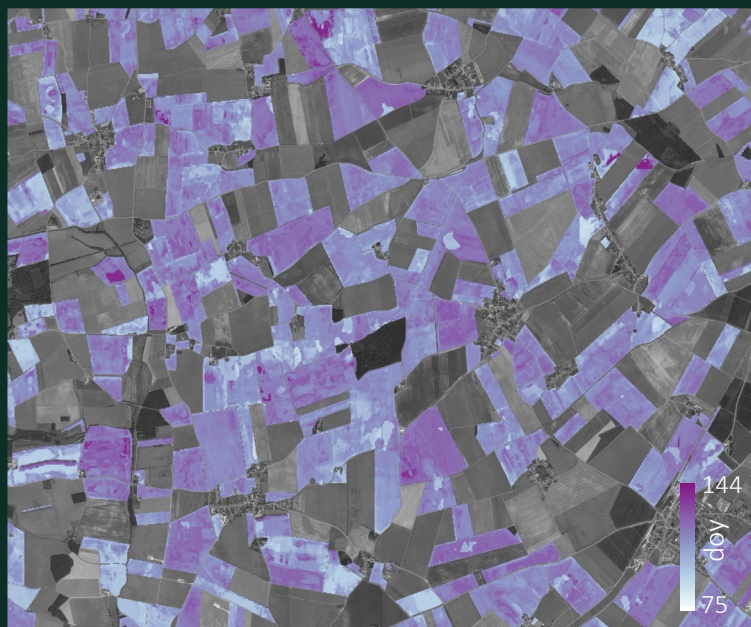


# Coherent-set of agri-environmental variables

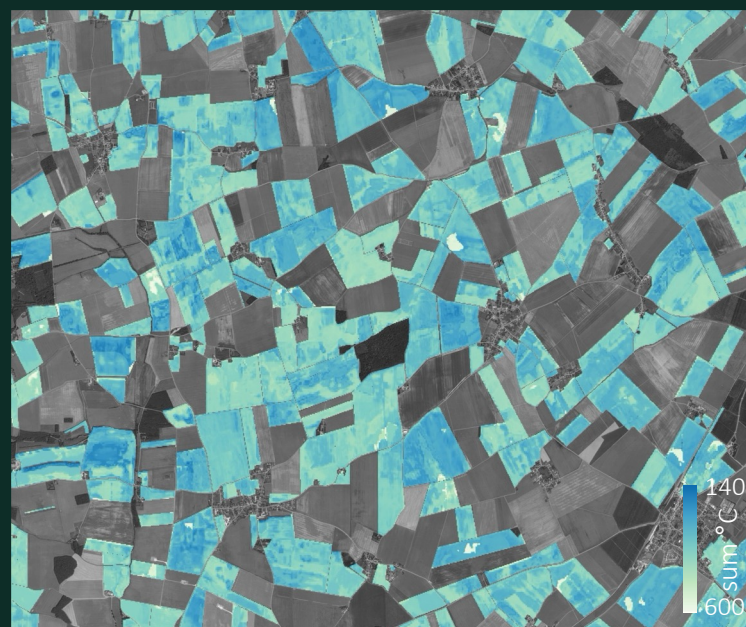
Dry Above ground biomass



Net annual  $\text{CO}_2$  flux



Day of emergence



Maturation phase

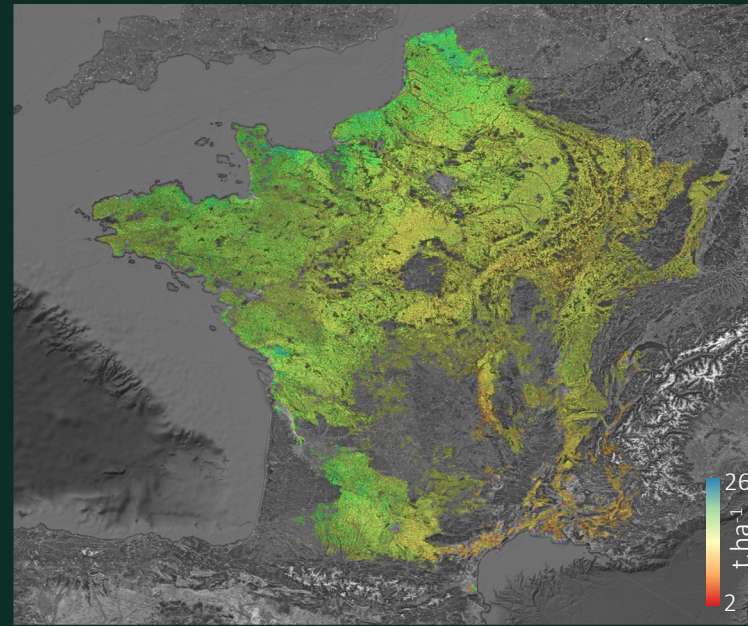


Senescent phase

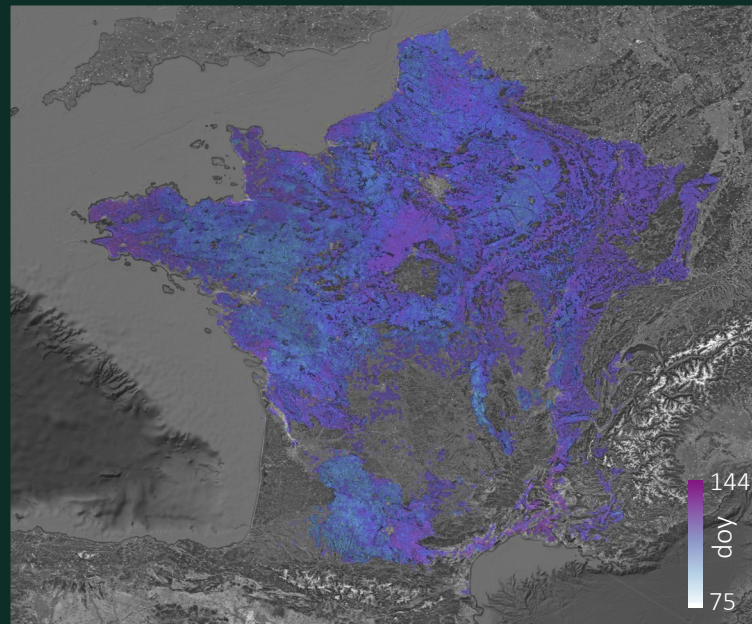
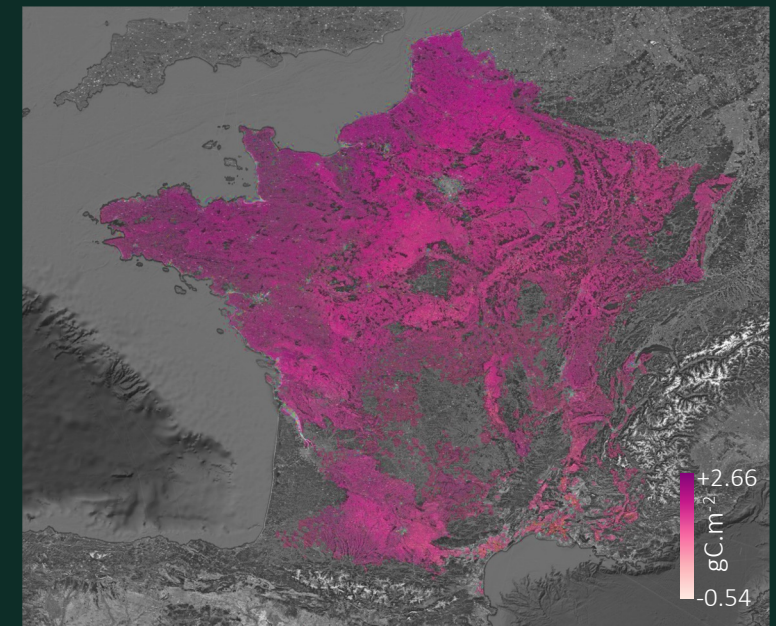


# Coherent-set of agri-environmental variables

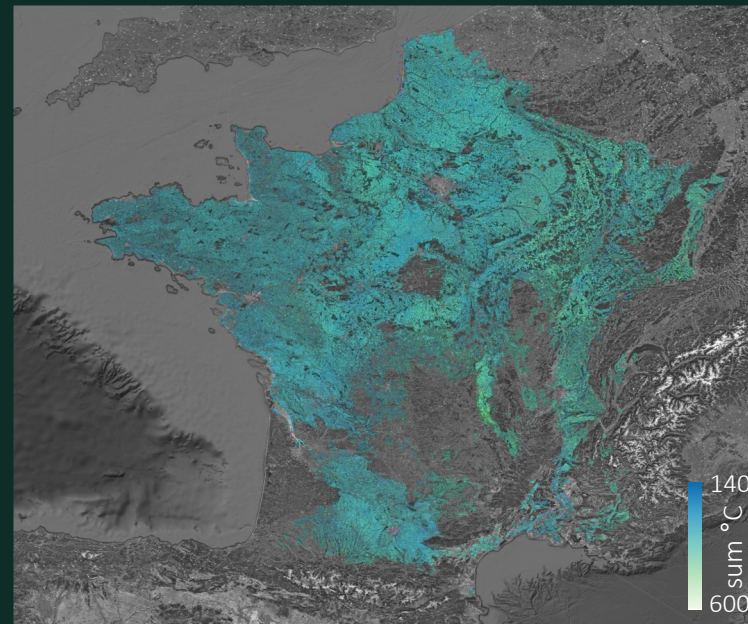
Dry Above ground biomass



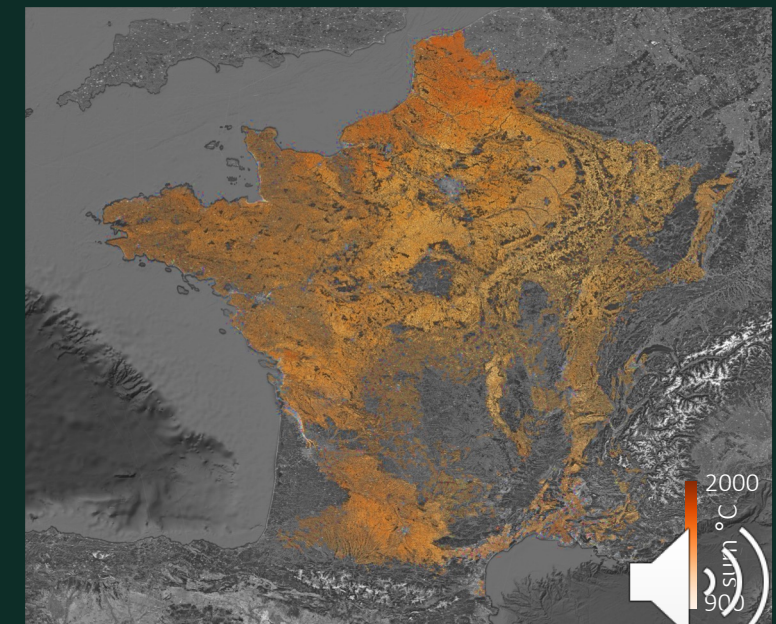
Net annual CO<sub>2</sub> flux



Day of emergence



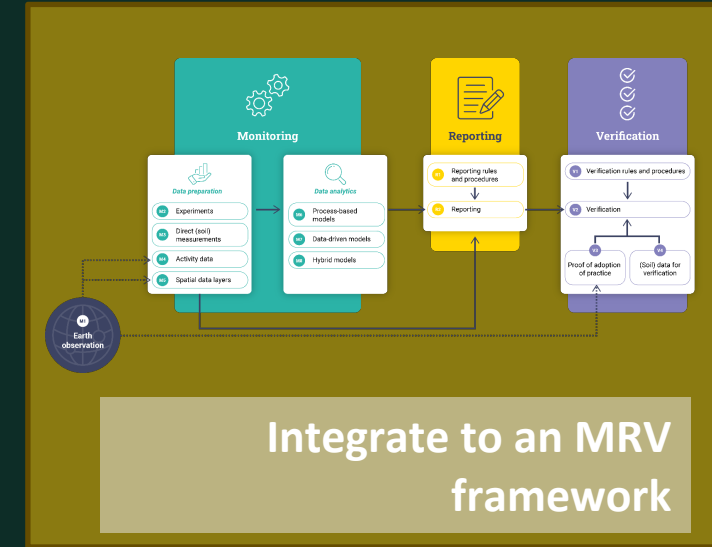
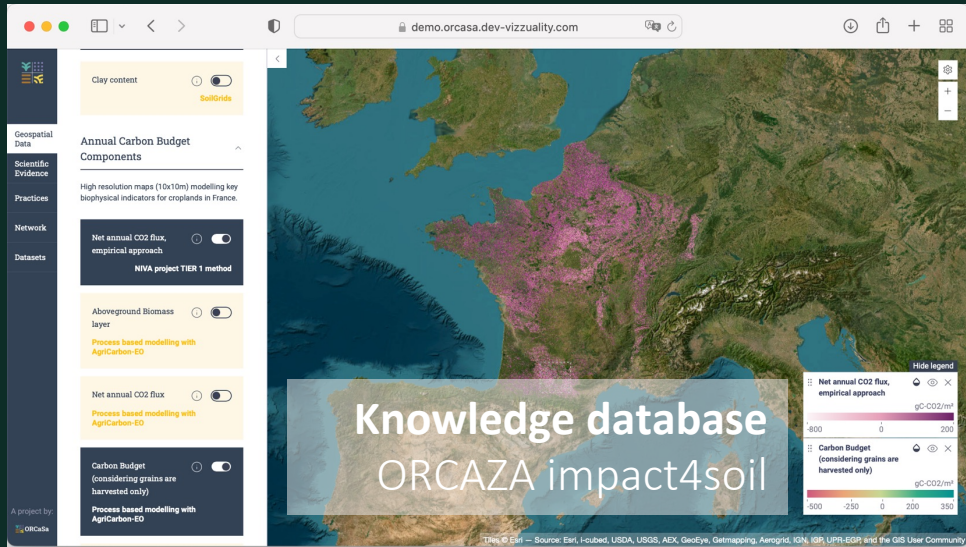
Maturation phase



Senescent phase



# Collaborating...to address the challenges



ORCaSa

## Soil Carbon

International Research Consortium

5 REGIONAL NODES

A Horizon Europe project to restore soil health

Knowledge sharing  
CIRCASA | ORCASA | IRC Soil Carbon

Kerk INSTITUTE FOR RURAL STUDIES



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