



# Mapping crop residues cover presence, persistence and quantity with EO: solution with current Copernicus data and perspective of new missions for MRV

CNR IREA - Natural Resources Lab.



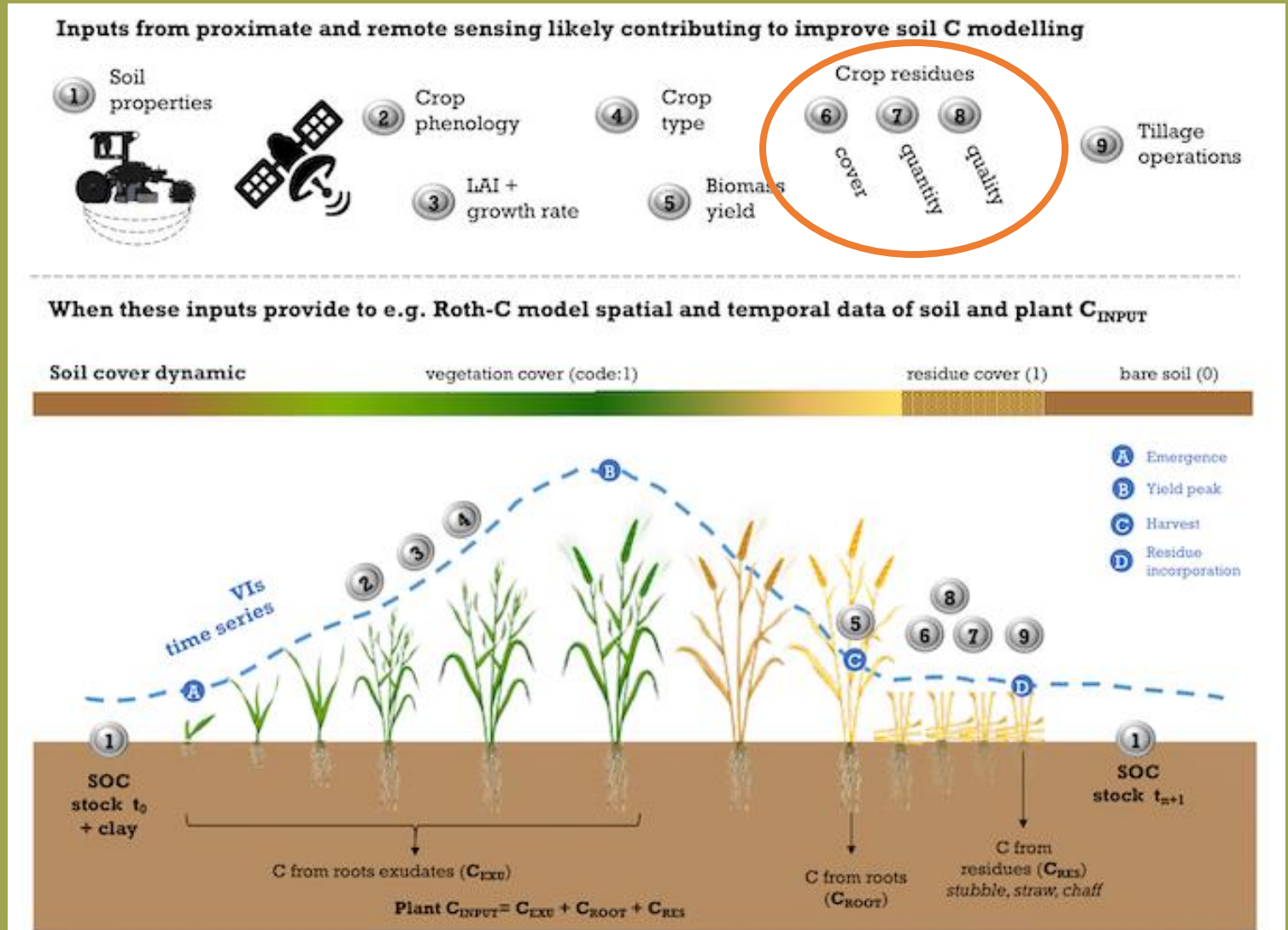
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Francesco Nutini<sup>1</sup>, Andrea Ferrarini<sup>2</sup>, Mirco Boschetti<sup>1</sup>

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*2. Department of Sustainable Crop Production, Università Cattolica del Sacro Cuore, Piacenza, Italy*

# Information requirements on crop residues

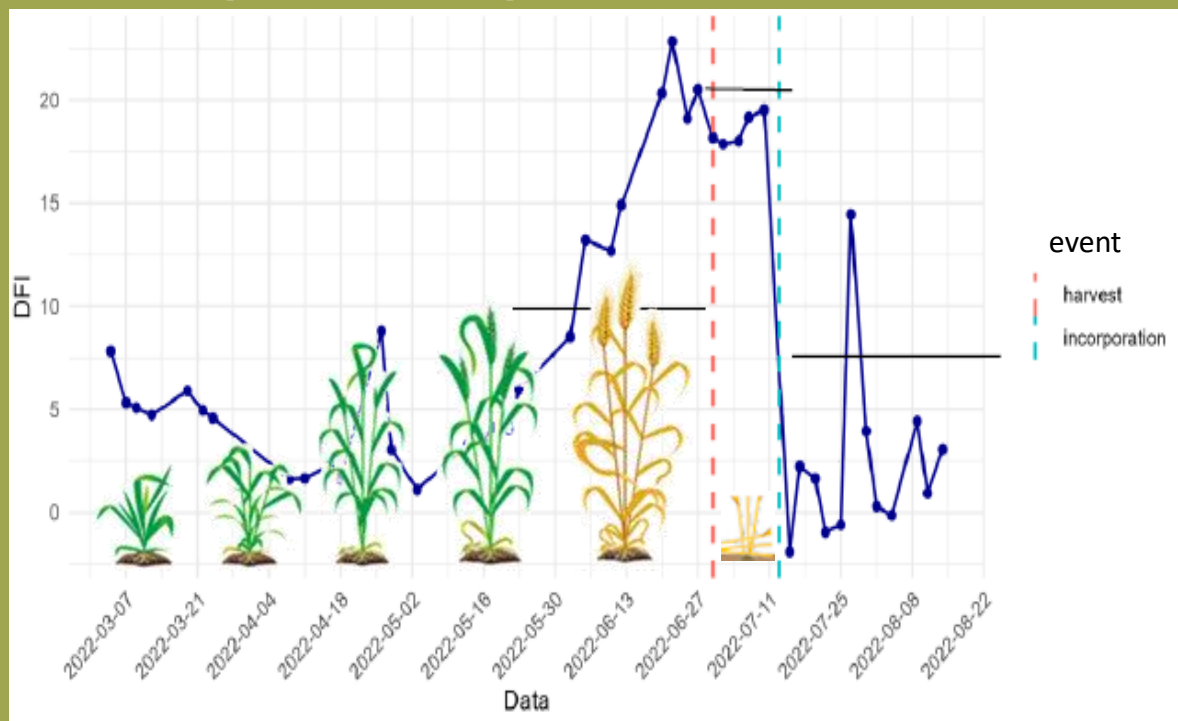
- Are fields covered by crop residues? **presence**
- How long? **persistence**
- How much? **quantity**  
(fraction/biomass)



Remote-C project

# Information from Remote Sensing

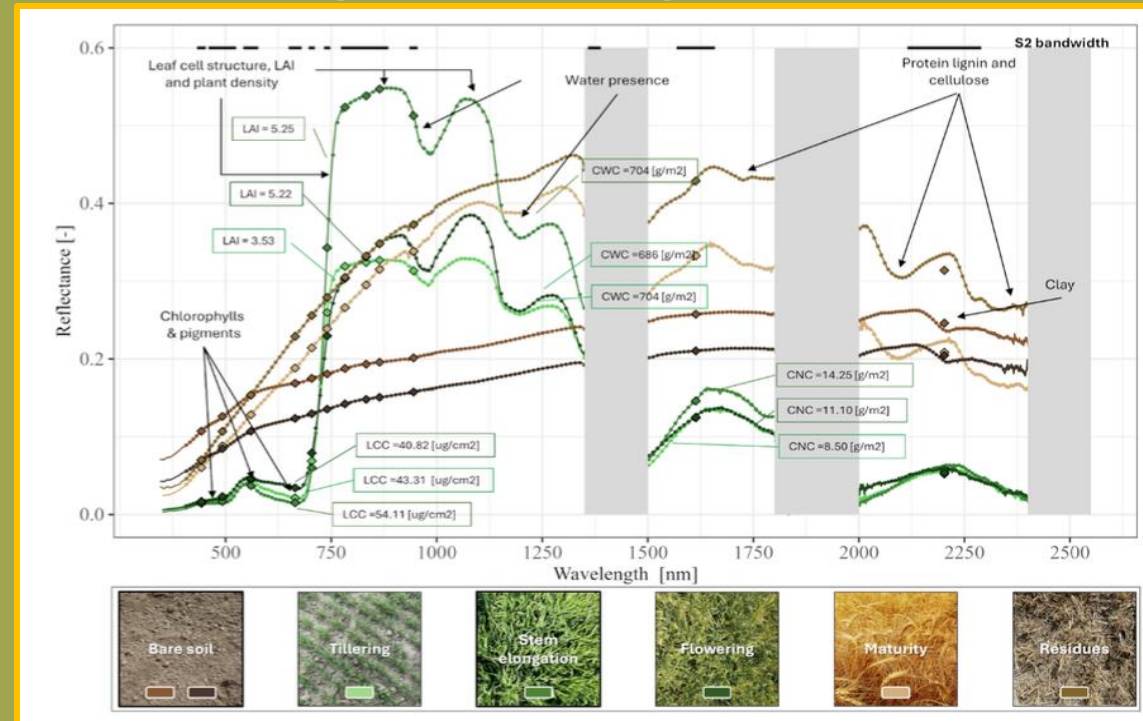
## Temporal component



## Operational multispectral missions

- Crop development
- Crop management
- Spectral/temporal changes due to harvest and tillage

## Spectral component



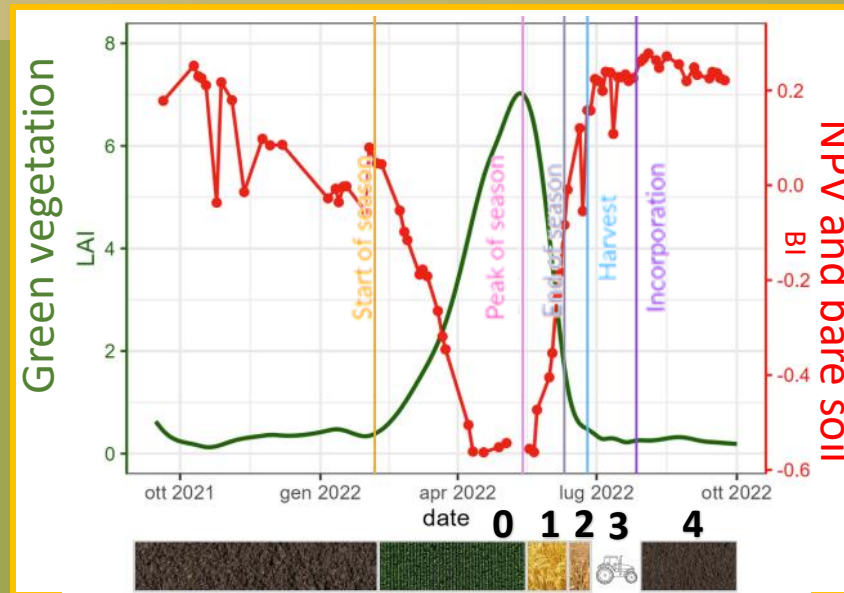
## Experimental Hyperspectral missions

- Recognition of different targets (Green Vegetation, Bare Soil, NPV)
- Characterisation of crop residues (lignin-cellulose, stark)

# Crop Residue detection from Sentinel 2 time series

## Source

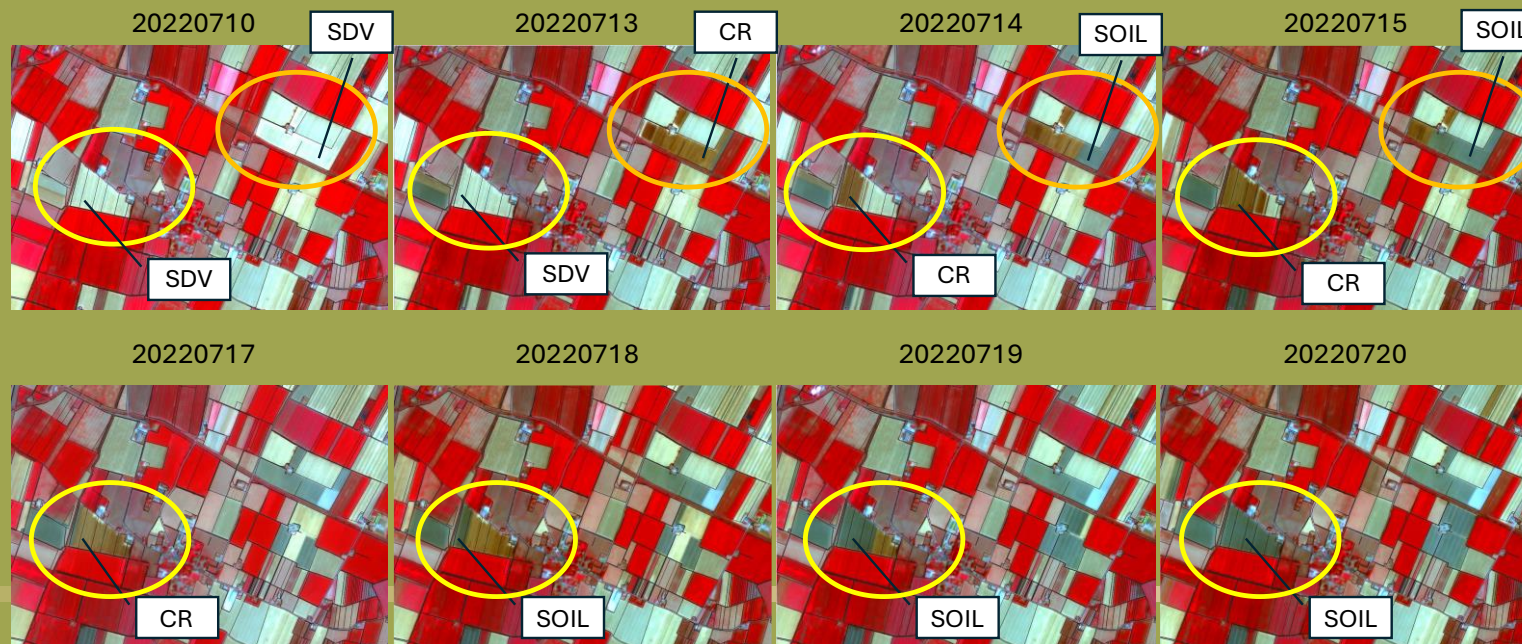
Sentinel-2  
time series  
Of spectral  
data and  
indexes



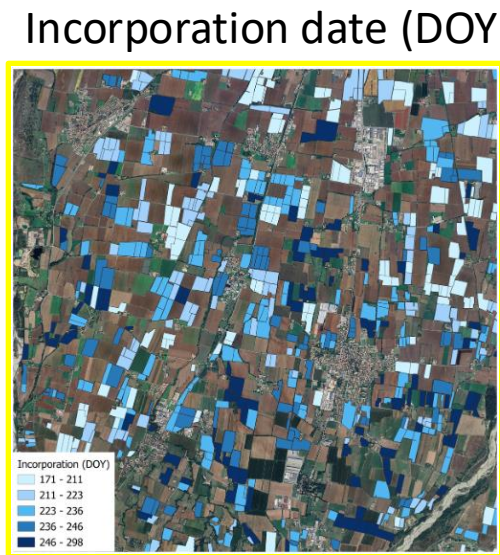
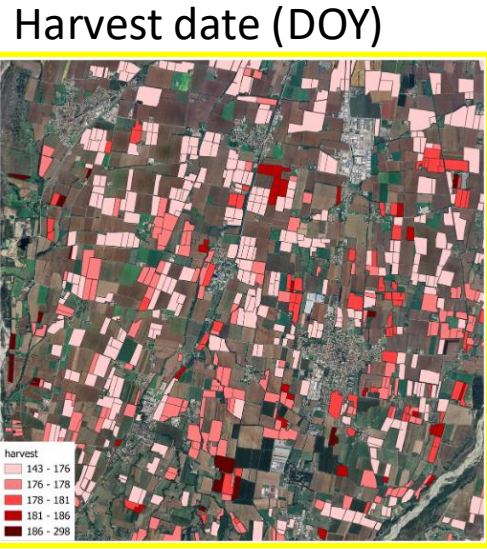
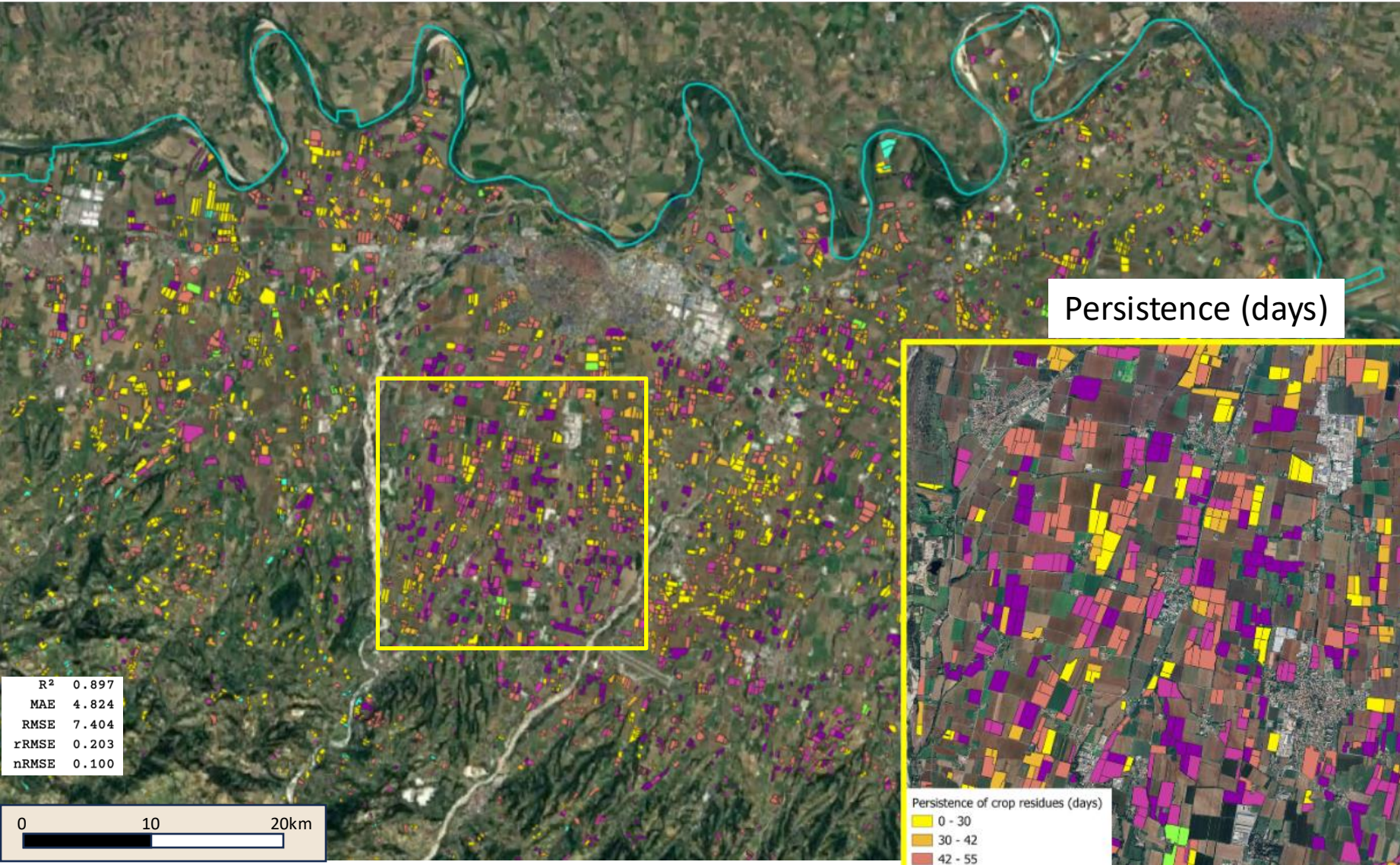
- 0 vegetative phase
- 1 senescence
- 2 standing dead veget.
- 3 residue cover
- 4 bare soil

## Reference for model(cal/val)

condition as  
detected by  
PlanetScope.  
Harvest and  
tilling is an high  
dynamic process!



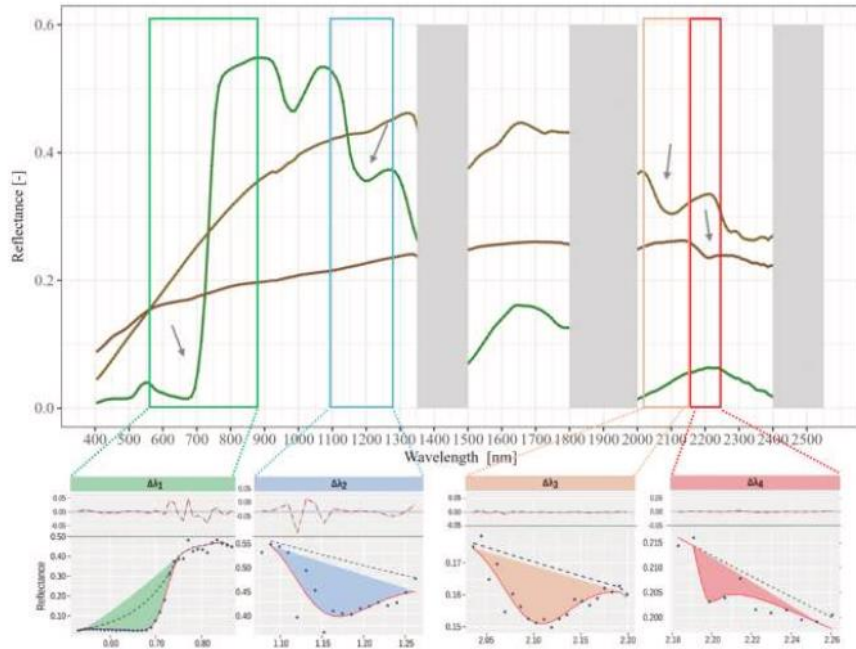
# Crop Residue detection from Sentinel 2 time series: Results



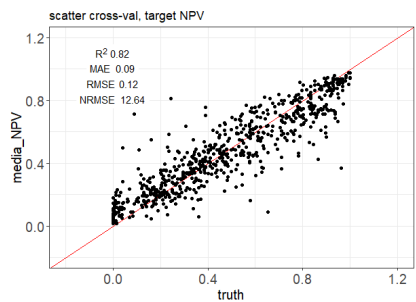
# CR quantification by hyperspectral missions



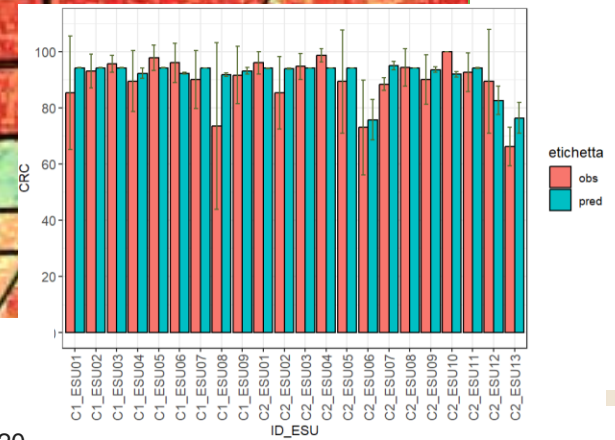
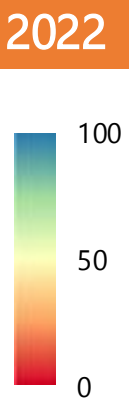
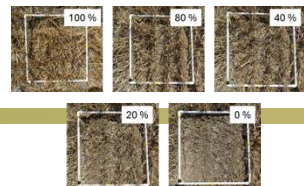
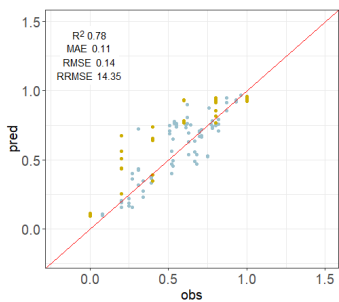
Spectral region and features



Cross validation



Independent validation

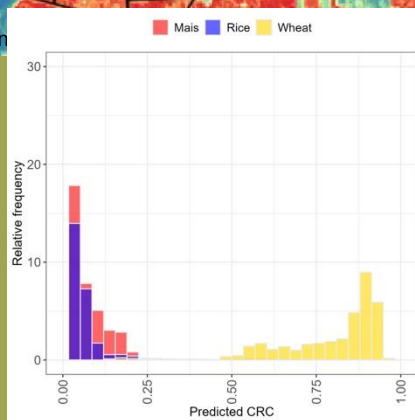
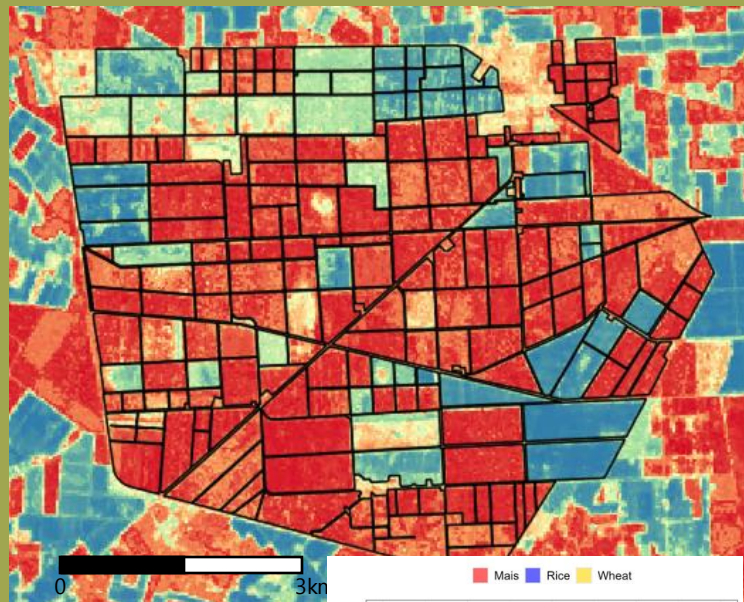


September 14, 2023

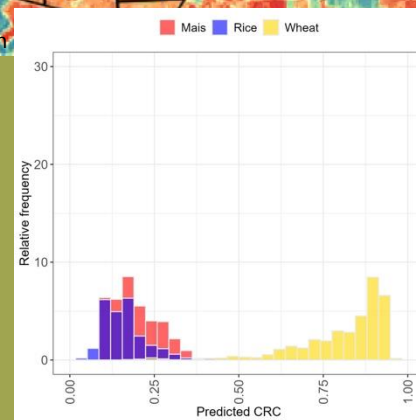
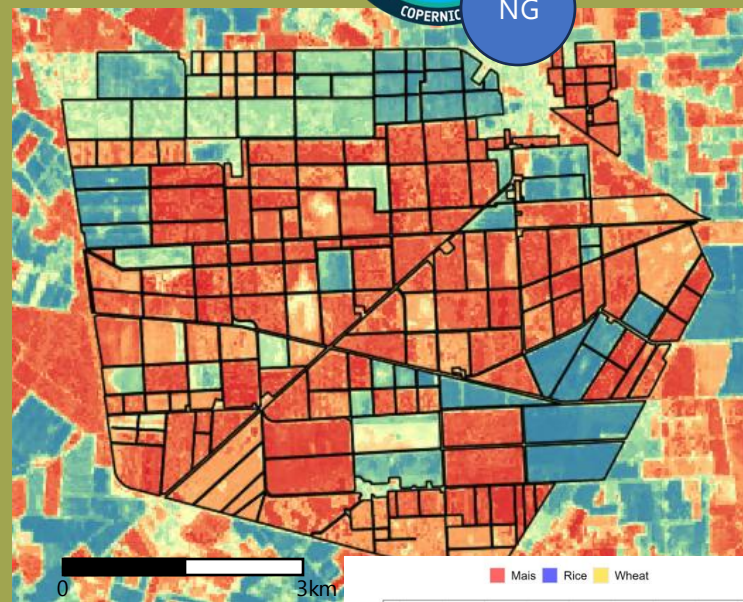
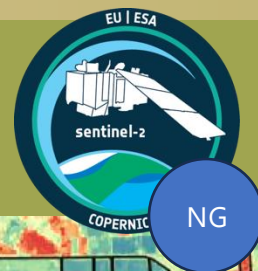
Pepe, M., Fagherifard, K., Dehkordi, R. H., Nutini, F., Candiani, G., & Boschetti, M. (2024). SPECTROSCOPIC DETERMINATION OF CROP RESIDUE COVER USING EXPONENTIAL-GAUSSIAN OPTIMIZATION OF ABSORPTION FEATURES AND RANDOM FOREST WITH PRISMA DATA. *AIT Series: Trends in earth observation*, 120.

# Next generation multispectral

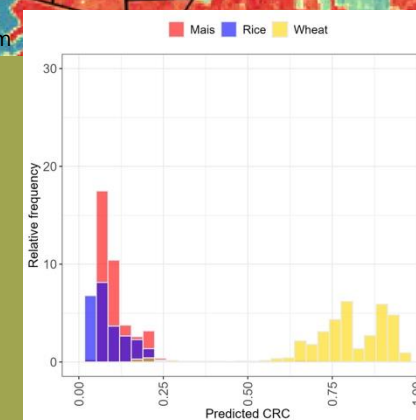
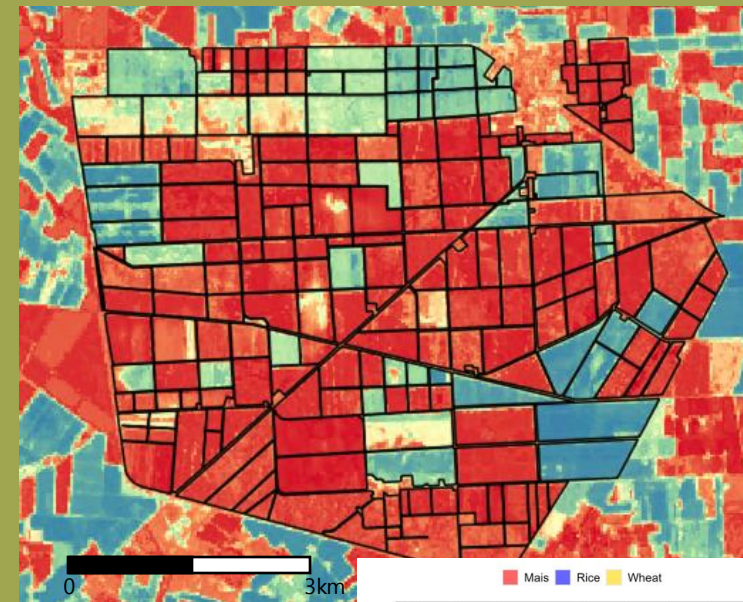
EnMAP  
25 July 2023



Simulated  
Sentinel 2NG



Simulated  
Landsat neXt

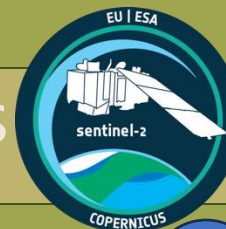


# Conclusions

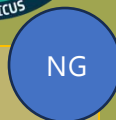
## Mapping Crop Residues

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- How long? **persistence**
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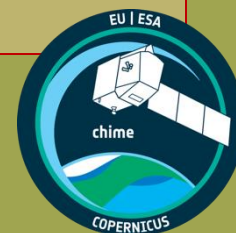
Current multispectral missions



NextGen multispectral missions



Forthcoming hyperspectral missions



Data integration: usage of SAR missions (clouds, crop events convergence)

Data synergies: sensor-agnostic algorithms to exploit multiple missions

A photograph of a vast golden wheat field under a clear blue sky. In the background, a yellow combine harvester is visible, moving across the field and kicking up a cloud of dust. The foreground is filled with sharp, golden wheat stalks.

Thank you for listening

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