

CUP₄SOIL: Wie können zukünftige EO-Bodenprodukte im Rahmen des Copernicus Land Monitoring Service aussehen?



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Nationales Forum für Fernerkundung
und Copernicus 2024



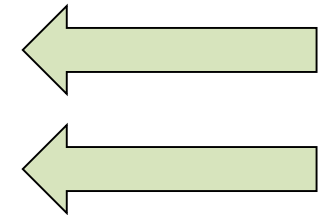
Knowledge for Tomorrow



CUP₄SOIL general objective

Objectives

- Prepare a potential Copernicus downstream service to support national and European actors for reporting on soil health/quality.
- **Generate European-wide example data products characterising soil health/quality**
- **Develop a user community that tests and validates data products for soil health/quality information**
- Ensure close cooperation with the ESA WorldSoils project activities and other related projects/initiatives such as the EJP SOIL projects and others etc. ...



User requirement survey - Development

- A user survey was launched to understand more about the required specifications of the spatial soil products
- 23 questions
- Sent out to people across Europe on soils and EO
- Results will be made publically available via the CUP₄SOIL webpage
- Results approved by a interactive questionnaire during the User requirement meeting in Dec 2023

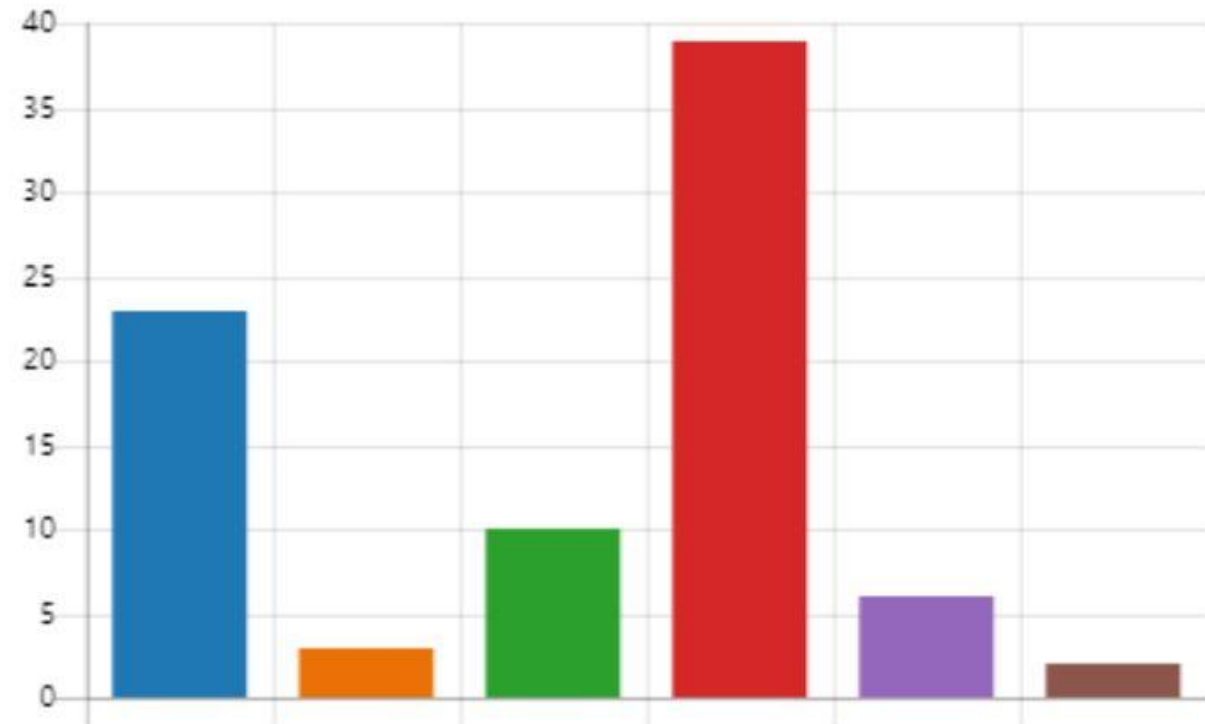
CUP₄SOIL Webpage



User requirement survey - Summary

2. What best describes your organization?

	National government	23
	European / international orga...	3
	Business	10
	Research	39
	Education	6
	NGO	2



User requirement survey - Summary

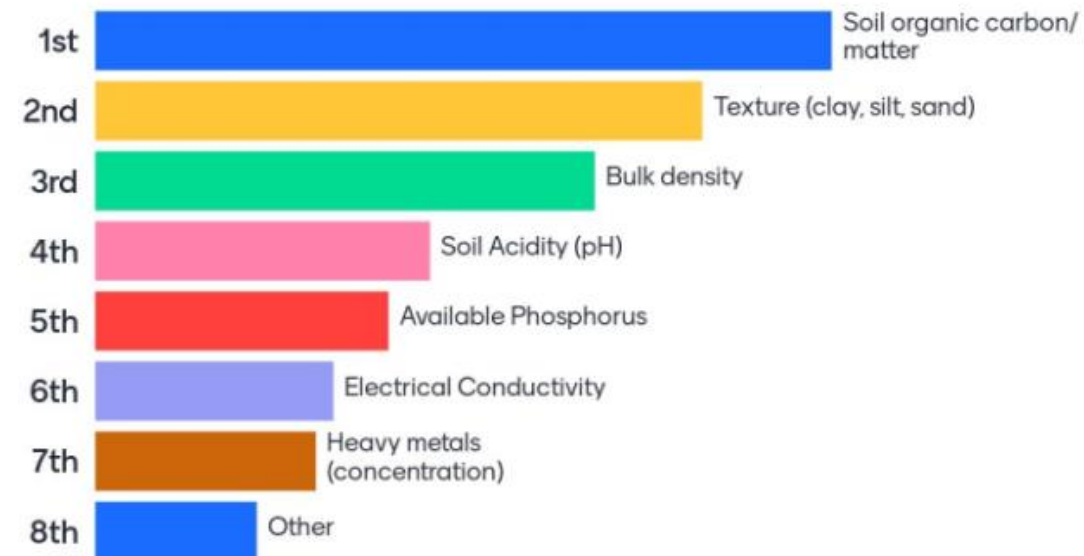
- 54 / 83 user are **missing** soil related information at the Copernicus service (24 maybe)
- Most wanted **soil products** are:
 - SOC, texture and bulk density, soil water holding capacity, erosion, soil compaction, soil biodiversity
- Majority needs information for **monitoring yearly**
- Spatial resolution winner is **10 m pixel size**
- Spatial scale: Clear trend from **one or several fields** (50 / 83) to the European scale (15 / 83)
- Very important is to measure the quality/uncertainty: **Confidence interval** (42 / 83)

14. For which purpose do you need the soil information?

● Status (once)	22
● Status (several times)	51
● Monitoring	64
● Other	6

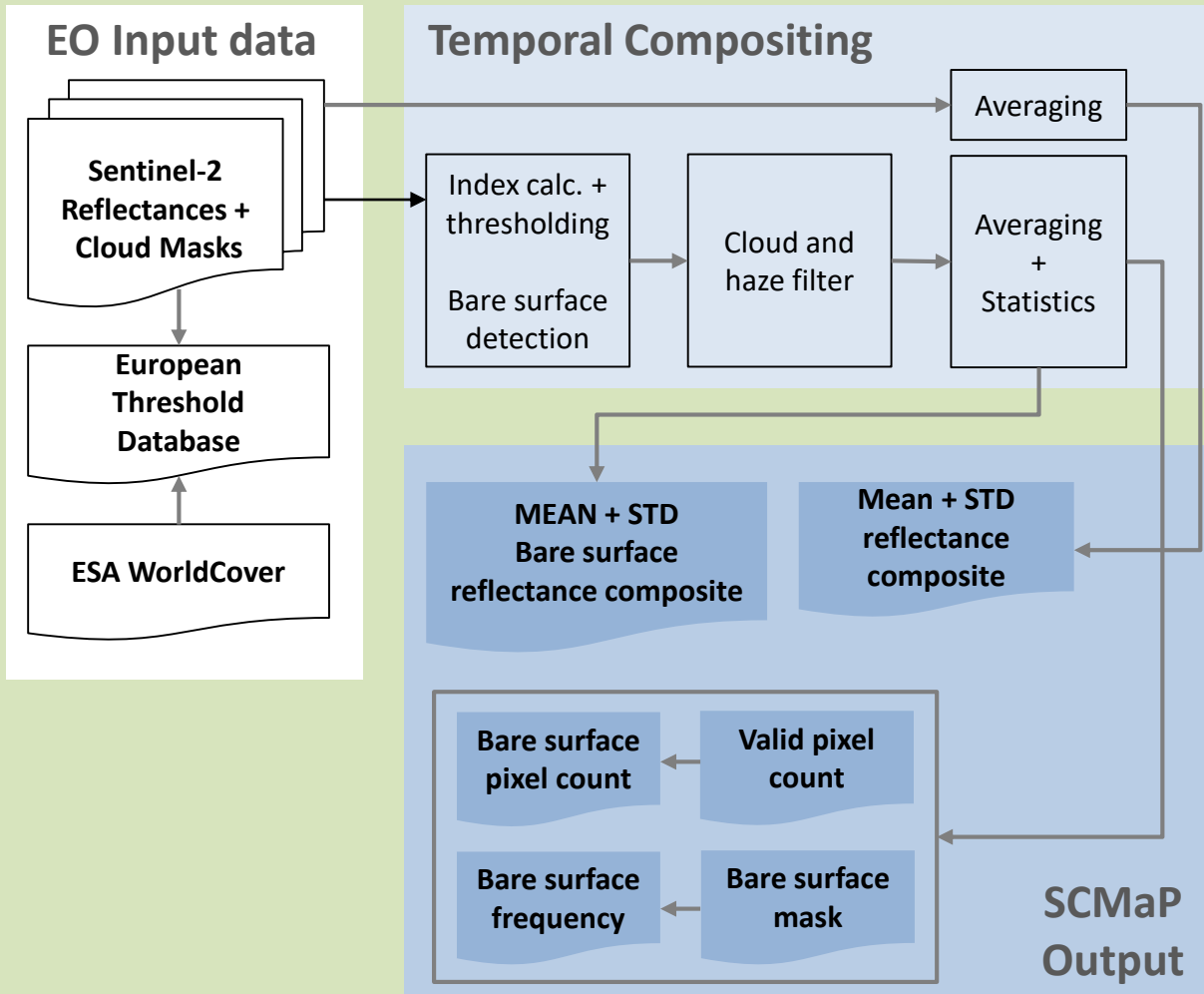


Which soil-related spatial information would be helpful for your work (derived/complex properties)?

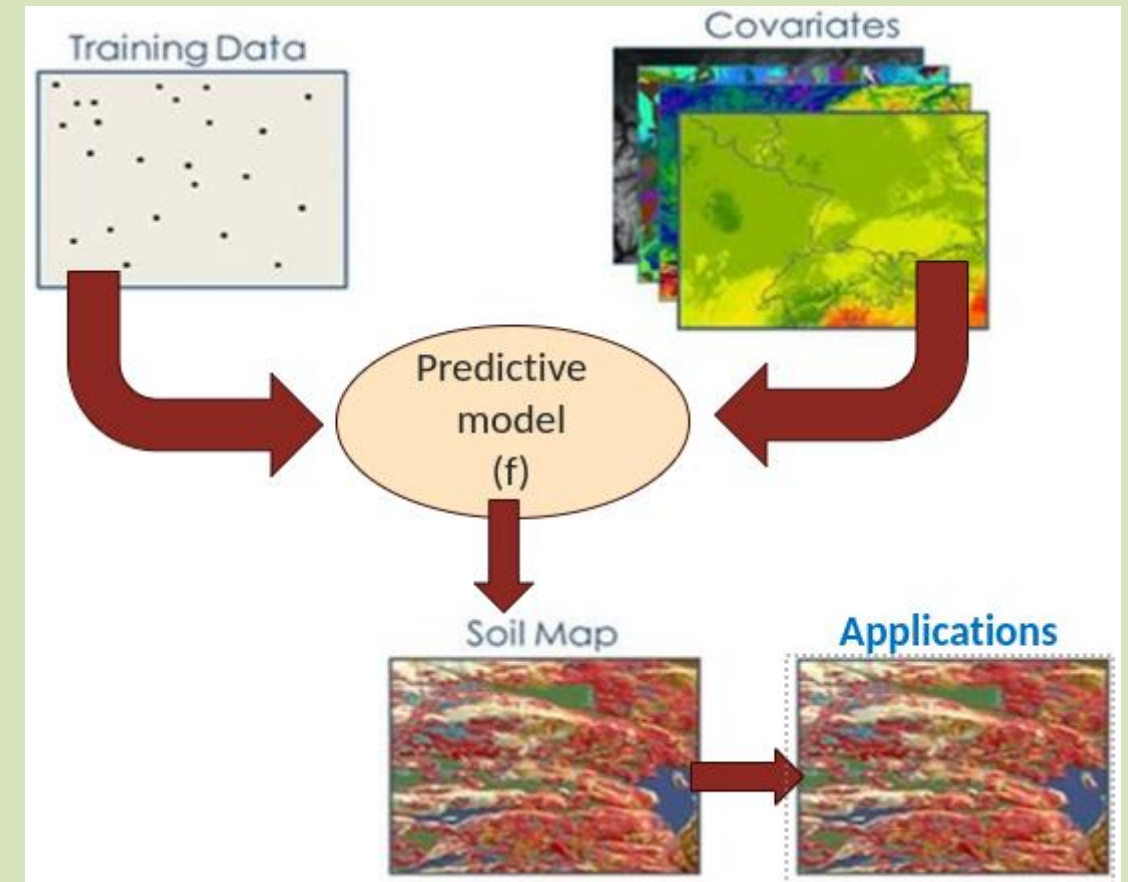


General overview

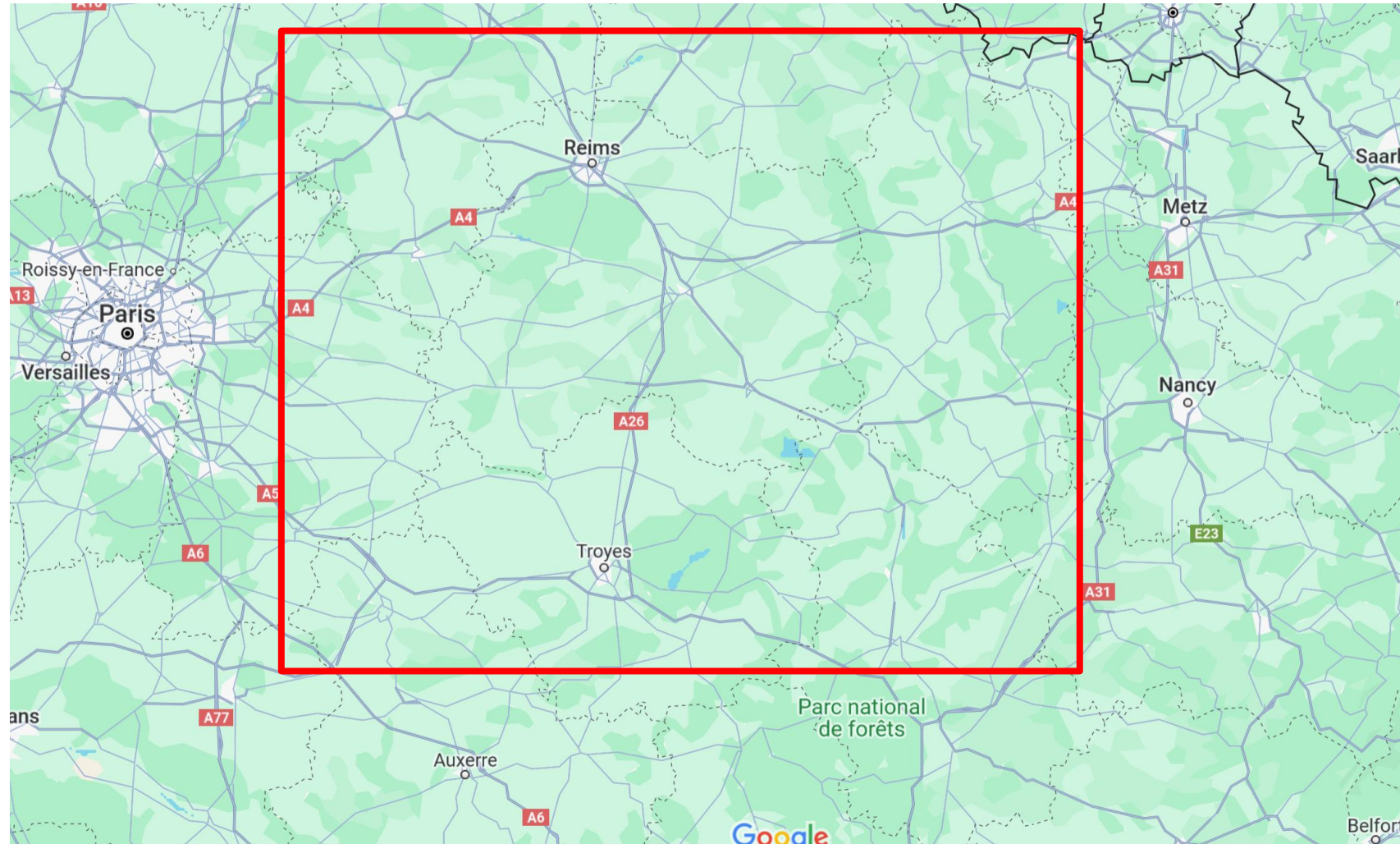
Soil Composite Mapping Processor (SCMaP)



Digital Soil Mapping of ISRIC



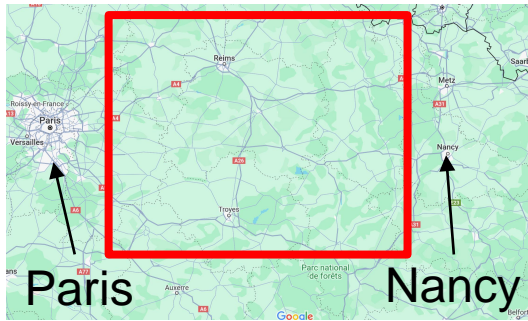
Example Data France



Example France SCMaP products

Mean Surface Reflectance

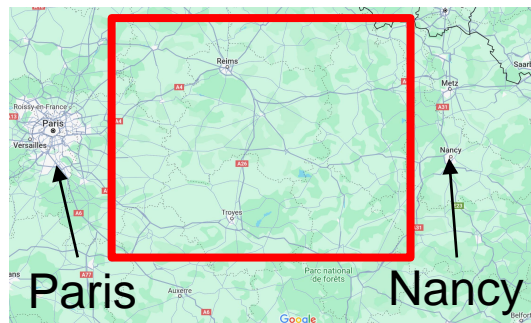
- Sentinel-2
- L2A reflectance
(MAJA processed)
- 2018 – 2022



Example France SCMaP products

Bare Soil/Surface
Reflectance –

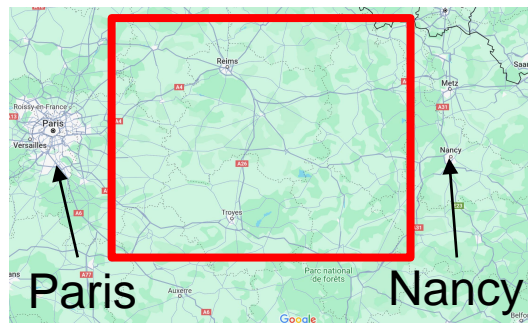
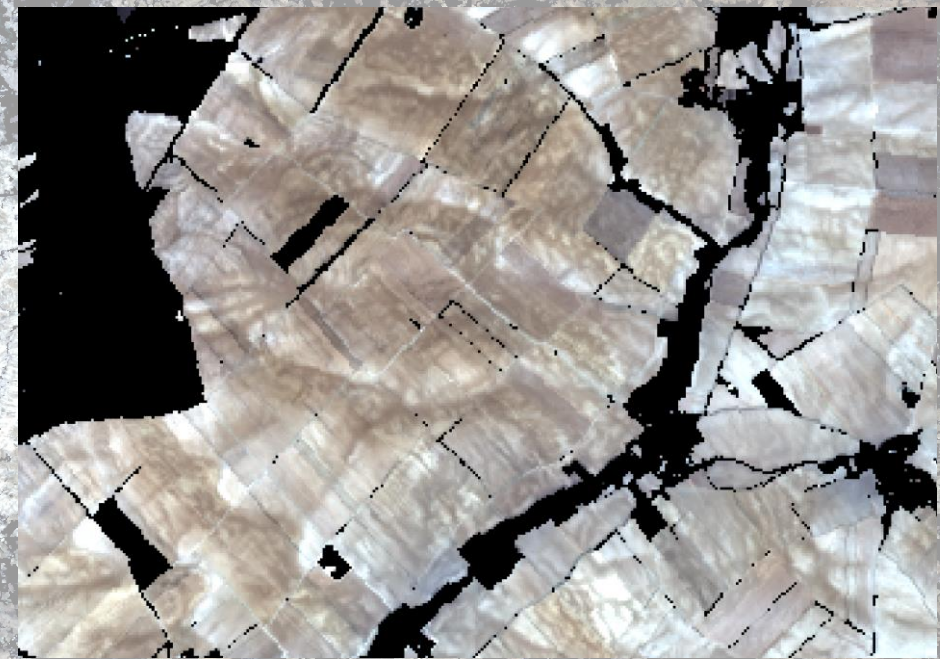
- Sentinel-2
- L2A reflectance
(MAJA processed)
- 2018 – 2022
- PV+IR2
- Regionalised
thresholds



Example France SCMaP products

Bare Soil/Surface Reflectance –

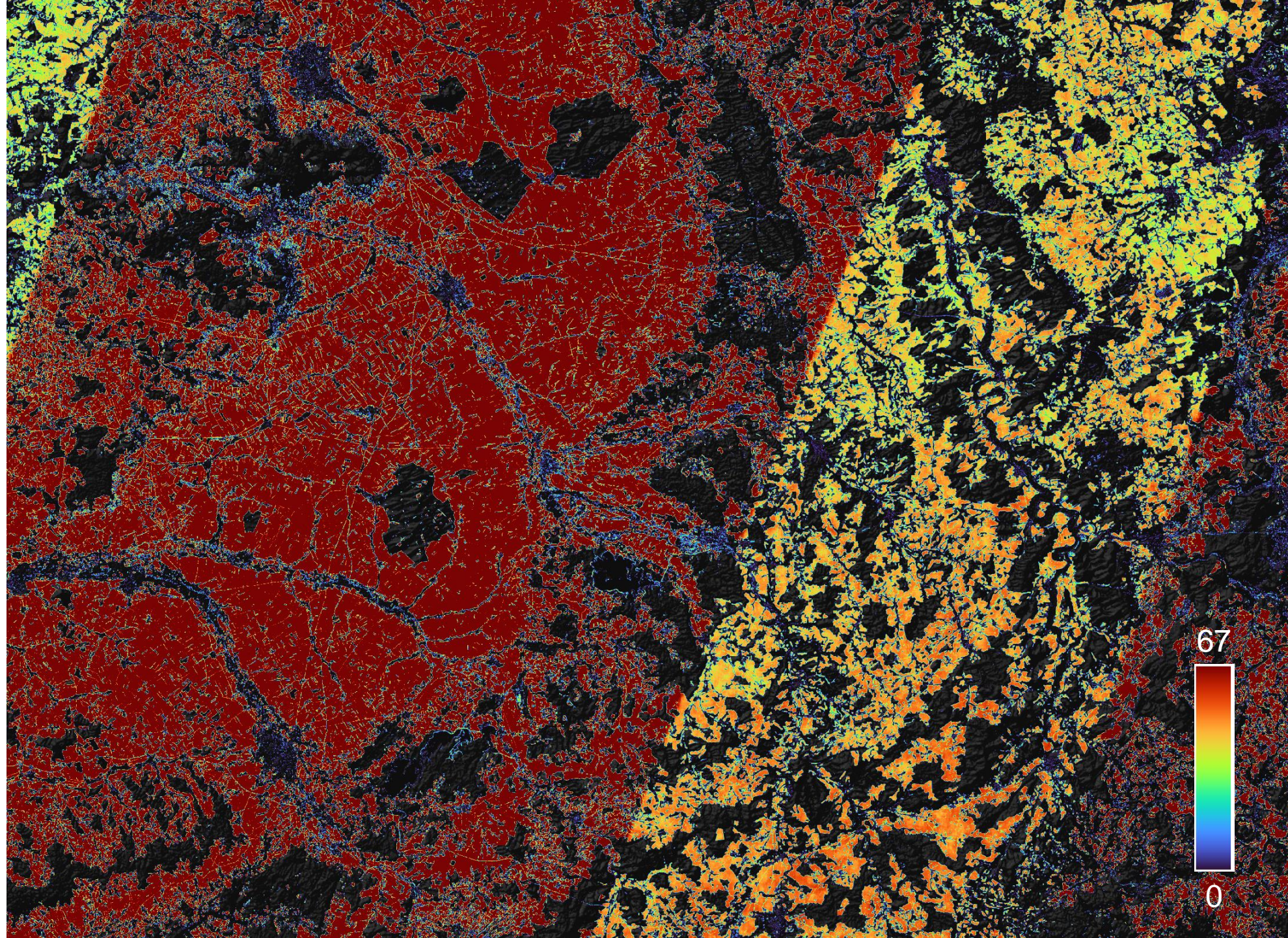
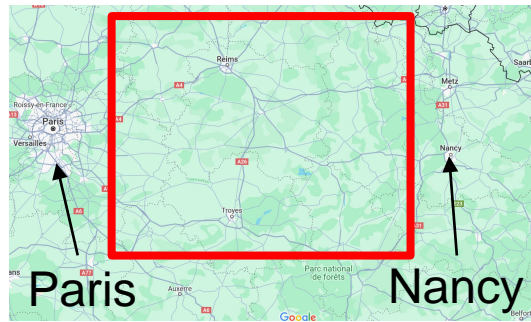
- Sentinel-2
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Example France SCMaP products

Valid Pixel Count

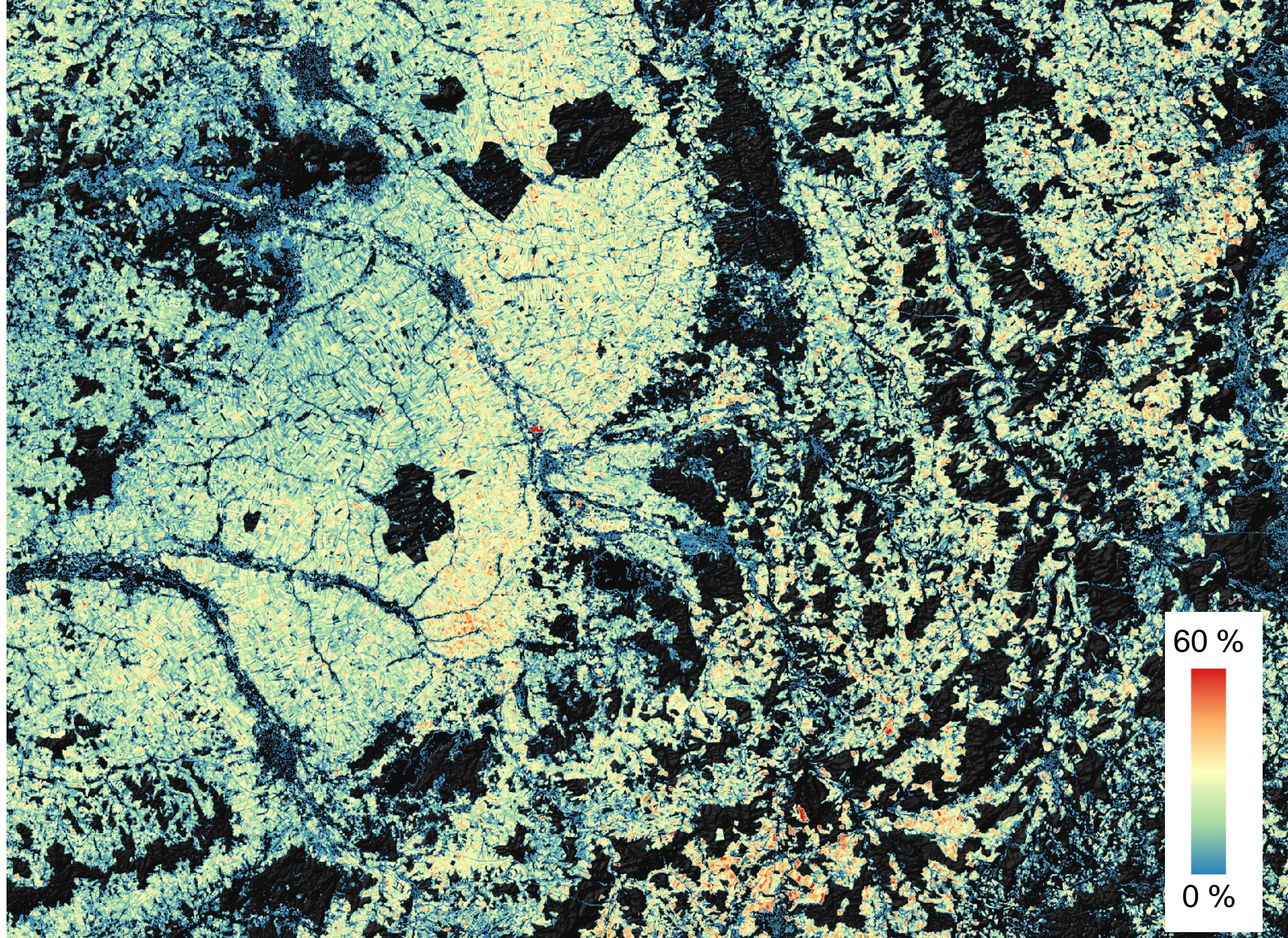
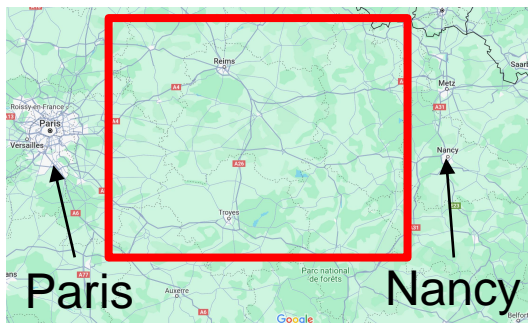
- Sentinel-2
- 2018 – 2022



Example France SCMaP products

**Bare Soil
Frequency [%]**

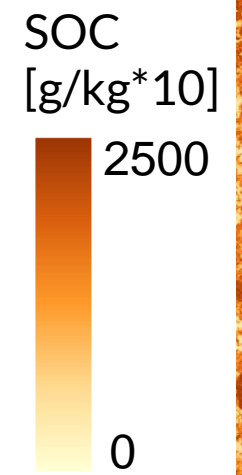
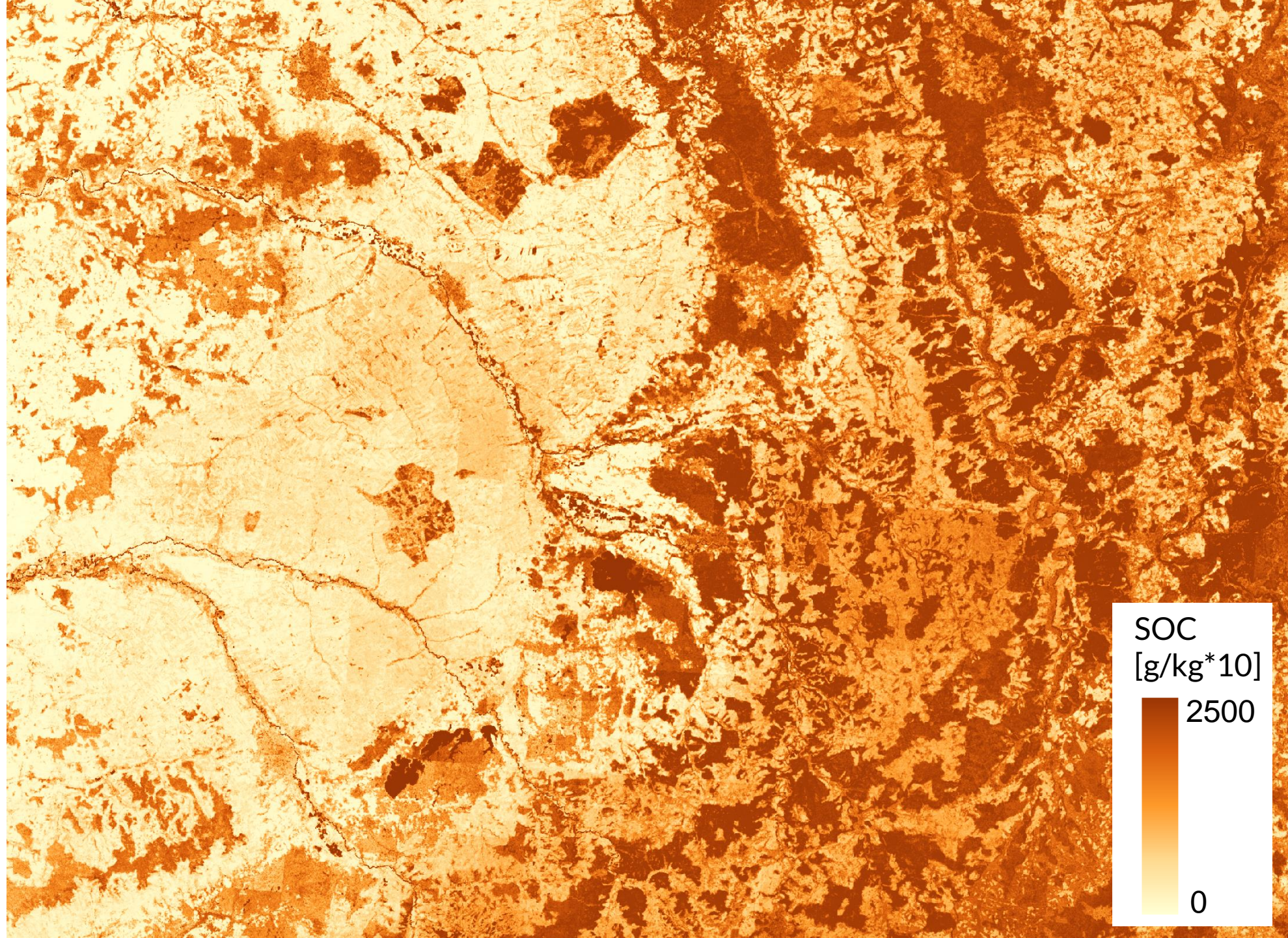
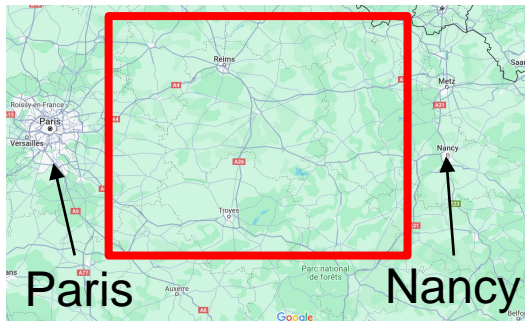
- Sentinel-2
- 2018 – 2022
- PV+IR2
- Regionalised thresholds



Example France Soil parameter

Soil Organic Carbon Content

- Topsoil - 0-30cm
- $\text{g/kg} \cdot 10$



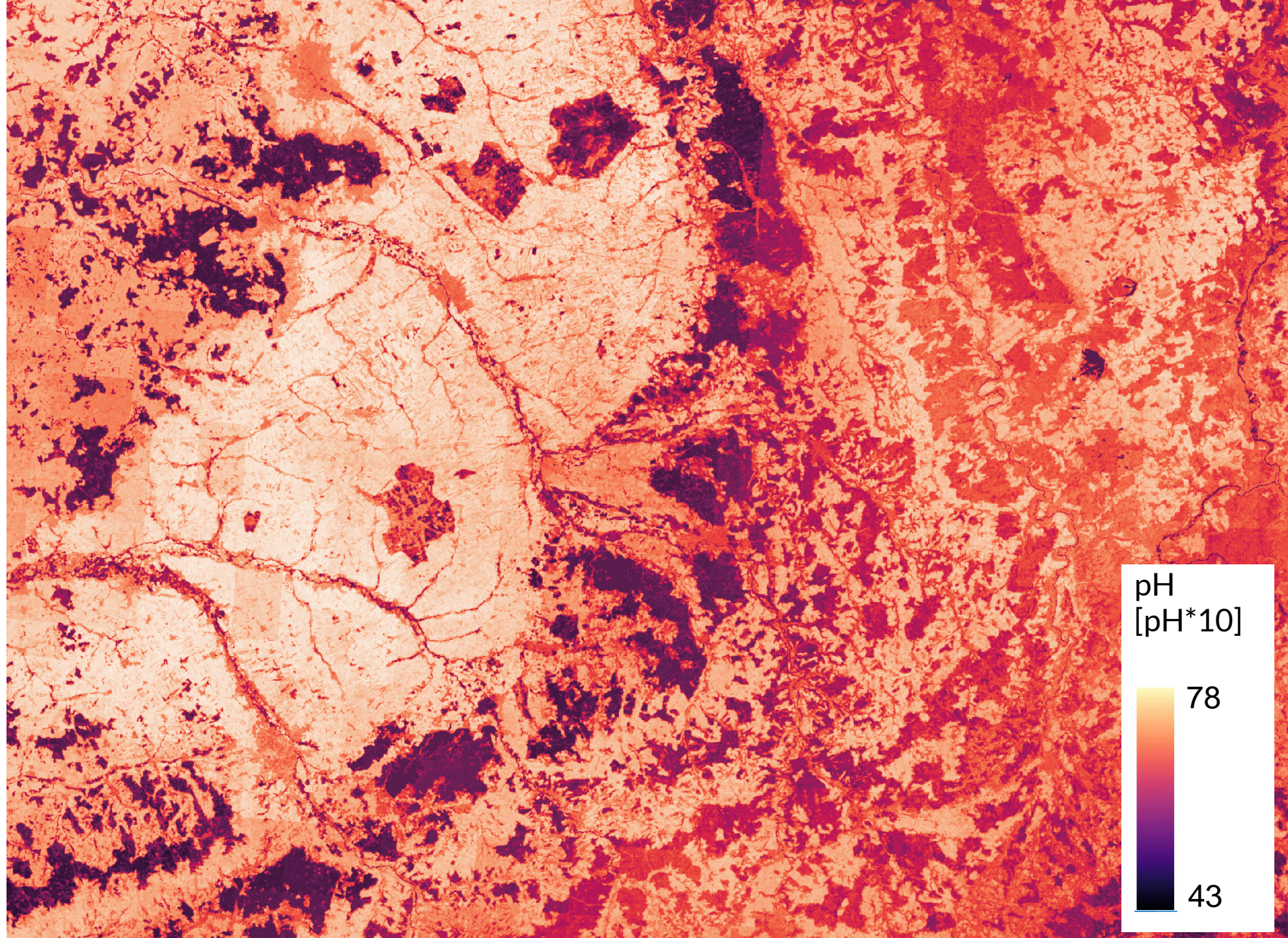
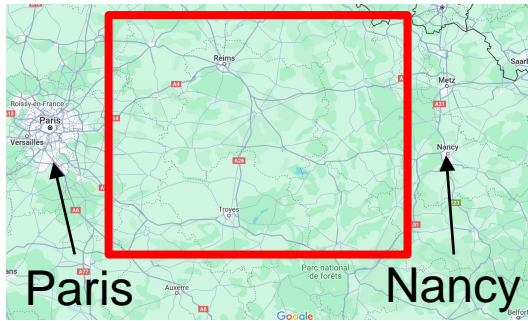
Example France

Soil

parameter

pH in water

- Topsoil - 0-30cm
- pH*10

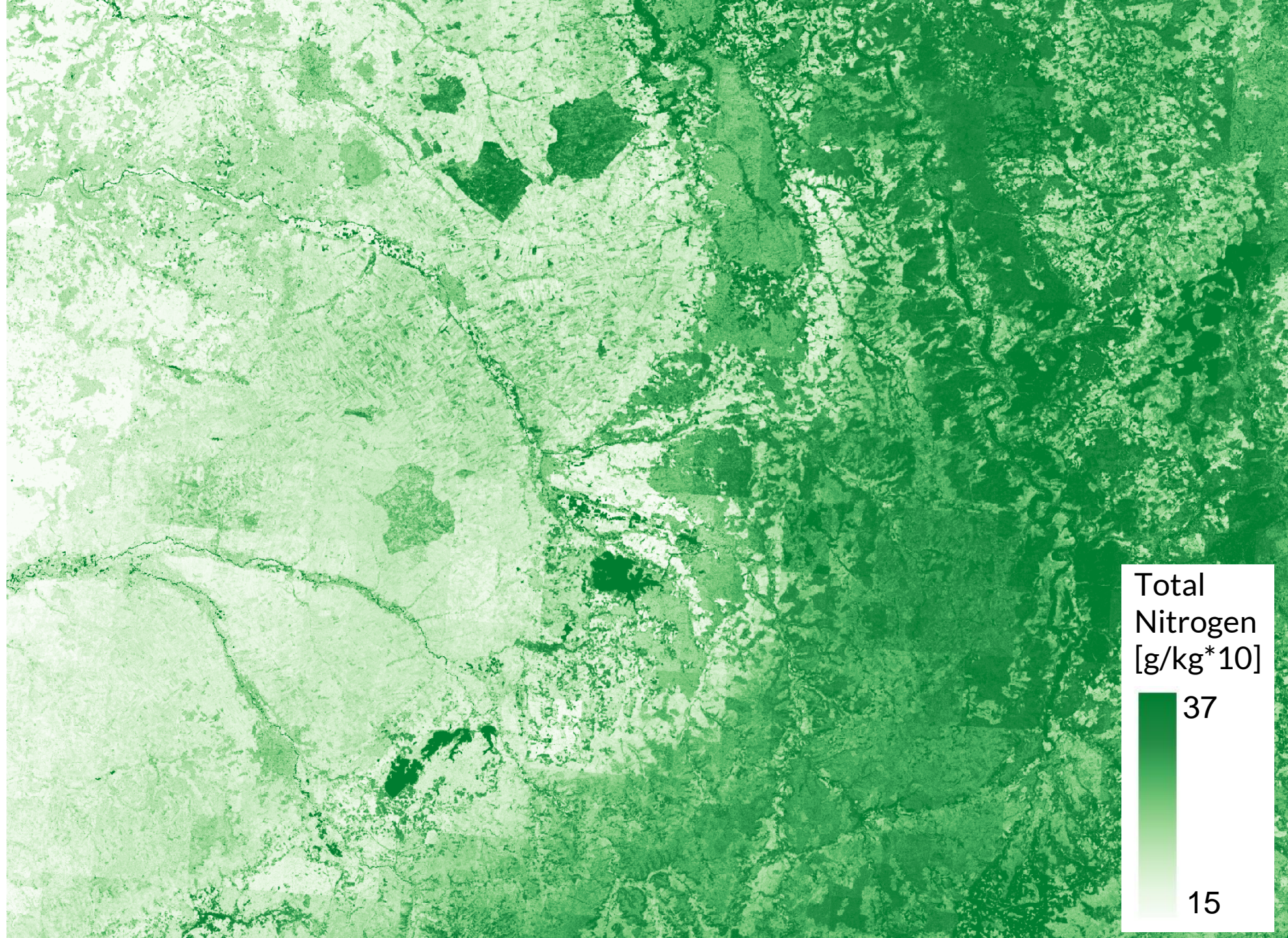
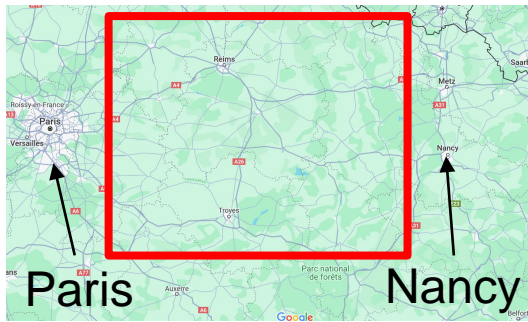


Example France

Soil parameter

Total Nitrogen

- Topsoil - 0-30cm
- [g/kg*10]



Total
Nitrogen
[g/kg*10]

37

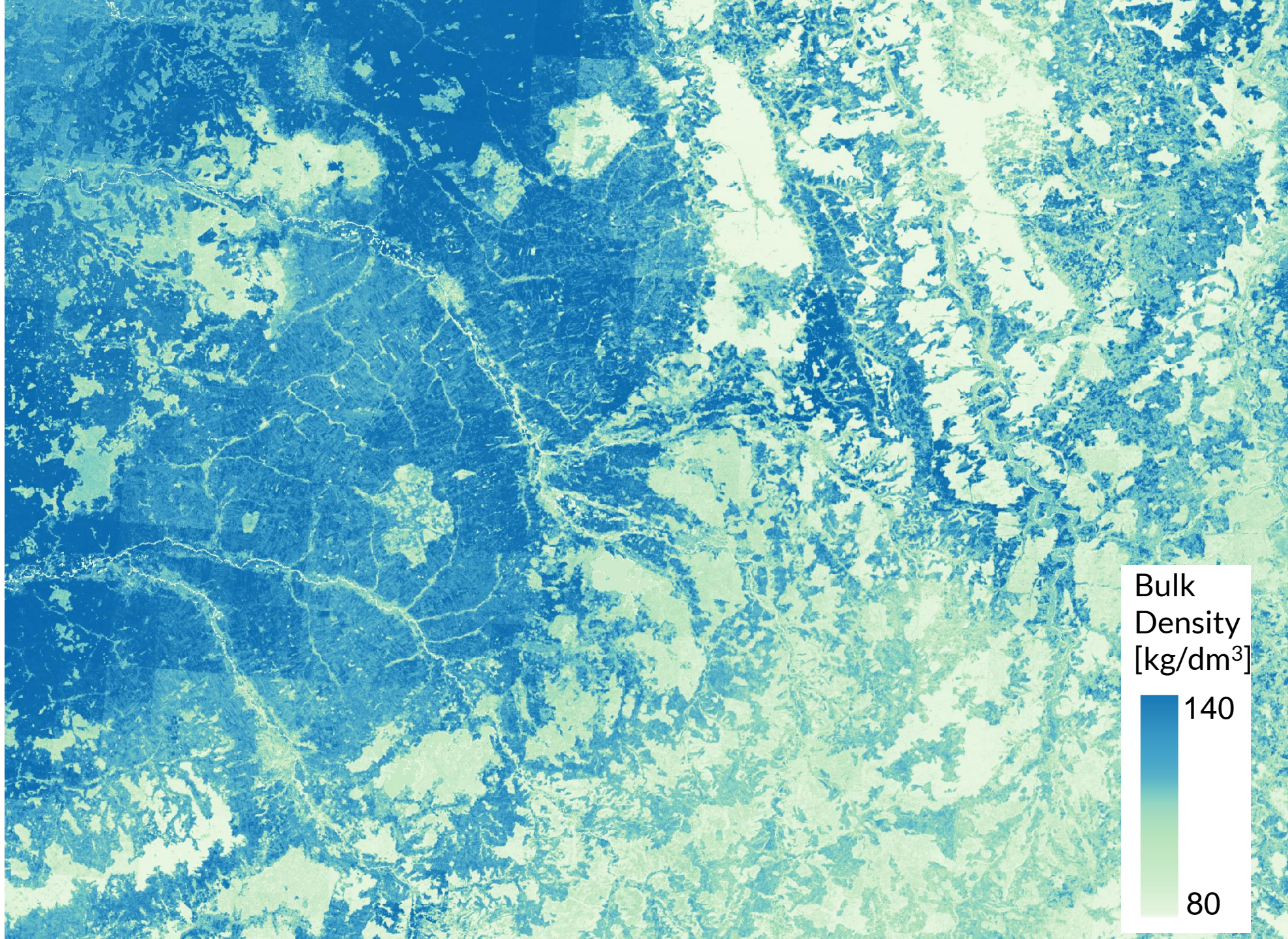
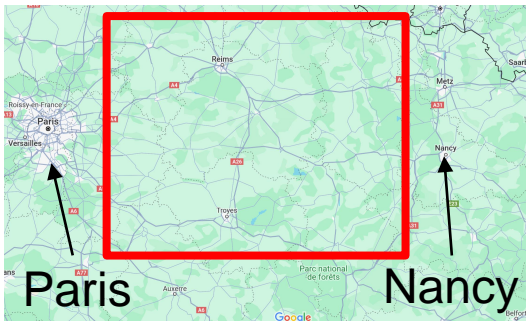
15

Example France

Soil parameter

Bulk density, oven dry

- Topsoil - 0-30cm
- [kg/dm³]



Cross-validation

1

- DEM, land cover, etc. (Copernicus layers)
- Geology/parent material (JRC)
- Simple radar products from Sentinel1

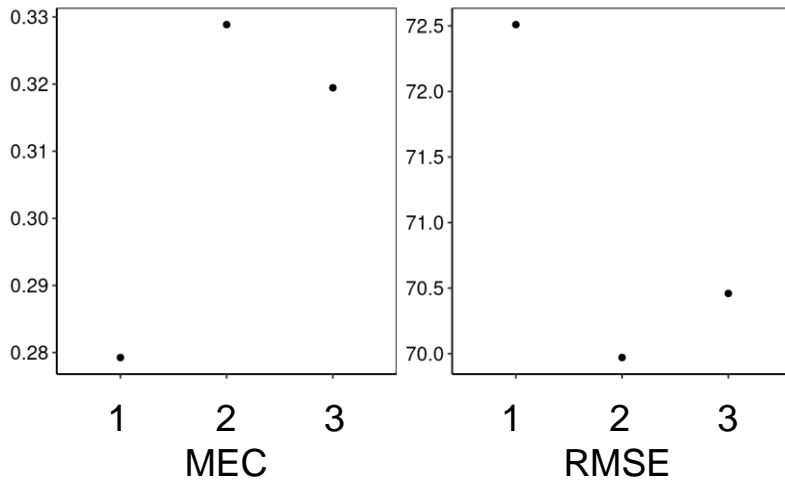
2

- DEM, land cover, etc. (Copernicus layers)
- Geology/parent material (JRC)
- Simple radar products from Sentinel1
- SCMaP: Mean reflectance composite (MEAN)

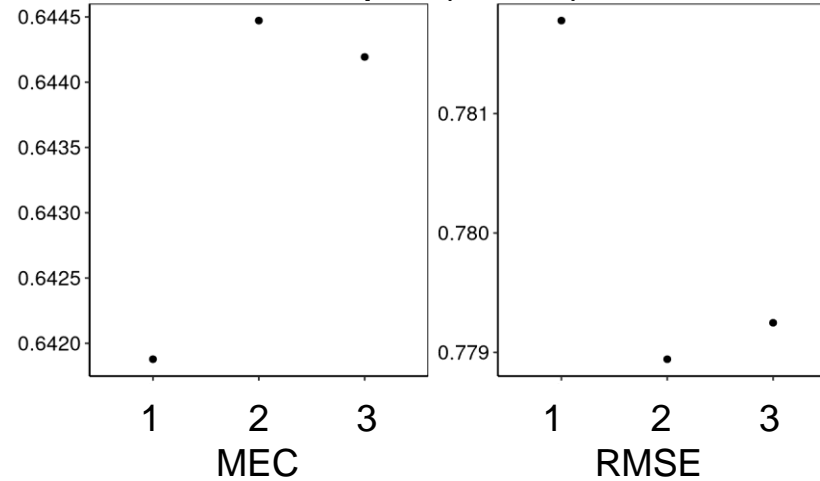
3

- DEM, land cover, etc. (Copernicus layers)
- Geology/parent material (JRC)
- Simple radar products from Sentinel1
- SCMaP: Mosaic of MEAN and soil reflectance composite (SRC)

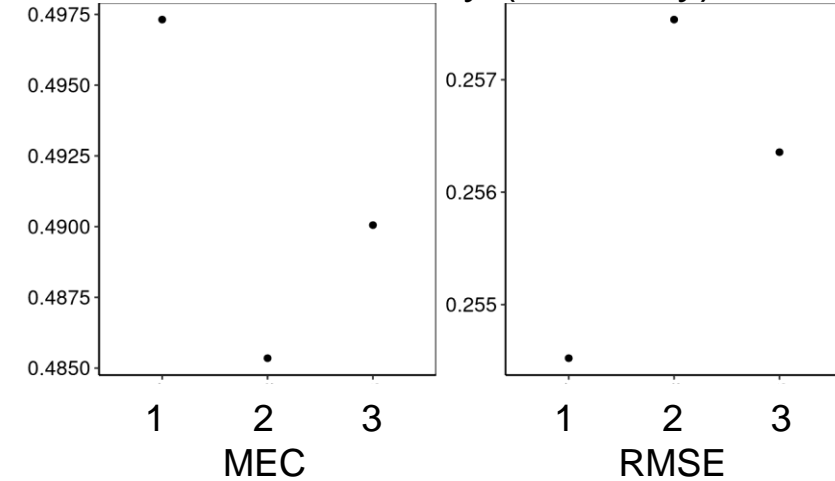
SOC



pH (water)



Bulk density (oven dry)



*MEC - model efficiency coefficient, equivalent to R²

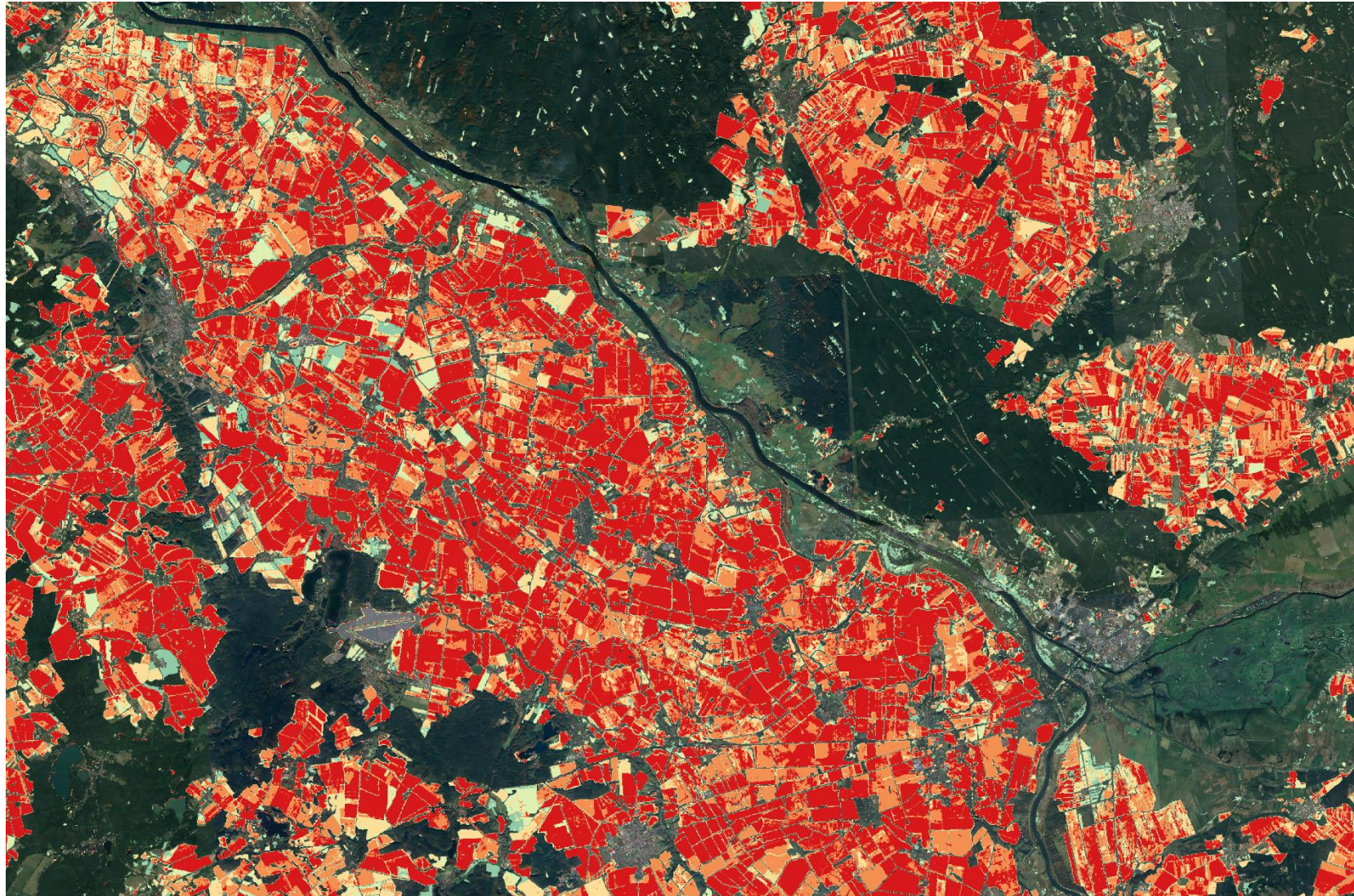
Application

Oderbruch



- Agricultural area (Oderbruch) at the border between Poland and Germany

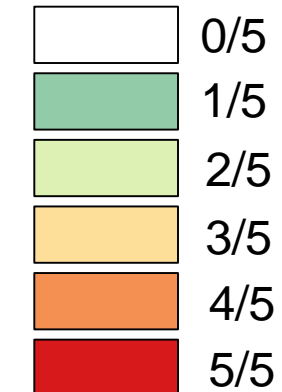
Oderbruch



- Agricultural area (Oderbruch) at the border between Poland and Germany
- Yearly bare soil appearance (2018 – 2022) -> request from Project CropGrün

2018 – 2022

Umbruch



Summary and future developments

Summary:

- DLR and ISRIC partnered to produce European-wide:
 - SCMaP intermediate products
 - Final soil parameter
- Test about the best choice of covariates – direct spectral covariates could improve the modelling
- Data will be published and made available free and open

Future developments:

- Preparing the webserver
- Pixel-based uncertainty
- External validation (show-cases)



CUP₄SOIL - Thank you very much!

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DLR



ISRIC

World Soil Information