



© Vladislav Chanev, Well with Nature / EEA

The CUP4Soil Project

1st CLMS General Assembly

Presented by Uta Heiden (DLR)

03.06.2024

CUP4SOIL - Project Introduction

- High-resolution soil property service development for National and European soil carbon reporting
- DLR and ISRIC partnered for the 2-years project (2023 – 2024)
- Funded by FPCUP - Framework Partnership Agreement on Copernicus User Uptake



- Objectives:

- Prepare a potential Copernicus downstream service to support national and European agencies 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
- Close cooperation with the ESA WorldSoils project activities
- Cooperation with other EU soil related projects and initiatives (e.g. EJP SOIL, Soil Mission, ...)



PROGRAMME OF THE
EUROPEAN UNION



Implemented by



CUP4SOIL – First achievements

- European-wide EO data products and soil maps (20 m pixel size):
 - Soil property maps (e.g. soil organic carbon, soil texture) and
 - Information about soil and vegetation dynamics including quality indicators
- Documents (User requirement document, key soil product description, scientific and grey publications, ...)
- Finished User Survey (83 institutions, companies, NGO's)
- Meetings + Workshops:
 - 07.12.2024 (online) – Virtual meeting for discussing and consolidating User Requirements
 - 07.03.2024 – First soil information products are presented, user requirements will be updated (session during the ESA Symposium on EO for Soil Protection and Restoration)
 - Q4/2024 – Final project workshop to assess key user feedback, recommendations and future directions

CUP4SOIL
Webpage



PROGRAMME OF THE
EUROPEAN UNION



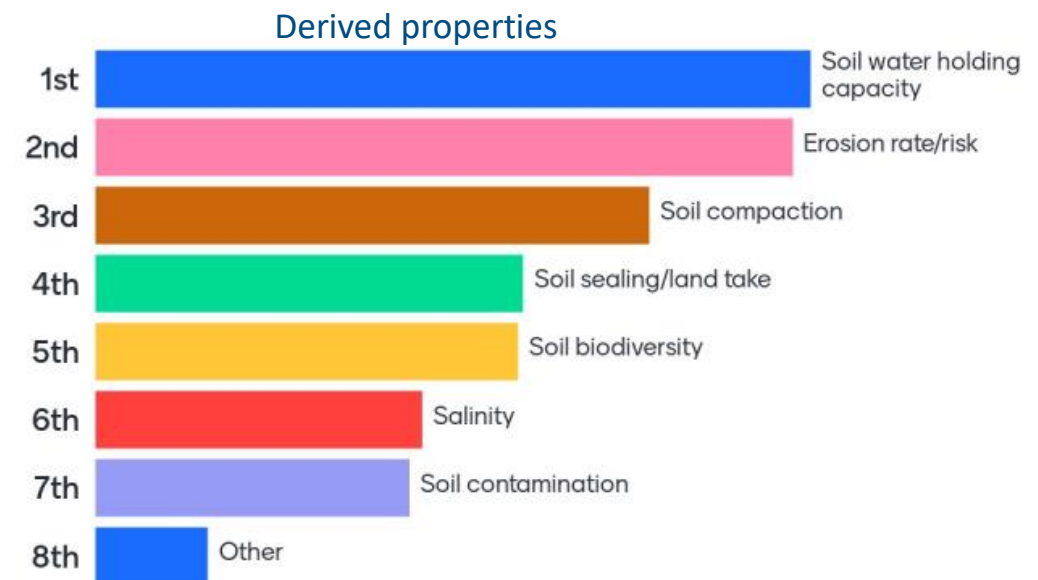
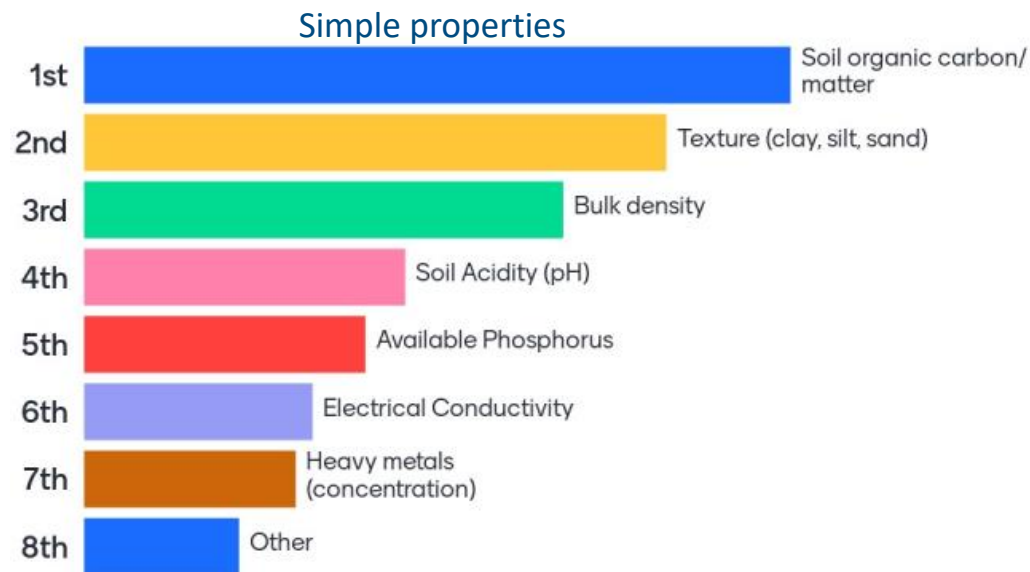
Implemented by



CUP4SOIL – Online User Survey

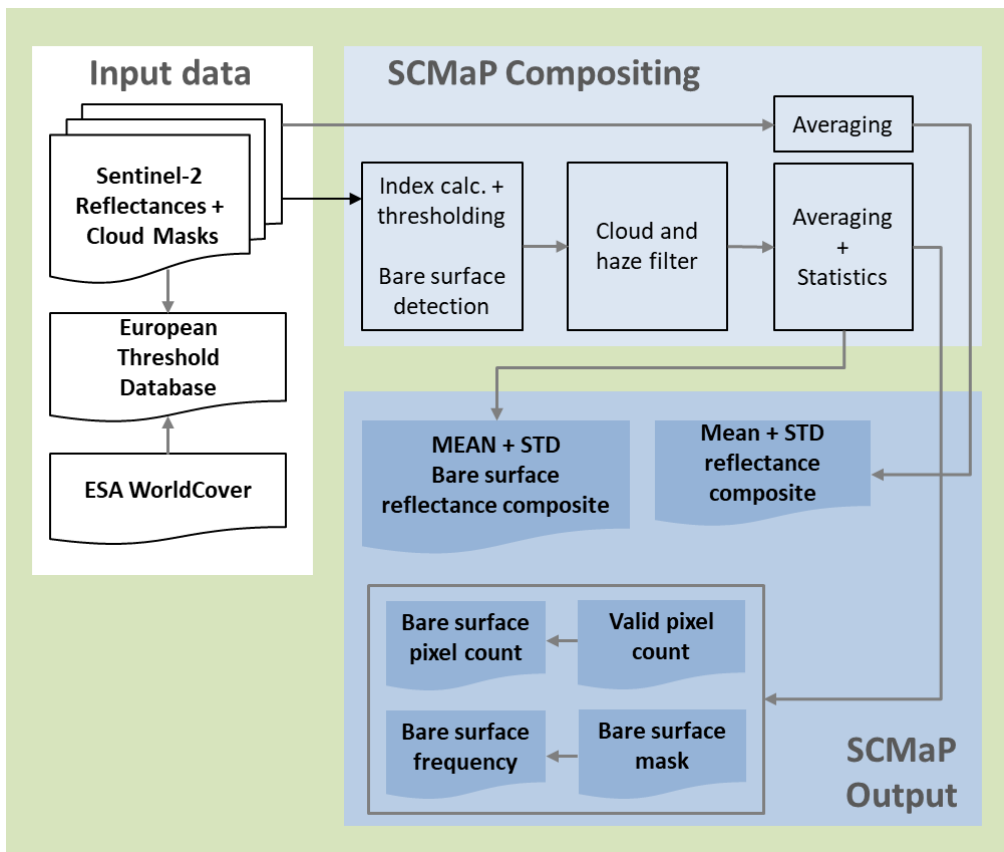
23 questions, sent out to people across Europe on soils and EO (Oct 2023 – Feb 2024)

- 54 / 83 users are missing soil related information at the Copernicus service
- Spatial patterns are useful but quantitative correct values with confidence intervals are more important
- Majority needs information for monitoring yearly, but if not possible less often is still useful.
- Purposes are MRV, monitoring, CAP
- Spatial resolution winner is 10-20 m pixel size, but coarser pixel sizes are still useful

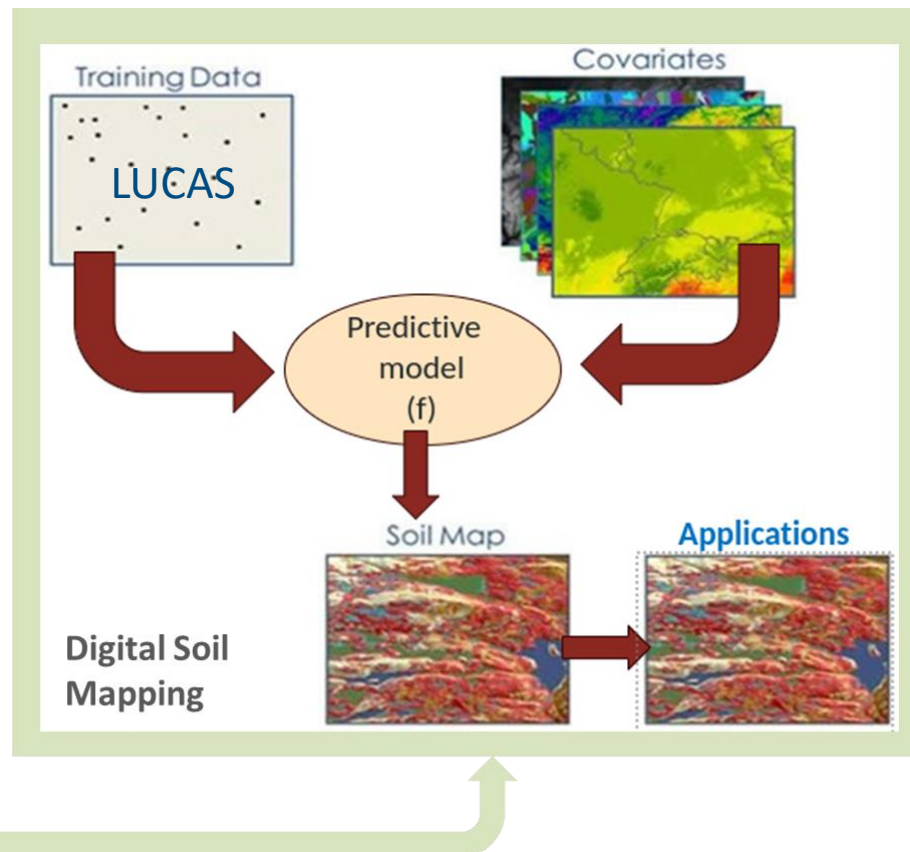


CUP4SOIL – EO and soil data products

- Temporal compositing using Sentinel-2



- Digital soil mapping



Covariates:
SCMaP outputs
Copernicus (DEM, LC,
Geology (JRC),
Sentinel-1

Model:
quantile random forest

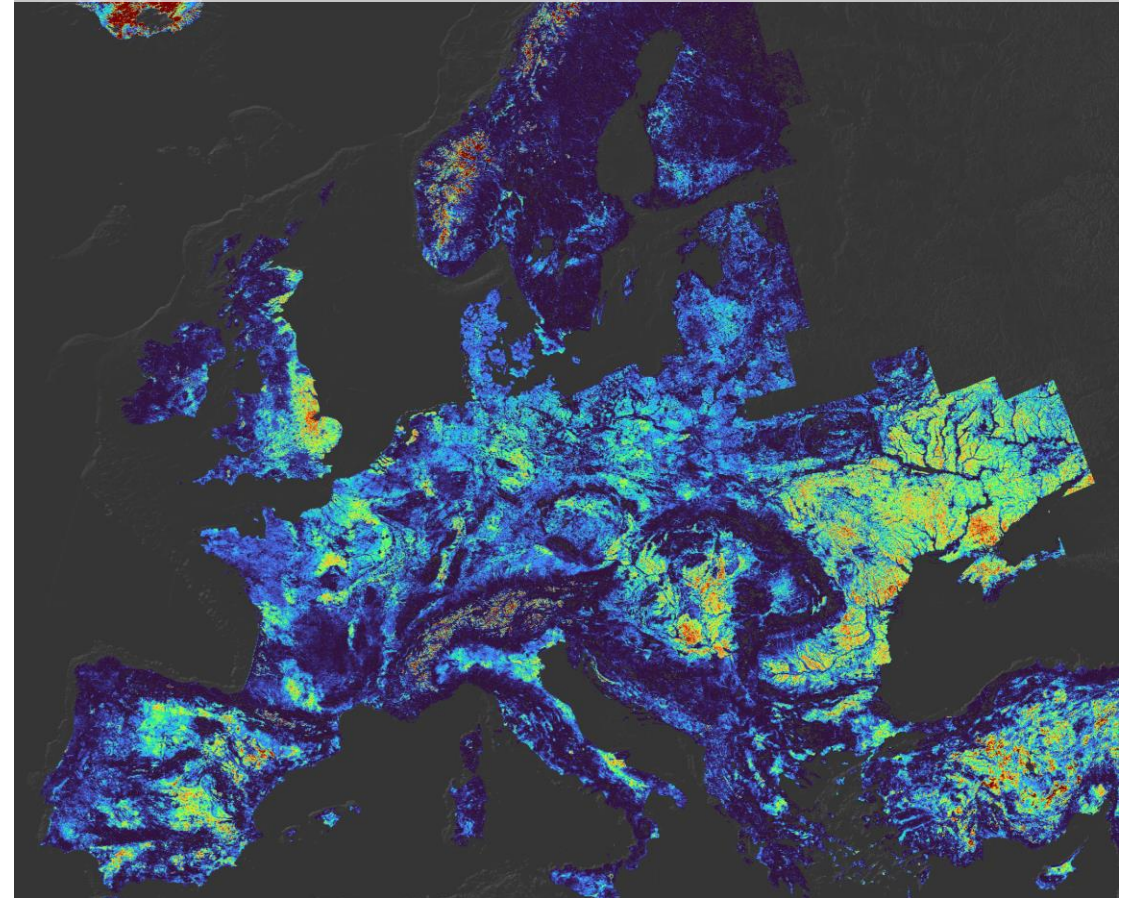
Outputs:
Primary soil properties
Uncertainty index

CUP4SOIL – Soil composite information

Soil reflectance composite
(Sentinel-2, 2018 – 2022, Mean, RGB – B4/B3/B2)



Soil frequency
(Sentinel-2, 2018 – 2022)



PROGRAMME OF THE
EUROPEAN UNION



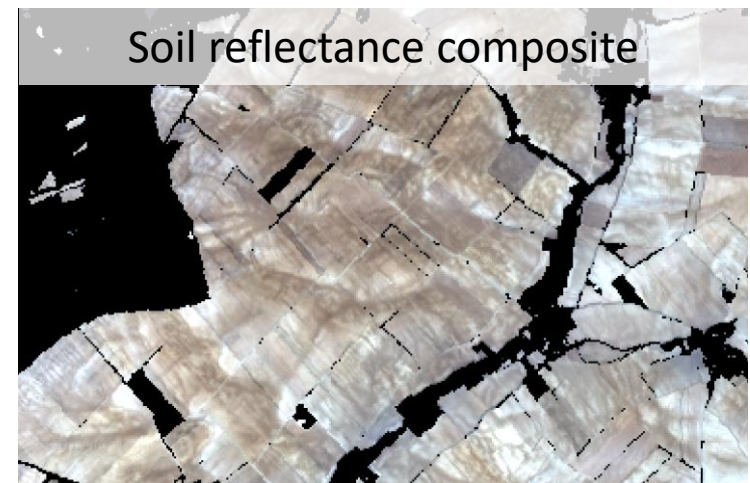
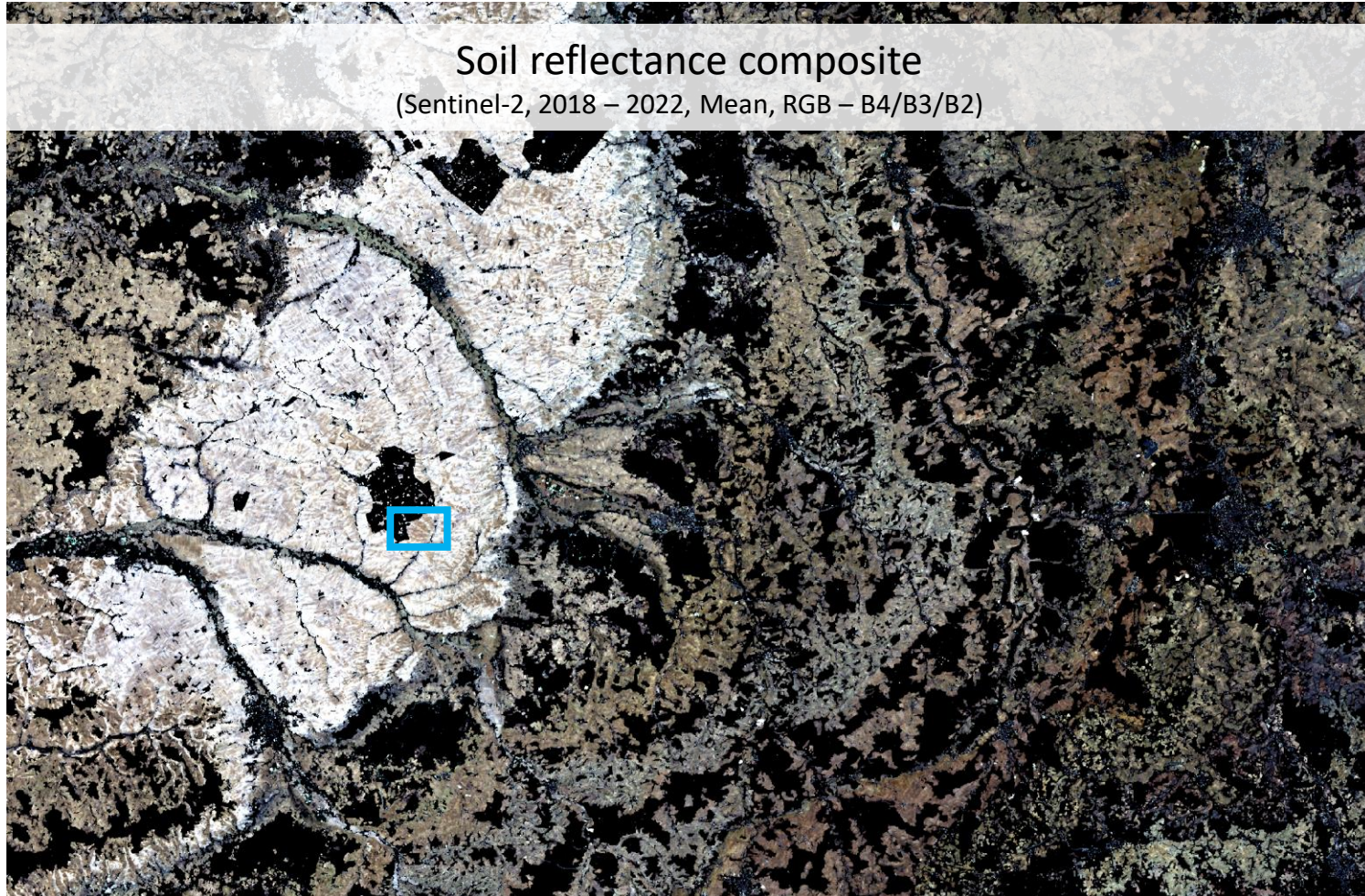
Implemented by



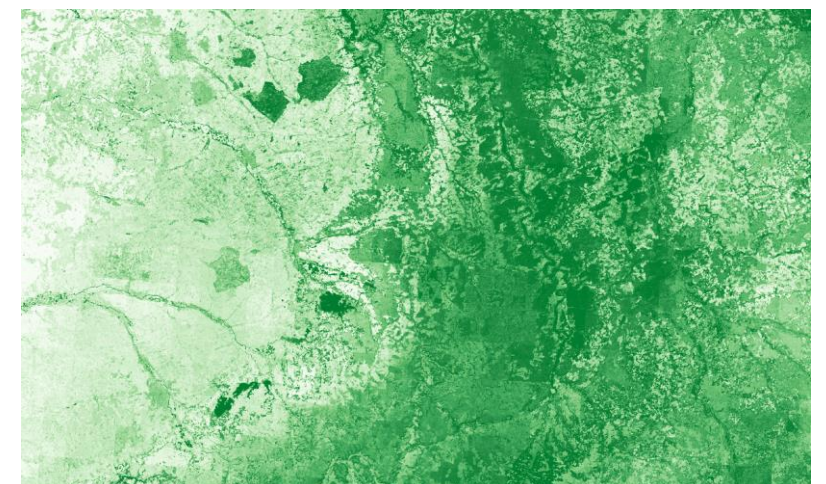
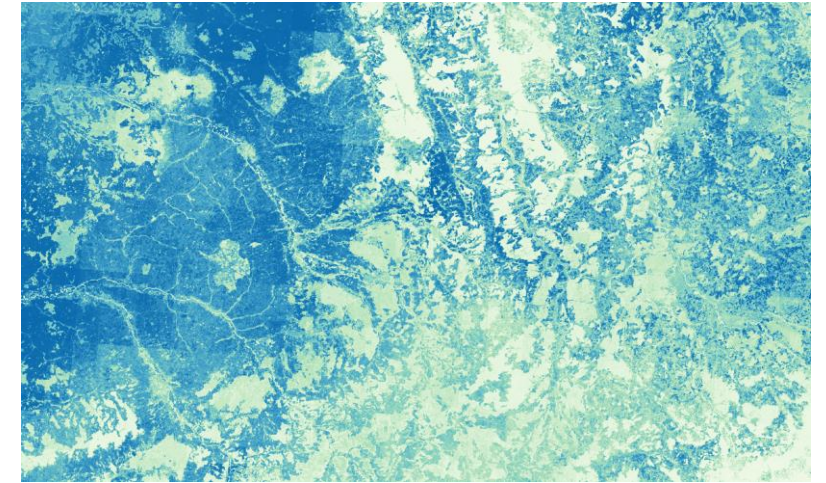
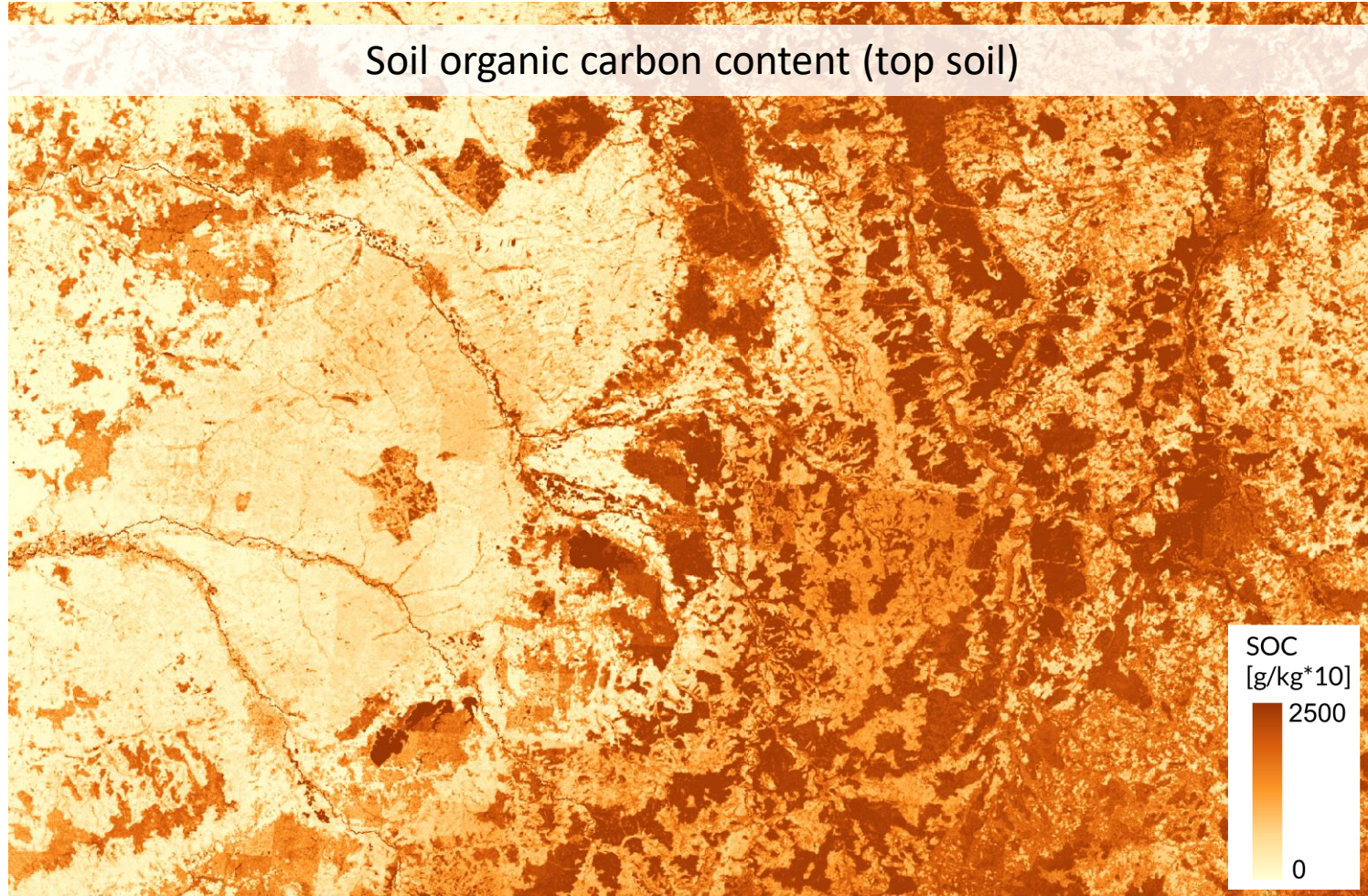
European
Environment
Agency



CUP4SOIL – Soil composite information (Champagne – France)



CUP4SOIL – Soil composite information (Champagne – France)



CUP4SOIL – Cross validation

1

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

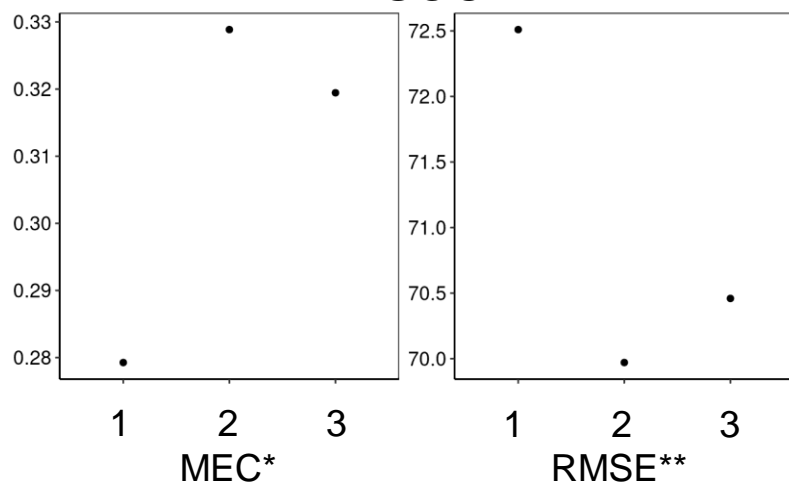
2

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

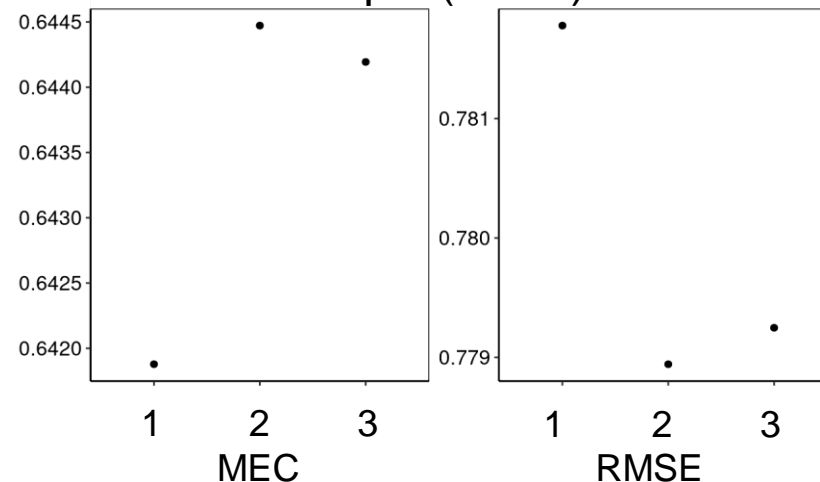
3

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

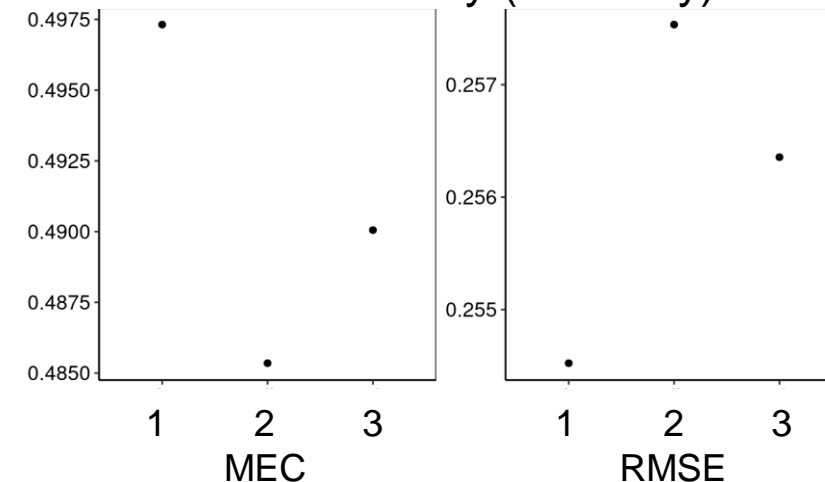
SOC



pH (water)



Bulk density (oven dry)



*MEC - model efficiency coefficient, equivalent to R^2

** RMSE - Root Mean Squared Error



PROGRAMME OF THE
EUROPEAN UNION



Implemented by



CUP4SOIL – Summary and future directions

Summary:

- DLR and ISRIC partnered to suggest new soil related products for the CLMS
- User requirement study done including literature and project review, user requirement survey (online)
- SCMaP intermediate products integrated into digital soil model - soil parameter with new quality generated
- Test about the best choice of covariates – direct spectral covariates could improve the modelling

Future developments:

- Data will be published and made available free and open
- Preparing the webserver
- Pixel-based uncertainty
- External validation (show-cases)

CUP4SOIL
Webpage



PROGRAMME OF THE
EUROPEAN UNION



Implemented by



European
Environment
Agency





© Vladislav Chanev, Well with Nature /EEA



Thank you

Contacts:

DLR: uta.heiden@dlr.de; pablo.angelo@dlr.de

ISRIC: Laura.Poggio@isric.org;
fenny.vanegmond@isric.org;



PROGRAMME OF THE
EUROPEAN UNION



Implemented by

