Session 3 – SOC prediction maps validation concept

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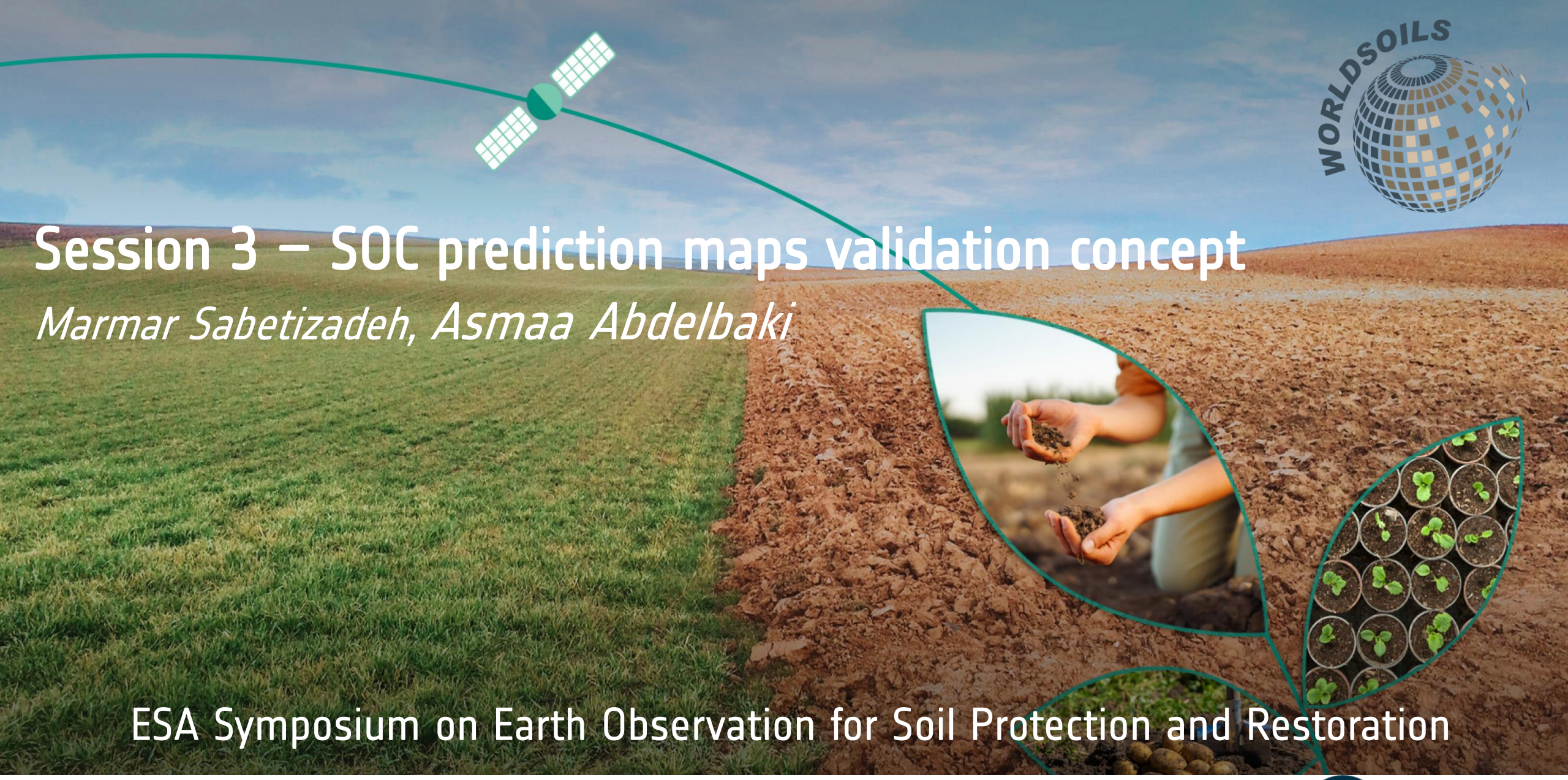

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Validation Concept and Purpose

Validation plan

An overview detailing validation regions, validation methods for soil organic carbon products, and the soil monitoring system.

Goal:

To ensure data and predictions;

- Align with established standards,
- Are representative of real-world conditions,
- Meet the requirements of end-user and stakeholders.

Methods:

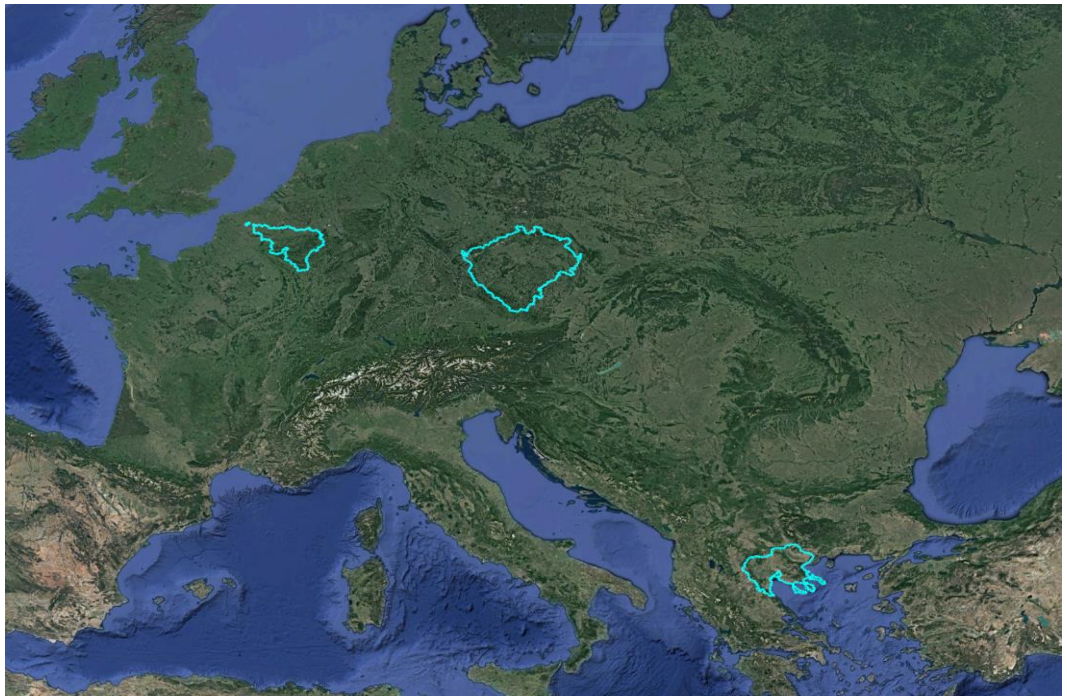
Assessing SOC prediction against independent and external reference data, which are traceable to highly accurate in-situ measurements.

Validation Concept and Purpose

Validation regions

Three validation regions, each representing different bioclimatic zones of Europe, were chosen:

- Wallonia-Belgium
- Macedonia-Greece
- Czech Republic

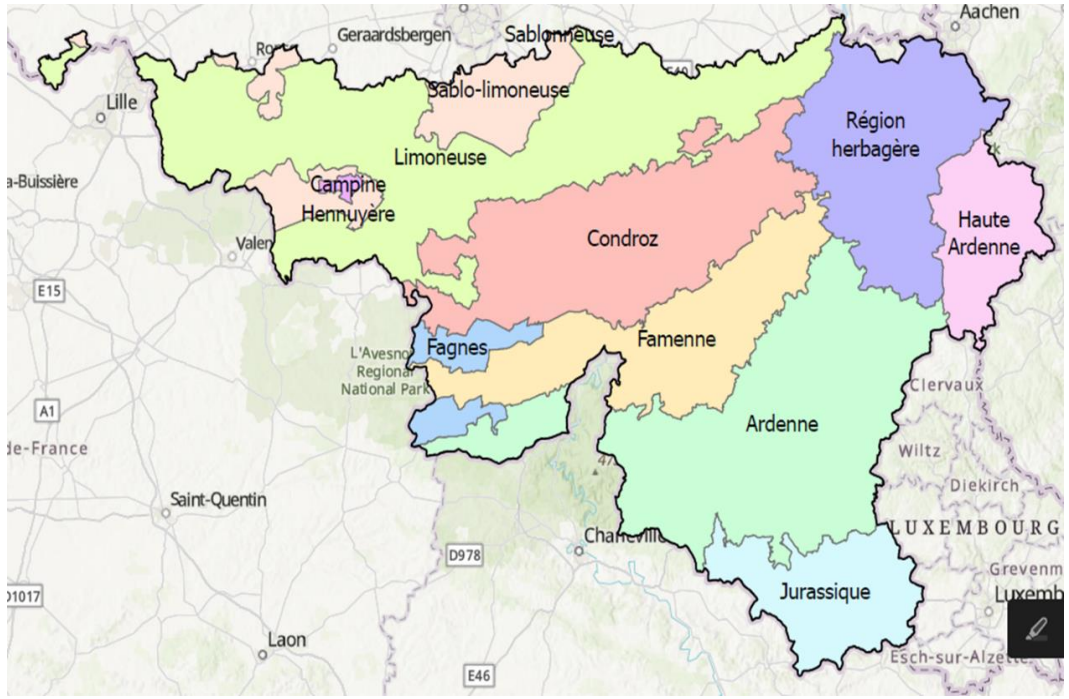


Location of three validation regions

Validation Concept and Purpose

Wallonia

- Temperate maritime climate
- From the northwest to the southeast:
  - Increase in precipitation along with elevation and a decrease of mean annual temperature
  - Haplic Luvisols to Dystric Cambisols, with Fluvisols on valley bottoms
  - Croplands, in more fertile land of the northern region
  - Grassland, in the cooler areas of the southern region

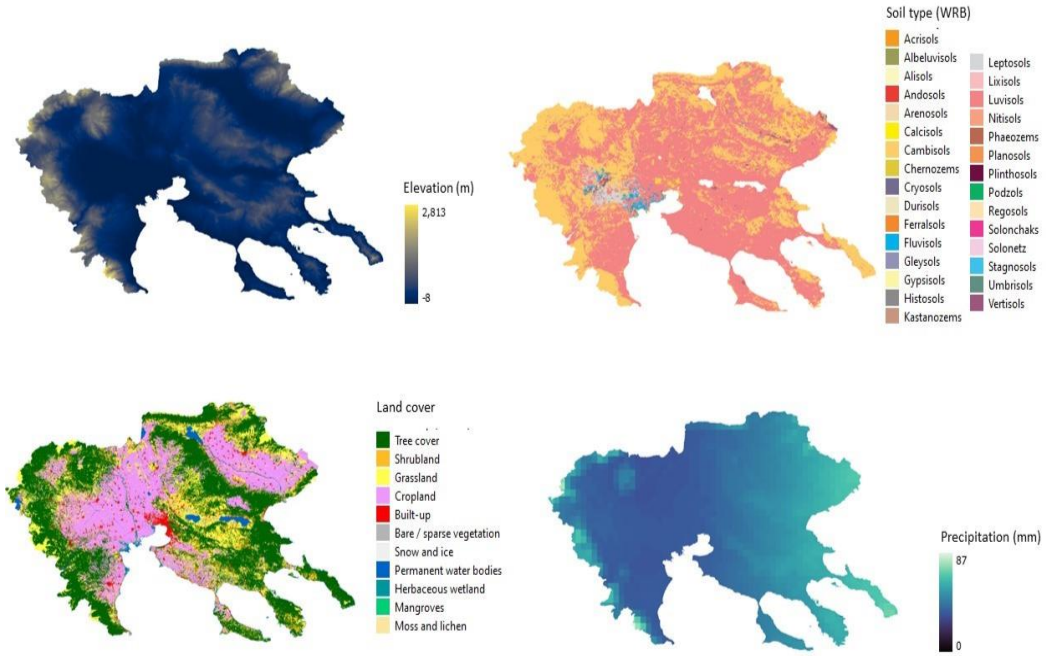


Map of the agricultural regions in Wallonia

Validation Concept and Purpose

Macedonia

- Mediterranean climate:
  - Hot, dry summers
  - Mild, wet winters
- The region's agricultural sector :
- Ample sunshine and long growing seasons
- High-value crops like olives, grapes, and cotton, with a large number of tree crops
- Cambisols and Luvisols, with Leptosols and Fluvisols along river flood plains

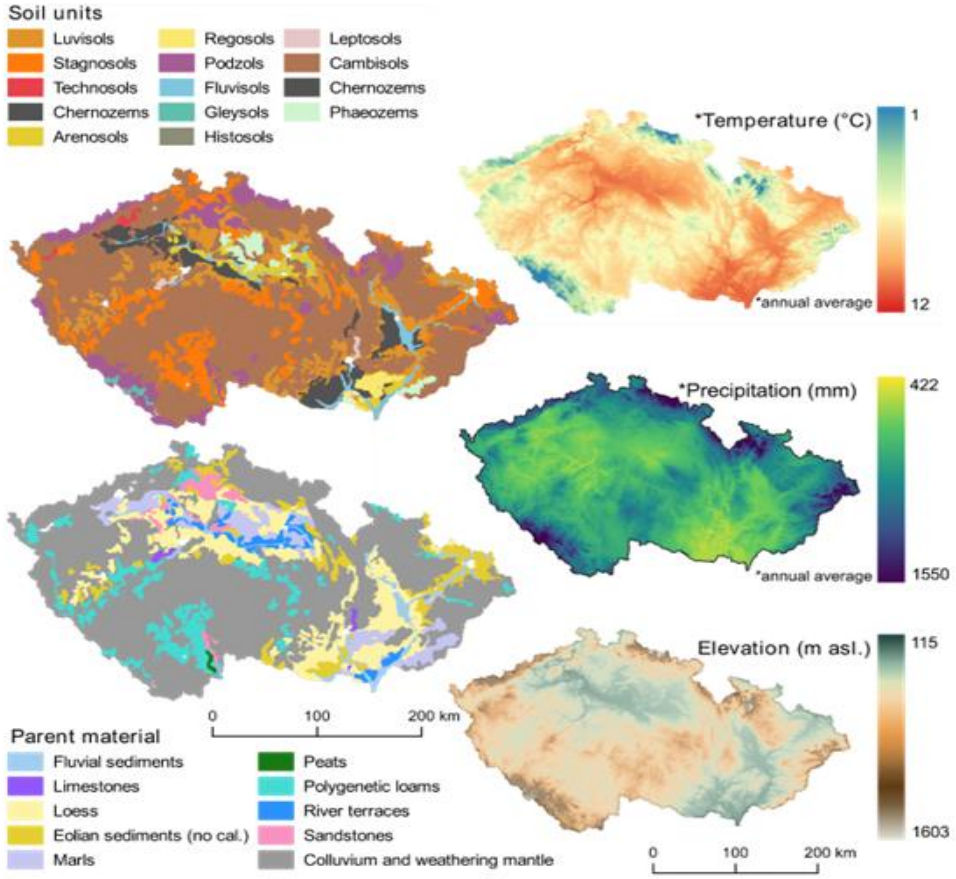


Environmental characteristics in the Greek Central Macedonia

Validation Concept and Purpose

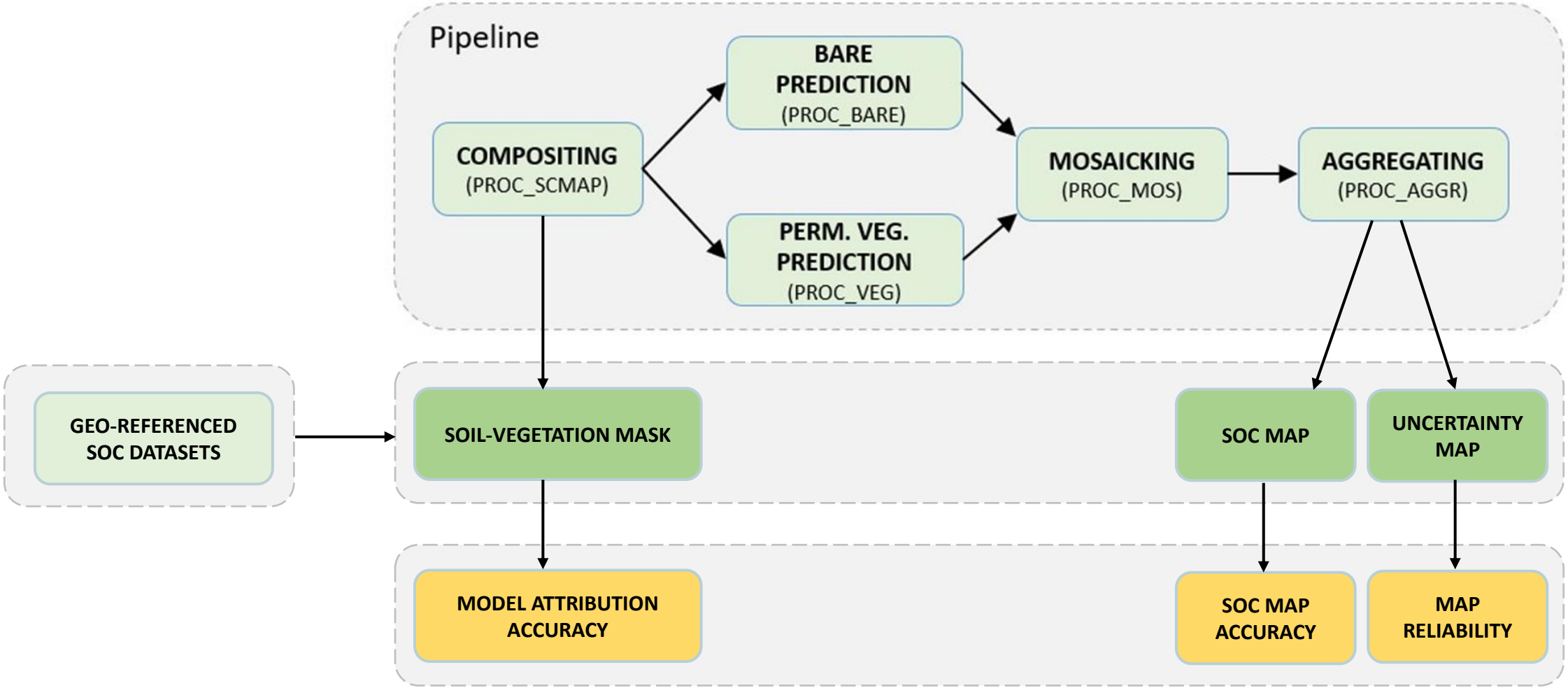
Czech Republic

- Continental and temperate climate:
  - Mean annual temperatures ranging from 6.8 to 8.9 ◦C
  - Mean annual precipitation from 559 to 893 mm
- Soil units:
  - Cambisols, in association with Stagnosols
  - Chernozems, Phaeozems, and Luvisols in lower positions
  - Fluvisols and Regosols, along river floodplains and terraces



Environmental characteristics in the Czech Republic

Workflow of Validation Process

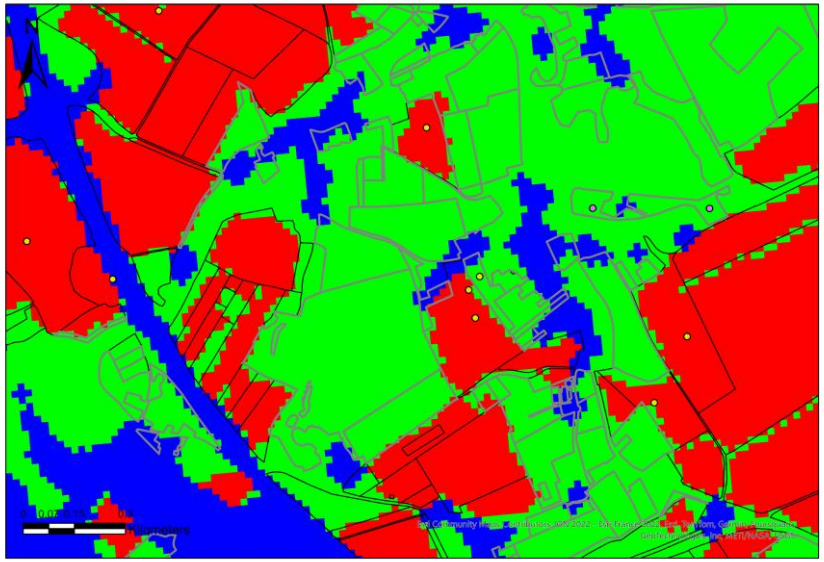


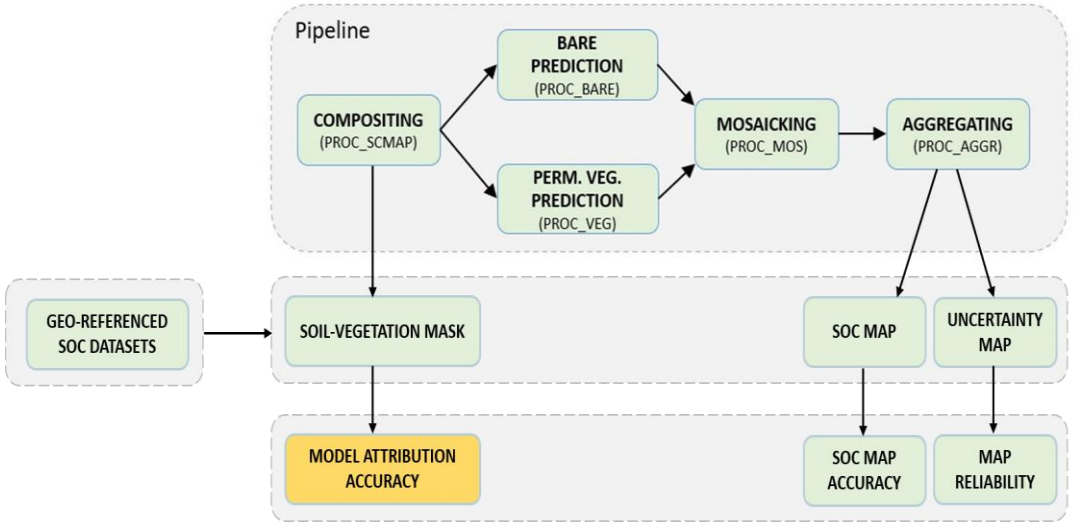
Model attribution accuracy

Confusion matrices

- Inputs:
  - Soil-vegetation masks
  - Land cover reference data from independent external datasets

- For each year, a spatial extraction process was implemented to obtain land cover classes from the masks using the coordinates of referenced data.



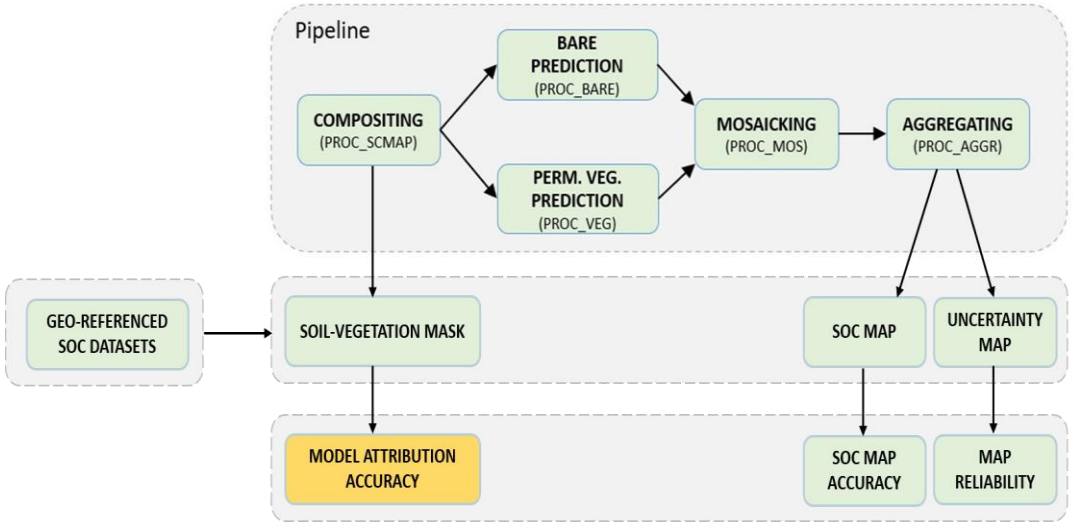


Model attribution accuracy

Confusion matrices

- Confusion matrices were generated to evaluate the land cover classification's accuracy of the masks against the observed data.

- The confusion matrices were used to detect incorrectly attributed point data into corresponding models.

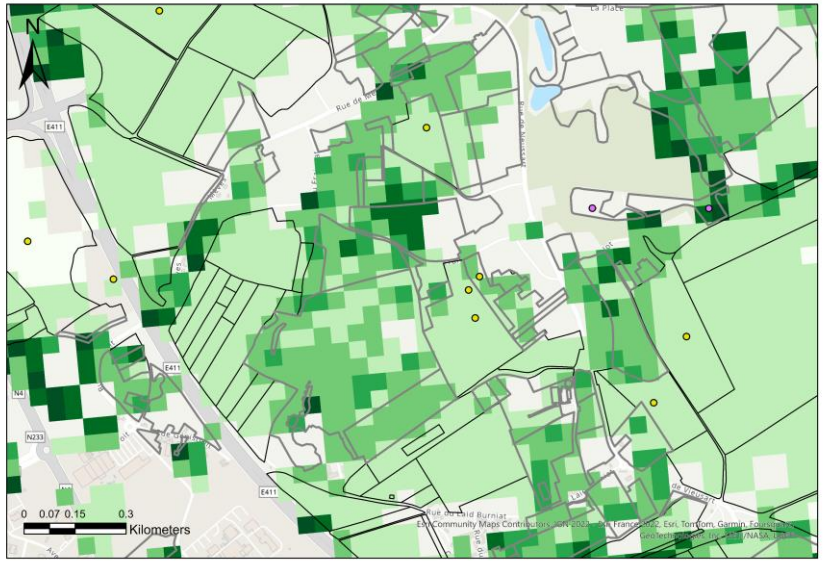


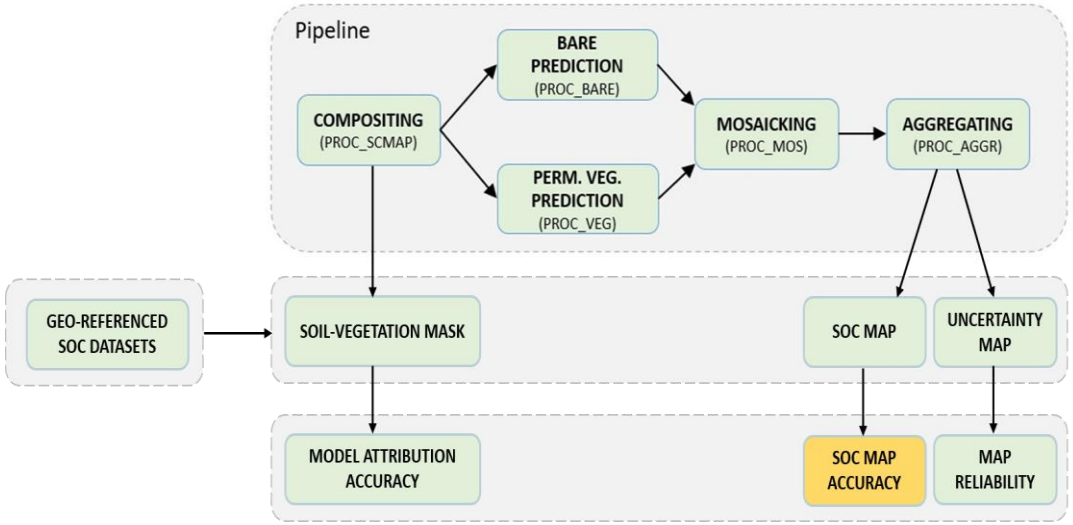
SOC map accuracy

Observed vs predicted SOC content

- Inputs:
  - SOC prediction maps
  - Reference SOC data from independent external datasets

- The sample points were spatially matched with the SOC map, to extract corresponding SOC predictions, allowing for the comparison of observed and predicted SOC values.



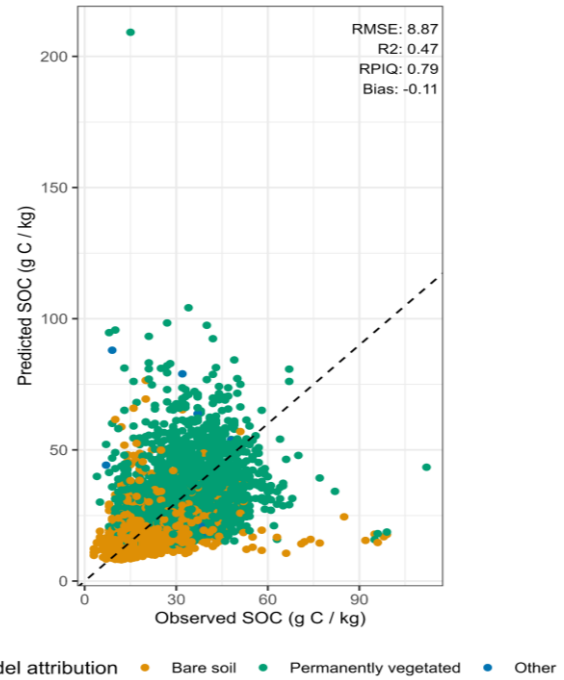


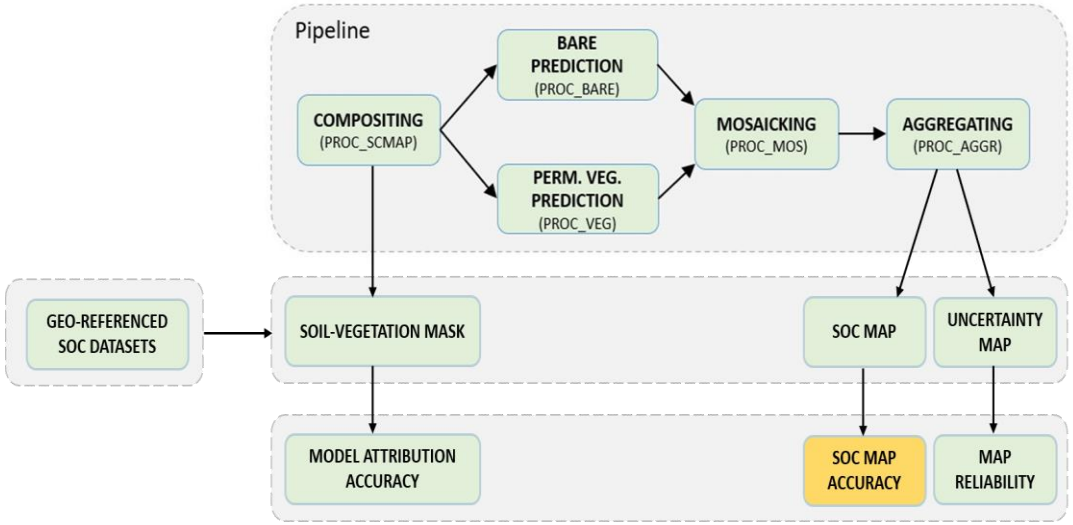
SOC map accuracy

Observed vs predicted SOC content

- The incorrectly attributed point data were removed from dataset to recalculate the metrics.

- Assessment metrics of the prediction accuracy:
  - The root mean square error (RMSE)
  - Ratio of Performance to Inter-Quartile Range (RPIQ)
  - Bias

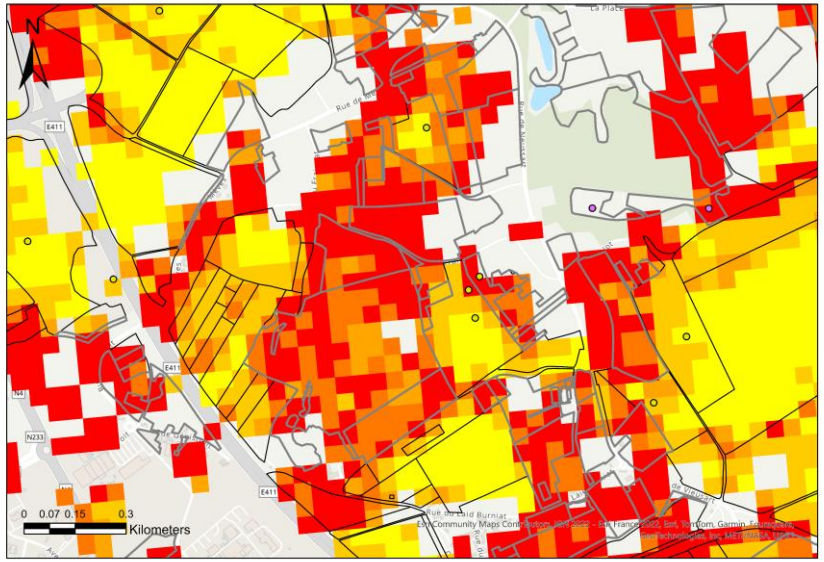


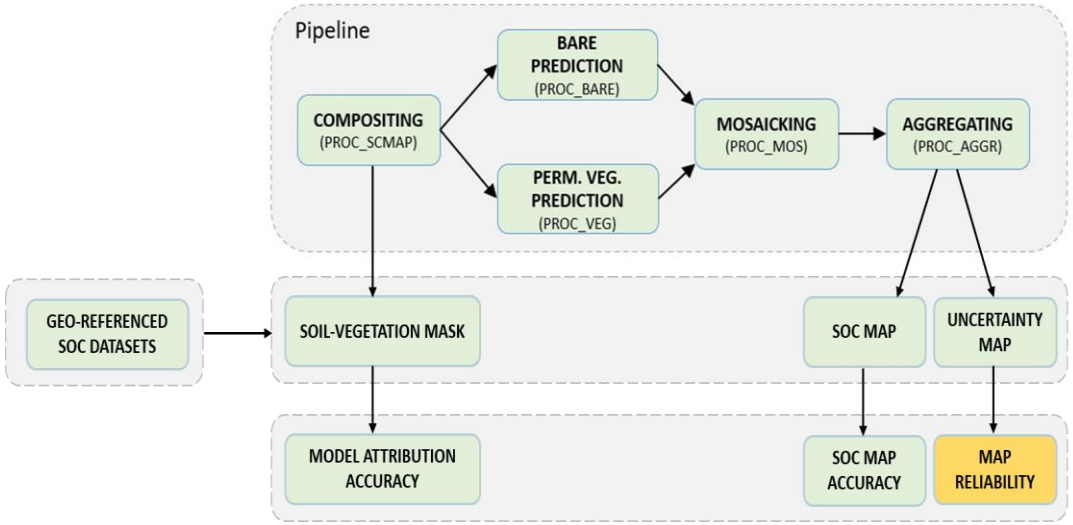


Map reliability

Ground truth of uncertainty map

- The uncertainty associated with each SOC prediction was used to calculate upper and lower SOC prediction ranges, providing a 90% confidence interval for each prediction.
- The extracted values were integrated with the reference data to determine the percentage of observed SOC values that fell within the predicted confidence intervals.





Thank you!

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