Creation of detailed soil properties maps of the Czech Republic based on national legacy data and digital soil mapping

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Introduction

- In the Czech Republic, a large-scale mapping of agricultural land completed in 1970.

- We used the legacy soil samples to create national scale map of selected soil properties by using digital soil mapping (DSM) methods.

- Prelliminary results– soil organic carbon modelling (SOC).

SOC- Data

- Legacy soil samples (1 sample/100 ha).

- Heterogeneous pilot area (2440 km^2 in total).

- 1375 soil samples in total, data splitting 80/20 for validation.

- Covariates
  1. DEM (20m/pixel) and multi-scale approach applying gaussian blurr filter.
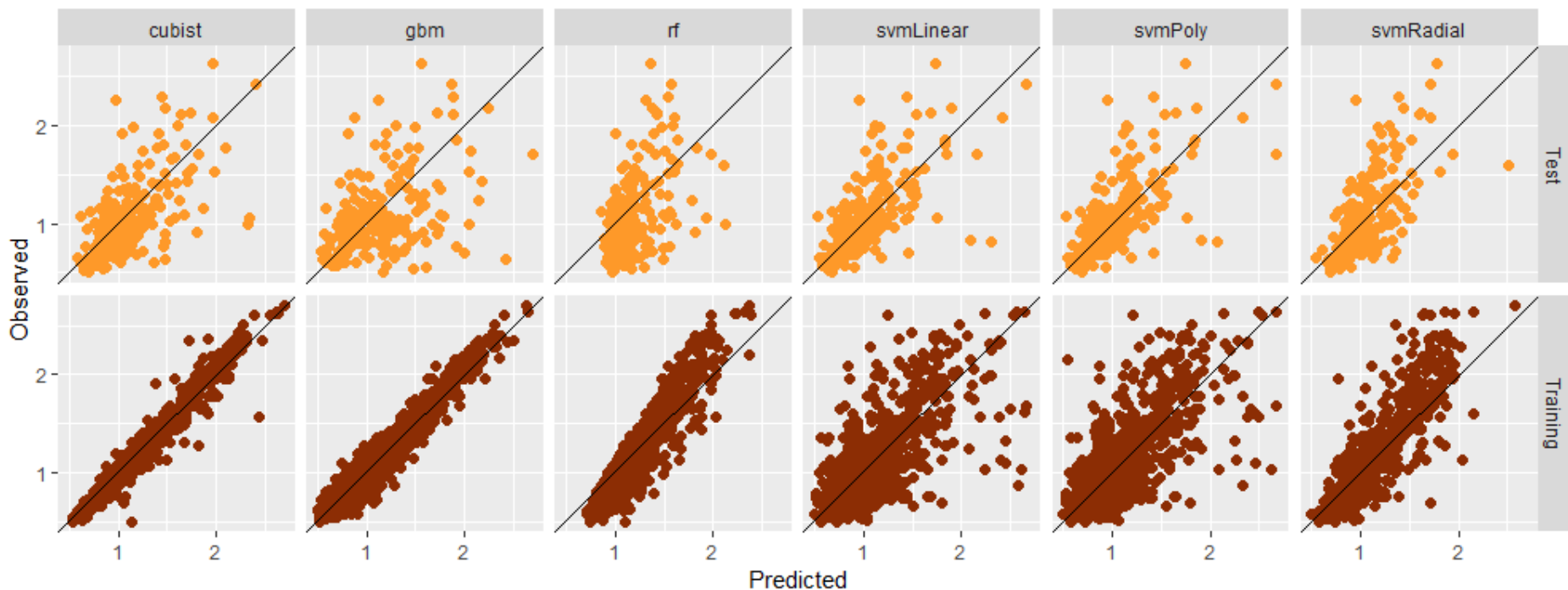 2. Original maps of soil types.

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SOC- Models

- Random forest, Cubist regression, Boosted Tree, Support vector machine,

- Random hyperparameters tunning with k-fold cross-validation,

- Models were evaluated using external validation.

SOC– results

Soil organic carbon content (%)

model	RMSEP	CCC
Cubist regression	0,421	0,664
Boosted tree	0,478	0,542
Random forest	0,493	0,523
SVM [linear ker.]	0,466	0,643
SVM [polynomial ker.]	0,560	0,188
SVM [radial ker.]	0,456	0,639

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SOC- Highlights

- The most important covariates were connected with topography and erosion and accumulation processes.

- The multi-scale approach is important in national scale mapping. Blurred covariates were more important.

- The overall accuracy of all models is moderate. We conclude that the addition of more relevant covariates would increase the accuracy.

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Future work

- Create more relevant covariates in national scale.
    1. Use more advanced multi-scale approach proposed by Behrens et al. (2018).
    2. Create Bare soil composite for Czechia from Sentinel-2 images (almost done by authors).
    3. Include geographical covariates to ML (coordinates, distance maps).

* Behrens, T., Schmidt, K., MacMillan, R. A., & Viscarra Rossel, R. A. (2018). Multi-scale digital soil mapping with deep learning. *Scientific Reports*, *8*(1). https://doi.org/10.1038/s41598-018-33516-6

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