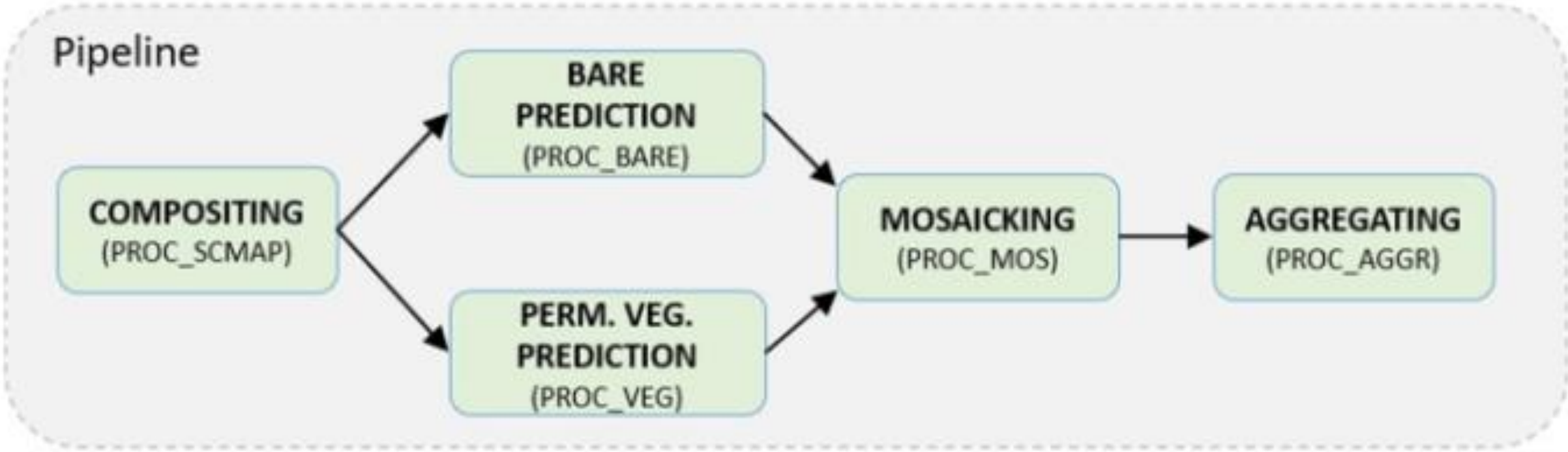
Session 3 – SOC prediction algorithms for Vegetated areas

Laura Poggio

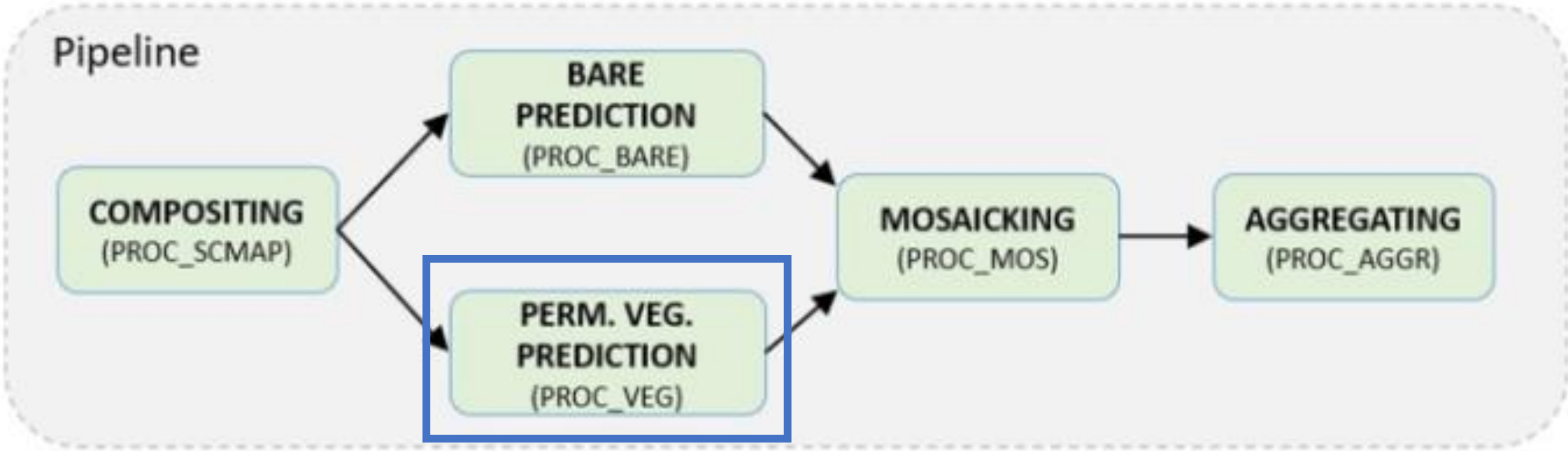
ESA Symposium on Earth Observation for Soil Protection and Restoration

Contract 400131273/20/I-NB

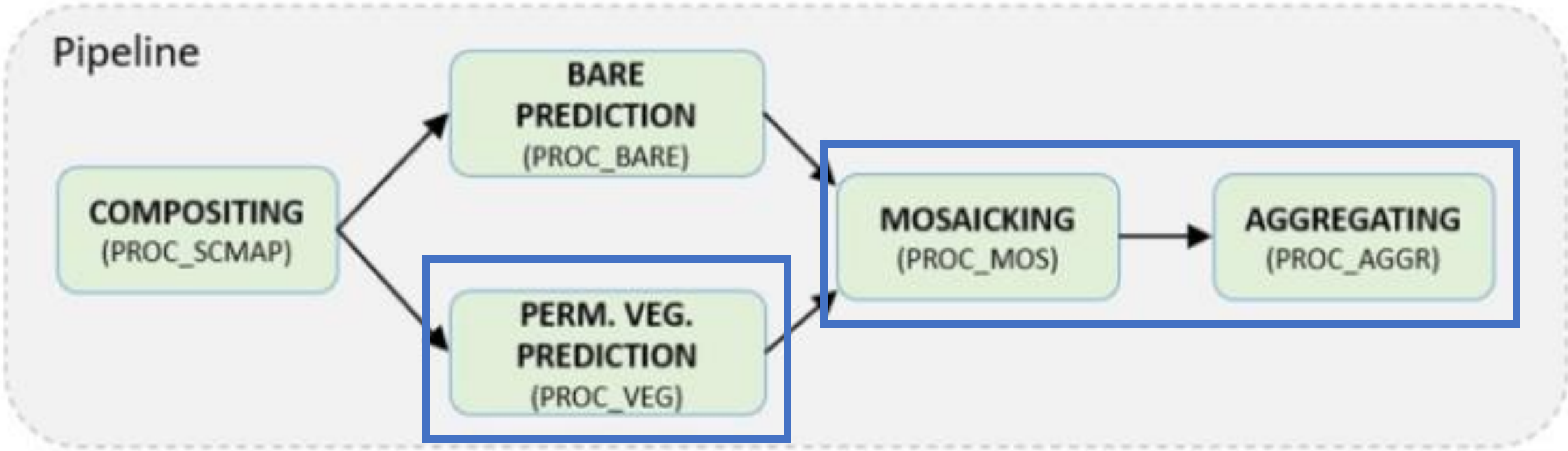
WorldSoils – general framework



WorldSoils – general framework

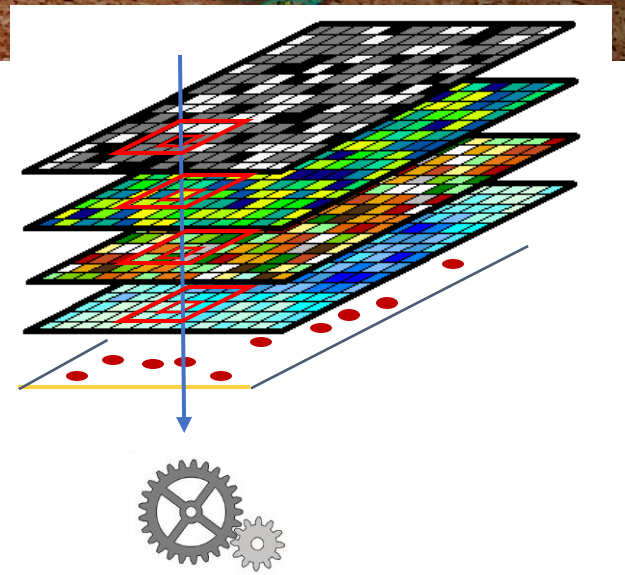


WorldSoils – general framework

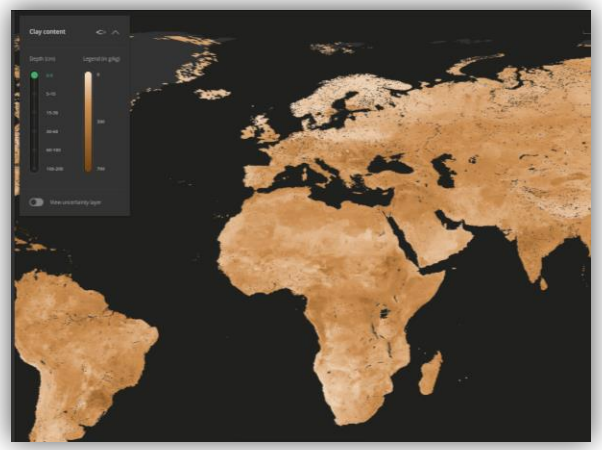


Digital Soil Mapping

- Statistical model between soil observations and environmental variable
- Not a direct link but via proxies representing the soil forming factors: vegetation, management, climate,...
- Uses covariates that are available for the region of interest.
- Few studies considering EO temporal composites as covariates



Soil property maps



SCMaP Product suite

Sentinel–2 mean reflectance composite (2017 – 2019), East of Munich

Environmental covariates

- **Sentinel 2** (just described in previous presentation)

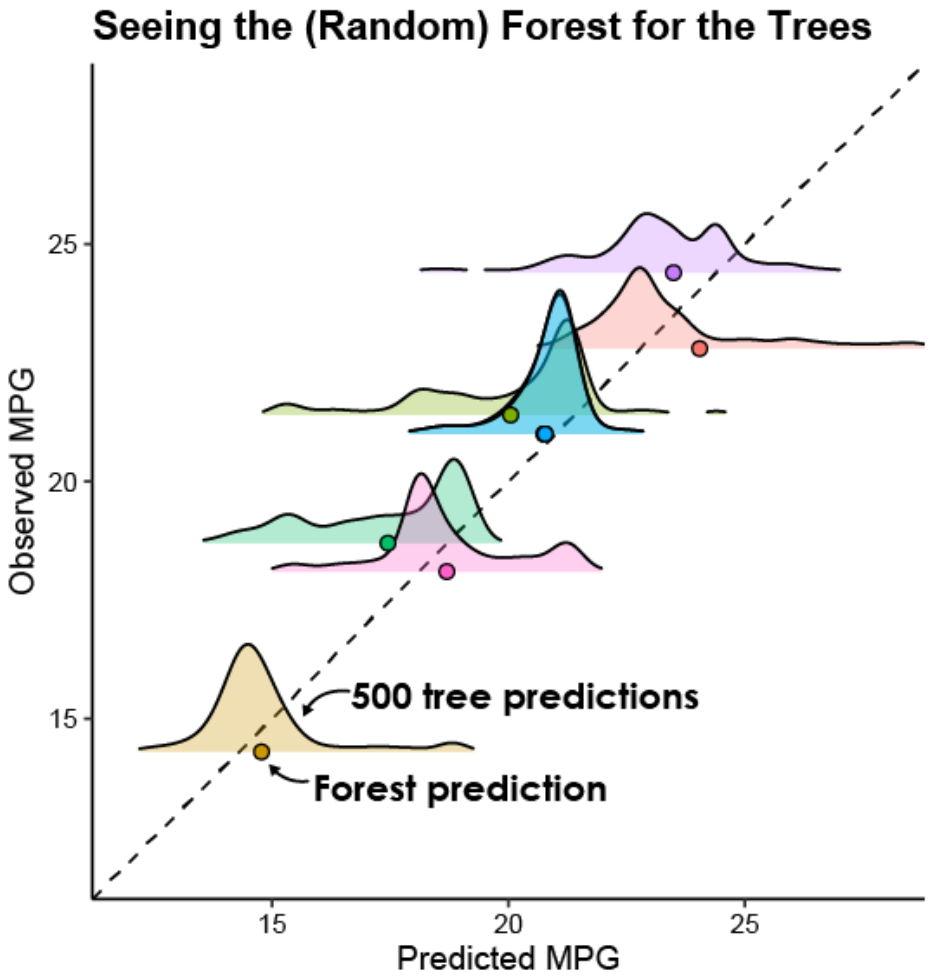
- Copernicus **Digital Elevation Model**:
  - Elevation from sea level (m)
  - Slope
  - Topographic wetness index
  - Multi-resolution Valley Bottom Flatness

- **Climate** data (**ERA5**):
  - temperature (2m), total precipitation, runoff, total evaporation, surface net solar radiation.

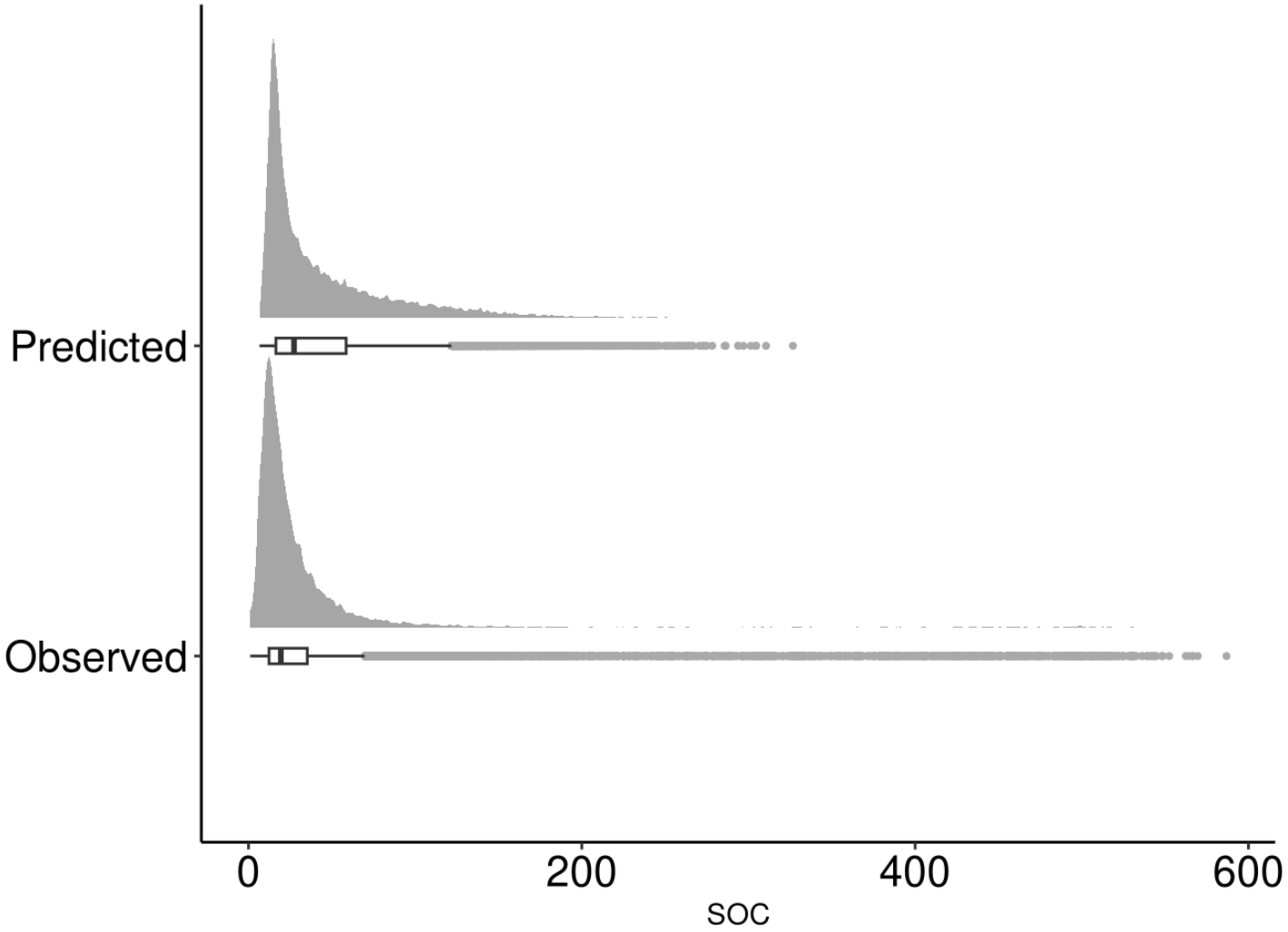
Modelling

- Quantile RandomForest
- 10 folds cross-validation
- Hyper-parameters optimisation (including Recursive feature elimination)
- Predictions
- Pixel based uncertainty (quantiles):

(Q095-Q005)/(Q050)

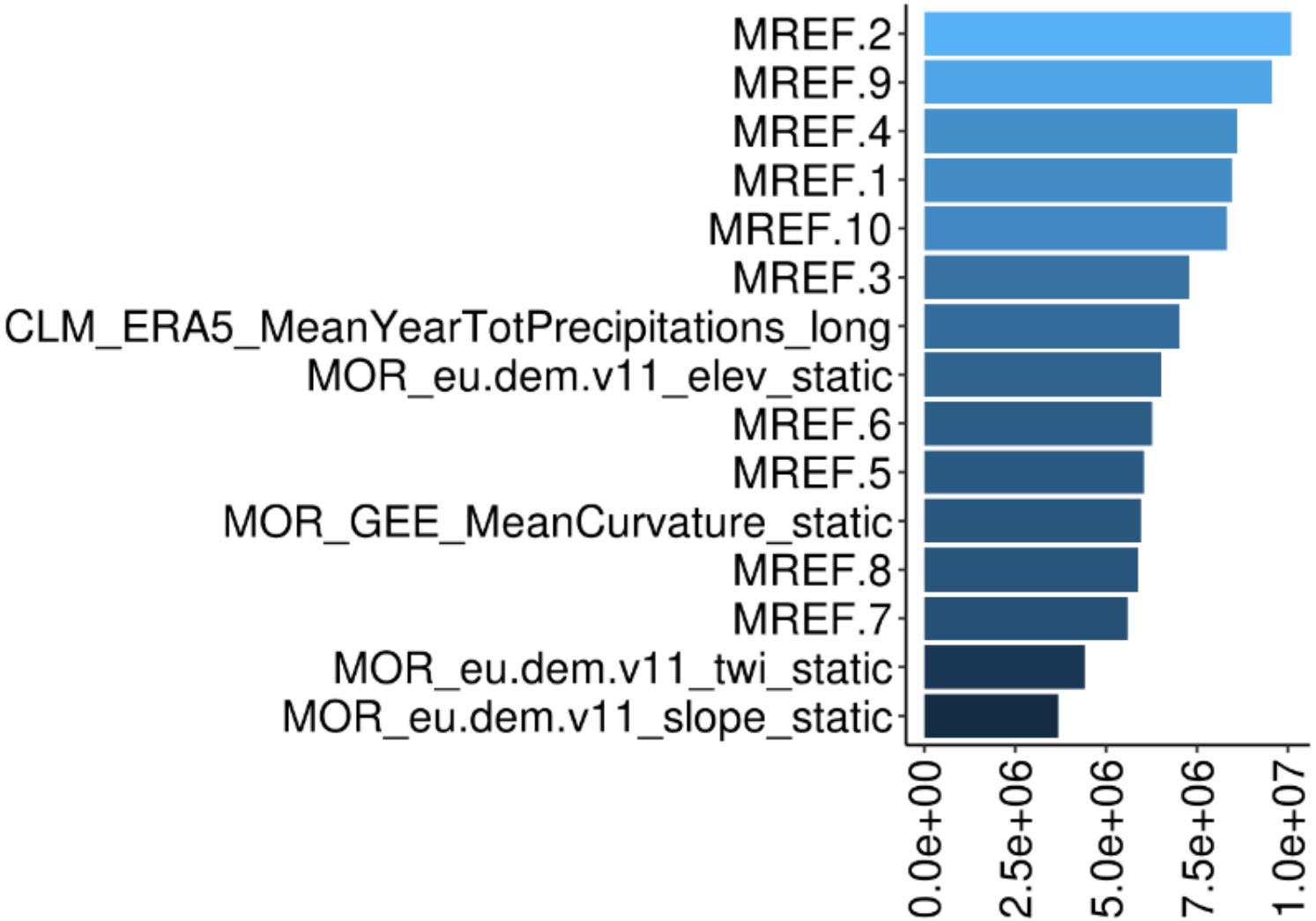


Results vegetated soil model



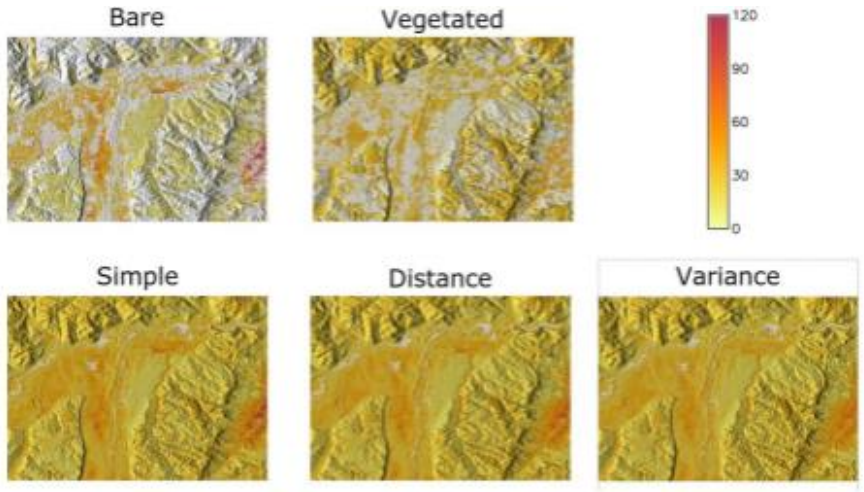
MEC	RMSE (g / kg)	NRMSE	MAE (g/kg)	PICP
0.28	67.35	0.88	31.67	0.94

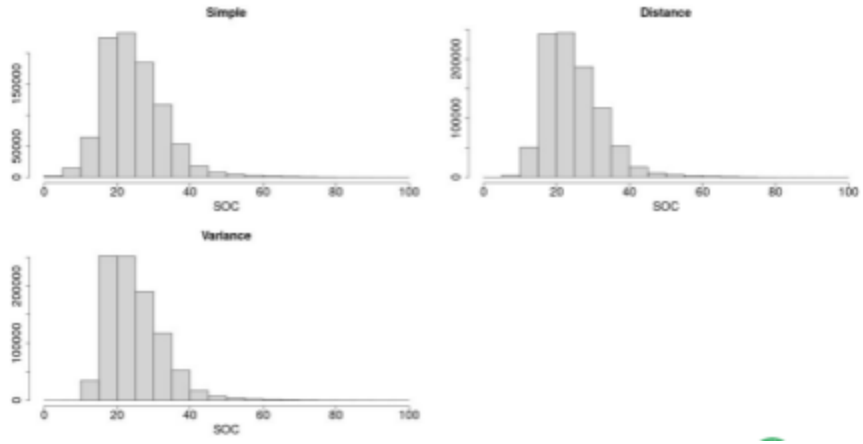
Results vegetated soil model



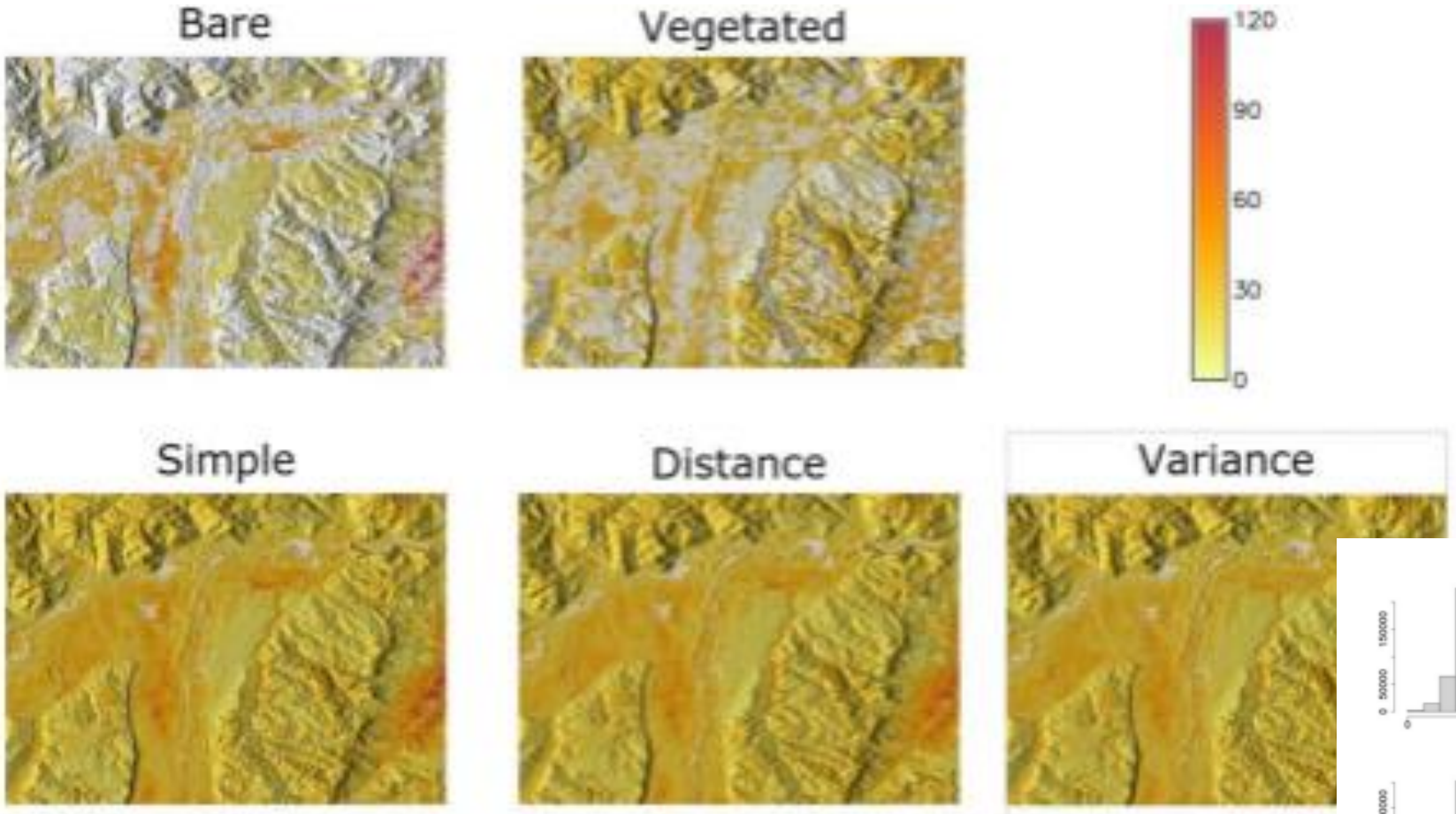
Integration bare and vegetated soil results

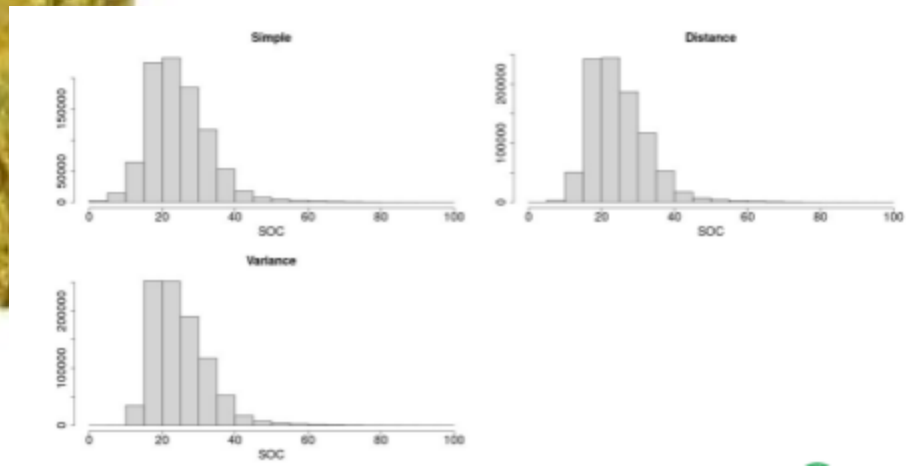
- Mosaic between the bare and vegetated predictions:
  - If bare soil predictions are present they take precedence
  - Around the edges of the bare soil a small distance weigheted smoothing is applied to reduce the edge effect





Integration bare and vegetated soil results





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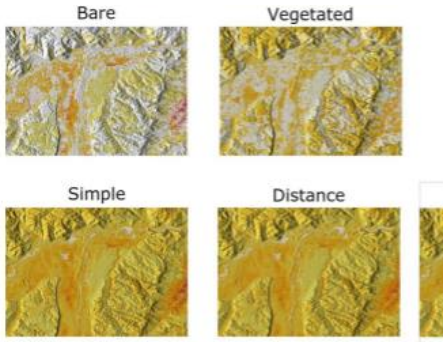

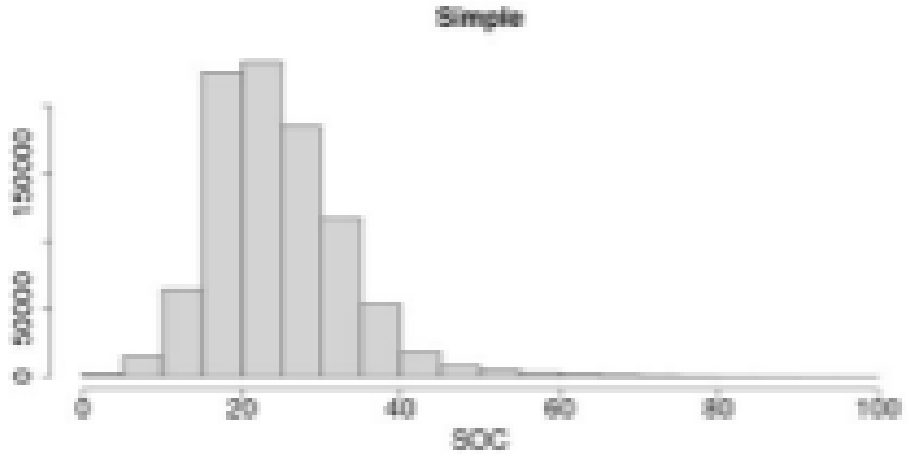

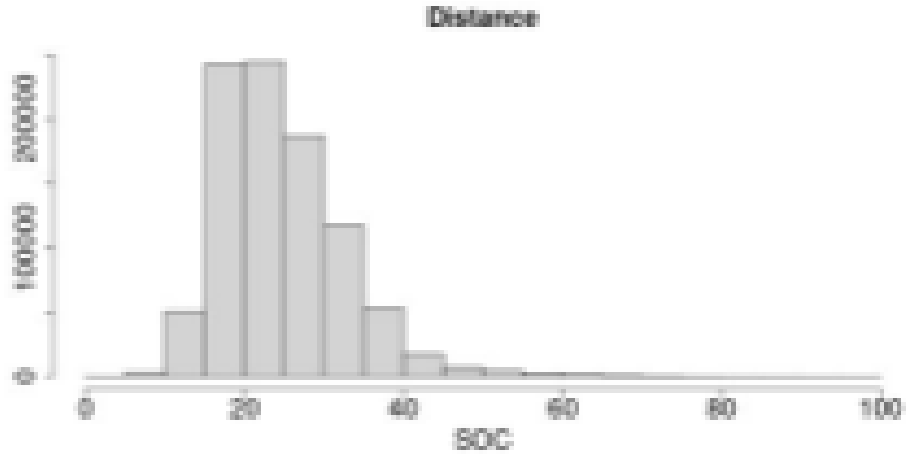

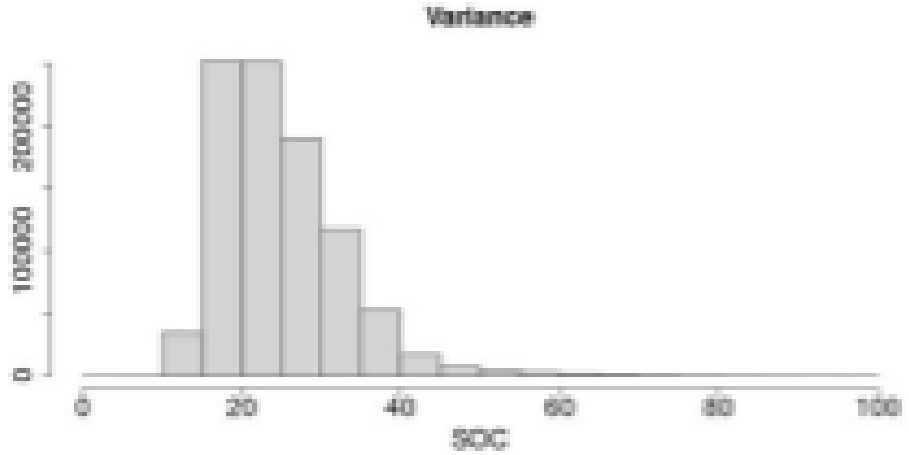

Technical implementation details

- All the computations are based on self-contained "containers. They can run in the same way on different infrastructures
- Process is fully reproducible
- All softwares used are open source

Summary remarks

- Model for vegetated soil fitted with state of the art covariates and latest available soil observations
- Acceptable cross-validation
- Acceptable landscape patterns recognition
- Full working reproducible system

Thank you!

Presenter e-mail

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