Session 3 – SOC prediction algorithms for Vegetated areas

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ESA Symposium on Earth Observation for Soil Protection and Restoration
Pipeline

WorldSoils – general framework

COMPOSITING (PROC_SCMAP)

BARE PREDICTION (PROC_BARE)

MOSAICKING (PROC_MOS)

PERM. VEG. PREDICTION (PROC_VEG)

AGGREGATING (PROC_AGGR)
WorldSoils – general framework

Pipeline

- COMPOSITING (PROC_SCMAP)
- BARE PREDICTION (PROC_BARE)
- MOSAICKING (PROC_MOS)
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- PERM. VEG. PREDICTION (PROC_VEG)
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
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):

  \( (Q_{095} - Q_{005}) / (Q_{50}) \)
Results vegetated soil model

<table>
<thead>
<tr>
<th>MEC</th>
<th>RMSE (g/kg)</th>
<th>NRMSE</th>
<th>MAE  (g/kg)</th>
<th>PICP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.28</td>
<td>67.35</td>
<td>0.88</td>
<td>31.67</td>
<td>0.94</td>
</tr>
</tbody>
</table>
Results vegetated soil model

CLM_ERA5_MeanYearTotPrecipitations_long
MOR_eu.dem.v11_elev_static
MREF.6
MREF.5
MOR_GEE_MeanCurvature_static
MREF.8
MREF.7
MOR_eu.dem.v11_twi_static
MOR_eu.dem.v11_slope_static
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 weighted smoothing is applied to reduce the edge effect
Integration bare and vegetated soil results
Integration bare and vegetated soil results
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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