Improving SOC predictions from Sentinel-2 soil composites by assessing surface conditions and uncertainties

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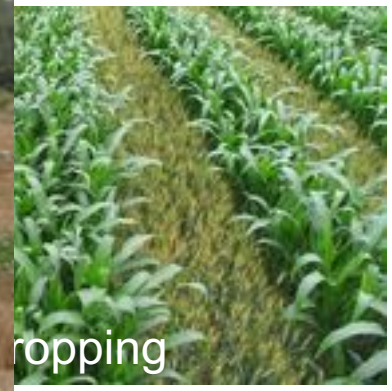
WORLDSOILS

➔ Conservation farming stimulating SOC sequestration



Methodology

Large scale SOC monitoring

What do we need?

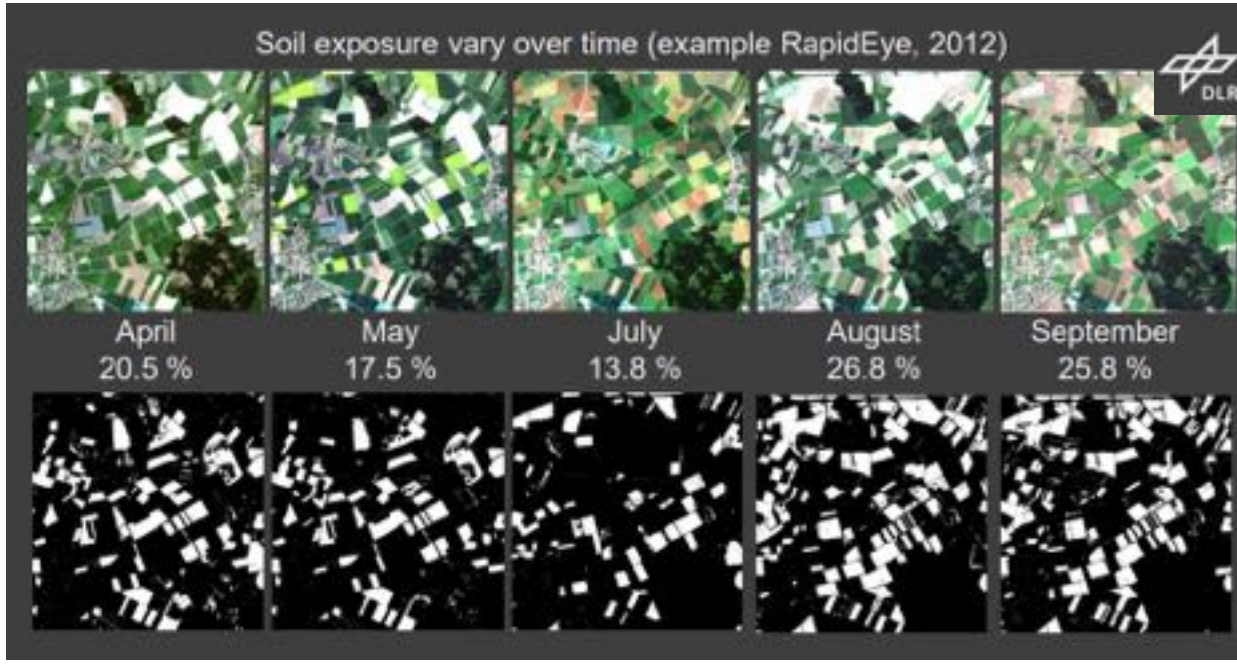
Algorithms that allow SOC predictions

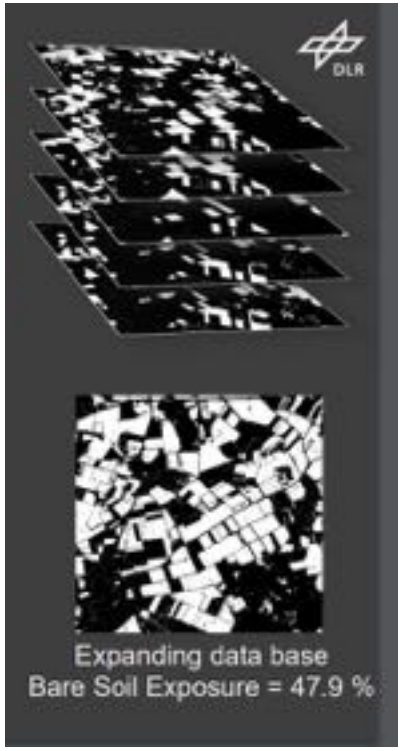
- over large areas
- at low costs (i.e. no recurrent field work)

How to achieve this?

Sentinel-2 mission

Exposed soil composites



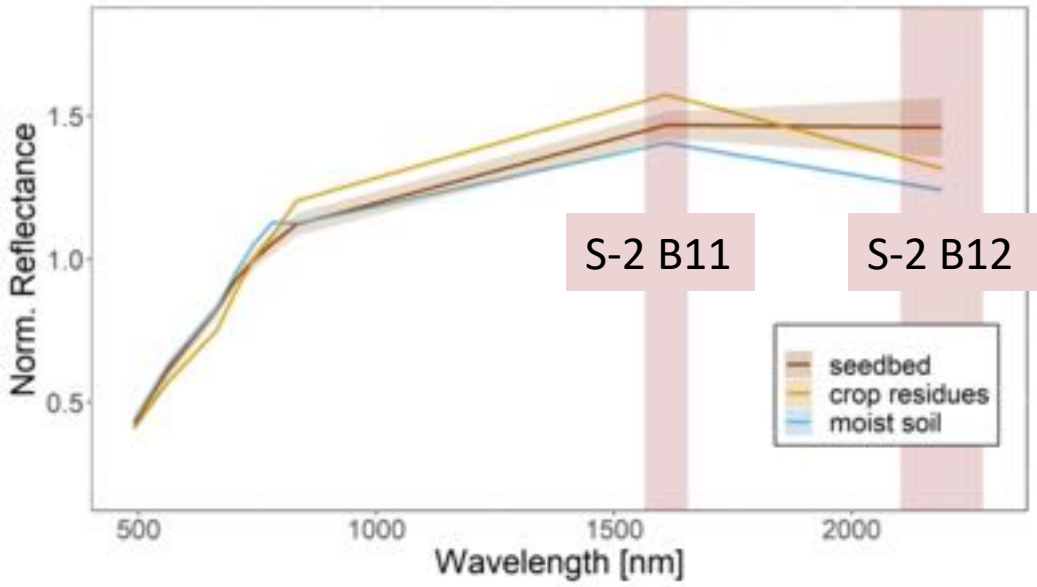


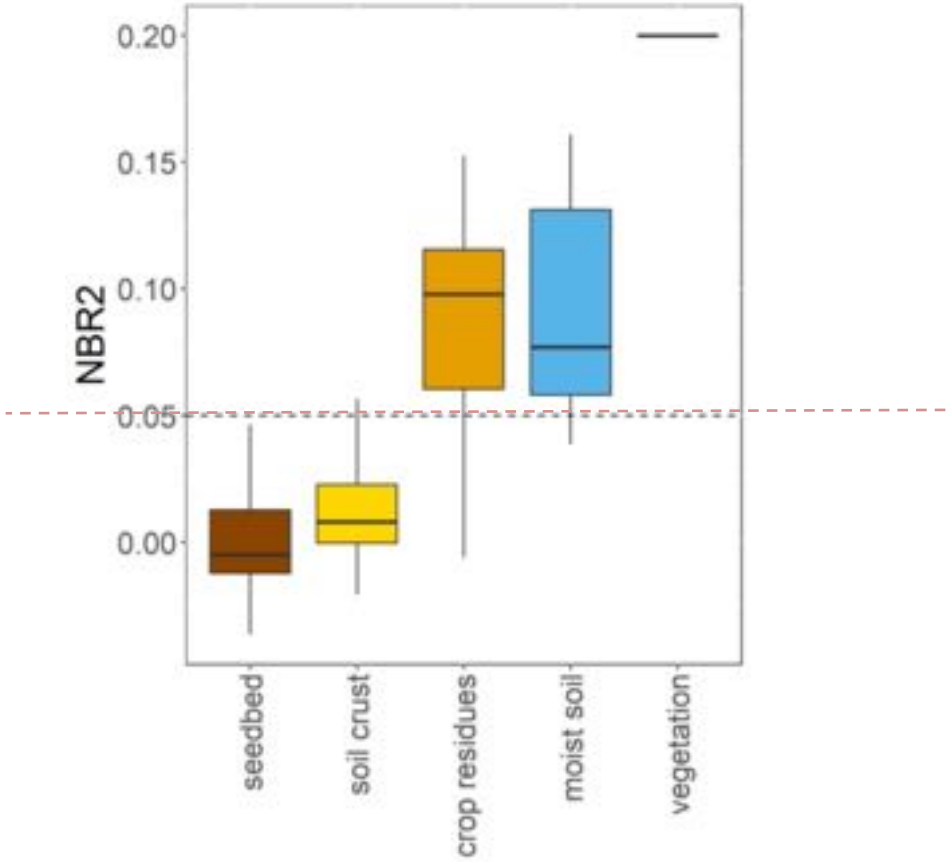
How do we eliminate/correct Sentinel-2 reflectance spectra that are affected by crop residues, soil moisture and crusts?

Solved since the 70ies (NDVI)

NBR2 to remove crop residues and soil moisture

$$\text{NBR2} = \frac{B11 - B12}{B11 + B12}$$





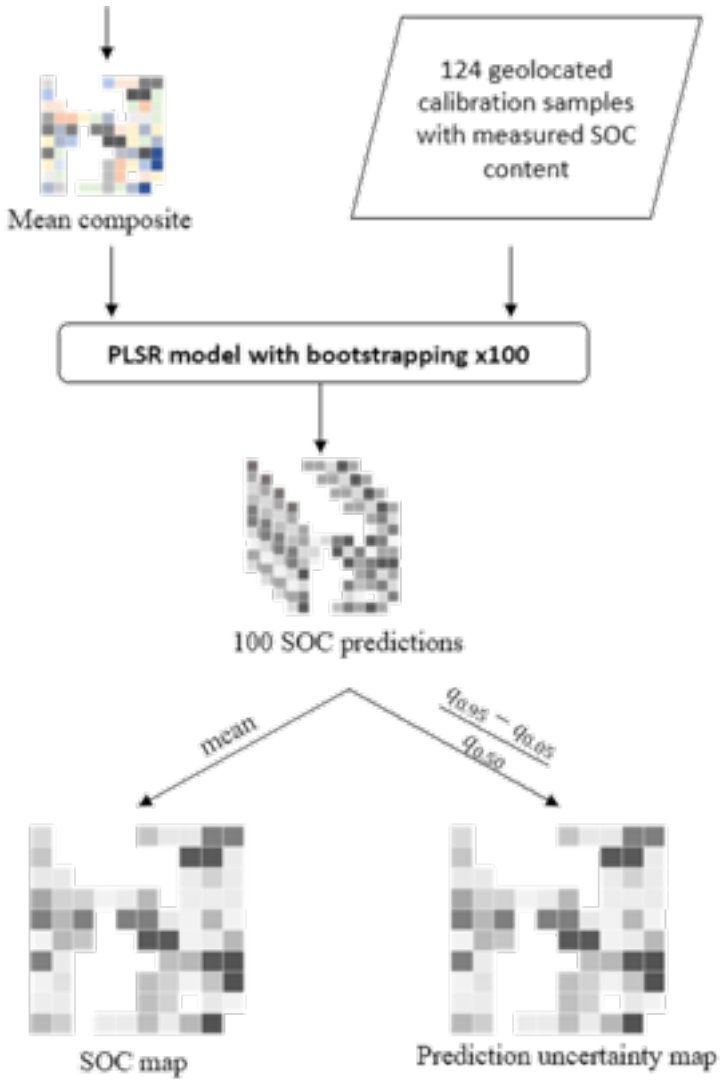
NBR2 < 0.05 is effective to mask soil moisture and crop residues

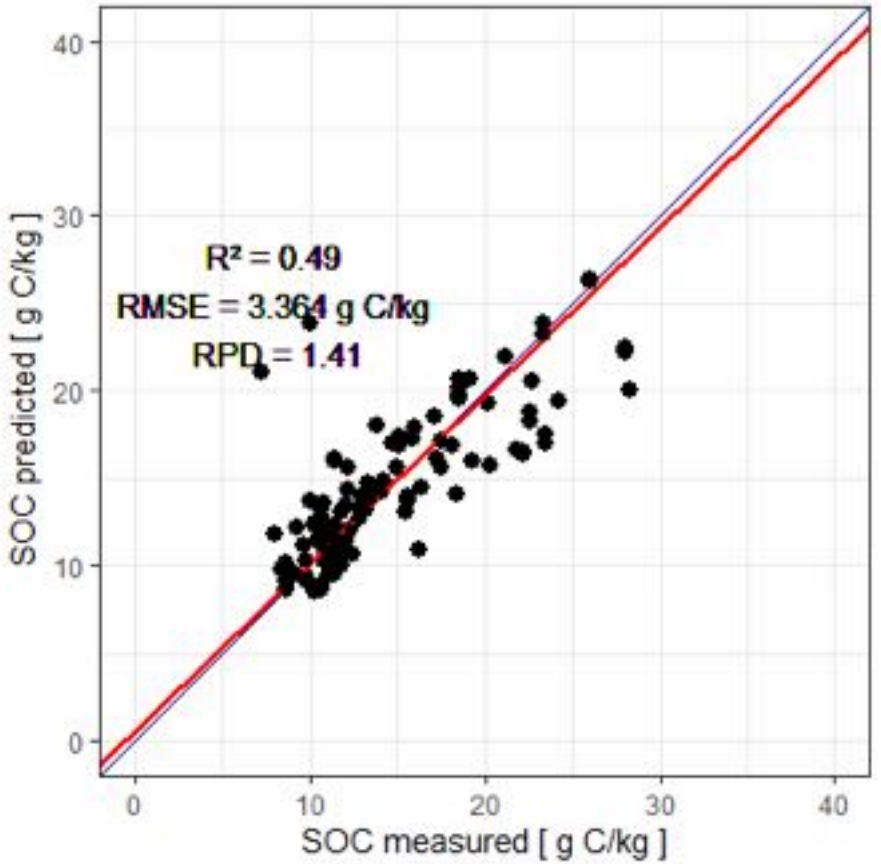
Study area & methods

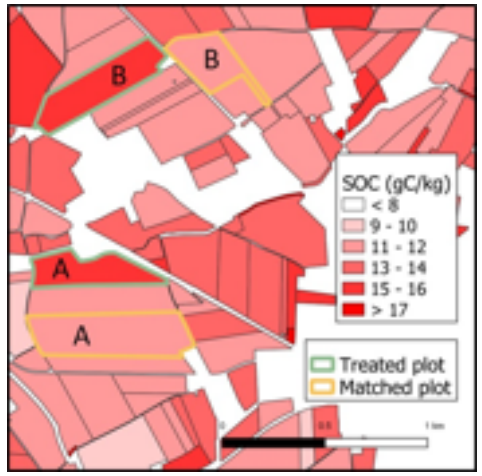
- 3 S2 tiles covering croplands
  - Belgian loam belt
  - Dutch polders
- 124 geolocated calibration samples (in blue)
- PLSR model

Achievements

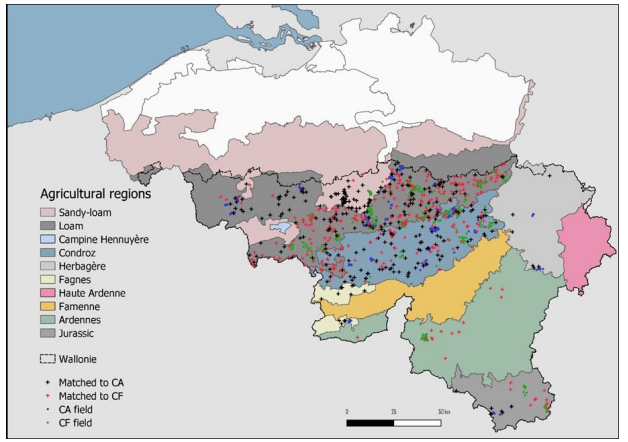
PLSR modelling & Uncertainty

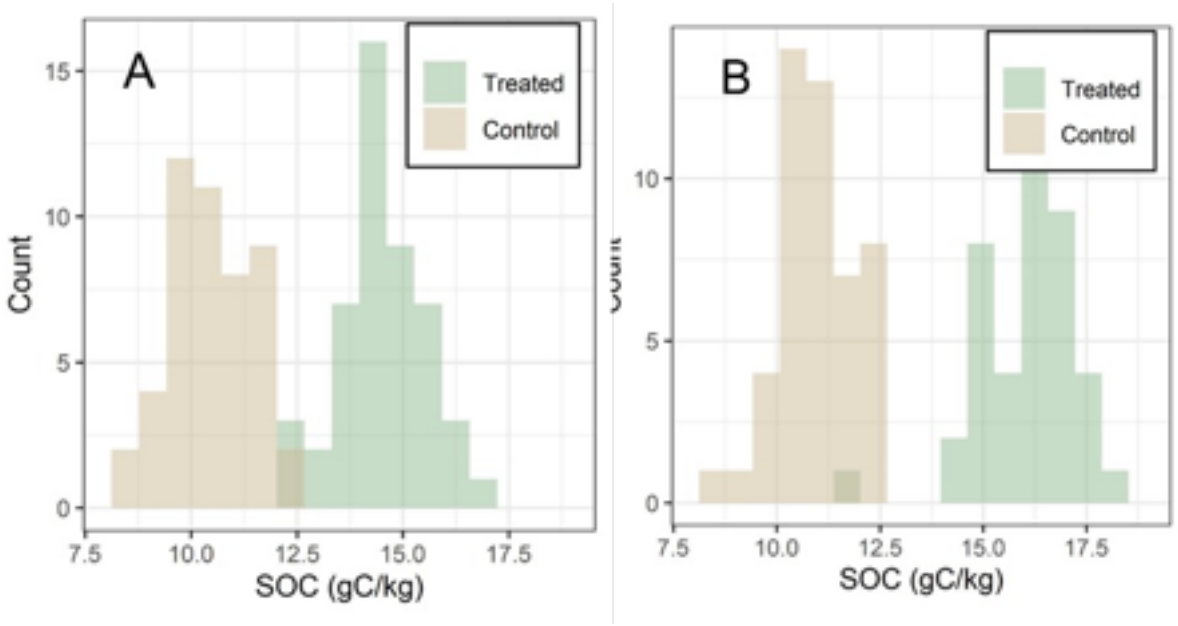




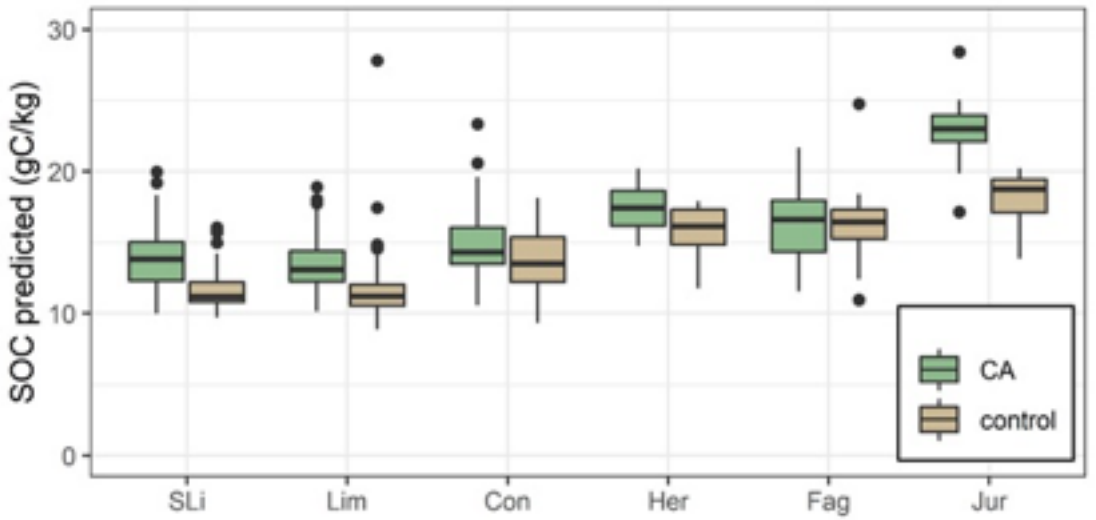


Effects of conservation agriculture on SOC content





Bootstrapping: differences between fields



Paired fields : differences within a region

Future steps

- An improved detection of residues by narrow SWIR bands (2030, 2100 and 2210 nm)
- Bootstrapping distinguishes CA from paired fields (70 %)
- Optimization of soil composites: spatial coverage vs length of acquisition
- Time series analysis for drivers of SOC change: cover crops, tillage, length of bare soil period