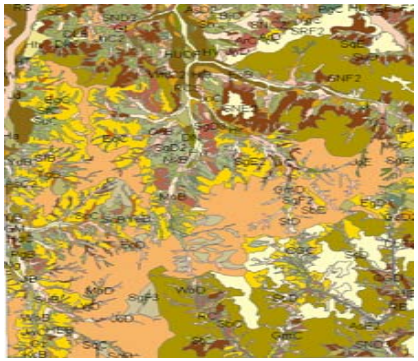

Digital Soil Mapping of Soil Properties in Korea

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Objective

This presentation estimates soil organic carbon and clay content at the 6 standard depths for Korean soils using the equal-area smoothing spline functions based on the GlobalSoilMap.net specification

Data Used

Prediction

- A Korean soil database based on
  - "Taxonomical Classification of Korean Soils"(2000, NIAST, RDA)
  - mostly collected in **1970's** for soil profile description
  - 380 soil series (as of now 391 soil series in Korea)
  - Soil organic carbon: Tyurin method
  - Clay content: Pipette method

Validation

- Newly collected 168 soil series data **(2009~2011)**
  - used for independent validation
  - checking for the accuracy and uncertainty
  - Soil organic carbon: Walkley-Black method
  - Clay content: Pipette method

Methodology

The Spline tool version 2.0

※ ASRIS 2011, Malone et al., 2010

- a generalisation of the quadratic spline model of Bishop et al. (1999)
  - standard depths: 0-5, 5-15, 15-30, 30-60, 60-100, 100-200 cm
  - 1-cm interval depth from 0-200 cm

Mapping depth-wise soil properties

- derived mean values from the fitted spline at standard depths
- matching soil series to the soil map polygons
- rasterized the results to 100 m grid according to G.S.M.net criteria

Validation/Uncertainty of prediction

- The spline predicted soil properties were resampled to match with the soil depth of recently collected soil profiles: 0 to 15~60 cm

※ GlobalSoilMap.net specification

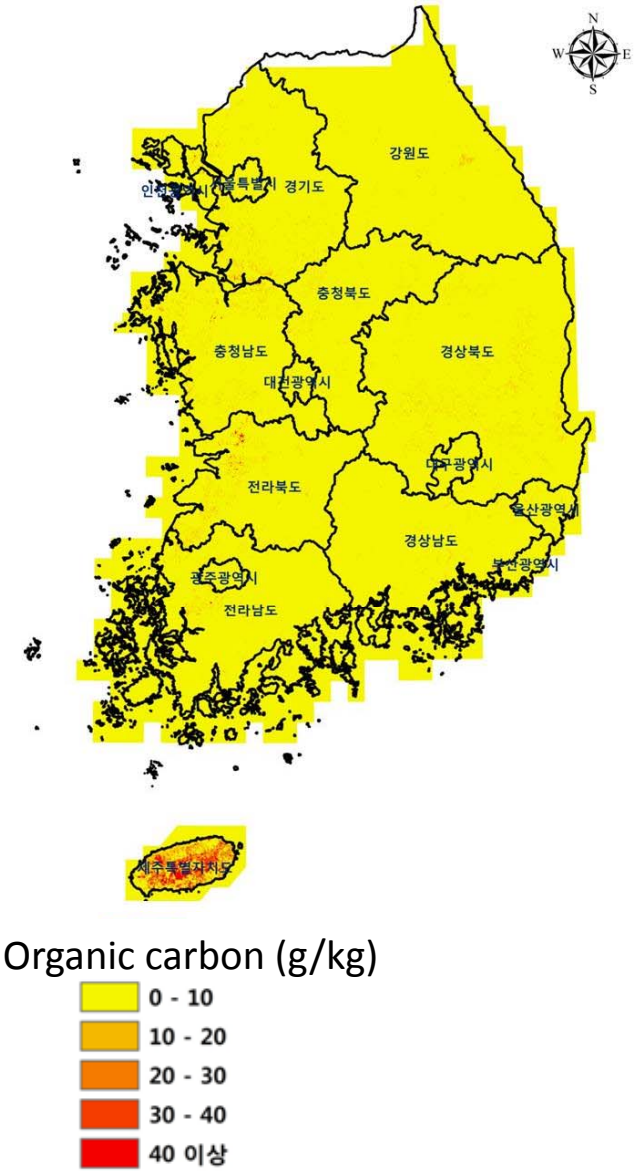
Results

Distribution of soil organic carbon and clay content at different soil depth

Standard depth(cm)	Organic carbon (g/kg)			Clay content (%)		
	mean	median	std.dev.	mean	median	std.dev.
0-5	12.7	9.8	10.1	12.2	10.6	7.4
5-15	11.7	9.4	9.0	12.4	9.5	7.2
15-30	8.3	7.1	6.4	12.8	9.8	7.0
30-60	4.5	4.9	4.9	12.7	11.1	7.2
60-100	3.2	2.9	6.9	11.2	8.4	8.0
100-200	3.3	3.0	8.6	10.8	7.5	8.4

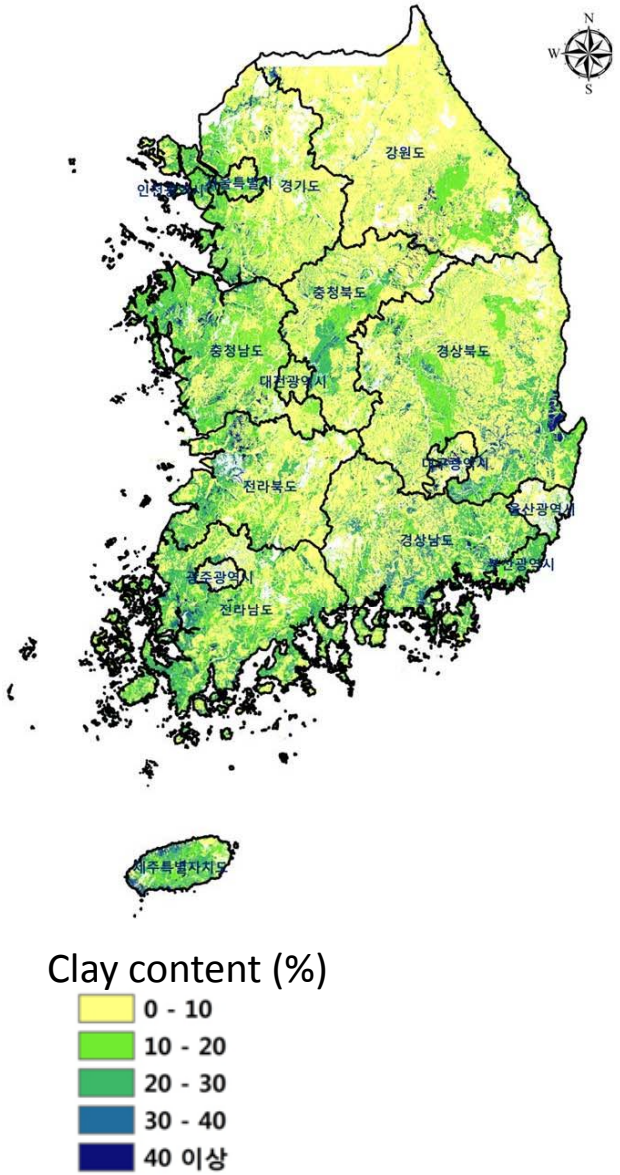
Results

60-100cm



Organic carbon (g/kg)

- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 이상

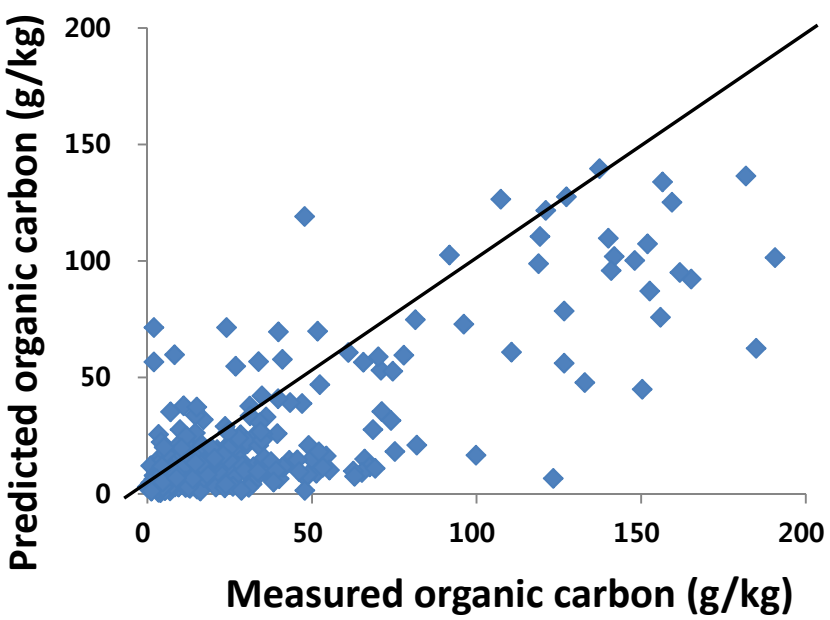


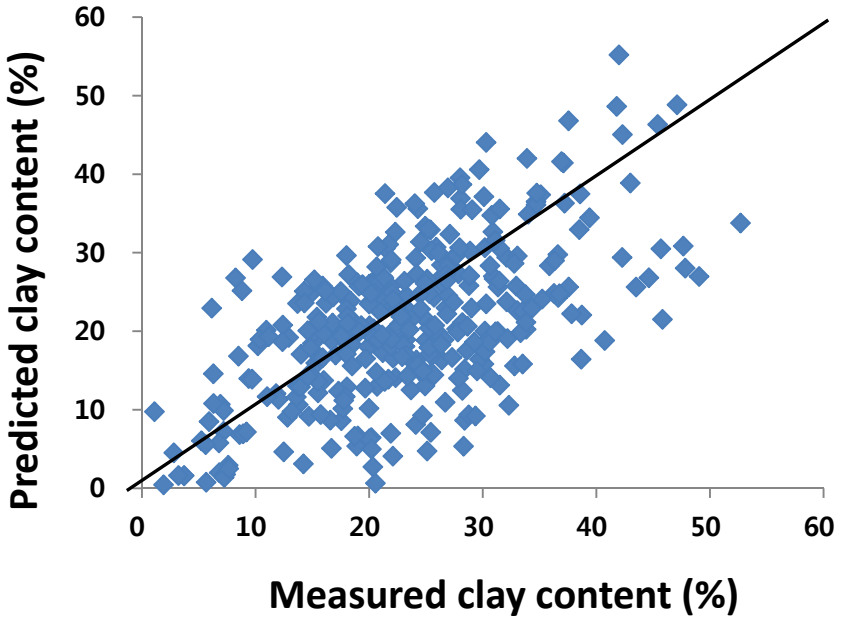
Clay content (%)

- 0 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 이상

Predicted soil profile of organic carbon and clay content in 5 profile layers

Results





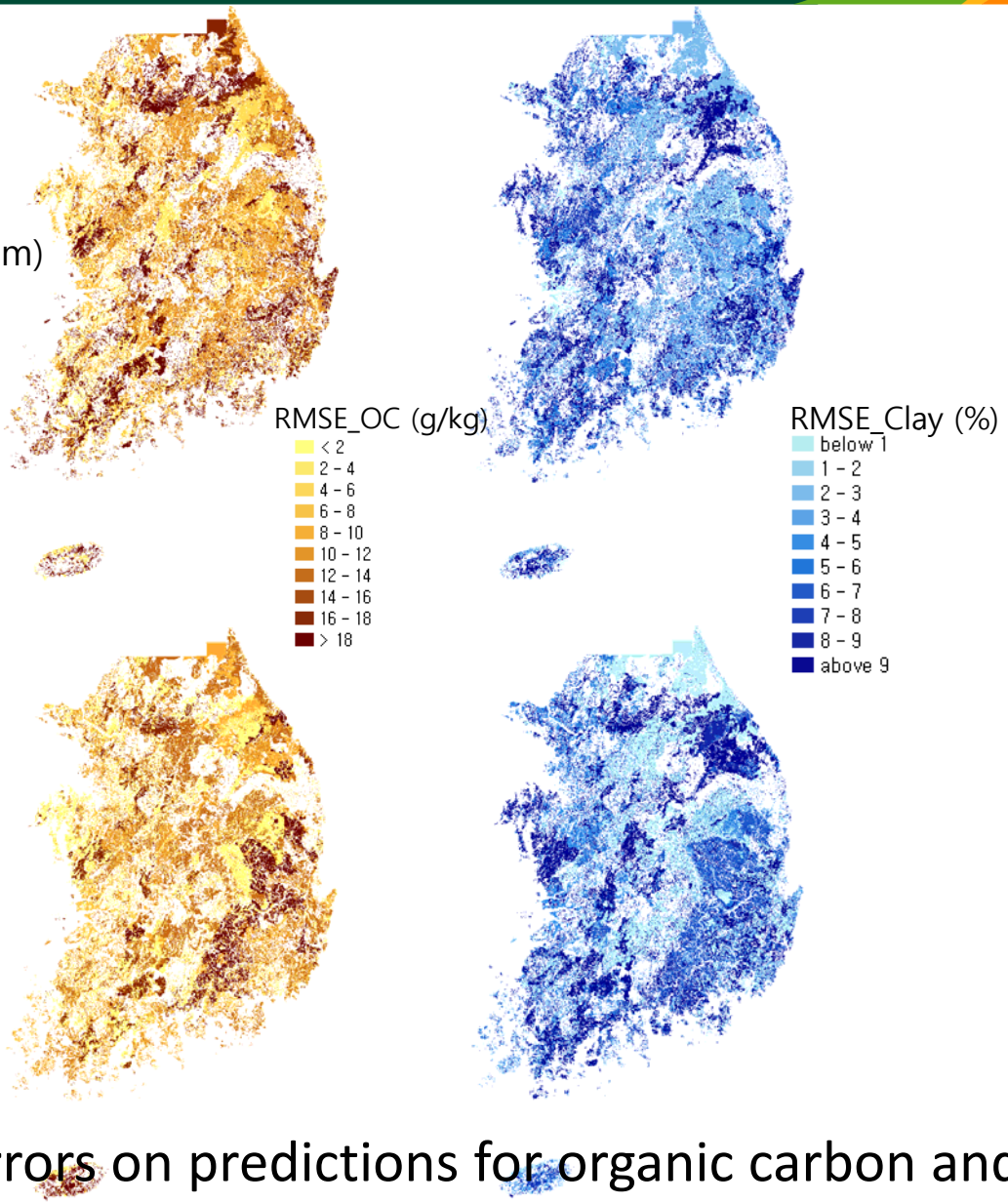
Scatter plot of predicted vs. recently measured organic carbon(left) and clay content(right) from 0 to 15~60 cm

Results

Uncertainty
Expressed as RMSE

0~ ≒35 cm
(Mostly 0~below 20 cm)

≒15 ~ ≒40 cm



Root-mean-square errors on predictions for organic carbon and clay content in 2 profile layers

Summary

Soil organic carbon and clay content for Korean soils were estimated based on the equal-area smoothing spline and mapped corresponding soil series to produce spatial and depth-wise soil property maps.

Recent collected point data used as validation/uncertainty estimates

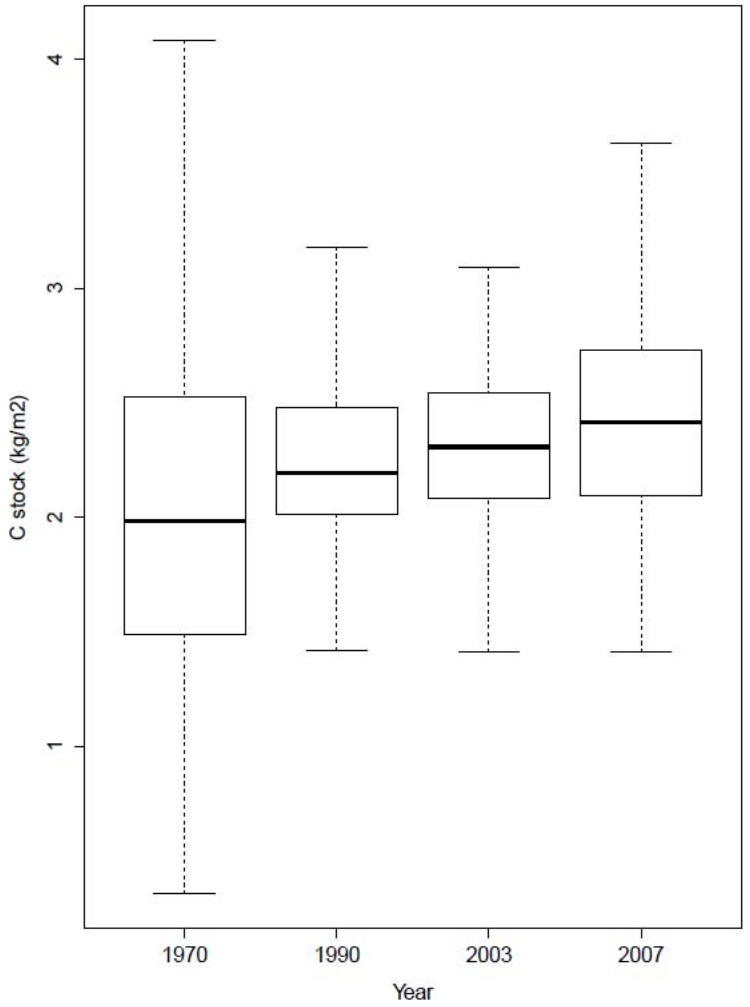
Mapped clay content showed good agreement with recently sampled data.

Detailed soil map can create maps of continuous soil properties with great accuracy!

Summary

- Soil organic carbon map showed a high uncertainty which may be due to the dynamic nature of soil carbon

Sand, Silt, pH,…



Minasny et al. 2012. Global Biogeochemical Cycles