Monitoring soil Organic CArbon in croplands using Imaging Spectroscopy (MOCA)

Research programme for earth observation STEREO II

Federal Science Policy Belgium, collaboration with Fonds National de la Recherche Luxembourg

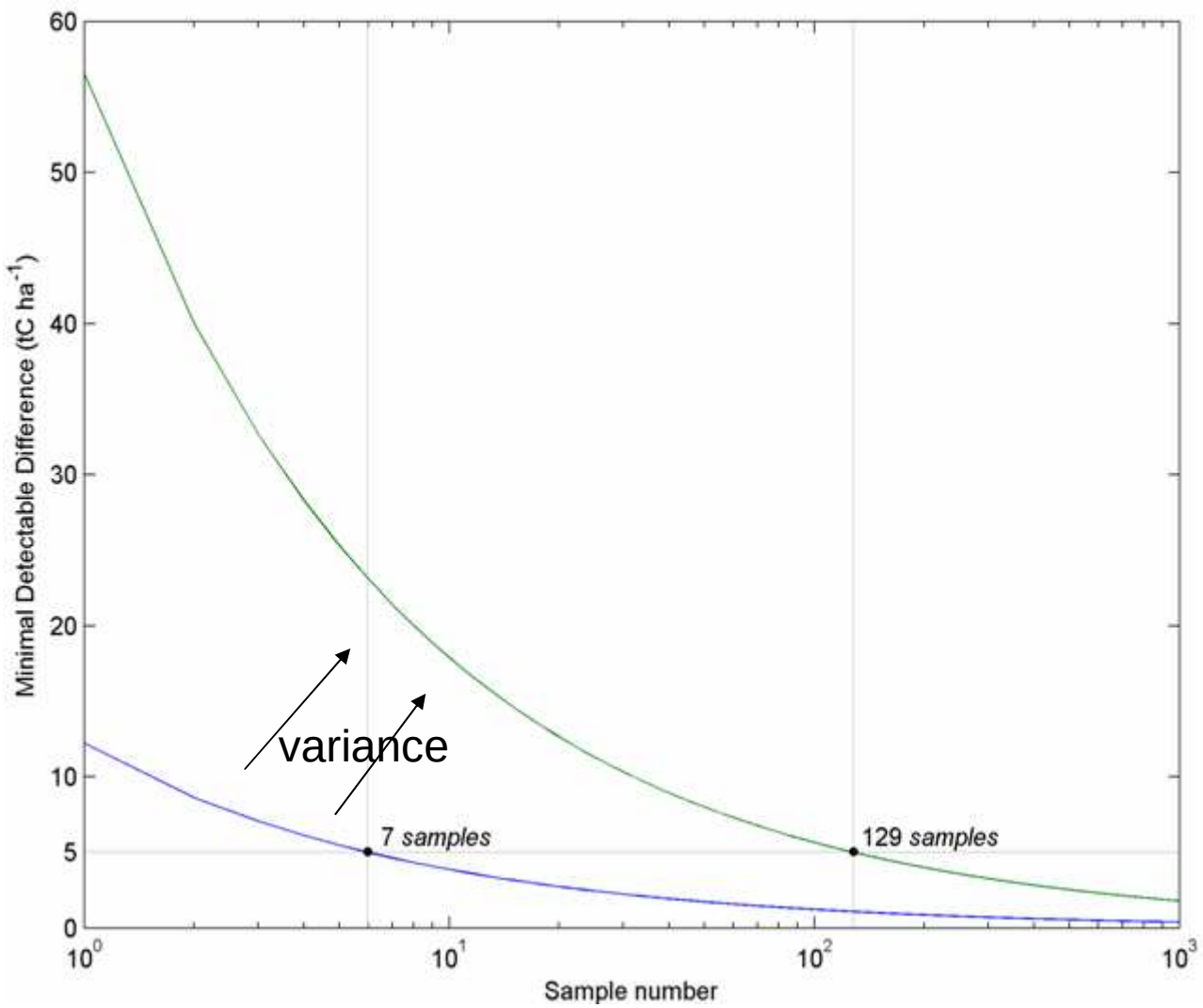
Partners

- Department of Geography, Université catholique de Louvain
- Department of Environmental Science and Management, Université de Liège
- Centre de Recherche Gabriel Lippmann
- Herdbuch Service Elevage et Génétique CONVIS

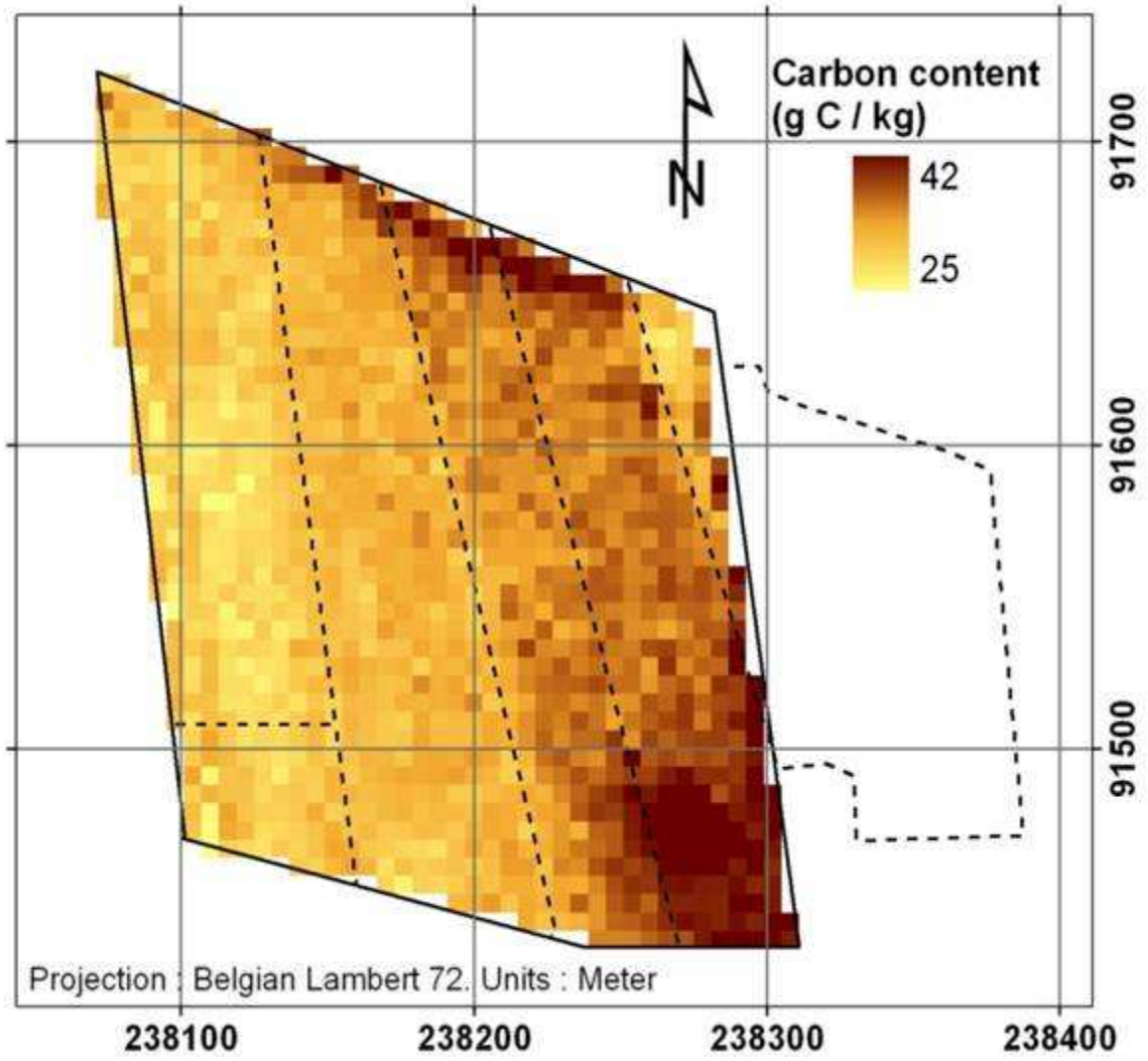
Objectives

- Develop an efficient and operational methodology to detect/map Soil Organic Carbon (SOC) concentrations of topsoils in cropland using imaging spectroscopy
  - Large variability and slow reaction of SOC to agricultural practices
  - Techniques providing a large number SOC data for each field
  - Base line to evaluate effects of management over c. 5 years

Context


Minimal Detectable Difference (tC ha-1)
Sample number
variance
7 samples
129 samples
60
50
40
30
20
10
5
0
10^0
10^1
10^2
10^3

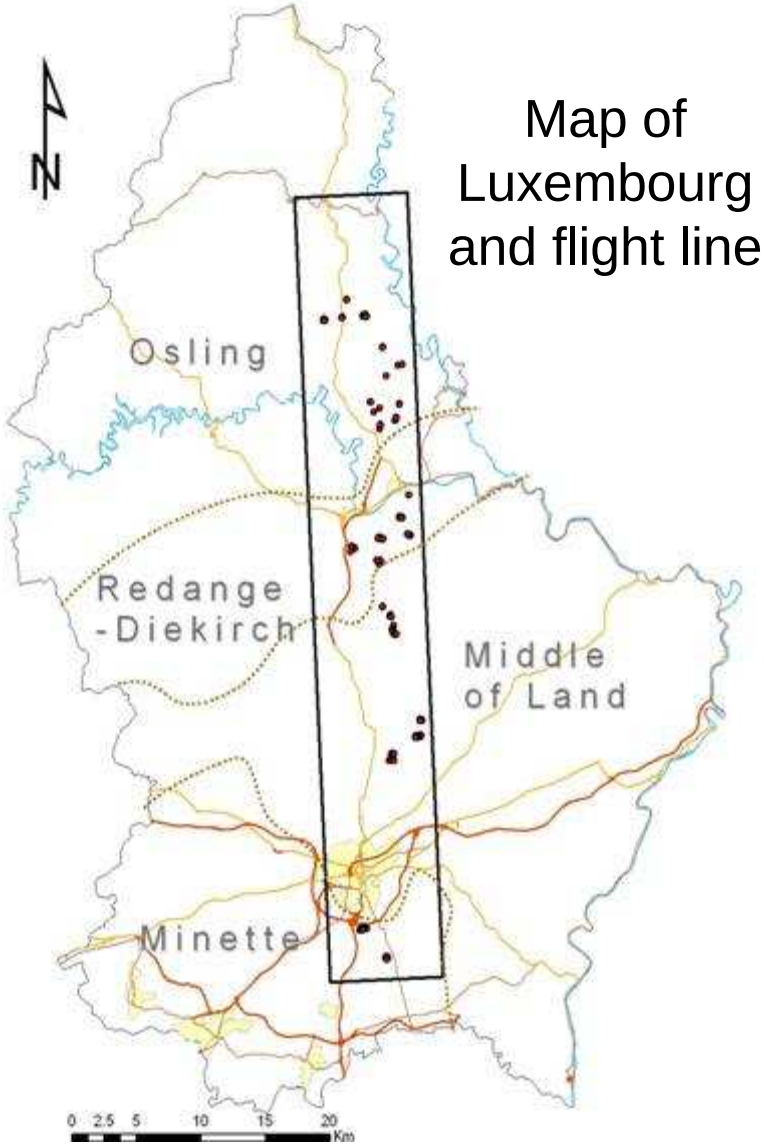
Context


Carbon content
(g C / kg)
42
25
N
91700
91600
91500
238100
238200
238300
238400
Projection : Belgian Lambert 72. Units : Meter

Context

- SOC determination is based on statistical models (PLS regressions)
- In practice, variation in soil properties (other than OC) degrades SOC prediction across space:
  - Soil type/texture
  - Moisture content
  - Roughness (soil self shadow)
  - Vegetation residues
- What is the stability of the method when applied to a large area and soil surface conditions vary ?

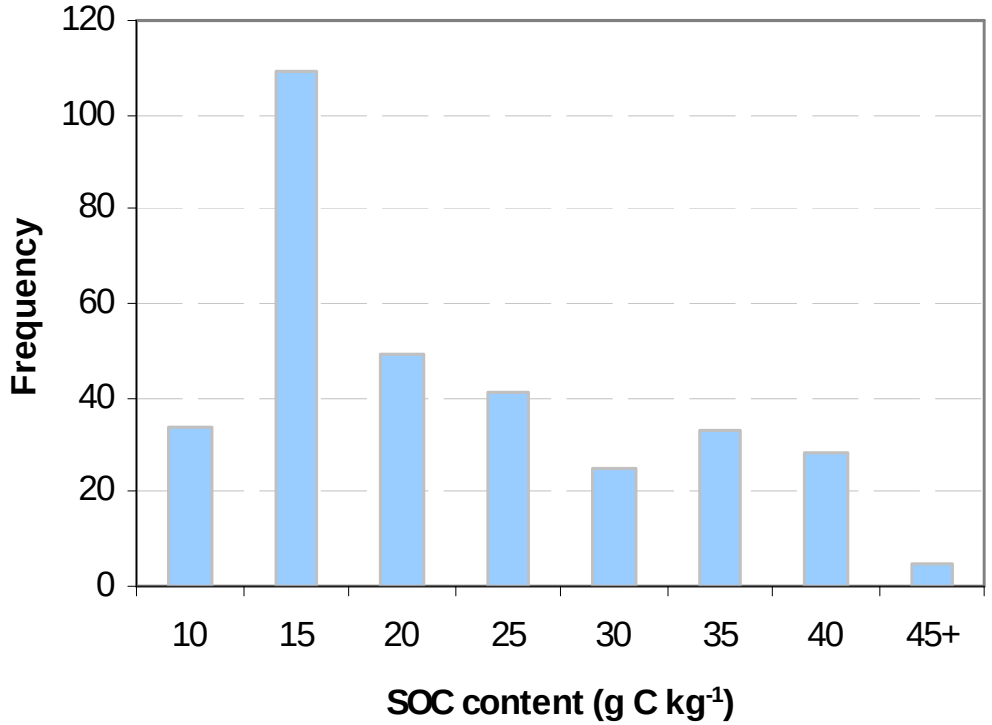
Study area and flight campaign



Map of Luxembourg and flight line

- Imaging spectrometer: AHS-160 (80 bands from .45 to 2.5 µm)
- Ground measurements
  - 325 samples collected in 51 bare agricultural fields
  - SOC content
  - Moisture content of top 1 cm
  - Bulk density
  - Field spectral measurements
  - Soil relative shadow

Results of the measuring campaign



Area	N	Mean	Max	Min	CV
		g C kg^{-1}	g C kg^{-1}	g C kg^{-1}	%
Minette	50	13	17	10	11
Middle Land	101	21	41	7	57
Osling	80	29	61	14	24
Redange	95	16	24	11	19
All	325	20	61	7	48

Expected results

- Different PLS-spectral model for each agropedological region/soil type and a global model
- Production of SOC maps along the transect
- Feasibility and optimal conditions for the use of imaging spectroscopy
- Time required to detect a change in SOC based on variance (error + spatial variability) and number of samples

Thank you for your attention