Digital Soil Mapping

Future Directions in Europe

European Commission
DG JRC

Florence Carré & Luca Montanarella
1. Who are we?

2. DSM basic principles

3. European soil context

4. How DSM can help the European policies?
What is the Joint Research Centre?

The JRC is a Directorate General of the European Commission

European Commission
25 Commissioners

Mr Janez POTOČNIK
European Commissioner for Research

DG RESEARCH

DG JRC

DG ENVIRONMENT

OTHER DGs

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EUROPEAN SOIL BUREAU NETWORK

Soil data

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4. How DSM can help the European policies
To provide quantitative soil data, producible at low cost and easy-to-interpret-and-use (for other scientists and policy makers)

To elaborate quantitative methods:
- for mapping;
- for estimating associated accuracy;

Using easily accessible indirect soil information (auxiliary data)
DSM outputs vs traditional maps

Soil type map

CLAY

EC

OM

uncertainty

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Soil observations

Auxiliary data

Soil inference system (spatial, attribute)

Soil attributes
Soil classes

Spatial accuracy

DSM principles
1142 samples over 3700 km²: contents of Cu, Pb, Ni, Zn
DSM principles

Soil observations

Soil inference system (spatial, attribute)

Soil attributes
Soil classes

Spatial accuracy

Auxiliary data
Auxiliary data

NDVI from Landsat image

depth to ground water (InGWD)

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DSM principles

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Spatial accuracy
1. Multiple Linear Regression

\[
Y_j = a_1 X_1 + a_2 X_2 + \ldots + a_n X_n + \varepsilon_j
\]

Soil variable \( j \)  
Auxiliary data \( i \)  
residuals \( j \)

2. Kriging (interpolation process according to spatial autocorrelations of the variable)

3. Summation of the two maps

Regression-kriging
Soil observations

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The European Soil Context

Main target
Make a sustainable use of soil

Main Political frames
The new Soil Thematic Strategy
⇒ To preserve soil functions against threats

The Reform of the Common Agricultural Policy
⇒ To solve the dilemma producing food while preserving the environment (air, water, soil)

The UN Conventions on Climate Change, Desertification & Biodiversity
⇒ To fight against soil desertification & to preserve biodiversities
⇒ To limit greenhouses gases

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The European Soil Thematic Strategy

-Basics-

- It is been adopted by the EU Commission the 22\textsuperscript{nd} of September 06

- It is built to fill the gaps in terms of soil protection between existing soil related politics

- It is based on the fundamental that soil is a non renewable resource

- The objectives are for the EU countries to adopt specific measures for protecting soil functions against soil degradations

- The specific measures are addressed in a 10 years agenda

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The European Soil Thematic Strategy
-Functions against Threats-

**Recognized functions**

- Biomass production
- Storage, filtration & transformation of nutrients, substances and water
- Physical and Cultural medium
- Carbon pool
- Biodiversity pool
- Source of raw material
- Geologic & archaeologic heritage

**Recognized threats**

- Erosion
- OM decline
- Compaction
- Salinisation
- Landslide
- Contamination
- Sealing
- Flooding (COM179/2002)
- EC (COM231/2006)
The European Soil Thematic Strategy
-Obligations for EU states-

PREVENTION

- Integration into sectorial politics
- Precautionary measures
- Preventing contaminations
- Measures to limit and avoid soil sealing

IDENTIFICATION

- Identification of risk areas for the “agricultural threats” - 5 yrs
- Identification of contaminated sites - 25 yrs

ACTION

- Program of Measures
- National Remediation Strategy
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Example of applications

- Soil observations
- ‘scorpan’ layers

Soil inference system (spatial, attribute)

- Soil attributes
  - Soil classes

- Spatial accuracy

Soil functions

Soil threats

Modelling potential erosion in Europe
Use for forecasting the soil erosion dynamics
Modelling changes in soil erosion during one decade

- European Soil Database
- Soil observations
- ‘scorpan’ layers
- Soil inference system (spatial, attribute)
  - Soil attributes
    - Soil classes
  - Spatial accuracy
    - Soil functions
    - Potential erosion
    - Soil threats
  - PESERA Model
- Climate (WorldClim)
- Biomass (NDVI from MODIS)
- Relief (SRTM)
- Time (1990-2000)

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Changes in soil erosion between 1990 and 2000

Work done by S. Selvaradjou
Conclusions

For Europe

- All the threats have to be delineated at the European scale and by EU countries
- In order to take precautionary measures against soil degradation, research should be done on
  - Soil functions modelling (Working Group)
  - Scenario modelling with necessary time series soil data acquisition

For the World

Consortium of Global Digital Soil Mapping (initiative of ISRIC)

- Big effort for delivering maps of soil properties at 90 m resolution
- The soil properties should be then used for modelling threats and functions
Thank you for your interest!

“Unity in diversity”

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