Towards a better understanding of γ-ray for soil mapping – analysis of γ-ray measurements at field sites across Europe

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Motivation

γ-ray data as part of mobile geophysical platforms for DSM
• fast and efficient data acquisition for large areas
• use for geophysical transfer function, also at landscape scale

1. Reliability of towed measurements (carborne) compared to point measurements
2. Comparability of field measurements at different field sites and times

Carbon 40K; decay series of 238U and 232Th
• concentration [% ppm]
• 90% of topmost 30 cm
• 5 s sampling interval

Reliability of towed measurements

Comparison between towed and point field measurements at the same time

Field site of Roßlau

Reliability of towed measurements

<table>
<thead>
<tr>
<th>Easting [UTM]</th>
<th>Northing [UTM]</th>
</tr>
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<tr>
<td>311200</td>
<td>5751400</td>
</tr>
<tr>
<td>311400</td>
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<td>5752000</td>
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<tr>
<td>312000</td>
<td>5752200</td>
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</tbody>
</table>

Towed measurements 1 m profile distance in subplots
15 minute point measurements

Soil properties
• Geological origin
• Grain size
• (clay mineralogy)
• Organic matter

Challenge
• Soil moisture
• Meteorological conditions
• Fertilization

Comparison between towed and point field measurements at the same time

Subplot A

Subplot B
Comparability between field sites

1. Motivation
2. Introduction
3. Reliability of towed measurements
4. Comparability of field sites
5. Conclusion

Roßlau: flood plain area, Germany
Gleysols
October (dried and surface)

γ-ray point measurements (15 min)
soil sampling

Lany: Upper carboniferous
Czech Republic
Haplic Cambisols and Luvisols
September (in-depth dry soil)

γ-ray point measurements with calibration soil samples

higher lab values

good correlation for K and Th
no correlation for U

radio active decay

238U

different daughter products

226Ra

214Bi

206Pb

gas

leaks from soil under dry conditions

accumulates in soil and on surface under wet conditions disturbs equilibrium

but not such problems with Th and K!

Conclusion

1. Reliability of towed measurements (carborne) compared to point measurements
   → no need for time consuming point measurements (resolution, driving velocity, profile distance)

2. Comparability of field measurements at different field sites and times
   → lab γ-ray data of K and Th values for comparison between sites
   → lab γ-ray data of U are not useful
Thank you for your attention!

Sampling schemes

Digital Elevation Model,
(Other additional Information)

Latin Hypercube Sampling