Chair of Hydrology and River Basin Management
TUM School of Engineering and Design
Technical University of Munich

Study Project – Environmental Engineering

Workload: 12 ECTS, 360 Hours

Verification of soil scanners – A case study in Lower Bavaria

Description:

Soils are essential but relatively unknown variables in hydrological modelling, and due to limited measurement development, it is difficult and expensive to get spatially distributed detailed information about them. Recently, scientific groups developed so-called soil scanners. These rovers combine different measurement devices to achieve soil water content and particle size profiles. While moving across cropland or grassland, scientists use them to create a 3D model of the topsoil.

At the beginning of the vegetation period (probably mid of March until the beginning of April), two different scanners (Geophilus of ZALF and a Veris soil scanner) will scan some acres of crop and grasslands in Lower Bavaria. With this study project, we (the developers and chair staff) would like to compare and assess the measurement quality of the devices performing a field survey and subsequent soil analysis in our soil lab. The gathered data could be part of a publication in a peer-reviewed scientific journal.

Tasks:

- Create a short literature review about available soil scanners.
- Plan, develop and perform a field survey to get enough undisturbed and disturbed soil samples in different soil depths.
- Analyze the soil samples in the laboratory using sieving, sedimentation and drying.
- Compare the data of the soil scanners with the laboratory results.
- Quantify the measurement uncertainties of the laboratory and the scanner results.
- Assess the quality of the scanners' measurement results with an appropriate method.
- Optional: Be part of the publication team and learn how to write a peer-reviewed scientific paper.

Processing period: 02/2022 – 06/2022

Prerequisites:

- Interest in fieldwork
- Flexibility concerning the field survey, as it is dependent on weather and agricultural conditions
- Some basic knowledge and interest in statistics for the uncertainty quantification
- Motivation and engagement for work in an actual scientific project

Literature:

Meyer, Kling, u. a. 2019: Creating soil texture maps for precision liming using electrical resistivity and gamma ray mapping. In: Precision agriculture '19, 12th European Conference on Precision Agriculture https://doi.org/10.3920/978-90-8686-888-9_67, ResearchGate.

Bönecke, Lück, u. a. 2018: Determining the within-field yield variability from seasonally changing soil conditions. In: Precision Agriculture 19, pp 750-769 https://doi.org/10.1007/s11119-017-9556-z.

Bönecke, Meyer, u. a. 2020: Guidelines for precise lime management based on high-resolution soil pH, texture and SOM maps generated from proximal soil sensing data. In: Precision Agriculture 22, pp 493-523 https://doi.org/10.1007/s11119-020-09766-8.

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