Monitoring and Modelling of Soil Moisture at Characteristic Sites in Lower Franconia (Germany)

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The study is part of the European Development Fund-Project "BigData@Geo - Advanced Environmental Technology Using AI in the Web" which aims to develop a high-resolution regional earth system model for the region of Lower Franconia. The present work provides ground-truth data in order to calibrate the modelling approaches with the regional climate model REMO and the regional soil moisture model WaSiM-ETH.

Lower Franconia belongs to those regions in Germany which are expected to be strongly affected by climate change. Regional climate models show that average temperatures will rise and dry periods as well as extreme precipitation events occur more frequently. However, the consequences of changing climate conditions on soils, landscapes as well as on land use are not sufficiently known for Lower Franconia.

Yields of forestry and agriculture depend very much on the availability of soil water. During the growing season the water retention capacity of soils is therefore highly relevant. Up to present, datasets as well as modelling results of future scenarios on soil moisture are only scarcely available on local as well as on regional scale. In order to generate future scenarios, calculation of the soil moisture regime forms the base in order to evaluate present day conditions as well as to develop prognostic studies. As we intend to obtain most realistic parameters, generation of real-time soil moisture data with high temporal resolution at selected sites is crucial. Our monitoring sites are characteristic for Lower Franconia and serve to calibrate regions for modelling approaches.

In order to obtain data on dynamics and causes of soil moisture fluctuations as well as to understand process flows, soil geographical surveys form an essential component of our research design for selected sites related to the monitoring stations. Furthermore, relevant sedimentological and pedological parameters such as grain size distribution, permeability, and bulk density are analyzed in the laboratory. Thus, our representative test sites combine detailed ground-truth data with soil moisture and thus, form consecutive modules as parts of soil moisture models. These modules drive and control the modelling procedures of the sub-projects and they further serve for assessments and calibration of the area-wide hydrological and climate modelling in the "BigData@Geo" ERDF-project.

Based on our data we can provide qualitative soil moisture information to the public, such as precipitation and infiltration thresholds and seasonal patterns. Combined with the real-time availability of the monitoring data via our online platform "Klimaatlas Unterfranken", we provide valuable information for the shareholders decision making process – regarding for instance plant health, risk assessment during extreme weather events or adapting their businesses to the future climate and soil moisture conditions.