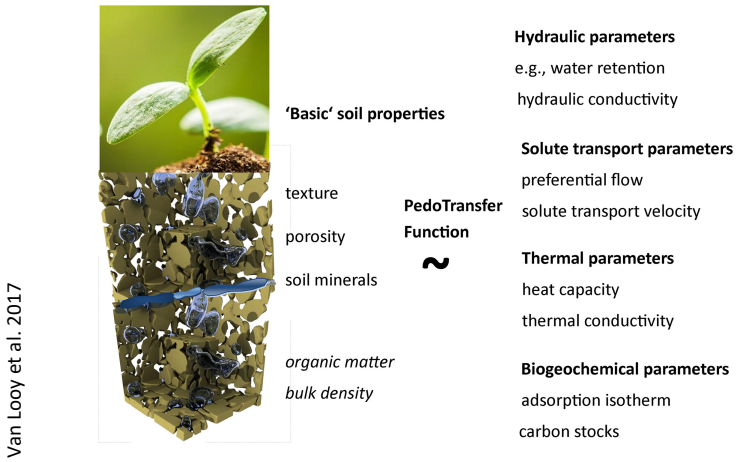
Physics of Soils and Terrestrial Ecosystems (PoSE)

Chair of Hydrology and Water Resources Management

Master Thesis offered

Development of Pedotransfer Functions for Plant Available Water in Ethiopia



Van Looy et al. 2017

Motivation

Quantification of plant available water is critical to assess crop water requirement in water limited areas like Ethiopia. In non-irrigated crops and pastures, plant available water is crucial for the survivability of vegetation. It becomes even more important during a drought. Climate change will lead to more frequent and longer-lasting droughts, making plant available water a crucial factor for predicting future vegetation growth and crop yields. The amount of plant available water does not only depend on climate, but on soil hydraulic properties controlling the water retention. Because the direct measurement of the soil hydraulic properties is not feasible for large areas, pedotransfer functions (PTFs) are applied to estimate soil hydraulic properties. PTFs are mathematical rules (in the simplest case analytical expressions) that link soil hydraulic properties to easily measurable soil characteristics such as texture, bulk density, and organic matter content. These functions can also incorporate remote sensing data, such as average temperature and average precipitation, to further enhance their predictive capabilities. However, PTFs are often region-specific and require validation before they can be applied to new areas. Accordingly, it is expected that none of the existing PTFs can predict the soil hydraulic properties and thus the plant available water for Ethiopia. The aim of this master thesis is to (i) test existing PTFs and (ii) to develop and validate new PTFs for plant available water in Ethiopia, utilizing state-of-the-art statistical methods such as multiple linear regression and machine learning algorithms. The PTFs will be developed using these methods to identify the most important soil and climate properties for estimating plant available water which could contribute to improving future soil moisture management in the area.

You will:

- gain valuable knowledge and skills in applying statistical techniques to real-world data, which can be applied to many other fields beyond soil science.
- explore the relationship between soil properties and the availability of water for plants. This understanding can help inform soil management practices, leading to better agricultural and natural resource management.
- learn how to generate maps that indicate spatial distribution of plant available water in Ethiopia. Such maps can be used to make informed decisions on crop and water management.

Timeline

The project can be started from now on and is supervised by Dr. Peter Lehmann, Julian Schoch and Mosisa Wakjira. We are looking for a student interested in soil physics and statistics.

If you are interested in the project, please contact Julian.Schoch@usys.ethz.ch