EGU2020-15243, updated on 26 Oct 2021
https://doi.org/10.5194/egusphere-egu2020-15243
EGU General Assembly 2020

Systemic modelling of soil functions under the impact of agricultural management

Sara König[1], Ulrich Weller[1], Birgit Lang[2], Mareike Ließ[1], Stefanie Mayer[3], Bastian Stößel[1], Hans-Jörg Vogel[1], Martin Wiesmeier[3], and Ute Wollschläger[1]

[1]Helmholtz Centre for Environmental Research - UFZ, Soil System Science, Halle (Saale), Germany (sara.koenig@ufz.de)
[2]Senckenberg Museum of Natural History, Görlitz, Germany
[3]TUM Technical University of Munich, Germany

The increasing demand for food and bio-energy gives need to optimize soil productivity, while securing other soil functions such as nutrient cycling and buffer capacity, carbon storage, biological activity, and water filter and storage. Mechanistic simulation models are an essential tool to fully understand and predict the complex interactions between physical, biological and chemical processes of soil with those functions, as well as the feedbacks between these functions.

We developed a systemic soil model to simulate the impact of different management options and changing climate on the named soil functions by integrating them within a simplified system. The model operates on a 1d soil profile consisting of dynamic nodes, which may represent the different soil horizons, and integrates different processes including dynamic water distribution, soil organic matter turnover, crop growth, nitrogen cycling, and root growth.

We present the main features of our model by simulating crop growth under various climatic scenarios on different soil types including management strategies affecting the soil structure. We show the relevance of soil structure for the main soil functions and discuss different model outcome variables as possible measures for these functions.

Further, we discuss ongoing model extensions, especially regarding the integration of biological processes, and possible applications.