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Modelling the temporal dynamics of soil hydraulic properties influenced by agricultural management practices

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Soils under cultivation are increasingly under pressure due to rising demands for food production and occurrence of extreme weather events. As a result, agricultural management practices (AMPs) such as conservation agriculture, crop-residue retention and intercropping are often undertaken with a view to improve soil structure and mitigate the detrimental effects of soil erosion. It is well known that storage and movement of water and nutrients in the soil is regulated by soil pore space geometry and hence, the soil structure. Characteristics such as saturated and near-saturated hydraulic conductivity, bulk density or macroporosity are sensitive to the different AMPs and are common indicators used to characterize the effects of such practices on soil physical properties. However, integrating the results of such measurement into mathematical equations that quantify the changes in soil structure is hardly undertaken. A stochastic modelling approach with physically based coefficients was developed by Or et al. (2000) and Leij et al. (2002a,b) to predict the changes in soil pore size distribution as a function of time and pore radius. Consequently, the saturated hydraulic conductivity and later, in combination with porosity, the unsaturated hydraulic conductivity can also be predicted. The objective of this paper is to incorporate the measurement results of selected studies into the existing model that describes the temporal evolution of soil pore size distribution resulting from different management practices. In this talk, we will show the relevance of inclusion of management-induced temporal dynamics of soil hydraulic properties to improve hydrological modelling. We will also discuss how this will improve our ability to evaluate the overall impacts of different management practices and land-use change on the water balance and, finally, promote relevant practices for sustainable land management.

References

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