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Is it possible to reduce prediction uncertainty of Pedotransfer functions by accounting for spatial structure of soil properties

Shengping Wang (1,2,3), Peter Strauss (3), and Guenter Bloeschl (2)

(1) College of Environmental Science and Engineering, North China Electric Power University,Beijing, China (wangshp418@gmail.com), (2) Institute of Hydraulic Engineering and Water Resources Management, Technical University Vienna, Vienna,Austria (wang@hydro.tuwien.ac.at), (3) Institute for Land and Water Management Research, Federal Agency for Water Management,Petzenkirchen, Austria

Abstract: Pedotransfer functions (PTFs) are commonly used in hydrological models for providing soil hydraulic parameters. Although a considerable number of PTFs have been developed for different regions and different soil types, one major concern remains on how their prediction uncertainty changes when applying established PTFs to different regions. Various sources of uncertainties and their propagated effects on hydrological modelling, therefore, have been widely discussed. However, an issue being rarely understood is if spatial structure of soil properties plays an important role in controlling prediction uncertainty of PTFs. To address this issue, we assessed uncertainty of different PTFs for predicting soil water content at wilting point and field capacity using bootstrapping combined with semivariogram analysis. The soil dataset for the study was from different agricultural production areas of Austria. Bootstrapped PTFs were firstly developed for each sampling domain and then applied to domains with a different spatial extent. Prediction uncertainties were assessed for the various domain applications. Prediction uncertainty of PTFs could be reduced considerably when spatial correlation lengths of soil properties were accounted for. However, it seems that the increase in sampling domain radius was not absolutely conducive to reduce the prediction uncertainty further. Since Bootstrapping only explained parameter uncertainty, further work will focus on examining how the other source of uncertainty (including input uncertainty and model uncertainty) would change when spatial structure of soil properties are accounted for in developing PTFs.