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Spatial prediction of soil water retention curves from particle size distribution data using Arya-Paris model

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Predicting soil water retention curves (SWRC) or their model parameters at any unsampled locations using a geostatistical spatial interpolation technique requires a number of high quality retention data. Obtaining SWRC is, however, generally tedious, time consuming, and sometime expensive. Therefore, pedotransfer functions (PTF), which allow one to predict soil hydraulic properties, such as SWRC, from easily measured soil properties, have been developed. One of the common PTF by Arya and Paris (AP) predicts water retention curves from particle size distributions (PSD) and dry bulk densities. In this study a geostatistical spatial interpolation technique was coupled with the AP model to predict water retention curves at given unsampled locations from PSD. There are two approaches available: (1) First, SWRC are predicted from PSD at given observed locations using the AP model. SWRC are then predicted at given unsampled locations through the geostatistical spatial interpolation technique from those predicted by the AP model. This approach is referred to as the PTF-first and Interpolation-later approach or the PI approach. (2) First, PSD and the bulk densities are predicted at given unsampled locations using the geostatistical spatial interpolation technique from observed PSD. Then, SWRC are predicted at the unsampled locations by the AP model from the interpolated PSD and bulk densities. This approach is then referred to as the Interpolation-first and PTF-later approach or the IP approach. Current study compares the performance of these two approaches to predict SWRC at any given unsampled location. Ordinary kriging (OK) one of the most commonly used geostatistical interpolation technique was used. The data used in this study were obtained from the Las Cruces trench site database, which contains water retention data for 448 soil samples. The dataset was then split into two sets, prediction and validation sets. This allows for the computation of prediction errors (mean absolute error or MAE and mean error or ME). The results show that performances of the PI and IP approaches were comparable, while the PI generally requires less workload as the number of kriging one needs to perform is much less for the PI compared to the IP. It was also shown that MAE were almost the same between the PI and the IP.