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Estimating saturated hydraulic conductivity in spatially-variable fields using neural network ensembles

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Modeling contaminant and water flow through soil requires accurate estimates of soil hydraulic properties in field scale. Although artificial neural networks (ANNs) based pedotransfer functions (PTFs) have been successfully adopted in modeling soil hydraulic properties at larger scales (national, continental and intercontinental), the utility of ANNs in modeling saturated hydraulic conductivity (K_s) at smaller (field) scale has been rarely reported. Hence, the objectives of this study are: (i) to investigate the applicability of neural networks in estimating K_s at field scales; (ii) to compare the performance of the field-scale PTFs with the published neural networks program *Rosetta;* and (iii) to compare the performance of two different ensemble methods, namely Bagging and Boosting in estimating K_s. Datasets from two distinct sites are considered in the study. The performances of the models were evaluated when only sand, silt, and clay content (SSC) were used as inputs, and when SSC and bulk density BD (SSC+BD) were used as inputs. For both datasets, the field scale models performed better than *Rosetta*. The comparison of field-scale ANN models employing bagging and boosting algorithms indicates that the neural networks model employing the boosting algorithm results in better generalization by reducing both the bias and variance of the neural network models.