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Quantifying Uncertainty of Pedotransfer Functions on Soil Water Retention and Hydrologic Model Output

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Pedotransfer Functions are often used to estimate soil water retention which is an important physical property of soils and hence quantifying their uncertainty is of high interest. Three independent uncertainties with regard to uncertainty in Pedotransfer Functions are analysed using a probabilistic approach: (1) uncertainty resulting through a limited data base for Pedotransfer Function calibration, (2) uncertainty arising through unknown errors in the measurements which are used for developing the Pedotransfer Functions, and (3) uncertainty arising through the application of the Pedotransfer Functions in a modeling procedure using soil maps with textural classifications. The third uncertainty, arising through the application of the functions to random textural compositions, appears to be the most influential uncertainty in water retention estimates especially for soil classes where sparse data was available for calibration. Furthermore, the bulk density is strongly influencing the variability in the saturated water content and spatial variations in soil moisture. Furthermore, the propagation of the uncertainty arising from random sampling of the calibration data set has a large effect on soil moisture computed with a mesoscale hydrologic model. The evapotranspiration is the most affected hydrologic model output, whereas the discharge shows only minor variation. The analysis of the measurement error remains difficult due to high correlation between the Pedotransfer function coefficients.