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Pedotransfer functions to predict the water retention curves of eastern and northern Tanzanian soils

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Most of the published pedotransfer functions (PTFs) used to predict soil-hydraulic properties from basic soil properties have been developed and evaluated using data from soils of temperate regions. However, those PTFs often perform rather poorly when applied in a tropical context, because of distinct differences in chemical and physical properties of soils from both regions. The objective of the study was to test whether eight existing point and parametric PTFs to predict the soil-water retention curve and developed for soils of the tropics are reliable for Tanzanian soils, and to present new 'Tanzanian' parametric PTFs. Undisturbed (#76) 100 cm^3 large soil cores were taken in northern and eastern Tanzania from 19 horizons covering eight soil orders (Soil Taxonomy/WRB) and six textural classes (Soil Taxonomy). Soil-water retention curves were established between -1 and -1500 kPa using tension tables and pressure chambers. Various soil properties including organic matter, sand, silt and clay content, bulk density, $pH_{H2O,}$$pH_{KCl}$, CEC, base saturation, dithionite-citrate-bicarbonate extractable Fe and Al, and X-ray determined clay mineralogy, were determined. In order to correct the soil-water retention curves for changing bulk density in case of swel/shrink soils, soil-shrinkage characteristic curves were determined when appropriate. When considering the water content at -10, -33 and -1500 kPa, and available water capacity AWC (10-1500 kPa, 33-1500 kPa), best results were obtained with the parametric PTF of Hodnett and Tomasella [2002; Geoderma 108: 155-180], although a distinct overestimation was observed for water contents below 0.35 m^3 m^{-3}, and an underestimation for water contents exceeding 0.45 m^3 m^{-3}. Mean Root Mean Square Difference of this PTF was 0.077 and the Mean R^2_{adj} was 0.776. In

presenting a new PTF to predict the van Genuchten parameters for Tanzanian soils, backward multiple regression has shown that θs and θr were highly related to bulk density, silt content, sand content and pH_{H2O} (r=0.97 and r=0.99 resp.), ln(α) to sand content and pH_{H2O}(r=0.89), and n to sand content (r=0.78). Pearson correlation coefficients between the van Genuchten parameters and the various soil properties also showed a strong relationship with CEC. The results indicate, however, that pH_{H2O} was a sufficiently accurate predictor to represent clay mineralogy.