



Evaluation of four models for predicting water retention curves of water repellent soils using parameters from wettable samples

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Soil water retention curve (SWRC) models are useful for studying hydrological processes in wettable and water repellent soils. However, SWRC measurement is time-consuming. For quantification of water movement in water repellent soils, it is necessary to develop a general SWRC model based on hydrophilic SWRC data and the independently determined degree of water repellency. In this study, we investigated four hydrophobic SWRC models based on the van Genuchten equation using water retention data (desorption) of wettable and water repellent sand, loam, and silt loam. Sum of squared errors (SSE), root of mean squared errors (RMSE), and Akaike information criterion (AIC) are applied to compare the model predictions against measurements. The four models are: (1) vG-4, van Genuchten equation with four fitting parameters (θ_s , θ_r , n and α) from hydrophobic soil; (2) vG-1, van Genuchten equation with one fitted parameter (α_{obic}) and three known fixed parameters (θ_s , θ_r , and n) from the corresponding hydrophilic soil sample; (3) vG- α_{single} , modified van Genuchten equation by adjusting the known parameter α_{ilic} from hydrophilic sample with the initial air-dried hydrophobic soil contact angle and the three known fixed parameters (θ_s , θ_r , and n) obtained from hydrophilic samples; and (4) vG- α_{mult} , modified van Genuchten equation by adjusting the hydrophilic parameters α_{ilic} with soil contact angles from hydrophobic samples measured under different water contents, and the three known fixed parameters (θ_s , θ_r , and n) of hydrophilic soils. Although relative lower SSE, RMSE and AIC values are found for the vG-4 model and the vG- α_{mult} model, the vG- α_{mult} model is recommended due to its capability of predicting the hydrophobic SWRC by using the van Genuchten parameters from hydrophilic soil samples along with easily measured contact angles.