Estimating Unsaturated Hydraulic Conductivity: Study the Effect of Tortuosity Factor

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Unsaturated soil hydraulic conductivity is one of the key soil hydraulic properties that, in one hand, is widely used in the studies of water and solute transport in soils, and on the other hand its direct measurement is time consuming and expensive. In this research, in order to study tortuosity factor (l) in the Burdine-Brooks-Corey (BBC hereafter), 59 soil samples from the GRIZZLY database were used. Using a sensitivity analysis, sensitive parameters of this model were determined. To study tortuosity factor, its different values e.g. 2, 1, 0.5, 0, -0.5, -1 and -2 were used in the estimation of unsaturated hydraulic conductivity. The results of sensitivity analysis showed that BBC model is more sensitive to the saturated water content and pore size distribution index. Whereas, the BBC model is less sensitive to tortuosity factor and saturated hydraulic conductivity. The calculated statistical parameter SAE in estimation of unsaturated hydraulic conductivity indicated that the BBC model error with l=2 is less than other values. The results also showed that tortuosity factor is linearly correlated with the power of BCC model with goodness of fit R2=0.96. Based on this approach, tortuosity factor was removed from BCC model, and a new empirical equation was developed to estimate unsaturated hydraulic conductivity. This model was verified using 33 samples of the UNSODA database. The results showed that the developed empirical equation estimated unsaturated hydraulic conductivity better than BCC model in which tortuosity factor was assumed to be equal to 2.