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Prediction of van Genuchten Model Parameters using Fractal Dimension of Soil Water Retention Curve

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The soil water retention curve (*SWRC*) is one of the most important soil hydraulic parameters, mathematical description of *SWRC* is crucial to the study of water movement and solute transport particularly in unsaturated zone. Many efforts including fractal methods have been made in last decades. The fractal geometry was used in this study to establish a relationship between the fractal dimension of *SWRC* and the van Genuchten model parameters. This helps us to estimate the van Genuchten *SWRC* model parameters based on the fractal dimension of *SWRC* and soil clay content. In this study, 75 soil samples with a wide range of soil texture from *UNSODA* database (Leij et al., 1996) were used to analyze the presented relationships in the literature and 20 soil samples with 6 different textures were applied to evaluate the four following methods for parameter estimation, method 1 is based on one extracted physical relationship in this study, method 2 is on the basis of *Rosetta* software, method 3 is a neural network based method developed by Minasny and McBratney (2007) and method 4 is on the basis of empirical relationship developed by using 75 soil samples of *UNSODA* data base in this study. In methods 1 and 4, to achieve the fractal dimension of *SWRC*, Huang and Zhang relationship (2005) between the fractal dimension and soil clay content was used, of which the van Genuchten model parameter, m, was predicted. In method 2 and 3, the m values were predicted using, *Rosetta* model (2003) and Minasny & McBratney method (2007) base on the sand, silt and clay percentages

and using $m = 1 - 1/n$ and $m = 1 - 2/n$ equations, respectively. The results of comparison among m values estimated by the proposed methods showed that methods 1 and 4 are able to predict the van Genuchten model parameter, m, better than methods 2 and 3 but none of the methods used in the estimation of α are able to predict this parameter properly.