Review of Some Fractal Models for Simulation Soil Water Retention Curve

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Abstract

Environmental conservation is one of the main objects of human societies. Contaminants produced by industrial companies are transferred into the soil, rivers and ground waters and make serious environmental problems. To solve this problem, it is necessary to use mathematical models to investigate solute and water movements and soil properties like soil moisture curve and unsaturated hydraulic conductivity. Soil water retention curve is one of the most important characteristics for estimation of soil hydraulic properties such as unsaturated hydraulic conductivity as its direct measurement is time consuming and expensive. Since, measurement of soil moisture curve is unavoidable, soil scientists have tried to use indirect methods like pedotransfer functions and empirical relationships to estimate this characteristic easily. Recently, Fractal Geometry has been applied to characterize soil hydraulic properties i.e. particle-size distribution, soil water retention curve and unsaturated hydraulic conductivity. In this presentation, fractal models of soil water retention curve and their advantages and disadvantages are discussed. Tyler and Wheatcraft (1990) represented a fractal pore-size distribution using Sierpinski carpet model. They assumed no lower cut-off of scale and derived power equation like Brooks and Corey (1964) model. Rieu and Sposito (1991) developed a general theoretical framework for a self-consistent fractal representation of soil as both a fragmented natural material and a porous medium. Their model supposed a lower cut-off of scale vice versa Tyler and Wheatcraft (1990) model. Recently, a more generalized model for *SWRC* was developed based on the pore-solid fractal (*PSF*) distribution (Bird et al., 2000). The *PSF* model displays symmetry between the solid and pore phases (Bird et al. 2000) and covers several existing models as its special cases i.e. Tyler & Wheatcraft (1990) and Rieu & Sposito (1991). Literatures have showed that the *PSF* function fit all the data sets well, whereas the other retention functions (special cases) only matched the retention data for some soils.

Keywords: Fractal dimension, Fractal geometry, Soil water retention curve.