Overview and application of the Raats superclass of soils equations

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The capacity of the soil to hold water and to conduct it through its pores is determined by the water retention and hydraulic conductivity characteristics. Many mathematical relationships have been proposed in the literature to describe these characteristics. Raats (1992; A superclass of soils. In: M.Th. van Genuchten, F.J. Leij and L.J. Lund (eds.), Indirect Methods for Estimating the Hydraulic Properties of Unsaturated Soils, pp. 45-51, UC, CA) introduced a general functional relationship with only four parameters that encompasses four pre-1990 models found in the literature, including the well-known relationships by Mualem – Van Genuchten and Brooks and Corey. To our best knowledge the Raats model has not been used before to describe experimental data.

The aim of this study is i) to present the Raats model in terms of the water retention characteristic, the hydraulic conductivity characteristic and the derived expressions for the differential moisture capacity, water diffusivity and matric flux potential, and ii) to apply the Raats model to experimental data. Soil water retention and hydraulic conductivity data for eleven soils were successively used to optimize the values of the four major parameters in the Raats model. In none of the cases the optimized coefficients indicated that the Raats model approached one of the four sub-models that it includes. Thus, the Raats model gives a unique description of the observed data.