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Estimating Soil Water Retention and Unsaturated Soil Hydraulic Conductivity of Aggregated Soils Using the Additivity Model

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Soil-water potential and hydraulic conductivity relationships with soil water content are needed for many plant and soil-water studies. Conventional soil pore space model lying in the base of “one pore region – one continuum”, described by pair of water retention and unsaturated soil hydraulic functions, often oversimplifies representation of variably saturated porous media as a homogeneous textural pore space. Soil structure has a major effect on soils ability to retain and to conduct water. This is especially right for aggregated soils in which pore space consists of interconnected intra- and inter-aggregate pores with distinct hydraulic properties. When a proportion of the inter-aggregate pore space is significant, in many cases the conventional description of water flow provides results that don’t much an experimental data.

In case of developed “aggregated soil” based on the concept “two pore regions – two continuums” soil pore space is described by two pair of both unsaturated soil hydraulic functions. A special model to estimate these functions is developed based on input data of bulk and aggregate density, structural and textural component distributions. This model was tested with experimental data measured of water retention and hydraulic conductivity of soil cores consisting of aggregates with sizes within narrow ranges. Cores were fabricated from separated individual aggregate fractions of Halpic Chernozem, Podzoluvisol, Halpic Kastanozem soils and artificially prepared aggregates. The obtained results demonstrate the sensitivity of the “additivity” model to estimate both unsaturated soil hydraulic functions for each pore regions.

Keywords: aggregated soil, soil structure, soil water retention, additivity model