



Obtaining soil hydraulic properties with dynamical model of water, vapor and heat transfer using soil drying kinetics

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Soil hydraulic properties, i.e. water retention curve, hydraulic conductivity function and vapor diffusivity depend on soil pore size distribution and soil structure. Although these properties are related and can be expressed one from another, measuring any of them is a time-consuming task. We propose express method for obtaining WRC and other hydraulic functions by fitting detailed model of water and heat transport in the soil to specific experiment of soil drying. The model describes fluid and energy transport in soil as a solution of the coupled system of equations, taking into account processes of water and vapor diffusion due to matrix potential gradient, vapor diffusion due to temperature gradient, thermal conductivity and heat transport due to evaporation and condensation. Experiment is set up as follows: soil sample is fully saturated with water, then it is heated by light with power adjusted in time, so temperature of the surface layer of soil sample remains constant (60 C), during the drying process sample weight and temperature at the bottom of soil sample are measured and recorded. By fitting these time series of drying kinetics with the transport model, hydraulic functions of the soil sample are obtained. The method is tested on samples of typical Chernozem under agricultural use (Kursk region, Russia).