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A simple model describing the soil hydraulic properties over the entire moisture range: Revisiting the water flow process under dry conditions

Yunquan Wang (1), Menggui Jin (1), and Zijuan Deng (2)

(1) China University of Geosciences, School of Environmental Studies, China (wangyq@cug.edu.cn), (2) Center for Carbon, Water and Food, The University of Sydney, Australia

Including film flow into soil hydraulic model development has become a main method to improve the model performance under dry conditions. The relative importance of the capillary flow and film flow, however, is strongly model dependent and is still largely unclear, particularly under the low moisture conditions. In addition, to account for film flow, the existing models usually add complexity to the basic capillary models. In this paper, we present a new simple model that can describe the soil hydraulic properties over the entire moisture range. Different from existing models that regard the film flow as the dominate flow process at low water contents, we assume that the capillary water, though retained in very fine pores, and in small amount, can be more effective in transporting water. The new model, therefore, doesn't need to consider the conductivity results from film water separately. The new model presents a very simple form, with no extra parameters to the basic capillary models. Model testing with universal soil dataset shows that it performs comparably well as other complex models. Meanwhile, a great overestimation of film conductivity was found in the complex models. This new model, in a simple form as the capillary based modes and introduces no extra parameter, would facilitate the unsaturated water and solute flow modeling met in a broad area.