

Water retention behavior of sand as affected by a surrounding medium

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Abstract. An understanding and quantification of the distribution of soil moisture in the vadose zone is important in many applications involving land-atmospheric interaction, evaporation from soils, evapotranspiration, and land mine detection. Natural soil heterogeneity in combination with the flux conditions at the soil surface creates complex spatial and temporal distribution of soil moisture in the vadose zone. Capillary barrier effects at the interfaces of various soil textures contribute to this complexity. The water retention characteristics of soil vary over a wide range. Methods for measuring water retention curve in individual soils are well established. The macroscopic retention behavior in formations that are heterogeneous, however, is not well understood. The goal of this study is to obtain a better understanding on retention behavior of porous medium in a two-media system. We developed a small two-dimensional vertical cell in which two sands are packed in such a way that one sand is surrounded by another sand. Water saturation was measured at several locations within the cell and retention curve was constructed for each sand. Comparing the retention curves measured in the two-sand systems with those measured individually, it was found that the water retention behavior of the “surrounded” sand is affected by the “surrounding” sand. The effect was quite different in cases where coarse sand was surrounded by fine sand and in cases where fine sand was surrounded by coarse sand.