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Measurement of near-saturated hydraulic properties in an aggregated soil subjected to uniaxial compression.

K.R.J. Smettem

Centre for Ecohydrology, School of Environmental Systems Engineering, The University of Western Australia, Nedlands, W.A. 6009, Australia (smettem@sese.uwa.edu.au).

Soil compaction increases soil strength but reduces total porosity at the expense of the large soil voids. The result is a decrease in saturated hydraulic conductivity and an increase in 'field capacity'. In aggregated soils, compression deforms plastically if wetter than the plastic limit, leading to a progressive reduction of inter-aggregate pore space with increasing compression. The larger pores not only reduce in size but may also become isolated. If the soil is drier than the plastic limit the aggregates tend to flatten at their contact points and further compression is resisted. In both cases, the saturated hydraulic conductivity of the aggregated material is considerably reduced.

An increase in contact between aggregates reduces tortuosity for unsaturated flow and may lead to greater near-saturated sorptivity and hydraulic conductivity after compression.

This paper presents near-saturated measurements of soil hydraulic properties (over a range of negative supply potentials from -30 to -160 mm h_20) obtained from a stable aggregated soil at constant initial water content subjected to a range of uniaxial applied stresses from 400 kPa to 1600 kPa. Results are compared with those previously obtained for this soil in an uncompacted state. At negative supply potentials from -60 to -160 mm, unsaturated sorptivity and hydraulic conductivity increase with increasing applied stress and greatly exceed the measured values for the uncompacted soil. The implications for modeling soil water movement and characterizing soil structure by indices based on a flow-weighted 'mean' pore size are discussed.