



WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2002ID4B

Title: Physically Based Models for Hydraulic Properties of Swelling Soils

Project Type: Research

Focus Categories: Hydrology, Solute Transport, Agriculture

Keywords: Water Retention, Hydraulic Conductivity, Swelling Soils

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Abstract

Some of the most productive agricultural soils contain appreciable amounts of active clay minerals and exhibit shrink-swell behavior in response to changes in soil water content and chemical composition of the soil solution. Swelling and dispersion of clay minerals modify hydraulic soil properties and lead to increased surface runoff with negative impacts on water quality of rivers and lakes. Furthermore, cracks forming in dry clay soils provide fast preferential pathways for rapid transport of chemicals leading to potential risks for ground water contamination. In addition to myriad agricultural management and engineering problems associated with changes in mechanical properties and trafficability of such land surfaces, hydrologic predictions of flow and transport processes are seriously hampered. Changes in soil volume and pore space induced by shrink-swell behavior present a challenge to the development of predictive models for flow and transport, in particular to the development of constitutive hydraulic functions. Despite well-developed theory for crystalline and osmotic swelling of clay minerals, translation of lamellar-scale theory to formulation of constitutive hydraulic functions is lacking.