



Thermal Neutron Radiography of Soils

L. G. Tumlinson and J. W. Hopmans

University of California, Davis - Department of Hydrologic Sciences - 214 I Street
Davis, CA 95616, (lgtumlinson@ucdavis.edu)

As for x-rays, neutron radiography is a noninvasive imaging technique based on the attenuation of thermal neutrons. Neutron imaging is complementary to x-rays, as it is especially well suited for materials containing hydrogen atoms and mostly other low atomic weight attenuating materials. Although neutron attenuation techniques are routinely used in engineering, relatively little is known about its application to soils. We will present results demonstrating the tremendous potential of using neutron attenuation techniques to measure spatial and temporal distribution of water in soils at the 0.5 millimeter spatial resolution. The neutron source is a Mark II Triga Reactor at McClellan Nuclear Radiation Center (MNRC) in Sacramento, CA. The reactor runs at 1.8 MW and emits a poly-energetic neutron beam, including the thermal range. Unfortunately beam hardening and neutron scatter are major sources of uncertainty. Recent laboratory experiments conducted at MNRC suggest that beam hardening and scatter are considerably reduced when using deuteriated water, because its cross-section for attenuation of thermal neutrons is much lower than for regular water.