



Soil Water Estimation with Cosmic-Ray Neutrons and Th/K/U-Gamma Rays

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Soil water content is an important factor for hydrological processes (infiltration and runoff), agriculture (plant water availability), and radiation protection (radon emanation). It is known that neutron radiation as well as gamma radiation from natural sources are sensitive to the water content in the soil. Cosmic-ray neutron detectors above the ground are widely used to measure soil moisture by counting the number of ground-reflected neutrons. On the other hand, gamma-ray spectrometers are typically used to measure the spatial pattern of soil texture in the field. However, few experiments show the temporal dynamics of gamma radiation at a fixed location. In our study, we passively measured cosmic-ray neutrons and gamma radiation at the same location, while other studies are presented where both quantities are measured in a large spatial domain. It is found that both quantities show a significant response to rain events. In fact, during periods of soil drying and wetting, both neutrons and K/Th radiation show comparable behaviour. The presentation further describes state-of-the-art Monte Carlo simulations which support the understanding of the neutron response above air, and hypothesizes a direct relation to the natural gamma radiation.