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Utilizing Cosmic Ray data as input for neutron-based soil moisture measurement

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Neutrons on Earth interact with the soil and are substantially moderated by hydrogen atoms. Since the reflected neutron flux is a function of the soil water content, cosmic-ray neutron measurements above the ground can be used to estimate the average field soil moisture. Thus, if the local incoming neutron flux and the abundance of nearby hydrogen pools are known, the reflected neutron flux could be modeled and compared to observed detector count rates. However, the incoming neutrons are secondaries produced by interacting energetic Galactic Cosmic Rays (GCRs) in the atmosphere. The total neutron flux on the ground depends on the solar modulation-dependent GCR flux, the geomagnetic position, and the altitude within the atmosphere. So far, measurements of either the Jungfraujoch neutron monitor (NM) or a NM of similar cutoff rigidity have been used and altered to estimate the neutron flux at the position of each neutron detector. In this contribution we present a new method based on the Dorman function to directly compute the local neutron flux using remote neutron monitor data.

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