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Mobile Soil Moisture Management in High Elevations: Applications of the Cosmic Ray Neutron Sensor Technique for Estimating Field Scale Soil Water Content

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Meeting the demands of a growing global population is one of the principal challenges of the 21st century. Meeting this challenge will require an increase in food production around the world. Currently, approximately two thirds of freshwater use by humans is devoted to agricultural production. As such, an expansion of agricultural activity will place additional pressure on freshwater resources. The incorporation of novel soil moisture sensing technologies into agricultural practices carries the potential to make agriculture more precise thus increasing water use efficiency. One such technology is known as the Cosmic Ray Neutron Sensor (CRNS). The CRNS technique is capable of quantifying soil moisture on a large spatial scale ($\sim$ 30 ha) compared with traditional point based in-situ soil moisture sensing technology. Recent years have seen the CRNS to perform well when deployed in agricultural environments at low to mid elevations. However, the performance of the CRNS technique in higher elevations, particularly alpine environments, has yet to be demonstrated or understood. Mountainous environments are more vulnerable to changing climates and land use practices, yet are often responsible for the headwaters of major river systems sustaining cultivated lands or support important agricultural activity on their own. As such, the applicability of a mobile version of the CRNS technology in high alpine environments needs to be explored. This research details the preliminary efforts to determine if established calibration and validation techniques associated with the use of the CRNS can be applied at higher elevations. Field work was conducted during the summer of 2016 in the mountains of western Austria. Initial results indicate that the relationship between in-situ soil moisture data determined via traditional soil sampling and soil moisture data determined via the mobile CRNS is not clear. It is possible that the increasing intensity of incoming cosmic rays at higher altitudes may have an effect on the signal of the CRNS, however, more work is required to fully understand this phenomenon and is scheduled to resume in the summer of 2017.