A Protocol for Establishing Soil Moisture Observations at the Complex Mountainous Region.

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Soil moisture, controlling the fraction of the water between grounds and atmosphere, has been observed from various measurements to understand the hydrological cycle. Remotely sensing techniques using active and passive microwaves are regarded as an effective method for monitoring soil moisture at the regional scale. To evaluate remotely sensed soil moisture products, ground measurements including Time Domain Reflectometry (TDR) or Frequency Domain Reflectometry (FDR), and Cosmic-Ray Neutron Probe (CRNP) are widely used. In other words, field experiments considering the characteristics of sensors and soil must be preceded to retrieve soil moisture using remote sensing data. Especially, it is more even more important when applying remote sensing in complex terrain such as a mountainous region. Although there are still many challenges in the use of remote sensing technology in complex terrain, monitoring of inaccessible areas is one of the advantages of remote sensing. Therefore this study aimed to establish the soil moisture station, which employs the integration of a CRNP and FDR sensors installed within the CRNP footprint at multiple measurement depths (10, 20, 30, and 40 cm) at the mountainous region. The CRNP was firstly calibrated and subsequently combined with field average soil moisture based on a simple merging framework, to provide a field-scale soil moisture product at each corresponding layer. It was used to evaluate for large scale soil moisture validation by comparing with several model and satellite-based soil moisture products including GLDAS, SMAP, AMSR2, ASCAT, and SAR Sentinel-1. From the preliminary application of field-scale soil moisture for remotely sensed soil moisture evaluation indicated a reasonable accuracy with the highest correlation to GLDAS soil moisture product (0.87 at 40 cm), suggesting the potential of this station. An introduced protocol for estimating soil moisture in the complex mountainous region is expected to provide a better understanding of terrain impacts on soil moisture variability by assimilating field data and satellite-based products through Land Surface Model for improving soil moisture measurements.