



Using Cosmic-ray Neutron Probes in validating the Satellite Soil Moisture Products and Land Surface Models

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Cosmic-ray neutron sensing (CRNS) is a promising proximal soil moisture sensing technique at intermediate scale and high temporal resolution. The aim of this study is to assess the use of CRNP's in validation of satellite products and Land Surface Models that can be used in further hydrological and agricultural studies. Validations have been conducted using several existing CRNP stations of COSMOS database and a CRNP station that was installed in the south part of Turkey in October 2016 for the water years 2017 and 2018. Soil moisture values which were inferred from the CRNP station in Turkey was also validated using a time domain reflectometer (TDR) installed at the same location. The CRNP has a very good correlation with TDR which are showing consistent changes in soil moisture due to storm events. Satellite soil moisture products obtained from the Soil Moisture and Ocean Salinity (SMOS), the METOP-A/B Advanced Scatterometer (ASCAT), Soil Moisture Active Passive (SMAP), Advanced Microwave Scanning Radiometer (AMSR) and a global land surface model Global Land Data Assimilation System (GLDAS) are compared with the measurements of the CRNP's. A land surface model (Noah LSM) was also established to calculate soil moisture at various depths (0.1m, 0.3m, 0.6m and 1.0 m). Among the satellite products, SMAP has provided the most reliable results. Correlations with CRNP's of the COSMOS database and SMAP soil moisture products have been much larger at arid/semi-arid regions. H113/H114 Metop ASCAT SSM shows a dubious increase during summer due to sub-surfaces scattering effects in dry periods. The anomaly shows a fairly good response compared to precipitation. Triple Collocation (TC) has also been performed by considering soil moisture values obtained from Noah LSM, SMAP and CRNP. According to the TC results, signal to noise ratios of CRNP and Noah_LSM are higher compared to the satellite products. The potential use of satellite soil moisture products in semi dry areas is discussed in detail.