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Soil Moisture Estimation From Point Scale To Plot Scale

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Soil moisture measurement is crucial for determining hydrological state conditions, soil water fluxes in the vadose zone. Although conventional methods for soil moisture monitoring give data with acceptable range, they are generally invasive and they can not provide adequate spatial resolution easily. Remote sensing tools give the advantage to get spatial information but it is insufficient to understand vertical hydraulic fluxes. In this study, soil moisture measurements have been investigated with using a range of techniques spanning different spatial scales in a test basin, 526 km2 in area, in the south of Turkey. A cosmic ray sensor soil moisture probe (CRS) and an ML3 ThetaProbe (CS 616) water content reflectometry have been installed at an elevation of 1459 m to obtain continuous data. The installed CS616 and CRS soil moisture values have a good agreement; for example, for the dates 20-22.06.2016 the volumetric moisture content obtained from CS616 and CRS were 25.14%, 25.22%,25.96% and, 23.24%, 22.84%, 23.28%, respectively. Undisturbed and disturbed soil samples have been collected from the CRS footprint area, to perform lab analysis for calibrating the CRS and the CS-616, and to analyze the pore water conductivity range. According to the lab analysis, bulk density and porosity vary between 1.719 (g/cm3) -1.390 (g/cm3) and 0.44 -0.56, respectively, whereas D50 particle size average is 0.019 mm. Dominant soil texture is silty-clay-loam and silt loam within the footprint. Moreover, the average pore water conductivity value is obtained as 933 μS/cm and its variation is not directly related to clay content. We explored the use of electrical resistivity imaging (ERI) as a method for mapping variation in water content at a scale that bridges that of the CS616 probes and the CRS sensor. ERI with concurrent TDR surveys were conducted three times in the field. We adopted an ERI electrode spacing of 0.50 m along 19.5 m profiles to examine variation in shallow soil resistivity. Archie's law has been used to investigate the relationship between the water content and resistivity data. From laboratory measurements, Archie's cementation index (m) and saturation index (n) for soils with the footprint of the CRS sensor are 1.57 and 1.152, respectively. Measured bulk conductivity and pore water conductivity values have been used to understand the relationship between soil moisture and resistivity measurements. From these measurements it appears that ERI has limited sensitivity to moisture content as resistivity is principally controlled by variations in pore water conductivity and textural properties.