

LARGE-SCALE REMOTE SENSING OF SOIL MOISTURE USING ACTIVE AND PASSIVE SATELLITE DATA

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Abstract

With large-scale coverages, satellite active and passive microwave data can be used to assess the increase or decrease in the occurrence frequency of precipitation distribution. The approach is to determine the frequency of soil moisture events and the time scale of such events, where in-situ soil moisture and other meteorological data are available to calibrate and to validate remote sensing results. We use active QuikSCAT/SeaWinds Ku-band scatterometer data (global coverage) in conjunction with concurrent passive radiometer data such as TRMM Microwave Imager (TMI, coverage between latitudes 40°N and 40°S), and combined with in-situ measurements from hydrological network such as Soil Climate Analysis Network (SCAN) and from global weather network such as National Climatic Data Center Global Summary of the Day (NCDC GSOD). We show evidence of the correlation of the Ku-band backscatter signature to in-situ soil moisture measurements covering various meteorological conditions and seasonal vegetation growth stages over more than one full year of time-series records. Observed results indicate that surface soil moisture events due to precipitation can be well detected, especially for extreme wet and dry events, with the time-series backscatter data. With a time-resolution of approximately one day, QuikSCAT/SeaWinds data are applicable to determine the time scales from a day, to week, and to longer term. Backscatter signature reveals time scales in the order of days to weeks associated with meteorological events and also the seasonal time scale in the annual cycle associated with vegetation growth. We extract TMI data at 10.65 GHz and 19.35 GHz for both vertical and horizontal polarizations over the same area and the same time period of QuikSCAT/SeaWinds time-series. Auto-correlations of active and passive time-series data reveal the time scale of surface soil moisture variations due to precipitations in the short term and seasonal vegetation changes in the long term. Cross-correlations between active and passive data indicate differences in the response to soil moisture and vegetation changes.