



AN IMPROVED MULTI-INDEX MODEL FOR ESTIMATION OF SURFACE SOIL MOISTURE USING LANDSAT-8 SATELLITE DATA

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ABSTRACT

The surface soil moisture (SM) is one of the key parameter in environmental and hydrological processes. It regulates the exchange of water and energy fluxes at the land surface/atmosphere interface. Timely and accurate estimation of the spatio-temporal variations of SM is important for numerous purposes. Various methods have been developed for quantifying the surface SM profile of vegetated and non-vegetated land covers. Recent remote sensing advances have shown that SM can be measured with a variety of satellite data (optical and SAR), each with its own potentials. In this study, a new approach was developed to estimate SM based on multi index model using different spectral indices derived from Landsat-8 multispectral satellite imagery at three different dates. The combination of normalized difference vegetation index (NDVI), enhanced vegetation index (EVI), normalized multi-band drought index (NMDI) and shortwave infrared water stress index (SIWSI) indices were used to establish the improved multi index model for the estimation of surface SM. NMDI and SIWSI were found more sensitive for soil moisture due to incorporation of near infrared (NIR) and short wave infrared (SWIR1 and SWIR 2) spectral bands because of higher reflectance of soil surface in the SWIR1 and SWIR 2 bands in comparison to any other spectral bands. The parameterization of improved multi-index model was performed using least square optimization techniques and simulated the SM values. Furthermore, the developed model was validated with in-situ SM measurements made on fields each of size 30 m × 30 m. The statistical analysis provided good accuracy ($R^2 = 0.847$) between the computed SM values from the multi-index model and in-situ measurements. The results indicated that an approach of including these indices have significant potential to improve the multi-index model for the estimation of accurate surface soil moisture using multispectral Landsat-8 data.

KEYWORDS: Multi-index model, SM, NDVI, NMDI, EVI, SIWSI