Soil moisture retrieval from combined use of microwave (RADARSAT-2) and optical remote sensing (MODIS)

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The potential of using the newly available, quad-polarized, RADARSAT-2 synthetic Aperture Radar (SAR) data in near surface soil moisture retrieval was examined. Seven Radarsat-2 images have been acquired over the Paddle River Basin (PRB), Alberta, Canada and soil samples, from 9 sites (agricultural, herbaceous and pasture land sites and 25 soil samples from a plot about 200m x 200m per site), have been collected within the basin on those 7 days when the RADARSAT-2 satellite flew over the study site to obtain actual soil moisture information. Soil moisture was retrieved from the RADARSAT-2 SAR data using the popular theoretical Integral Equation model (IEM), linear and nonlinear regressions. Normalized Difference Vegetation Index (NDVI) and Land Surface temperature (LST) from the optical sensor of the Moderate resolution Imaging Spectroradiometer (MODIS) satellite have also been used as predictors in the regression algorithms. The combined use of radar backscatters, LST and NDVI as the predictors produced the best soil moisture retrieval results than using radar backscatters as the only predictor. This is probably because radar and optical data together could provide more information than radar backscatters alone the surface characteristics and the effects of vegetation on soil moisture. With reference to field measurements, soil moisture retrieved from HH polarized RADARSAT-2 SAR data by the best regression and the IEM models over the 9 sites achieved correlation coefficients of 0.89 and 0.91, respectively. Our results are slightly inferior to that of Biftu and Gan (1999) who also retrieved soil moisture for PRB using single (HH) polarized RADARSAT-1 SAR data probably because we conducted our study in the early growing season and so subjected to more pronounced effect of vegetation on soil moisture retrieval than that of Biftu and Gan (1999) who conducted their study during the post harvest season.