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The synergistic use of Sentinel SAR and optical remote sensing for mapping high-resolution soil moisture

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The launch of series of Sentinel constellations has provided data continuity of ERS, Envisat, and SPOT-like observations, in order to meet various observational needs for spatially explicit physical, biogeophysical, and biological variables of the ocean, cryosphere, and land research activities. The synergistic use of this publicly-accessible SAR images and temporally collocated optical remote sensing datasets has provided great potential for estimating high-resolution soil moisture information. In this study, advanced integral equation model (AIEM) which simulates the backscattering coefficient of bare soil and the Water-Cloud Model (WCM) accounting for the scattering effect from vegetation, are coupled to map high-resolution soil moisture. Validation conducted in large-scale campaign of Heihe Watershed Allied Telemetry Experimental Research (HiWATER-MUSOEXE) in northwest of China showed RMSE of 0.04~0.071 m3m3. In addition, the accuracies in describing vegetation contribution from backscatter coefficient were intercompared between different models including WCM and ratio vegetation model. Sensitivity analysis of soil moisture estimation accuracy to vegetation index also extends to different optical remote sensing data sets including Sentinel-2, Landsat 8 and MODIS.