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Evaluating three approaches for disaggregating SOMOS soil moisture to 100 m resolution over bare soil using MODIS optical/thermal and Sentinel-1 radar data

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The DISPATCH (DISaggregation based on Physical And Theoretical scale CHange) method is used for disaggregating the 40 km resolution SMOS (Soil Moisture and Ocean Salinity) soil moisture at a 1 km based on MODIS optical/thermal data. For further disaggregation to 100 m resolution, three distinct radar-based methods are tested over a bare site in Morocco by linking the spatio-temporal variability of the backscatter coefficient and soil moisture data at the 1 km and 100 m resolution. The three methods are known hereinafter as: 1) the weight method which relates the backscatter spatial pattern to soil moisture spatial variability, 2) the regression method that employs the near linear relationship between backscatter and soil moisture 3) the Cumulative Distribution Function (CDF) method which accounts the relative soil moisture as a function of the cumulative probability of the backscatter. Results of each method are evaluated against in situ measurements collected between January 1st, 2016 and October 11th, 2016 over a bare soil site in central Morocco. The weight method significantly improves the correlation between remotely sensed and in situ soil moisture with a determination coefficient (R2) of 0.52 in comparison with that observed between 1 km resolution DISPATCH and localized in situ soil moisture (R2 = 0.31). In contrast, the regression and CDF methods have marginal effect on improving the DISPATCH accuracy at the station scale with R2 between remotely sensed and in situ soil moisture of 0.29 and 0.34, respectively. Likewise, the soil moisture estimates of the weight method show the lowest root mean square difference with in situ measurements (RMSD = 0.032 m3 m-3).