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A performance assessment method for SAR satellite-derived surface soil moisture data using a soil-water balance model, meteorological observations, and soil pedotransfer functions.

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The validation of surface soil moisture products derived from SAR satellites data is challenged by the difficulty of reliably measuring in-situ soil moisture at shallow soil depths of a few centimetres, consistent with the penetration depth of the microwave beam. Our analysis shows that the apparent accuracy of the remote sensing products is underestimated by comparison with inconsistent probe data or measurements at greater soil depths. Our alternative approach uses in-situ meteorological measurements to determine rainfall and potential evapotranspiration, to be used with soil hydrological properties as inputs to a water balance model to estimate surface soil moisture independently of the satellite data. In-situ soil moisture measurements are used to validate and refine the model parameters. The choice of appropriate soil hydrological parameters with which to convert remotely sensed surface soil moisture indices to volumetric moisture content is shown to have a significant impact on the bias and offset in the regression analysis. To illustrate this, Copernicus SSM data is analysed by this method for a number of COSMOS-UK soil moisture monitoring sites, showing a significant improvement in the coefficient of determination, bias and offset over regression analysis using in-situ measurements from soil moisture probes or the cosmic ray soil moisture sensor itself. This will benefit users of such products in agriculture, for example, in determining actual soil moisture deficit.