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# Surface sealing effect on validation of remotely sensed soil moisture predictions

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Recent advances in remote sensing technologies have led spaceborn platforms to emerge as successful tools in studying and monitoring soil moisture dynamics. A common need for all remote sensing missions is intensive ground soil moisture samplings for validating predictions and the calibration of retrieval algorithms usually conducted using a network of soil moisture probes. These probes generally have a minimal size of approximately 5 cm, due to technical limits. When these probes are used for validation at the top soil layer, the validation depth is deeper than the sensor effective penetration depth generally of 0-3 cm, a bias which can affect validation results. In dryland areas, where physical sealing of the soil is a wide spread phenomenon, validation can be even more complex. The seal layer has different hydraulic parameters than the underlying soil, with a much lower hydraulic conductivity that affect both infiltration and evaporation fluxes. The seal layer effective depth was found to be 2 cm or more, depending on soil type and initial conditions at formation. Therefore, the sensor effective penetration depth lies within the seal layer, while the soil moisture probe used for validation is averaging soil moisture reading of both the seal and the underneath soil layers. Whether this can lead to a bias in validation is still an open research gap. To address this gap, a physically-based model was used to simulate synthetic soil moisture dynamics at a single soil profile. The seal layer was assumed to have a 2 cm thickness and was integrated into the model using the Mualem and Assouline (1989) model. The results indicate a significant difference between soil moisture values of the 0-2 and 0-5 cm soil depth intervals under unsealed conditions, with a strong signal of diurnal effect. This effect was found to be highly supressed when the presence of the seal layer is accounted for. Stepwise regression between hourly soil moisture values in the profile and explanatory topographic parameters found the seal layer to supress the effect of radiation and to reduce substantially evaporation fluxes. Therefore, accounting for soil surface sealing when and where relevant could help reduce bias in remote sensing validation measurements.