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# Investigating the impact of improved satellite-rainfall error characterization on soil moisture simulations by land surface modeling

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This study assesses the impact of satellite-rainfall error structure on soil moisture simulations with the NASA Catchment Land Surface Model. Specifically, the study contrasts a multi-dimensional satellite rainfall error model (SREM2D) to the standard rainfall error model used to generate rainfall ensembles as part of the Land Data Assimilation System developed at the NASA Global Modeling and Assimilation Office (NASA-LDAS). The study is conducted in the Oklahoma region, which presents a good coverage by weather radars and multi-year satellite rainfall products. We used high-resolution (25-km / 3-hourly) satellite rainfall fields derived from the NOAA CMORPH global satellite product and rain gauge-calibrated radar rainfall fields (considered as reference rainfall). The NASA-LDAS simulations are evaluated in terms of both rainfall and soil moisture error analysis fields. Comparisons of SREM2D simulated rainfall against reference radar rainfall show that the more complex SREM2D error modeling technique, unlike the standard NASA-LDAS error model, could preserve the rainfall error characteristics across different spatial scales. The study confirms that a multi-dimensional error-structure, as modeled in SREM2D, is needed to generate rainfall ensembles with realistic variability capable of enveloping the reference rainfall. The rainfall uncertainty structure is shown to propagate and produce similar patterns in terms of surface and root zone soil moisture. Thus, soil moisture simulations appear sensitive to the complexity of the error modeling approaches used to generate ensembles. As a conclusion the study shows that perturbing satellite rainfall fields with a complex error model leads to more variability and better accuracy in the simulated soil moisture fields, which should have a beneficial impact on soil moisture data assimilation.