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Assimilation of passive and active microwave soil moisture retrievals

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The assimilation of remotely sensed near-surface soil moisture, typically retrieved from active or passive microwave observations, has been shown to improve modeled profile soil moisture. The assimilation of passive and active microwave soil moisture data has not yet been directly compared, and so this study compares the impact on soil moisture skill of assimilating soil moisture observations retrieved from the passive microwave Advanced Microwave Scanning Radiometer (AMSR-E) and the active microwave Advanced Scatterometer (ASCAT). The assimilation is performed with NASA's Catchment land surface model, using an Ensemble Kalman Filter (EnKF) over 3.5 years. The impact of each assimilation is evaluated using in situ soil moisture observations from 85 sites in the US and Australia, in terms of the anomaly time series correlation-coefficient, R. The skill gained by assimilating either ASCAT, AMSR-E, or both was very similar, even when considered by land cover type. For each land cover type represented, all of the assimilation experiments increased the mean surface and root-zone R, and each assimilation also significantly increased the surface and root-zone R averaged across all 85 sites. Assimilating both data sets consistently matched or slightly exceeded the best results from assimilating either ASCAT or AMSR-E. Also, the ASCAT soil moisture retrieval skill was significantly lower over complex terrain, while assimilating the AMSR-E data generated small improvements at these locations. For maximum accuracy and coverage it is then recommended that active and passive microwave observations be assimilated together.