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A two-pass method to assimilate microwave data into a land model for improving soil moisture and energy partition

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Low-frequency microwave brightness temperature is strongly dependent on near-surface soil moisture, and thus it is possible to improve the output of a land surface model by assimilating these satellite data. However, parameter values in both the model operator (a land model) and the observing operator (a radiative transfer model) may significantly change the products of a data assimilation system. In this study, a two-pass data assimilation technique was introduced to solve this issue. That is, model parameter values are inversely estimated at first using forcing data and brightness temperature data during a long period (so-called Pass 1) before estimating near-surface soil moisture and surface energy partition in each daily assimilation cycle (so-called Pass 2). In the system, the model operator is the SiB2 with some improvements for its applicability to sparse vegetation surfaces, and the observing operators is a Q-h model to estimate the microwave brightness temperature. The forcings are GPCP precipitation and other NCEP reanalysis data with some corrections based on in situ data. The AMSR-E low frequency brightness temperature is assimilated into the land model. This system was tested in the Tibetan Plateau, which is a CEOP reference site. The system not only qualitatively reproduced very significant contrast of soil moisture and energy partitions between eastern and western Tibet Plateau, but also quantitatively reproduced energy partitions observed in the eastern Tibet CEOP reference site.