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Development of a sattelote land data assimilation system coupled with a numerical weather prediction model, WRF

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A satellite Land Data Assimilation System (LDAS-WRF) was developed by coupling the Weather Research and Forecasting Model (WRF), as an atmospheric driver, to physically introduce the soil moisture observations and improve the representation of land surface and lower boundary conditions in Numerical Weather Prediction (NWP) online. The LDAS-WRF consists of Simple Biosphere model version 2 (SiB2) as a land surface driver and a model operator of the system, a radiative transfer model (RTM) as an observation operator, and Ensemble Kalman Filter (EnKF) as a sequential assimilation algorithm. The LDAS-WRF assimilates the soil moisture heterogeneity, using passive microwave brightness temperature at the lower frequency, which has a high sensitivity to soil moisture, and the RTM treats surface and volume scattering of surface soil layer.

The LDAS-WRF was applied to a mesoscale region in the Tibetan Plateau, where the land-atmosphere interactions affect the atmospheric dynamics considerably to evaluate the capability of the system. The experimental results show that the soil moisture and land surface energy fluxes obtained by the LDAS-WRF are successfully improved compared with no assimilation case. It was demonstrated that the LDAS-WRF has ability to apply satellite land observations to estimation of land conditions with high accuracy and provide more correct lower boundary condition to atmosphere in NWP.

Keywords: data assimilation, land-atmosphere interactions, satellite observations, WRF