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Joint Assimilation of MODIS Land Surface Temperature and Airbone L-band Microwave Brightness Temperature into Land Surface Model in Irrigated Fields

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Both surface soil moisture and soil temperature are input variables for microwave transmission model which is as observation operator in a land surface data assimilation system. And the optimal estimation of soil moisture in irrigation fields is restricted by a lack of accurate irrigation information. The objective of this study was to evaluate the impact of the joint assimilation of passive microwave brightness temperature and land surface temperature data in a land surface model on soil moisture characterization under unknown (or known) irrigation conditions. A series of data assimilation experiments was conducted to evaluate the joint assimilation of MODIS land surface temperature and airborne Polarimetric L-band Multi-beam Radiometer (PLMR) brightness temperature into the Common Land Model (CoLM) using the Ensemble Kalman Smoother (EnKS). The Daman station, which is located at an irrigated maize farmland in the middle reaches of the Heihe River Basin, is selected in this study to investigate the performance of the proposed assimilation scheme. The following three tests were performed for unknown irrigation and known irrigation conditions: (1) assimilating brightness temperature observations only; (2) assimilating surface temperature observations only; and (3) assimilating both surface temperature and brightness temperature observations. The results show that the joint assimilation of surface temperature and brightness temperature results in the best characterization of soil moisture profiles under unknown irrigation conditions. The intake of irrigation information maintains good agreement with the true values, and tremendously reduce the RMSE exceed 50%. However, the single brightness temperature assimilation outperform the joint assimilation scheme under known irrigation conditions. Meanwhile, surface temperature assimilation resulted in improved estimation of soil moisture profiles.