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Effects of 4D-Var data assimilation using remote sensing precipitation products in a WRF over the complex Heihe River Basin

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Traditionally, ground-based, in situ observations, remote sensing, and regional climate modeling, individually, cannot provide the high-quality precipitation data required for hydrological prediction, especially over complex terrain. Data assimilation techniques are often used to assimilate ground observations and remote sensing products into models for dynamic downscaling. In this study, the Weather Research and Forecasting (WRF) model was used to assimilate two satellite precipitation products (TRMM 3B42 and FY-2D) using the 4D-Var data assimilation method. The results show that the assimilation of remote sensing precipitation products can improve the initial WRF fields of humidity and temperature, thereby improving precipitation forecasting and decreasing the spin-up time. Hence, assimilating TRMM and FY-2D remote sensing precipitation products using WRF 4D-Var can be viewed as a positive step toward improving the accuracy and lead time of numerical weather prediction models, particularly for short-term weather forecasting. Future work is proposed to assimilate a suite of remote sensing data, e.g., the combination of precipitation and soil moisture data, into a WRF model to improve 7–8 day forecasts of precipitation and other atmospheric variables.