

Improving streamflow prediction with assimilating the SMAP soil moisture data in WRF-Hydro

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Abstract

Surface soil moisture, which governs the partitioning of precipitation into infiltration and runoff, plays an important role in the hydrological cycle. The assimilation of satellite soil moisture retrievals into a land surface model or hydrological model has been shown to improve the predictive skill of hydrological variables. This study aims to improve streamflow prediction with Weather Research and Forecasting model-Hydrological modeling system (WRF-Hydro) by assimilating Soil Moisture Active and Passive (SMAP) data at 3 km and analyze its impacts on hydrological components. We applied Cumulative Distribution Function (CDF) technique to remove the bias of SMAP data and assimilate SMAP data (April to July 2015-2019) into WRF-Hydro by using an Ensemble Kalman Filter (EnKF) with a total 12 ensembles. Daily inflow and soil moisture estimates of major dams (Soyanggang, Chungju, Sumjin dam) of South Korea were evaluated. We investigated how hydrologic variables such as runoff, evaporation and soil moisture were better simulated with the data assimilation than without the data assimilation. The result shows that the correlation coefficient of topsoil moisture can be improved, however a change of dam inflow was not outstanding. It may attribute to the fact that soil moisture memory and the respective memory of runoff play on different time scales. These findings demonstrate that the assimilation of satellite soil moisture retrievals can improve the predictive skill of hydrological variables for a better understanding of the water cycle.

Keywords : Data assimilation, Soil moisture, WRF-Hydro, Streamflow, Ensemble

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