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Assimilating Multi-Mission Satellites Data into a Hydrological Model

Authors : Mehdi Khaki, Ehsan Forootan, Joseph Awange, Michael Kuhn

Abstract : Terrestrial water storage, as a source of freshwater, plays an important role in human lives. Hydrological models offer important tools for simulating and predicting water storages at global and regional scales. However, their comparisons with 'reality' are imperfect mainly due to a high level of uncertainty in input data and limitations in accounting for all complex water cycle processes, uncertainties of (unknown) empirical model parameters, as well as the absence of high resolution (both spatially and temporally) data. Data assimilation can mitigate this drawback by incorporating new sets of observations into models. In this effort, we use multi-mission satellite-derived remotely sensed observations to improve the performance of World-Wide Water Resources Assessment system (W3RA) hydrological model for estimating terrestrial water storages. For this purpose, we assimilate total water storage (TWS) data from the Gravity Recovery And Climate Experiment (GRACE) and surface soil moisture data from the Advanced Microwave Scanning Radiometer for the Earth Observing System (AMSR-E) into W3RA. This is done to (i) improve model estimations of water stored in ground and soil moisture, and (ii) assess the impacts of each satellite of data (from GRACE and AMSR-E) and their combination on the final terrestrial water storage estimations. These data are assimilated into W3RA using the Ensemble Square-Root Filter (EnSRF) filtering technique over Mississippi Basin (the United States) and Murray-Darling Basin (Australia) between 2002 and 2013. In order to evaluate the results, independent ground-based groundwater and soil moisture measurements within each basin are used.

Keywords : data assimilation, GRACE, AMSR-E, hydrological model, EnSRF
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