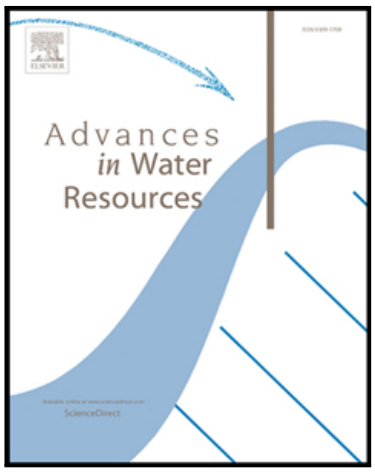

Combined assimilation of streamflow and satellite soil moisture with the particle filter and geostatistical modeling

Hongxiang Yan , Hamid Moradkhani

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Combined Assimilation of Streamflow and Satellite Soil Moisture with the Particle Filter and Geostatistical Modeling

Hongxiang Yan and Hamid Moradkhani

Remote Sensing and Water Resources Lab
Department of Civil and Environmental Engineering, Portland State University

Abstract

Assimilation of satellite soil moisture and streamflow data into a distributed hydrologic model has received increasing attention over the past few years. This study provides a detailed analysis of the joint and separate assimilation of streamflow and Advanced Scatterometer (ASCAT) surface soil moisture into a distributed Sacramento Soil Moisture Accounting (SAC-SMA) model, with the use of recently developed particle filter-Markov chain Monte Carlo (PF-MCMC) method. Performance is assessed over the Salt River Watershed in Arizona, which is one of the watersheds without anthropogenic effects in Model Parameter Estimation Experiment (MOPEX). A total of five data assimilation (DA) scenarios are designed and the effects of the locations of streamflow gauges and the ASCAT soil moisture on the predictions of soil moisture and streamflow are assessed. In addition, a geostatistical model is introduced to overcome the significantly biased satellite soil moisture and also discontinuity issue. The results indicate that: (1) solely assimilating outlet streamflow can lead to biased soil moisture estimation; (2) when the study area can only be partially covered by the satellite data, the geostatistical approach can estimate the soil moisture for those uncovered grid cells; (3) joint assimilation of streamflow and soil moisture from geostatistical modeling can further improve the surface soil moisture prediction. This study recommends that the geostatistical model is a helpful tool to aid the remote sensing technique and the hydrologic DA study.

Keywords: Data assimilation; Particle filter; Markov chain Monte Carlo; Soil moisture; Geostatistical modeling; ASCAT