Geophysical Research Abstracts
Vol. 19, EGU2017-6726, 2017
EGU General Assembly 2017

On the importance of measurement error correlations in data assimilation for integrated hydrological models

Matteo Camporese and Anna Botto
Department of Civil, Environmental and Architectural Engineering, University of Padova, Italy

Data assimilation is becoming increasingly popular in hydrological and earth system modeling, as it allows us to integrate multisource observation data in modeling predictions and, in doing so, to reduce uncertainty. For this reason, data assimilation has been recently the focus of much attention also for physically-based integrated hydrological models, whereby multiple terrestrial compartments (e.g., snow cover, surface water, groundwater) are solved simultaneously, in an attempt to tackle environmental problems in a holistic approach. Recent examples include the joint assimilation of water table, soil moisture, and river discharge measurements in catchment models of coupled surface-subsurface flow using the ensemble Kalman filter (EnKF). One of the typical assumptions in these studies is that the measurement errors are uncorrelated, whereas in certain situations it is reasonable to believe that some degree of correlation occurs, due for example to the fact that a pair of sensors share the same soil type. The goal of this study is to show if and how the measurement error correlations between different observation data play a significant role on assimilation results in a real-world application of an integrated hydrological model. The model CATHY (CATchment HYdrology) is applied to reproduce the hydrological dynamics observed in an experimental hillslope. The physical model, located in the Department of Civil, Environmental and Architectural Engineering of the University of Padova (Italy), consists of a reinforced concrete box containing a soil prism with maximum height of 3.5 m, length of 6 m, and width of 2 m. The hillslope is equipped with sensors to monitor the pressure head and soil moisture responses to a series of generated rainfall events applied onto a 60 cm thick sand layer overlying a sandy clay soil. The measurement network is completed by two tipping bucket flow gages to measure the two components (subsurface and surface) of the outflow. By collecting data at a temporal resolution of 0.5 Hz (relatively high, compared to the hydrological dynamics), we can perform a comprehensive statistical analysis of the observations, including the cross-correlations between data from different sensors. We report on the impact of taking these correlations into account in a series of assimilation scenarios, where the EnKF is used to assimilate pressure head and/or soil moisture and/or subsurface outflow.