Geophysical Research Abstracts
Vol. 18, EGU2016-5231-1, 2016
EGU General Assembly 2016

Mapping Spatial Variability of Soil Moisture in a Semi-distributed Hydrologic Modelling Framework

Hoori Ajami (1) and Ashish Sharma (2)

(1) University of New South Wales, Civil and Environmental Engineering, Sydney, Australia (h.ajami@unsw.edu.au), (2) University of New South Wales, Civil and Environmental Engineering, Sydney, Australia (a.sharma@unsw.edu.au)

The Soil Moisture and Runoff simulation Toolkit (SMART) is a computationally efficient semi-distributed hydrological modelling framework developed for water balance simulations at a catchment scale. The modelling framework is based upon the delineation of contiguous and topologically connected Hydrologic Response Units (HRUs) and distributed cross sections or equivalent cross sections (ECS) in each first order sub-basin to represent hillslope hydrologic processes. HRUs are delineated in each first order sub-basin based on topographic and geomorphic analysis of the entire catchment. A 2-d distributed hydrological model based on the Richards' equation performs water balance simulations across a series of ECSs formulated by aggregating topographic and physiographic properties of the part or entire first order sub-basins. Delineation of ECSs has the advantage of reducing computational time while maintaining reasonable accuracy in simulated fluxes and states. While HRU level soil moisture is well approximated in the ECS formulation compared to the distributed modelling approaches, spatial variability of soil moisture within a given HRU inside an ECS is ignored.
In this study, we developed a disaggregation scheme for soil moisture distribution within every ECS formulated in a first order sub-basin. The statistical disaggregation scheme is developed based on soil moisture simulations of the Baldry sub-catchment, Australia using the integrated land surface-groundwater model, ParFlow.CLM. ParFlow is a variably saturated flow model that solves the 3D Richards' equation for the sub-surface and it is coupled to the Common Land Model (CLM). The disaggregation scheme preserves the mean sub-basin soil moisture and maintains temporal correlation of simulated daily soil moisture. Our preliminary results illustrate that the spatial disaggregation scheme can approximate spatially distributed soil moisture field produced by ParFlow.CLM at 60 m resolution. In addition, the disaggregation scheme in this catchment performs better than the spatial disaggregation approaches based on topographic data. Future work is focused on assessing the performance of this scheme in catchments with dense soil moisture observation networks and incorporating the methodology in SMART modelling framework.