Geophysical Research Abstracts
Vol. 13, EGU2011-12749, 2011
EGU General Assembly 2011

Parameterization of subgrid heterogeneities for hydrologic modelling

Miguel Barrios (1) and Félix Francés (2)

(1) Faculty of Forest Engineering, University of Tolima, Colombia. (miguelbarrios1@yahoo.com), (2) Institute of Water and Environmental Engineering, Technical University of Valencia, Spain.(ffrances@hma.upv.es)

The importance of subgrid heterogeneities on hydrologic predictability has been tested by several researchers in the past. However, the issue of subgrid representation and linking parameters across scales are located at the frontier of current knowledge in hydrological science and it is still needed investigations related to the development of upscaling techniques to improve the description of dominant processes at mesoscale. In this work, we present an approach based on the use of non-stationary effective parameters to take into account the nonlinear effect of subgrid heterogeneities in three soil hydraulic parameters of the distributed hydrological model called TETIS: static storage capacity, upper soil saturated hydraulic conductivity and deep saturated hydraulic conductivity. Assuming a beta probability distribution function for static storage capacity, lognormal probability distribution function for saturate hydraulic conductivities and according to our inverse problem solution, we derived analytically the probability distribution functions of flow and state variables and formulated the averaging equations of non-stationary effective parameters at mesoscale in an integral form. Those analytical equations was solved by numerical integration and tested by Monte Carlo simulations. The main limitation of the analytical scaling equations is the need to carry out numerical integration to find the solution and its inability to take into account spatial autocorrelation of parameters at subgrid level. To overcome this limitation, we propose semi-empirical scaling equations of non-stationary effective parameters and its implementation in TETIS model. The performance of the hydrological model with and without scaling equations was compared using as a case study the Goodwin Creek experimental catchment. Results show a tendency to have better Nash-Sutcliffe efficiencies in validation when using the scaling equations against when using the hydrological model with stationary effective parameters. The findings of this case study are promising because of the improvement in hydrologic predictability, but it is needed the implementation of the scaling equations at other experimental watersheds to judge and contrast its performance at different conditions.