Hydrology and Earth System Sciences
An Interactive Open Access Journal of the European Geosciences Union

Hydrol. Earth Syst. Sci., 12, 77-89, 2008
www.hydrol-earth-syst-sci.net/12/77/2008/

Influence of rainfall observation network on model calibration and application

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Abstract. The objective in this study is to investigate the influence of the spatial resolution of the rainfall input on the model calibration and application. The analysis is carried out by varying the distribution of the raingauge network. A meso-scale catchment located in southwest Germany has been selected for this study. First, the semi-distributed HBV model is calibrated with the precipitation interpolated from the available observed rainfall of the different raingauge networks. An automatic calibration method based on the combinatorial optimization algorithm simulated annealing is applied. The performance of the hydrological model is analyzed as a function of the raingauge density. Secondly, the calibrated model is validated using interpolated precipitation from the same raingauge density used for the calibration as well as interpolated precipitation based on networks of reduced and increased raingauge density. Lastly, the effect of missing rainfall data is investigated by using a multiple linear regression approach for filling in the missing measurements. The model, calibrated with the complete set of observed data, is then run in the validation period using the above described precipitation field. The simulated hydrographs obtained in the above described three sets of experiments are analyzed through the comparisons of the computed Nash-Sutcliffe coefficient and several goodness-of-fit indexes. The results show that the model using different raingauge networks might need re-calibration of the model parameters, specifically model calibrated on relatively sparse precipitation information might perform well on dense precipitation information while model calibrated on dense precipitation information fails on sparse precipitation information. Also, the model calibrated with the complete set of observed precipitation and run with incomplete observed data associated with the data estimated using multiple linear regressions, at the locations treated as missing measurements, performs well.

Final Revised Paper (PDF, 868 KB) Discussion Paper (HESSD)

Citation: Bárdossy, A. and Das, T.: Influence of rainfall observation network on model calibration and application, Hydrol. Earth Syst. Sci., 12, 77-89, 2008. Bibtex EndNote Reference Manager