Geophysical Research Abstracts, Vol. 8, 08582, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08582

Multi-site validation of a distributed hydrological model on a Mediterranean mountainous catchment

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A multi-site validation approach is necessary to further constrain distributed hydrological models. Such an approach has been tested on the Gardon basin located in the mountainous Mediterranean zone of southern France using data gathered over a ten year period on nine internal subcatchments. A spatially distributed hydrological model linked to a Geographical Information System, was used on the basis of simplified physical process representations (infiltration, evapotranspiration, base flow, interflow, overland flow, channel routing), using conventional hydro-meteorological data and readily accessible geographical maps. The model parameters were estimated from a Digital Elevation Model, soil and land-use maps; only five parameters were calibrated for the whole catchment. Three procedures with different levels of calibration and validation were conducted at a daily time step, and the results of both calibration and validation were compared on the basis of their performance with regards to objective criteria representing the water balance and the Nash and Sutcliffe efficiency. The first application corresponds to the case of an ungauged catchment i.e. a simple application of the model without calibration. In the second application, the model was calibrated using discharge values measured at the outlet on the first five year period and validated using data from intermediate gauging stations and on the remaining period at the outlet. In the third application, a multi-site calibration and validation was conducted simultaneously for all available stations using the first five year period and validated on the second five year period for all stations. Calibration against the outlet station and internal validation against eight additional stations re-

vealed some short-comings for a few upstream tributaries. Further calibration against additional discharge stations improved the models performance at the subcatchment level. These different calibration and validation tests challenge the predictive capability of the model both at the catchment and subcatchment level and hence illustrate the possible improvements on the model structure, the input data, the parameterisation strategy, and the use of distributed models for predictions on ungauged catchments.