Simulation of average and low flows through the regional calibration of a rainfall-runoff model, II: model calibration and simulation results

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The study presents, in two companion papers, an approach for regional calibration of a rainfall-runoff model that may be applied also to ungauged or scarcely gauged catchments, since it is based on the knowledge of characteristics of the catchment and of its climate other than hydrometric measurements. In the companion presentation, we describe the use of a regional procedure for estimating selected river flow statistics that describe the main properties of the river flows time series, on the basis of geo-morpho-climatic attributes of the catchments. This second presentation describes instead i) the calibration of the rainfall-runoff model obtained by optimizing the simulation of the statistics derived in the companion presentation and ii) the analyses of the modelled streamflow in simulation mode, focussing in particular on the reproduction of average and low flows.

In detail, the maximum likelihood function in the spectral domain proposed by Whittle is approximated in the time domain by maximising the simultaneous fit (through a multiobjective optimisation) of the selected statistics of streamflow values, with the aim to propose a calibration procedure that can be applied at regional scale. A simple conceptual rainfall-runoff model will be used, of the lumped type and continuously simulating, characterised by a relatively low number of parameters to be calibrated. The experiments will be carried out for different study watersheds in the analysed region, where, along with detailed climatic and geomorfologic information, also precipitation and evapotranspiration daily time series are available. The selected catchments are treated as ungauged, but simultaneous daily series of streamflow are available, for evaluating the results and for a comparison with the simulation provided by a classical least squares calibration of the daily errors. The comparison will analyse, in particular, the performance indexes that highlight the fit of average and low streamflows.