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Automatic calibration using the SCE-UA algorithm for a hydrological distributed model. Application to a Regional Water Resources Estimation study

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Hydrological conceptual distributed models demand large amounts of data, information and parameters in order to accurately represent the spatial variability of the main hydrological processes and inputs. The parameter estimation is always a complex and expensive task which can usually be unaffordable and therefore hydrologists are forced to disregard distributed modelling in favour of lumped or semidistributed models. Our proposal is to distinguish between the effective parameter must be introduced in the model for each cell, and the watershed characteristic estimated from the available information, being the best estimation without loosing its physical meaning. In principle, the first one will be an unknown function of the latest. This function can be called correction function. If the correction function is taking into account the model and input errors, the temporal and spatial scale effects but also the watershed characteristics estimation error, it is reasonable to assume the correction function for each parameter is common to all cells within the watershed. At early stages in our research a general potential function was used, but not significant improvement in the results was obtained compared with an exponent equal to one. For this reason, a simple correction factor was finally adopted. A very important consequence of this parameter structure is that, from the calibration point of view, the number of variables to be adjusted is reduced dramatically: only the common correction factors need to be calibrated, instead of the number of parameters times the number of cells. The selected automatic calibration algorithm was SCE-UA and the variables to be optimized are the initial values of the main state variables and the correction factors. This automatic calibration strategy was used at 17 basins in the Basque Region (NE of Spain) for a Water

Resources Estimation study. The basin area ranges from 62 to 1360 km^2. The available recent year's data was used to calibrate the model. The validation process was performed at multi-site and temporally using remaining data. The final results confirm that it is feasible and efficient to use the SCE-UA automatic calibration method in distributed conceptual models, with 14 basins with a Nash-Sutclife index higher than 0.80. Finally, the daily scale meteorological information of past 50 years was used to generate continue series of daily discharges in more than 70 points.