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Identification of the parameters of rainfall-runoff models at ungaged locations: can we benefit from the regionalization of flow statistics?

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This study aims at finding the most likely parameter sets for an ungauged catchments, when an ensemble of parameter sets has been generated for one or more hydrologically similar donor catchments. We find ourselves in a situation where we suspect that these parameters, although equally acceptable for the donor catchment, are not equally valid for the ungauged catchment we are interested in. We need to add an additional constraint to sort the parameter sets.
Here, we want to use as additional constraint the output of previous regionalization studies, i.e. studies which aimed at identifying 'simpler' caracteristics of the ungaged catchments (long-term annual flow, high-and low-quantiles of the long-term catchment behavior, etc.) The interest of such a procedure comes from our experience with the regionalization of statistical flow values: it is a somewhat easier exercise, compared with the regionalization of model parameters (physiographic information seem to be a better explicans for statistical flow values than for model parameter values).
We show here that we can find a solution to combine constraints from different regionalization relationships, to reflect their uncertainty and possible complementarity. We illustrate our method on a large set of 900 French catchments. The application on a large dataset allows us to evaluate the strenghts and weaknesses of the proposed method.