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Testing the hypothesis of temporal transferability for hydrological models parameters in a changing climate: results obtained on 300 mountainous catchments

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In most hydrological studies, the parameters of hydrological models are calibrated on a period and used to simulate discharges on another. However, the temporal transferability of parameters remains a strong hypothesis, which is worth being confronted to facts. This is all the more true when climate evolutions are considered. This work focuses on mountainous areas, where water availability is closely linked with the processes of snow accumulation and melt controlling the distribution of flows along the year. Considering the trends on mean temperature (both observed and expected), mountainous catchments constitute therefore an interesting playground for testing the temporal/climatic transferability of hydrological models parameters. Series of split-sample tests were performed on a set of 300 French mountainous catchments with two rainfall-runoff models of contrasted structures. Our testing procedure showed that snow simulations can be significantly affected by the climatic conditions met during models' calibration. A tendency to simulate smaller and faster-melting snow packs was found when parameters were transferred to warmer period than the calibration one (as it would be the case in climate change impact studies), the reciprocal being true as well. Errors on annual volumes were limited but the impact on discharges seasonality was significant. This work provides an example of methodology designed for the purpose of hypothesis testing, which can be repeated to study various aspects of the transferability of model parameters. From these results, it can be concluded that temperature differences between calibration and simulation periods must be considered as a cause of additional modelling uncertainties for snow influenced catchments.

Keywords: rainfall-runoff modelling, snow parameters, transferability