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Diagnostic of a regional distributed hydrological model through hydrological signatures

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Distributed models are useful tools for the assessment of water resources in a context of global change. However, due to the high spatial heterogeneity of the corresponding catchments, these models end up being quite complex with a high number of parameters. In particular, it is not easy to obtain good performances and physically sounded parameter values at all points in the catchment. In order to complement the traditional evaluation approach based on performance criteria, we developed a diagnostic approach based on hydrological signatures. A set of hydrological signatures based on precipitation and runoff data was defined and applied to a regional model of the Rhône basin (100 000 km²) in France. The comparison of simulated and observed signatures for 45 contrasted sub-basins of various sizes, climates, geologies and land uses, show that performance and ability to reproduce signatures are not always correlated. The analysis of signature results, combined with additional hydrogeology expertise, provided directions to improve the model parameterization, especially in the groundwater compartment. The study also provided feedback on the degree of information contained in the signatures and allows us to make recommendations for future studies.