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On the use of three hydrological models as hypotheses to investigate the behaviour of a small Mediterranean catchment

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Selecting an adequate hydrological model is the first step to carry out a rainfall–runoff modelling exercise. A hydrological model is a hypothesis of catchment functioning, encompassing a description of dominant hydrological processes and predicting how these processes interact to produce the catchment's response to external forcing. Current research lines emphasize the importance of multiple working hypotheses for hydrological modelling instead of only using a single model. In line with this philosophy, here different hypotheses were considered and analysed to simulate the nonlinear response of a small Mediterranean catchment and to progress in the analysis of its hydrological behaviour. In particular, three hydrological models were considered representing different potential hypotheses: two lumped models called LU3 and LU4, and one distributed model called TETIS.

To determine how well each specific model performed and to assess whether a model was more adequate than another, we raised three complementary tests: one based on the analysis of residual errors series, another based on a sensitivity analysis and the last one based on using multiple evaluation criteria associated to the concept of Pareto frontier. This modelling approach, based on multiple working hypotheses, helped to improve our perceptual model of the catchment behaviour and, furthermore, could be used as a guidance to improve the performance of other environmental models.