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Assessment of soil moisture to set the initial conditions of a event-based rainfall-runoff model

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Flash floods are the most destructive natural hazard that occurs in the Mediterranean region. Rainfall-runoff models can be very useful for flash flood forecasting and prediction. Event-based models are very popular for operational purposes, but there is a need to reduce the uncertainties related to the initial moisture conditions prior to a flood event. The aim of the present study is to improve the existing event-based rainfall-runoff models by using several soil moisture indicators: local TDR measurement of soil moisture, outputs of a SVAT model (SIM, Météo-France), antecedent precipitation and base flow. A distributed version of the SCS rainfall-runoff model is used to reproduce the flood events in a small headwater catchment in the Cevennes region (France). The model was calibrated from a 21-flood sample, and led to a mean Nash value of 0.76. The local TDR measurements in the deepest layers of soil (80-140cm), were found to be the best predictors of the calibrated initial soil moisture (r2 =0.85). TDR measurements averaged over the whole soil profile, SIM, and base flow were found to be less efficient predictors, since r2 coefficients decreased to respectively 0.79, 0.73 and 0.76. The good correlations observed between the TDR predictors and the initial conditions in the model indicates that monitoring soil moisture could greatly improve event-based model applications.