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Analysis of flash flood processes dynamics in a Mediterranean catchment using a distributed hydrological model

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The present study aims at analyzing the hydrological processes involved in flash flood generation. It focuses on small catchments located in the Mediterranean region (Southern France) and often affected by extreme events (Gaume et al., 2009; Ruin et al., 2008).
The model used in this study is a spatially distributed rainfall-runoff model dedicated to extreme event simulation and developed on the basis of physical process representation. It is structured into three modules, which represent the soil component, the overland flow component and flow through the drainage network. Infiltration is described using the Green and Ampt model and the soils are assumed vertically homogeneous. Lateral subsurface flow is based on the Darcy's law for a confined aquifer. Surface runoff calculation is divided into two parts: overland flow and flow along the drainage network. Both are simulated using the 1D kinematic wave approximation of the Saint-Venant equations with the Manning friction law. In the drainage network, the friction difference between main channel and floodplain is taken into account.
Determination of model parameters requires terrain measurement data, usually issued from DEM, soil survey and vegetation or land-use. Four parameters are calibrated for the entire catchment using discharge measurements. Model sensitivity to individual parameters is assessed using Monte-Carlo simulations, the model is then calibrated using these results to estimate the parameters with a data assimilation process called the adjoint state method (Bessière et al., 2008; Castaings et al., 2009).
Flood events with different hydrometeorological characteristics are studied to compare the location of saturated areas, infiltration and runoff dynamics as well as importance of the subsurface flow. A better understanding of these processes is indeed necessary especially to improve the model efficiency when the simulation parameters cannot be calibrated and must therefore be transposed from gauged basins to ungauged basins.

Bessière, H., Roux, H. and Dartus, D., 2008. Data assimilation for distributed flash flood modelling, International Symposium on "Weather Radar and Hydrology", Grenoble, France.
Castaings, W., Dartus, D., Le Dimet, F.-X. and Saulnier, G.-M., 2009. Sensitivity analysis and parameter estimation for distributed hydrological modeling: potential of variational methods. Hydrol. Earth Syst. Sci. J1 - HESS, 13(4), 503-517.
Gaume, E. et al., 2009. A compilation of data on European flash floods. Journal of Hydrology, 367(1-2), 70-78.
Ruin, I., Creutin, J.-D., Anquetin, S. and Lutoff, C., 2008. Human exposure to flash floods - Relation between flood parameters and human vulnerability during a storm of September 2002 in Southern France. Journal of Hydrology, 361(1-2), 199-213.