Flash flood modelling for ungauged catchments

P-A Garambois, H Roux, K Larnier, and D Dartus

Fluid Mechanics Institute of Toulouse (IMFT), UMR CNRS/INP-UPS 5502, (pgarambo@imft.fr)

Flash flood is a very intense and quick hydrologic response of a catchment to rainfall. This phenomenon has a high spatial-temporal variability as its generating storm, often hitting small catchments (few km^2). Data collected by (Gaume et al. 2009) about 500 flash floods over the last 50 years showed that they could occur everywhere in Europe and more often in the Mediterranean regions, Alpine regions and continental Europe.

Given the small spatial-temporal scales and high variability of flash floods, their prediction remains a hard exercise as the necessary data are often scarce. Flash flood prediction on ungauged catchments is one of the challenges of hydrological modelling as defined by (Sivapalan et al. 2003).

Several studies have been headed up with the MARINE model (Modélisation de l'Anticipation du Ruissellement et des Inondations pour des évèNements Extrêmes) for the Gard region (France), (Roux et al. 2011), (Castaings et al. 2009). This physically based spatially distributed rainfall runoff model is dedicated to flash flood prediction. The study aims at finding a methodology for flash flood prediction at ungauged locations in the Cévennes-Vivarais region in particular.

The regionalization method is based on multiple calibrations on gauged catchments in order to extract model structures (model + parameter values) for each catchment. Several mathematical methods (multiple regressions, transfer functions, krigging...) will then be tested to calculate a regional parameter set.

The study also investigates the usability of additional hydrologic indices at different time scales to constrain model predictions from parameters obtained using these indices, and this independently of the model considered. These hydrologic indices gather information on hydrograph shape or catchment dynamic for instance. Results explaining global catchments behaviour are expected that way. The spatial-temporal variability of storms is also described through indices and linked with hydrograph shape descriptors in order to constrain model at ungauged locations.

In a multi scale point of view, regional characteristics about catchments geomorphology or rainfall fields' statistics should provide useful insight to find pertinent hydrologic response indices. These considerations with physically based distributed modelling may bring better understanding on flash floods generating mechanisms and catchment responses.