Geophysical Research Abstracts,
Vol. 11, EGU2009-5530-1, 2009
EGU General Assembly 2009

Value of distributed post-flood maximum discharge estimation for the evaluation of a regional flash-flood modelling approach

I. Braud (1), C. Manus (2), S. Anquetin (2), P. Viallet (3), J.D. Creutin (2), E. Gaume (4), and C. Manus (1)

(1) Cemagref, UR HHLY, Lyon Cedex 9, France (isabelle.braud@cemagref.fr), (2) Université de Grenoble, LTHE (CNRS, UJF, IRD, INPG), BP53, 38041 Grenoble Cedex, France, (3) HYDROWIDE, 1025 Rue de la Piscine, Domaine Universitaire, 38420 St-Martin D'Hères, France, (4) LCPC, Division Eau et Environnement, BP 4129, 44341 Bouguenais Cedex, France

In September 2002 a flash flood killed 23 human lives and generated 1.2 billion Euros of damages in less than 24 hours over an area of 20 000 km2 located in the south of France. The Gard river basin was hit by a storm that locally received more than 600 mm in one day. This storm triggered catastrophic flash floods on many upstream tributaries as well as the most important flood ever reported of the major rivers (Gard, Ceze and Vidourle). The distributed prediction of such extreme events remains an open question due to scarcity of observations and the unknown individual hydrological behaviour of very small basins. Due to the high spatial and temporal variability of rainfall and of the physiographic conditions, physically-based distributed hydrological models offer perspective for the simulation of such flash-floods at a regional scale, and more specifically in small ungauged basins which are recognized as the most vulnerable. However, the evaluation of model performance for such events remains largely open. Traditional stream gauge networks provide estimate at only a few locations, and these values are very uncertain for large discharges. Indeed, stage discharge relationship are in general extrapolated far beyond gauged values -if they are not destroyed- for extreme floods. Alternative sources of data are therefore necessary for model evaluation.

In this paper, such an alternative solution is presented and illustrated using data from the Gard September 2002 event. It consists in using a post flood field survey data set made of estimation of maximum peak discharge and time of peak. Such estimations are conducted at the regional scales for catchments of various sizes (for a few to about 100 km2) in areas affected by different rainfall amounts in order to sample a large range of hydrological responses. These estimations are derived from hydrological investigation using interviews of witnesses and river cross-sections surveys.

The distributed modelling approach was implemented within the numerical modelling LIQUID platform on the Cévennes – Vivarais region. The model is based on a spatial discretization in hydrolandscapes determined using the overlay of the sub-catchments map and the pedology map. Information taken from an existing soil data base about soil profiles structure and hydraulic properties deduced from pedo-transfer function were used to describe soil characteristics. The first version of the model, includes a representation of infiltration (Richards equation) on the hydro-landscapes, a calculation of the surface flux towards the nearest river reach and flow routing in the river network based on the kinematic wave approximation of the St-Venant equation. The model, forced using re-processed radar data at a 5min and 1 km2 resolution, was set up on 19 sub-catchments where post-flood maximum peak discharge estimation were available. Their size range from about 2 to 100 km2. Model estimates of maximum peak discharge were found to be in fair agreement with post flood field estimates. The observed maximum specific discharge versus catchment area relationship was also correctly simulated. This first example shows the value of post-flood field survey, combined with high resolution radar rainfall for improving our prediction capacity of extreme floods events.