Conceptual model for real time flood forecasting of Tiber river in Rome

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In the present work an application of a conceptual semi-distributed model to real time flood forecasting in Tiber river in Rome is proposed. The model, originally developed to evaluate the probability of inundation of Rome using a Monte Carlo analysis, was slightly modified to calibrate the parameters for ungauged sub-basins and to enable an easy on-line calibration.

The catchment area of Tiber river at Ripetta gauging station, in Rome, is more than 16000 km^2. In the upper part of the watershed is located Corbara dam, a reservoir encompassing an active storage of 165 hm^3. The catchment area downstream the Corbara dam is about 10000 km^2.

A complete hydrologic and hydraulic physically based model (TEVERE) was applied: the hydrologic module perform rainfall-runoff analysis on 38 ungauged catchements for a total area of 3000 km^2 (which constitutes one third of the watershed area downstream Corbara dam), the hydraulic module simulates flood wave propagation in a looped network of 8 reaches that represent the hydrographic network of Tiber river from Corbara dam to Tyrrhenian Sea. The hydrologic model was modified in order to perform real time flood forecasting: the parameters that characterized both surface and subsurface flow were correlated to area and average elevation of the gauged sub-basins by linear regressions, the remaining parameters, all of which refer to infiltration and subsurface flow, were correlated to SCS curve number CN_e of the event. On the whole 120 floods on 11 gauged sub-basins available were used to off-line calibration of the rainfall-runoff model and to define the regression equations that allows to reduce the number of the hydrologic parameters at 38, i.e. the value of CN_e of the storm for each sub-basin. In real time application, the ratio r=CN_e/CN_{II} is introduced for each sub-basin. In order to reduce the number of the on-line calibration parameters the values of r are kept constant in areas covering several sub-basins. The hydraulic model was considered as a deterministic component of the system (no parameter calibration).

To improve the forecasting accuracy, to support the decision maker, and reduce the possibility of false or missed alarms is necessary provide a usable quantification of the forecasting uncertainty. In the present work the prediction error is calculated in different ways and the confidence intervals of the predicted stages are estimated. The model is applied to simulate the forecasting of historical flood occurred in November

2005. The computation show the possibility to develop a flood forecast model with a lead time of 12 hours, which is useful for civil protection actions.