Geophysical Research Abstracts,
Vol. 11, EGU2009-10106, 2009
EGU General Assembly 2009

A semiprobabilistic approach for the design of river routing reservoirs

B. Bacchi, M. Balistrocchi, and G. Grossi
University of Brescia, DICATA, Brescia, Italy (giovanna.grossi@unibs.it)

In several mountainous areas located in West Europe, in recent years (Po River 1994, 2000 and 2002, the Elbe River 2002, the Rhone River 2003) urbanization has strongly affected the vulnerability of valleys and flood plain areas. As a consequence the structural defence of both cities and industrial areas has become fundamental with respect to the past situation, when the floodplain was almost exclusively utilized for agricultural purposes.
The use of control devices based on embankments is nowadays discouraged because it produces strong increase of peak discharges downstream in the large floodplain areas. Recently the most used procedure is that based on the use of routing reservoirs and selected flood prone areas. Because of the general scarcity of hydrometric data traditional methods for reservoir volume design is based on the use of synthetic hyetographs (derived from IDF curves) to produce through a suitable rainfall-runoff model some synthetic hydrographs which are the design forcing for the reservoir and its control devices.
In this work a first temptative to use a semiprobabilistic approach is proposed. The method is very similar to that already introduced for the design of quality control tanks for urban drainage systems.
The procedure is based on the hypothesis that the rainfall process is a sequence of wet and dry periods where a dry period is a random variable with a fixed lower limit IETD. The IETD value is fixed both on the basis of hydrological rainfall sequence and of the weighted sum of the detention time of the reservoir and of the lag time of hydrological response. For each storm event only the rainfall volume is considered and a hydrological loss model is formulated with an initial abstraction IA based on the CN-SCS scheme and a constant runoff coefficient.
In order to test the potentials of this methodology a case study located in the prealpine area in Northern Italy was selected: a detention tank was designed for the Garza River, just upstream the town of Brescia where the drained area is almost 50000 km2 wide. A long series of rainfall observations in a rain gage located in Brescia was used for the calibration of the rainfall stochastic model. Within this framework the efficiency of a designed off-line flood reservoir storage is derived in terms of the modified cumulative probability function (cdf) of the flood peak. The obtained cdf is then compared to the cdf retrieved from a continuous simulation using time series of rainfall observations and a rainfall-runoff model composed by a CN-SCS loss scheme and a Nash model to simulate the hydrological surface routing. Results are discussed on the basis of the different characteristics of the approach used.