Geophysical Research Abstracts
Vol. 14, EGU2012-7166, 2012
EGU General Assembly 2012

Continuous streamflow simulation for index flood estimation in an Alpine basin of Northern Italy

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Flood frequency estimation is crucial in both engineering practice and hydrologic research. In this context, regional analysis of flood peak discharges is used for more accurate estimates of flood quantiles in ungauged or poorly gauged catchments. This is based on the identification of homogeneous zones, where the probability distribution of annual maximum peak flows is invariant, except for a scale factor represented by an index flood. The numerous applications of this method have highlighted as a critical step obtaining reliable estimates of index flood, above all in ungauged or poorly gauged sections, where direct estimation by sample mean of annual flood series AFS is not possible or inaccurate. Therein indirect methods have to be used. Most indirect methods are based upon empirical relationships, developed by means of multiregression analysis, or simplified lumped representation of the process of transformation of intense rainfall into runoff. Limits of these approaches are more and more evident as the size and spatial variability of the catchment increases. In these cases use of a spatially distributed physically based hydrological model for time continuous simulation of discharge can improve estimation of index flood. This work presents an application of FEST-WB model for the reconstruction of 30-years hourly stream flows for an Alpine snow fed catchment in Northern Italy, to be used for index flood estimation. To extend length of simulated discharge time series, meteorological forcing given by daily precipitation and temperature at ground automatic weather stations are downscaled hourly by way of novel method, and then fed to FEST-WB. Accuracy of the method in estimating index flood is discussed, and suggestions for use of the methodology provided.