Geophysical Research Abstracts
Vol. 13, EGU2011-4613, 2011
EGU General Assembly 2011

Step changes in the flood frequency curve – process controls

Magdalena Rogger, Jürgen Komma, Ralf Merz, Alberto Viglione, Robert Kirnbauer, and Günter Blöschl
Institute for Hydraulic Engineering and Water Resources Management, Vienna University of Technology, Vienna, Austria,(rogger@hydro.tuwien.ac.at)

Threshold processes refer to a rapid changeover from one state to another and are frequently present in hydrological processes particularly when moving from small to extreme events. Such threshold behaviour can be observed when analysing measured runoff data in a flood frequency plot. Often data points of extreme flood events indicate a change of slope in the flood frequency curve at a certain return period. If only shown by one or a few events, change in slope may simply be due to the uncertainty in the estimation of the return period of big events. However, if such a step change is clearly shown by a larger number of data points it can also be associated with threshold processes. Still, this behaviour is currently not accounted for when fitting a flood frequency distribution to the observed runoff data although it might be important especially when using flood frequency plots for the choice of design values. In case a step change is present it will cause a significant difference when estimating a design value associated with a certain return period.

A case study has been performed in ten alpine catchments in Tyrol (max. size of 100 km2) in order to analyse whether and under which conditions such step changes occur. To this purpose a spatially distributed continuous rainfall-runoff model with high spatial and temporal resolution was used to capture the runoff process at the local scale as accurately as possible. The model was parameterised with all available information on the catchments such as high resolution orthophotos, landuse information, maps on runoff coefficients and hydrogeologic data. Of particular importance was a hydrogeological survey which allowed us to assess the size of the subsurface storage in the model from field data. A stochastic precipitation model was then used to generate long term precipitation series in order to perform Monte Carlo simulations with the calibrated rainfall-runoff model for more than 10000 years. The resulting runoff series was used to identify possible reasons for step changes in the flood frequency curve.

The outcomes of the study explain under which conditions step changes in the flood frequency plot may occur in alpine settings and show what influence step changes can have if considered in the choice of design values.