Geophysical Research Abstracts
Vol. 12, EGU2010-4137, 2010
EGU General Assembly 2010

An attempt to harmonize flood frequency statistics and rainfall-runoff modelling

Magdalena Rogger, Günter Blöschl, Alberto Viglione, Ralf Merz, and Robert Kirnbauer

Vienna University of Technology, Institute of Hydraulic Engineering and Water Resources Management, Austria (rogger@hydro.tuwien.ac.at)

Flood analysis is usually based on a probabilistic approach of fitting a statistical distribution to a sample of observed flood peaks or on a deterministic approach of calibrating an event based rainfall-runoff model to runoff data. While these procedures are reasonably accurate for the conditions the sample represents, extrapolation to conditions beyond the sample such as extreme events are often not very reliable. In many practical applications, such as for instance the determination of design values for flood control measures, this may cause significant problems, since the different methods yield flood peak estimates that may differ up to a magnitude of 3 for the same catchment and return period.

This project is addressing the scale gap by trying to reconcile regional scale statistical methods with local scale process based/deterministic methods in a number of pilot catchments. In order to bridge the gap between the different approaches a continuous rainfall-runoff model is used which allows interpreting flood frequencies as combined probabilities of rainfall and soil moisture conditions. By using a spatially distributed model all available information on the catchments (e.g. orthophotos, landuse information, hydrogeology, etc.) can be included to make a detailed description of the processes at local scale. A stochastic precipitation generator is then used to generate long term precipitation series in order to perform Monte Carlo simulations with the calibrated rainfall-runoff model for more than 10.000 years. Based on the resulting runoff series a flood peak with a certain return period can be estimated.
The new estimates shall build a basis for interpreting the reasons of the differences in the traditional approaches. The use of a spatially distributed rainfall-runoff model is especially interesting, because it allows for an assessment of the effect of the initial soil moisture conditions on the return period of a flood peak. Furthermore, by also including detailed hydrogeologic information, the change from small to big events can be investigated, i.e. the height of precipitation at which the storage capacity of the catchment is exceeded.

Currently a first case study is carried out on ten pilot catchments in the region of Tyrol (Austria).