Modelling extreme floods from snow melt for flood risk estimation

K. Hlavčová, S. Kohnová , and J. Szolgay

Department of Land and Water Resources Management, Slovak University of Technology, Radlinskeho 11, 813 68 Bratislava, Slovakia (kamila.hlavcova@stuba.sk, silvia.kohnova@stuba.sk; jan.szolgay@stuba.sk)

The methodology for simulation of extreme floods from rainfall and snow melt for flood risk estimation in small mountainous basins in Slovakia was developed. As a pilot basin the Vajnory – Raciansky Stream located in Southern Slovakia with an area of 24 km2 was selected. From the historical runoff data the flood wave observed in March 2006 was chosen to be representative for the analysis of extreme snow melting processes. The chosen spring flood occurred during the period with high snow storage in the basin and it was caused by combination of snow melting, intensive precipitation and the rapid increase in air temperature. For modelling runoff from precipitation and snow melt a conceptual rainfall-runoff model was applied in a daily time step. Parameters of rainfall-runoff model were calibrated on data from the period 1981-2007 and efficiency of the model was controlled comparing measured and simulated mean daily discharges and snow water equivalent by the Nash – Sutcliffe coefficient. Using the model with calibrated parameters, different scenarios of extreme floods based on combining high precipitation and snow water equivalent with return periods from 100 to 1000 years were developed. Under these scenarios, extreme floods with various return periods were simulated and flood peaks and volumes were compared. The methodology of estimating design floods from snow melt can be used in flood risk estimation and for proposals of flood protection measures in small catchments.