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Assessment of extreme flood characteristics based on a dynamic-stochastic model of runoff generation and the probable maximum discharge

L. S. KUCHMENT & A. N. GELFAN
Water Problems Institute of the Russian Academy of Sciences, 119991 Gubkin 3, Moscow, Russia
kuchment@mail.ru

Abstract A dynamic-stochastic model of flood generation consisting of a distributed physically-based model of snowmelt runoff genesis and a stochastic weather generator has been used for the assessment of extreme flood risk. Coupling this model with the Monte Carlo simulations of meteorological series allows the calculation of long series of runoff hydrographs and the exceedance probabilities of flood characteristics, as well as avoiding the application of the hypothesis of stationarity of hydrological series. However, for very rare events, the uncertainty in estimating flood risk because of the model inadequacy and insufficient lengths of the used data series may significantly increase. To decrease this uncertainty, it has been suggested that the peak discharge series obtained by dynamic-stochastic simulations be combined with the probable maximum discharge (PMD) calculated through the physically-based model of snowmelt runoff generation. This combining is achieved by fitting the estimated exceedance probabilities of simulated peak discharges by the Johnson distribution with the PMD as the parameter. Sensitivity of the fitted Johnson distribution to the errors of the PMD estimations is analysed. A case study was carried out for the Vyatka River basin in Russia (catchment area of 124 000 km^2) and the Seim River basin (catchment area of 7460 km^2).

Key words distributed hydrological model; flood risk; stochastic weather generator; probable maximum discharge