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Coupling of probabilistic and deterministic approaches for assessment of extreme flood risk

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Dynamic-stochastic model of runoff generation consisting of a distributed physically based model of snowmelt runoff genesis and a stochastic weather generator has been developed. Coupling this model with the Monte Carlo procedure of simulation of meteorological series allows one to calculate long series of possible runoff hydrographs and to calculate the exceedance probabilities of flood peak discharges and volumes. The implementation of such a dynamic-stochastic methodology gave an improvement of flood risk assessment in comparison with the traditional flood frequency analysis of the hydrological series for the exceedance probabilities of 0.01-0.001. However because of the model errors and insufficient lengths of the available hydrometeorological observation series, for more rare events the uncertainty in estimating risk of extreme floods may significantly increase. To decrease this uncertainty, it has been suggested combining of the peak discharge series obtained by dynamic-stochastic simulations 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 in which one from the parameters is the PMD. Sensitivity of the fitted Johnson distribution to the errors of the PMD-estimate has been studied. The opportunities of improving assessment of PMD on the basis of meteorological extremes are discussed. Case study was carried out for the Vyatka River basin located in the forest zone of Russia and the steppe Seim River basin (the catchment areas are 124000 sq.km. and 7500 sq.km, respectively)