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Long-term ensemble forecasting of snowmelt floods

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A methodology of long-term (with the lead time of 2-3 months) ensemble forecasting of snowmelt flood volumes and the peak discharges has been developed. The methodology is based on the use of a distributed physically based model including description of snow accumulation and melt, vertical transfer of heat and moisture in the soil, infiltration in the frozen and thawed soil, processes of runoff generation after the beginning of spring snowmelt. The model has been applied to calculate the runoff hydrographs during the lead time period, using the meteorological inputs and the measured initial values of basin condition characteristics (commonly, the snow water equivalent, soil moisture and depth of frozen soil) as well as missing initial river basin condition characteristics before forecasting The historical meteorological series, results of meteorological forecasting, or Monte Carlo simulations using weather generator have been used to provide opportunities of generating the meteorological inputs for lead time periods and to estimate the probability distributions of the forecasted runoff volumes and peak discharges. The weather generator consists of the stochastic models of daily temperature and precipitation. The case studies have been carried out for the Vyatka River basin, Sosna River basin and for the Seim River basin The results of deterministic forecasting of flood volumes have been compared with the results received on the basis of using the averaged meteorological conditions for lead time periods and regression relationships between spring runoff volume and the initial indexes of river basin conditions before forecasting (the present day procedures of long-term flood forecasting). It has been shown that the suggested methodology of the forecasting of snowmelt flood volumes and peak discharges using the physically based model can be efficiently applied for both deterministic and probabilistic long-term flood forecasts. The performances of the obtained probabilistic forecasts were compared on the basis of the ranked probability skill scores, and discrimination and reliability diagrams. It

has been shown that the application of Monte Carlo simulations using weather generator has given better results then using the historical meteorological series.