



## Long-term ensemble forecasting of snowmelt floods

**L. S. Kuchment** and A. N. Gelfan

Water Problems Institute of the Russian Academy of Sciences, Russia (kuchment@mail.ru  
/Phone: 7 095-1355403 /Fax: +7 095-1355415)

A technique of long-term (2-3 months) ensemble forecasting of the runoff volumes and the peak discharges of snowmelt floods has been developed. The technique is based on finite element physically based model which includes description of snow accumulation and melt, soil freezing, soil thawing, redistribution of soil moisture during autumn and winter period, overland and channel flow. This model is applied to calculate initial river basin conditions (the snow water equivalent, the indexes of soil moisture and depth of frozen soil over the area) before forecasting at the points where the corresponding measurements are absent and to estimate the runoff hydrographs during the lead-time period. The chosen weather scenarios during the lead-time period give the deterministic flood forecast. To receive the probability distributions of the forecasted runoff volumes and peak discharges, the weather generator with the Monte Carlo simulations are used. The averaged probabilistic forecasts are compared to the deterministic forecasts and the forecasts, which can be received on the basis of regression relationships between spring runoff volume and the initial river basin indexes under the averaged meteorological conditions during lead-time period (the present day procedure of long-term runoff forecasting). The case study has been carried out for the Seim River basin (catchment area is 7500 km<sup>2</sup>) and the Sosna River basin (catchment area is 16000 km<sup>2</sup>). Observed snowmelt floods for 42 years at the Seim river and for 30 years at the Sosna river have been used to estimate capability of the proposed forecasting technique.