Assessment of design flood characteristics for ungauged permafrost basin

O. Semenova[1, 2], L. Lebedeva[3], A. Zhirkevich[4]

[1] *Gidrotehproekt Ltd., Toreza pr. 44, St. Petersburg, Russia*
[2] *St. Petersburg State University, Universitetskaya nab 7-9, St. Petersburg, Russia*
[3] *Nansen Environmental and Remote Sensing Centre, 14 Line VO, 7, 199034 St. Petersburg, Russia*
[4] *Hydroproject Institute, Malaya Dmitrovka Str. 7, 127006 Moscow, Russia*
+79112132657, omakarieva@gmail.com

Development and construction in remote poorly gauged regions of Eastern Siberia require reliable estimation of future possible hydrological extremes. The applicability of traditional statistical methods to the assessment of maximum flood characteristics in permafrost basin under changing environmental conditions is questionable. Three different approaches to estimate maximum flood discharges for the design of the Kanku hydropower plant in ungauged Timpton River basin (Eastern Siberia) were used, namely probable maximum flood (PMF), deterministic-stochastic modelling and conventional probability analysis. Deterministic-stochastic approach consists of process-based Hydrograph model and stochastic weather generator. The Hydrograph model parameters relate to observable properties of soil and vegetation, therefore application of the model does not require calibration. The stochastic weather generator provides simulated meteorological input for the Hydrograph model (daily precipitation, average temperatures, and relative humidity at different points within river basin) taking into account temporal and spatial correlations between meteorological elements and characteristics of their annual variability according to historical observations or climate change scenarios. The Timpton River outlet at Kanku (26700 km^2) has no discharge measurements. The Hydrograph model was validated against flow data in two gauges upstream and downstream. Validated model was applied to studied basin using the ensemble of stochastically generated sets of meteorological input corresponding to different scenarios of climate change. Resulting probabilistic curves of maximum floods were compared to those developed on the base of statistical analysis and estimated according to PMF approach.