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Using information from data-rich catchments to predict flood hazard in data-poor catchments

An approach for assessing flood hazard in a poorly gauged basin is developed. First, a data-rich proxy-basin, which is hydrologically similar to the poorly gauged basin, is selected on the basis of the "conditional similarity criteria" proposed in (Kuchment and Gelfan, 2009). A model of flood generation for the proxy-basin is developed and calibrated against the available observations including streamflow data. Then, parameters of the developed model are transferred, with the adjustment, to the poorly gauged basin. The adjustment is carried out through calibration against the available observations other than runoff (snow, soil freezing, soil moisture, groundwater data, etc.) in the poorly gauged basin. Finally, the model is linked to a stochastic weather generator and forced by the long series of the artificial meteorological data simulated by this generator. As a result, multi-year series of runoff hydrograph are simulated in the data-poor basin and frequencies of extreme flood characteristics (volume, peak discharge) are derived from these series. The proposed approach has been applied for 16300 km2 Sosna River basin (considered as the data-poor study basin) and 20 km2 experimental Yasenok Creek basin (considered as the proxy-basin), both situated at the steppe-forest physiographic zone of the European Russia. It has been found that frequencies of flood volume have been derived with satisfactory accuracy while frequencies of flood peak discharge have been overestimated for "pseudo-ungauged" study basin. In order to correct the detected bias, ten-year streamflow observations in the study basin have been used for additional calibration of the model. The proposed approach is considered as a suitable alternative to the traditional practice of flood frequency analysis for poorly gauged basins.