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May long-term historical hydrological data be misleading for flood frequency analysis in current conditions of climate change?

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In June 2019, the extreme flash flood was formed on the rivers of the Irkutsk region originating from the East Sayan mountains. This flood became the most hazardous one in the region in 80 years history of observations.

The greatest rise in water level was recorded at the Iya River in the town of Tulun (more than 9 m in three days). The recorded water level was more than 5 m above the dangerous mark of 850 cm and more than 2.5 m above the historical maximum water level which was observed in 1984.

The flood led to the catastrophic inundation of the town of Tulun, 25 people died and 8 went missing. According to preliminary assessment, economic damage from the flood in 2019 amounted up to half a billion Euro.

Among the reasons for the extreme flood in June 2019 that are discussed are heavy rains as a result of climate change, melting of snow and glaciers in the mountains of the East Sayan, deforestation of river basins due to clearings and fires, etc.

The aim of the study was to analyze the factors that led to the formation of a catastrophic flood in June 2019, as well as estimate the maximum discharge of at the Iya River. For calculations, the deterministic distributed hydrological model Hydrograph was applied. We used the observed data of meteorological stations and the forecast values of the global weather forecast model ICON. The estimated discharge has exceeded previously observed one by about 50%.

The results of the study have shown that recent flood damage was caused mainly by unprepared infrastructure. The safety dam which was built in the town of Tulun just ten years ago was 2 meters lower than maximum observed water level in 2019. This case and many other cases in Russia suggest that the flood frequency analysis of even long-term historical data may mislead design engineers to significantly underestimate the probability and magnitude of flash floods. There are the evidences of observed precipitation regime transformations which directly contribute to the formation of dangerous hydrological phenomena. The details of the study for the

Irkutsk region will be presented.