ASSESSMENT OF MAXIMUM STORM PRECIPITATION CHANGES OVER LAST DECADES

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Abstract

An increase of maximum daily precipitation during storm rains has been observed recently at many meteorological stations around the world. The appearance of heavy precipitation is primarily due to an increase in air temperature and increased pollution in the urban areas, and other causes . The main purpose of the research is to analyze the possible criteria for assessment of storm precipitation change during last decades related to different geographical zones of European territory of Russia.

Keywords: climate change, storm precipitation; Mann Kendall's test

Methods

The object of the study is data from stations located in various natural zones: the foothills of the north Caucasus (mineral waters), the forest zone (Bryansk), the steppe zone (Volgograd). Chronological changes in the maximum daily precipitation are shown in fig. 1.

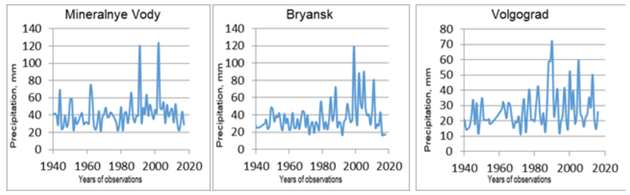

Figure 1: Examples of long-time observation at different meteorological stations.

Man Kendall's numerical criterion (Mann 1945) has been used for estimation of storm precipitation's trend. The procedure of estimation is based on using chronological series from n data. The size of differences is determined by comparing the data value from a later (Xi) time period to data value from an earlier (Xj) time period. If a data value from a later time period is higher than a data value from an earlier time period, the statistic S is incremented by 1.On the other hand, if the data value from a later time period is lower than a data value sampled earlier, S is decremented by 1. The net result of all such increments and decrements yields the final value of S. A positive value of S parameter means that the observations have a positive trend.

The following values of the criteria were obtained: Mineralnye Vody +255; Bryansk +205; Volgograd +429. Similar estimations were made for other time windows: a)1950–2017 and b)1960 – 2017. The following S-parameters were obtained correspondently a) 129; 118; 157 and b) 188; 219; 111 The next criterion takes into account the quantiles of maximum daily precipitation, which is determined with help of Weibull formula. The obtained results are represented in figure 2.

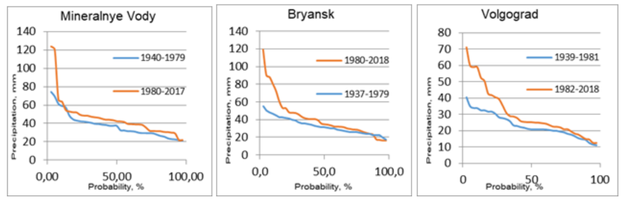

Figure 2: Points of quintile values of empirical probabilistic curves.

Results

All analyzed aspects allow us to conclude that there is an increase in maximum daily storm precipitation during the last several decades at all studied stations. The values of Man Kendall's numerical criterion are very significant even such value is located within 10-20 we believe that there is a clear positive test. Also we have to note that almost all quantiles of maximum daily precipitation during the last several decades are above the quantiles of previous decades. The differences are much more significant for smaller probabilities (3-5%).

Conclusions

All the considered criteria for assessing the increase in maximum daily precipitation validate each other; respectively, we can conclude that they are quite objective. The reliability of hydraulic structures on small rivers from the last century has been decreased due to increased rainfall. Empirical dependences (fig.2) between precipitation and of their probability (for the last decades) can be used for projecting small hydraulic structures within 5 - 10% of probability.

Bibliography

Groisman P.U., Knight R.W., Easterling T.R., Hegerl G.G., Razuvaev V.N. Trends in intense precipitation in climate record// J. Climate. 2005.18.1326-1350.

Dmowska, Ed.R. & Hartman D. & Rossby H.T. 2011. Statistical methods in the Atmospheric Sciences. Inter. Geoph. Series Vol.1. Oxford, OX51GB, UK, P. 668.

Ilinich V., Akulova E., Belchihina V. and Ponomarchuk K.. Estimation of Statistical Characteristics for Storm Precipitation with Long-term Data to Assess Climate Change. Journal of Climate Change, Vol. 2, No. 2 (2016), pp. 83–87. DOI 10.3233/JCC-160019

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