STATISTICAL ANALYSIS OF PRECIPITATION DATA FOR HYDROLOGICAL AND HYDRAULIC MODELING OF FLASH FLOODS

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IAHR YPN

Hosted by Spain Water and IWHR, China

Abstract

The purpose of this research was to pinpoint the pattern of the precipitation data and analyse the extreme events for the time series of data from 2001 to 2019.The Mann-Kendall trend test was used to detect the trend in the data at 5 % level of significance. Log Pearson Type III and Gumbel were applied for the analysis of the extreme rainfall events. Outlier testing was analysed and high , and low outliers were observed in the data and removed. As the computed p - value < 0.0001 is lower than the significance level alpha = 0.05, the null hypothesis Ho should be rejected, and the alternative hypothesis Ha should be accepted. As the alternative hypothesis Ha is accepted, it is concluded that there is a significant trend component in the time series data.

Keywords: precipitation, trend analysis, extreme events, Ethiopia

Methods

Trend component could be identified using parametric or linear methods and non-parametric **Mann-Kendal test**. Parametric or linear method is simpler than the non-parametric Mann-Kendall trend test. However, there is difficulty in establishing the year in which the trend begins. Therefore, we used the non-parametric Mann-Kendall trend test at **5 % significance level**. The **probable maximum precipitations** were analysed by frequency factor methods: Gumbel's method and Log Pearson Type III. Finally, **outlier test** was carried out as this is important for further analysis and prediction.

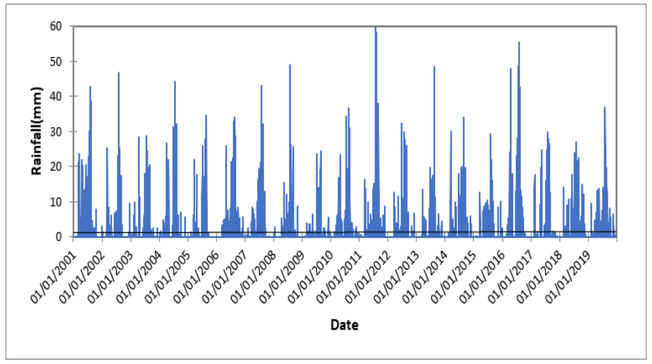

Figure 1: Trend analysis using Mann-Kendal test

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Results

The statistical parameters analysed with non-parametric Mann-Kendall trend test at 5 % significance level for the time series precipitation measurements from 2001 to 2019 were: maximum = 59.733 mm, minimum = 0 mm, mean = 1.5948 mm, standard deviation = 4.6923 mm, p-value < 0.0001,and alpha = 0.05 ,respectively. The probable maximum precipitations were estimated with **Gumbel's** and **Log Pearson Type III method** and the results are provided in Table 1 below. **Outlier test** was carried out for the same data used for precipitation frequency analysis at $\pm 0{,}4$ .The results were high outlier = 68.24 mm and low outlier = 20.74 mm.

Table 1: Probable maximum precipitation

Return period [years]	Gumbel [mm]	Log Pearson Type III [mm]
10	55	53
50	71	65
100	77	69
200	84	74

Conclusions

As the computed p - value is lower than the significance level alpha = 0.05, the **null hypothesis Ho was rejected**, and the **alternative hypothesis Ha was accepted**. Thus, there is a **significant trend component** in the time series. The peak values estimated using the Gumble's method are a bit higher than the values estimated by Log Pearson Type III due to the logarithmic transformation.Outliers were detected and removed.

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1st IAHR Young Professionals Congress (17-18 November 2020)