Review of: "Gumbel's Extreme Value Distribution for Flood Frequency Analyses of Timis River"

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Potential competing interests: No potential competing interests to declare.

This paper utilizes the Gumbel distribution, which is a widely accepted statistical method for analyzing extreme events in hydrology. This approach allows for the estimation of flood probabilities and peak flows, which are crucial for engineering design in water resource management. By focusing on the Timis River over a 30-year period, the study provides specific insights into flood frequency for this particular region. This localized analysis can inform decision-making processes related to infrastructure planning and flood risk management in the area. By considering return periods of 5, 10, 50, 100, and 150 years, the paper offers a comprehensive examination of flood frequency. This allows for a nuanced understanding of the likelihood and magnitude of floods over different time scales, aiding in risk assessment and mitigation strategies. However, the following observations were made to improve this paper:

1. The abstract should begin with **a brief but precise statement of the problem or issue, followed by a description of the research method and design, the major findings, and the conclusions reached**.

2. While the study covers a 30-year period (1993-2022), this may not capture long-term trends or fluctuations in flood frequency. A longer data set would provide a more robust analysis, especially considering climate change effects.

3. Flood frequency analysis often assumes that the underlying hydrological processes remain stationary over time. However, this assumption may not hold true, particularly in the context of climate change, where precipitation patterns and river behavior may alter significantly.

4. The accuracy of flood frequency analysis is highly dependent on the quality and reliability of the data used. Errors or inconsistencies in the data could lead to inaccuracies in the estimated probabilities and peak flows, potentially impacting the effectiveness of engineering designs and risk management strategies.

5. The introduction lacks contextualization regarding the significance of flood frequency analysis in the broader field of hydrology and water resource management. It does not provide a clear overview of the current challenges or gaps in flood risk assessment that the research aims to address.

6. The materials and methods section lacks discussion on the quality and reliability of the data used for the analysis. Without addressing potential sources of error or uncertainty in the data collection process, the validity of the study's findings may be compromised.

7. The Gumbel distribution method assumes stationarity in flood processes, implying that the underlying hydrological

conditions remain constant over time. This assumption may not hold true, particularly in regions experiencing climate change or significant land use alterations. Acknowledging the potential impact of non-stationarity on the accuracy of flood frequency estimates would enhance the robustness of the analysis.

8. While the study mentions the requirement of a minimum of ten years of historical data for applying the Gumbel distribution method, it does not discuss the implications of using a relatively short 30-year dataset. Longer-term data series could provide a more comprehensive understanding of flood frequency dynamics and improve the reliability of predictions.

9.The methods section lacks discussion on uncertainty analysis, including the assessment of confidence intervals or sensitivity analyses. Incorporating such analyses would provide insights into the reliability and precision of the flood frequency estimates, thereby enhancing the credibility of the study's findings.

10. The use of Gringorten's position representation formula for estimating exceedance probabilities may introduce biases, particularly in datasets with limited sample size or non-normal distribution. Providing justification for the choice of this method and addressing its potential limitations would strengthen the methodological rigor of the analysis.

11. The equations presented in the methods section could be clarified with additional explanations or step-by-step calculations to aid readers in understanding their implementation. Providing detailed examples or numerical illustrations would facilitate the replication of the analysis by other researchers.

By addressing these limitations and enhancing the clarity and transparency of the methodology, the study could improve the reliability and robustness of its flood frequency analysis.