Extreme Heat in Texas: A Statistical Analysis of Record-Breaking Temperatures in 2023

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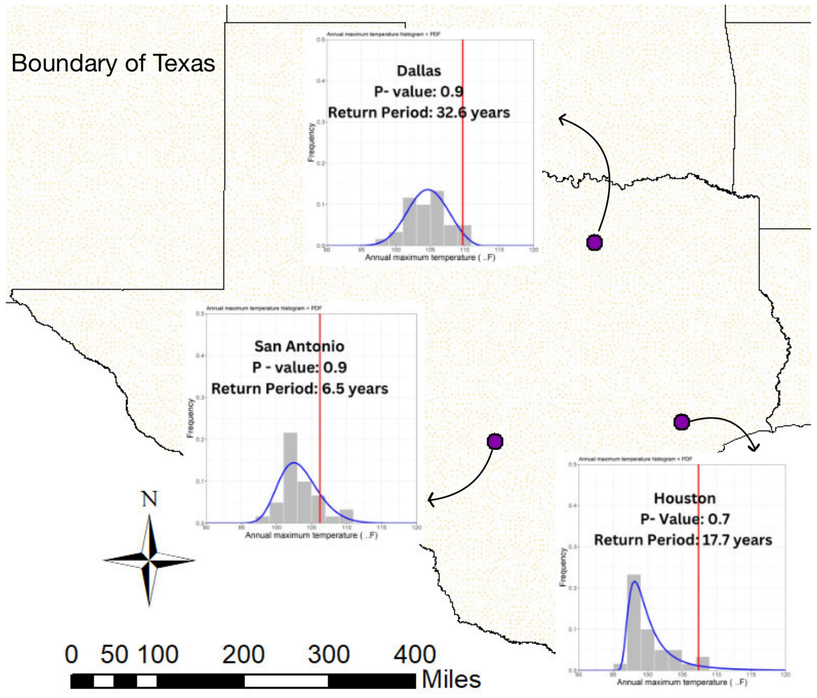
Introduction

- **Extreme temperatures can have a severe impact** on infrastructure, agriculture, transportation, natural ecosystems and health of the population.
- The frequency of extreme temperature can be investigated using probability distribution such as **Generalized Extreme Value and Generalized Pareto Distribution** (Huang et al., 2016; Pandžić at al., 2022).
- The objective of this study is to calculate the return period and p-value of **air temperature observed in major cities of Texas in 2023.**

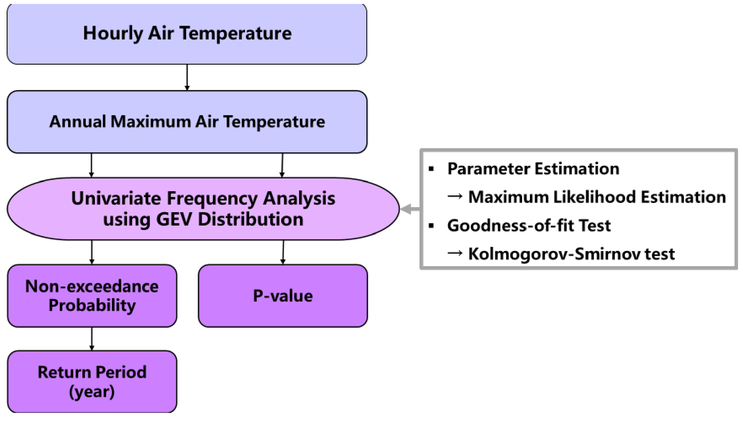
Extreme Air Temperatures in Texas



- Dallas recorded a temperature of **110.1°F** in 2023, with an estimated **32-year return period (p-value: 0.97)**, indicating a high confidence in the GEV model's prediction.
- Houston reached **108.3°F**, with a **17-year return period (p-value: 0.69)**, showing moderate confidence in the model's accuracy.
- San Antonio hit **109.9°F**, with a **6-year return period (p-value: 0.93)**, suggesting strong confidence in the predictive capability of the GEV model.

Methodology

- We estimated the parameters of Generalized Extreme Value by applying **Maximum Likelihood Estimation** and validated it using the **Kolmogorov-Smirnov test.**



Conclusions

- Our research reveals significant **differences in the severity of heat events** across major cities in Texas, indicating the localized nature of climate impacts.
- The variability underscores the urgent need for **city-specific adaptation and mitigation strategies** to address the unique challenges posed by escalating temperatures.
- For the future study, we will apply **our methodology to other major U.S. cities**, aiming to understand the extremeness of air temperature in 2023.
- We will also evaluate the **CMIP6-based Multi-model Hydroclimate Projection** to understand the future trend of air temperature.

References

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