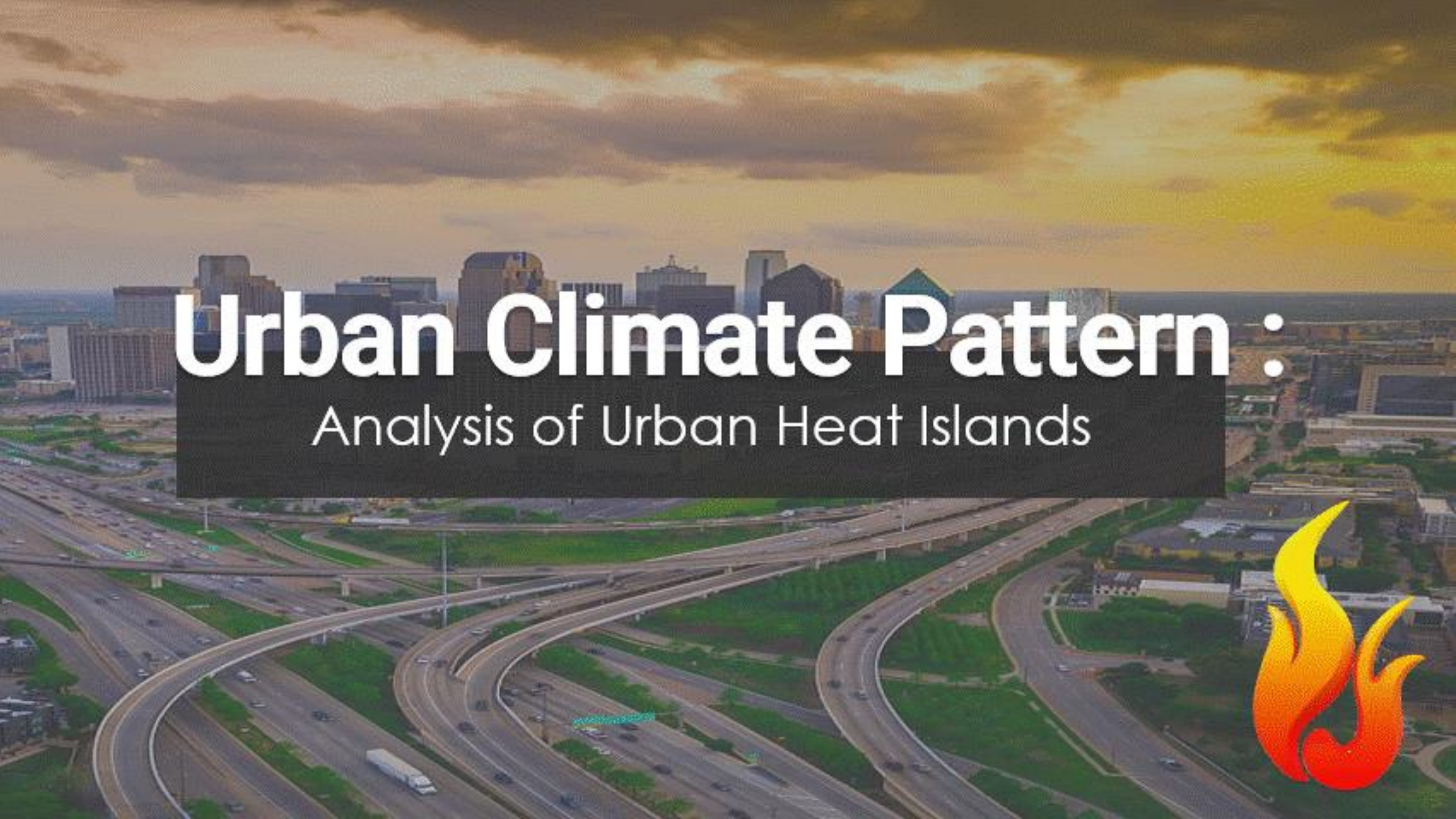
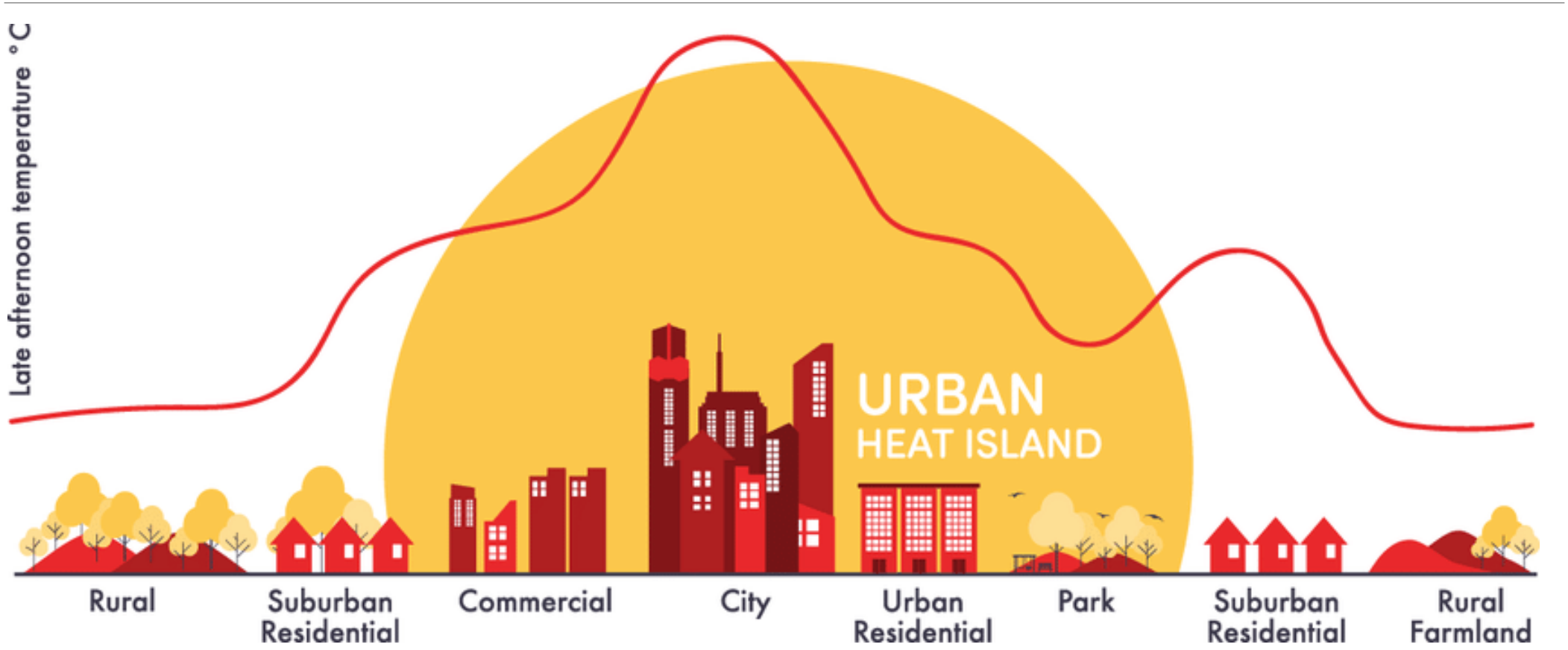
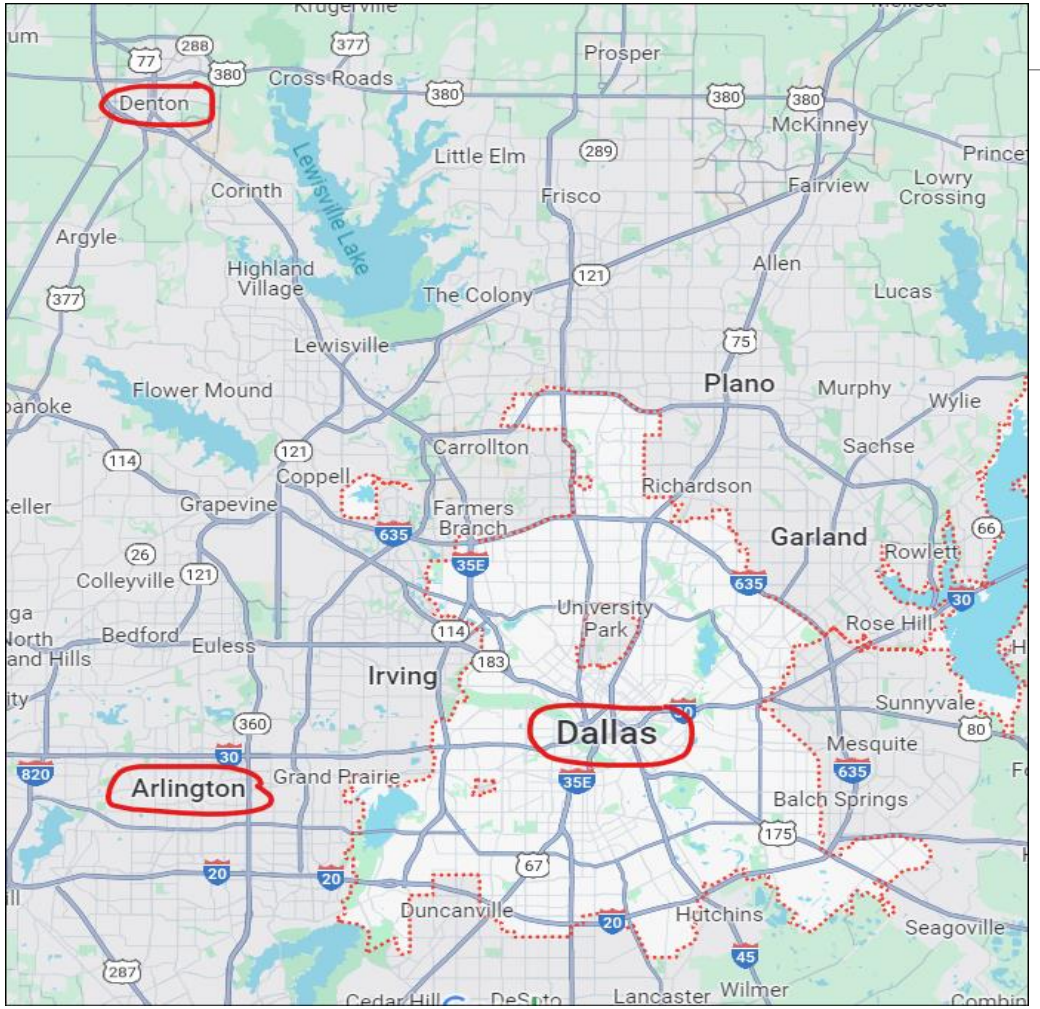

Urban Climate Pattern :
Analysis of Urban Heat Islands

URBAN HEAT ISLANDS

A UHI (“Urban Heat Island”) occurs when a city experiences much warmer temperatures than nearby rural areas.



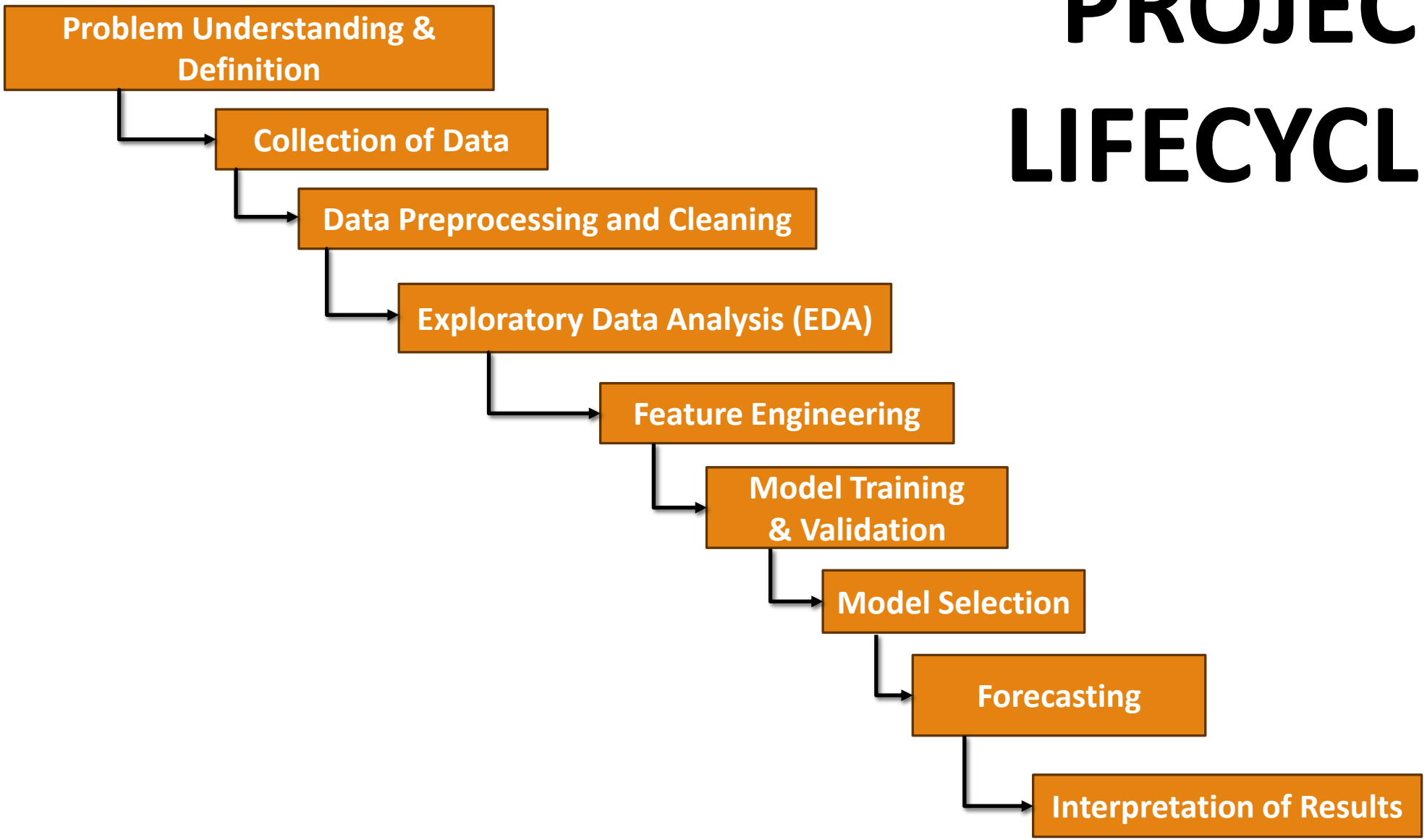
3 Cities for UHI Comparison



Dallas vs. Arlington vs. Denton

Three datasets for the year 2022 were obtained from the National Centers for Environmental Information, then combined into one major dataset

PROJECT LIFECYCLE



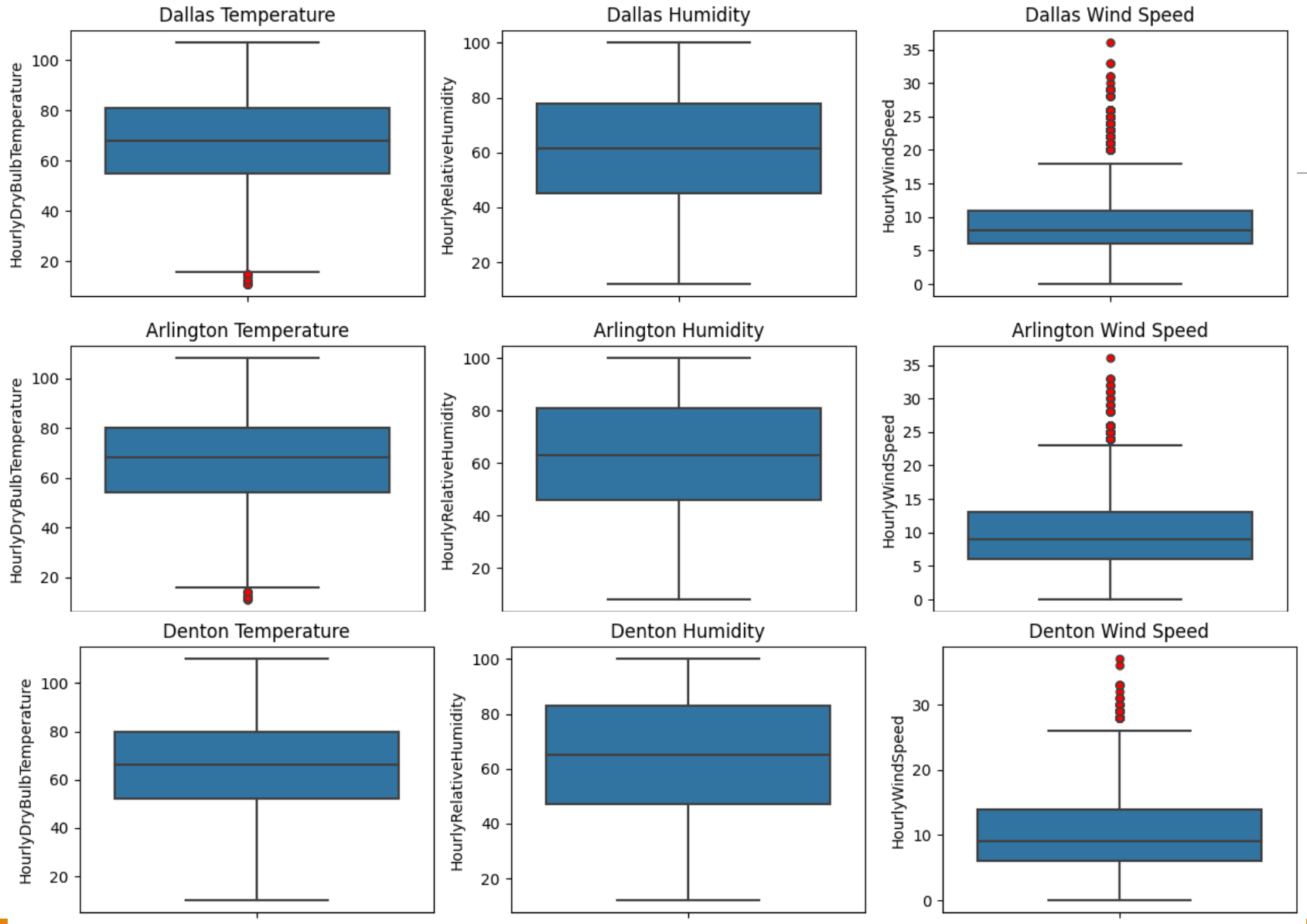
Data Preprocessing and Cleaning

- Data Collection
- Data Cleaning
- Data Aggregation
- Missing Values Imputation
- Feature Extraction
- Data Standardization

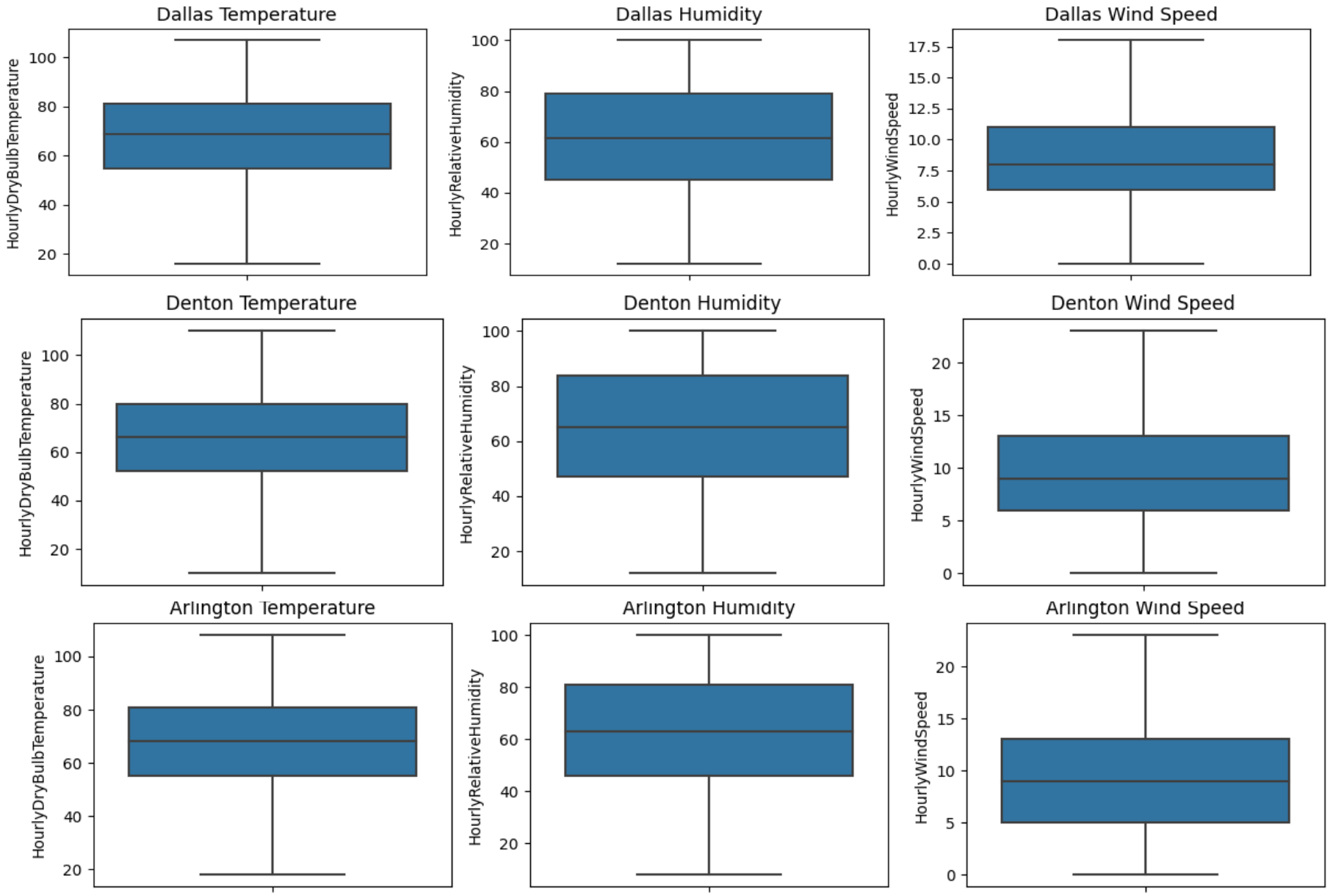
Exploratory Data Analysis (EDA)

1. Summary Statistics
2. Box Plots
3. Temperature plots
4. Histograms and Distributions
5. Correlation Analysis
6. Temporal Comparison

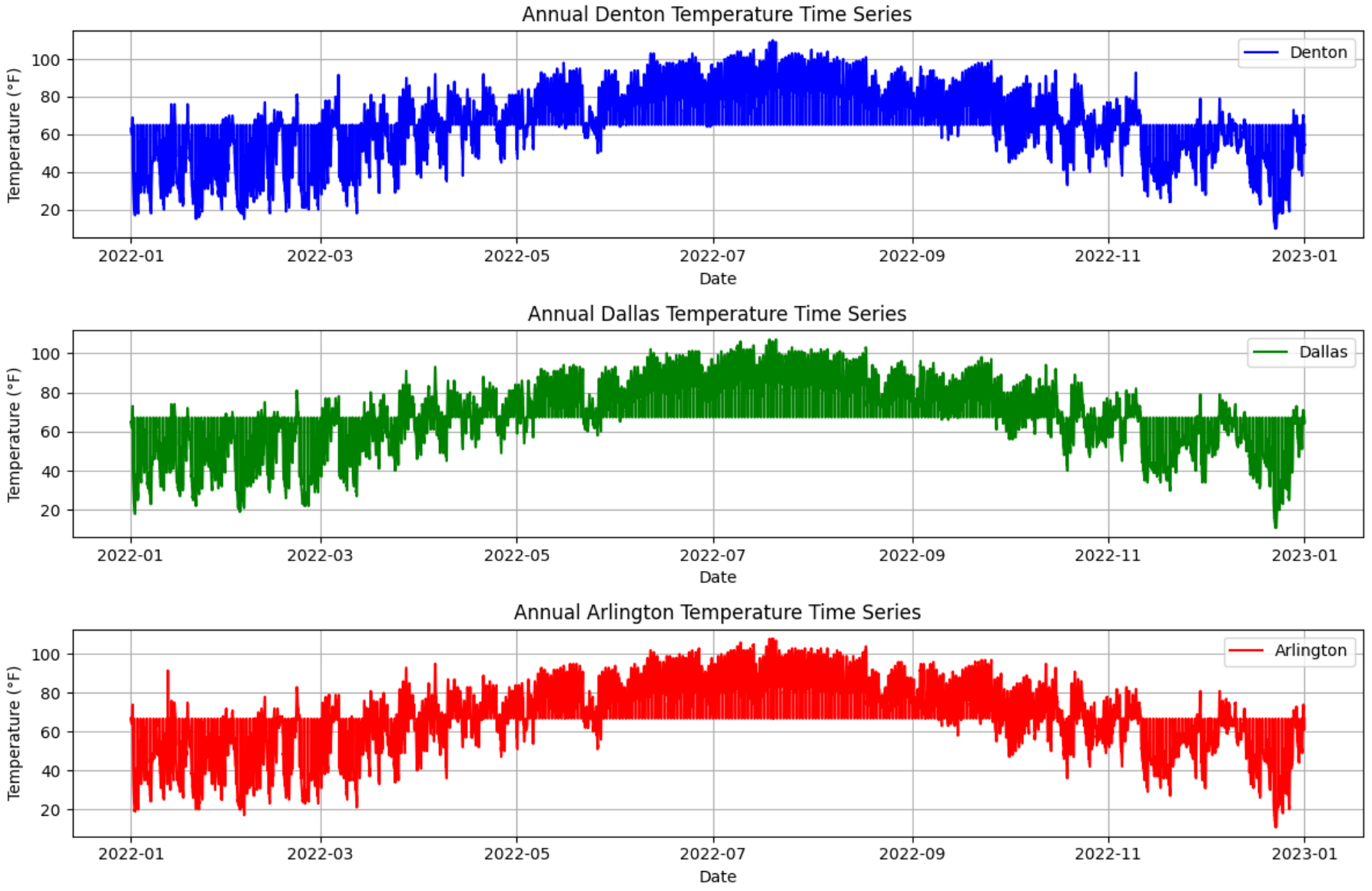
2. Box Plots: Outlier detection



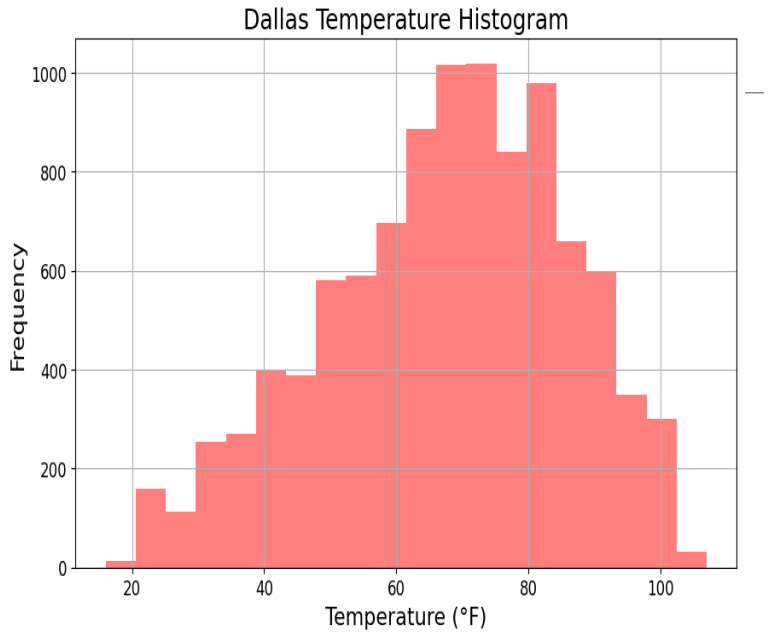
AFTER CLEANING

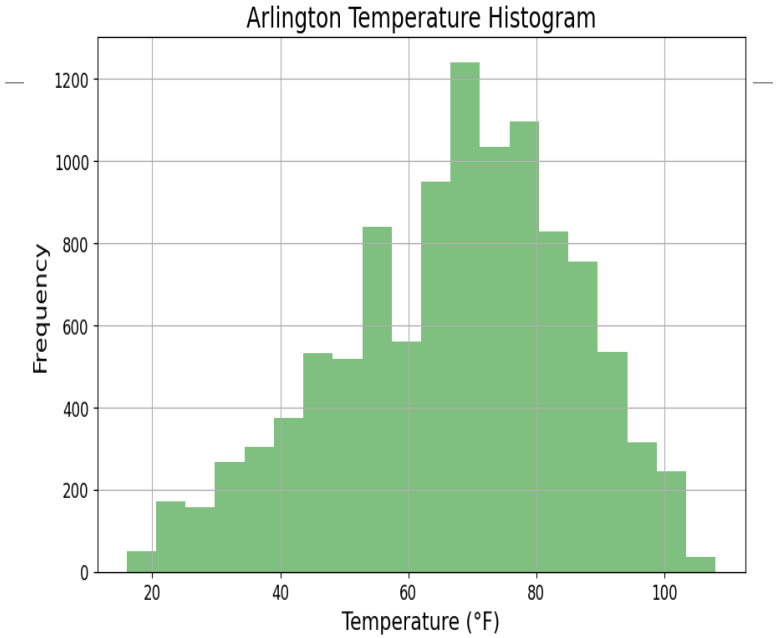


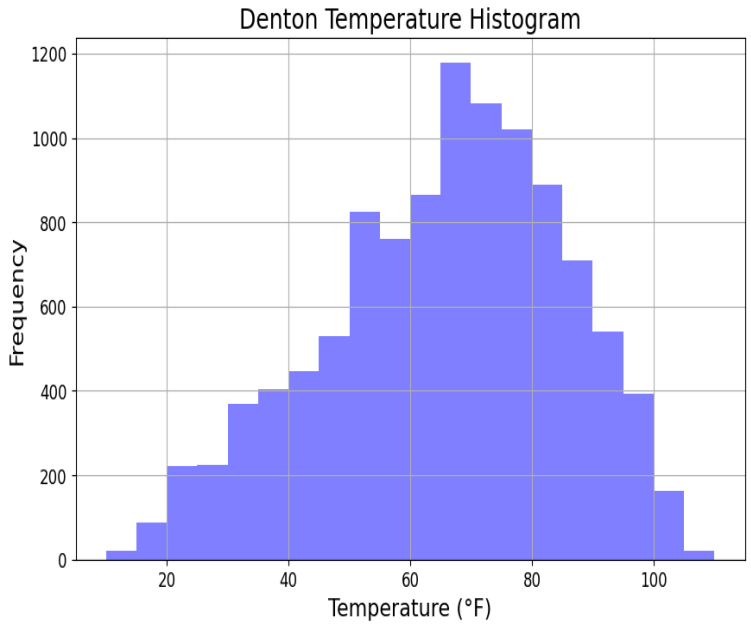
3. Annual variation of the temperature



4. Histograms and Distributions:

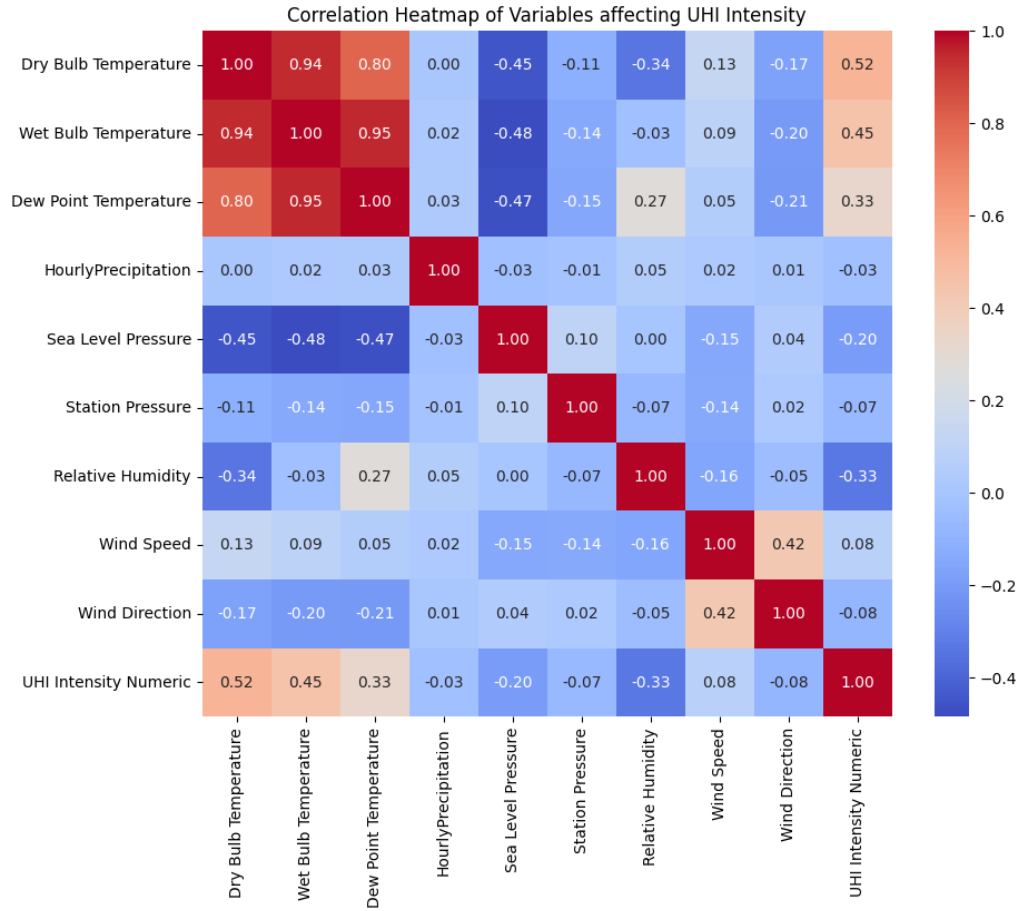




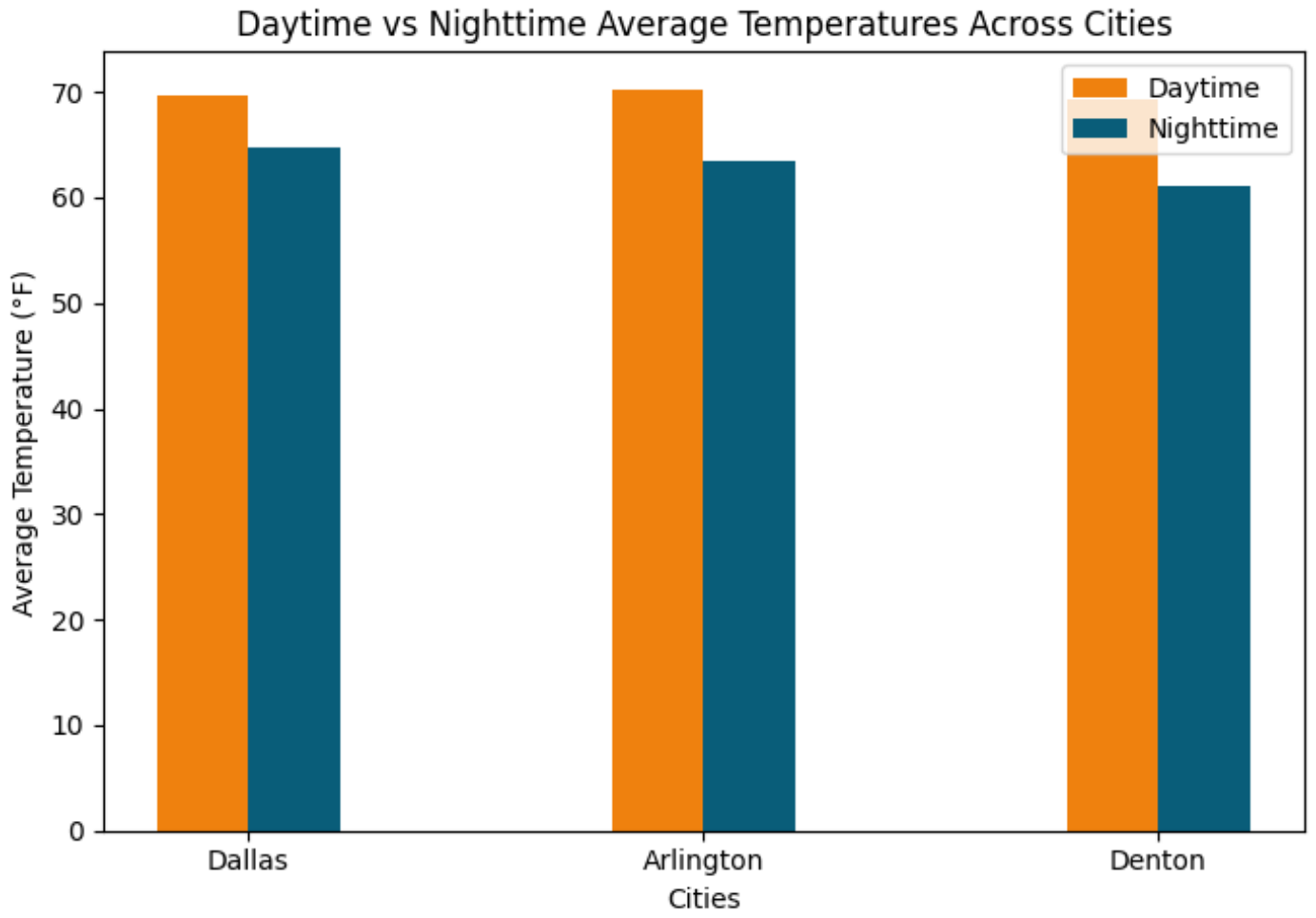


In all three cities, the **negative skew** suggests that there are **occasional periods of cooler** temperatures that pull the distribution's tail to the left. This might indicate that while the overall temperature range can be quite high, there are **fewer instances of extremely low** temperatures compared to the higher temperatures.

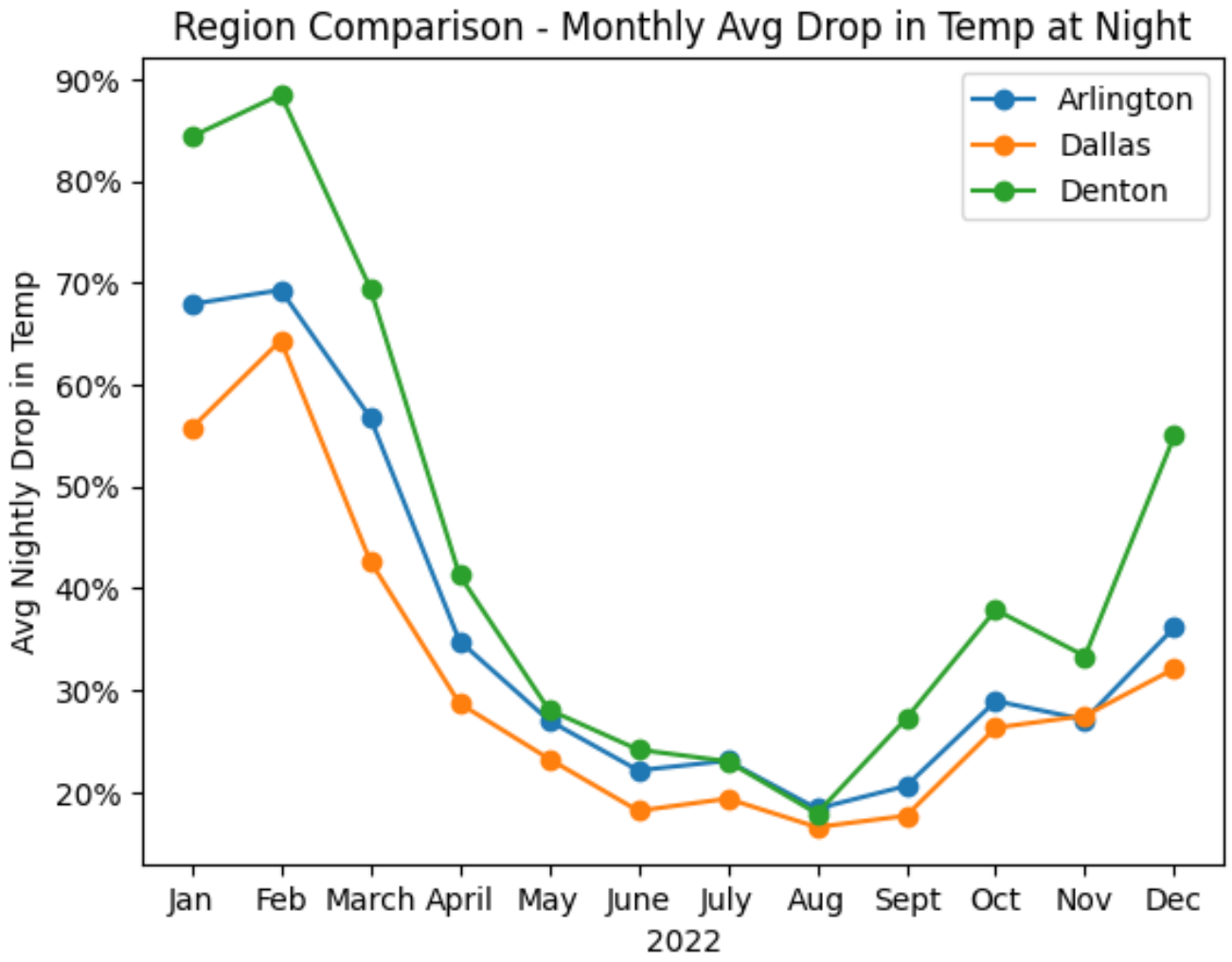
5. Correlation Analysis

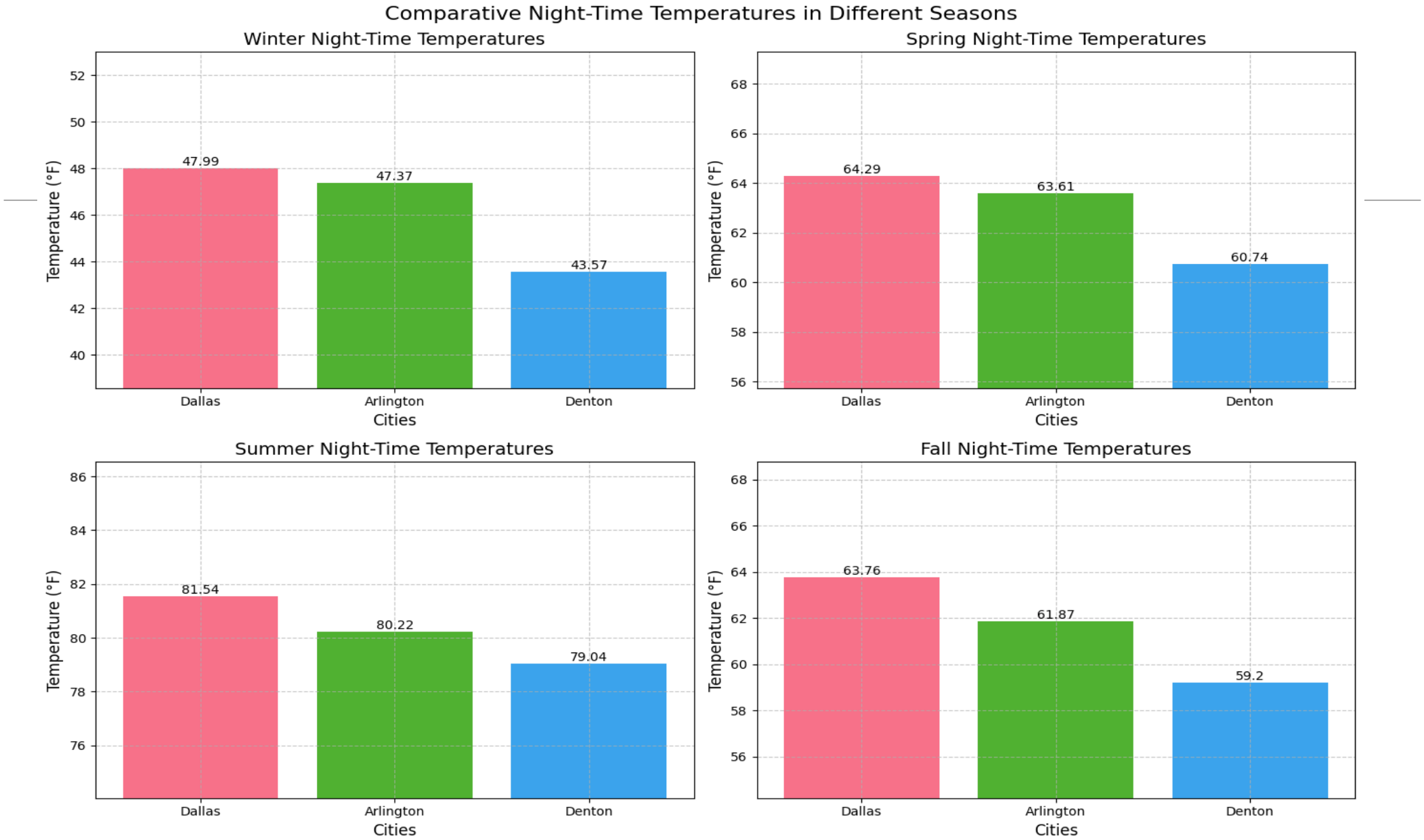


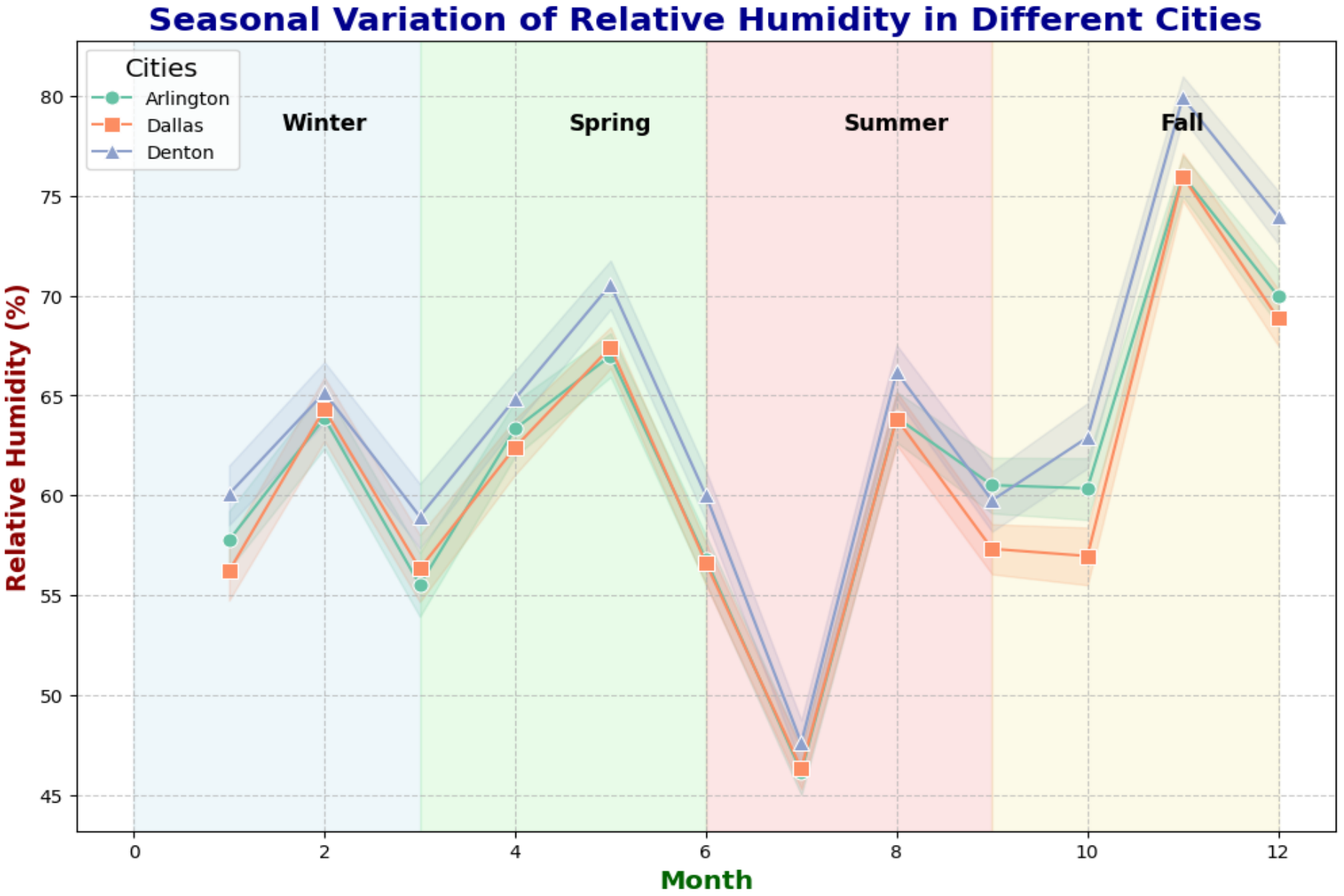
6. Temperature difference based on different times of the day



7. Region Comparison - Monthly Avg Drop in Temp at Night




Comparative Night-Time Temperatures in Different Seasons
Winter Night-Time Temperatures
Temperature (°F)
52
50
48
46
44
42
40
47.99
47.37
43.57
Dallas
Arlington
Denton
Cities
Spring Night-Time Temperatures
Temperature (°F)
68
66
64
62
60
58
56
64.29
63.61
60.74
Dallas
Arlington
Denton
Cities
Summer Night-Time Temperatures
Temperature (°F)
86
84
82
80
78
76
81.54
80.22
79.04
Dallas
Arlington
Denton
Cities
Fall Night-Time Temperatures
Temperature (°F)
68
66
64
62
60
58
56
63.76
61.87
59.2
Dallas
Arlington
Denton
Cities


Seasonal Variation of Relative Humidity in Different Cities
Cities
Arlington
Dallas
Denton
Winter
Spring
Summer
Fall
Relative Humidity (%)
80
75
70
65
60
55
50
45
0
2
4
6
8
10
12
Month

Feature Engineering

RECAP: This project aims to study and analyze climatological data for **Dallas, Arlington, and Denton**, categorizing them based on an "Urban Heat Island" (UHI) Intensity scale. The goal is to understand the microclimatic effects of urbanization in different settings and **classify UHI intensity levels**. The project will focus on three key aspects:

1.Dallas (Significant City):

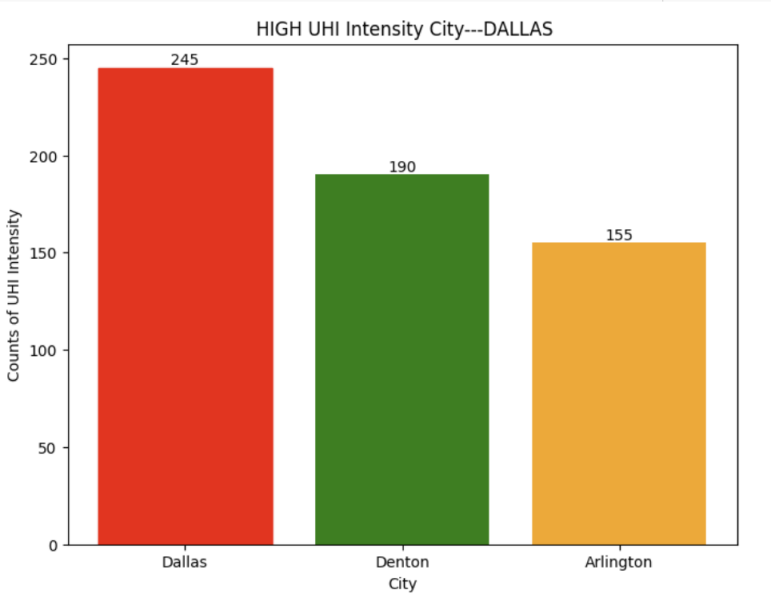
- Analyzing UHI in a major **metropolitan** area with **large** population density.
- Considering factors such as pollution, land use, and climate to determine UHI intensity.

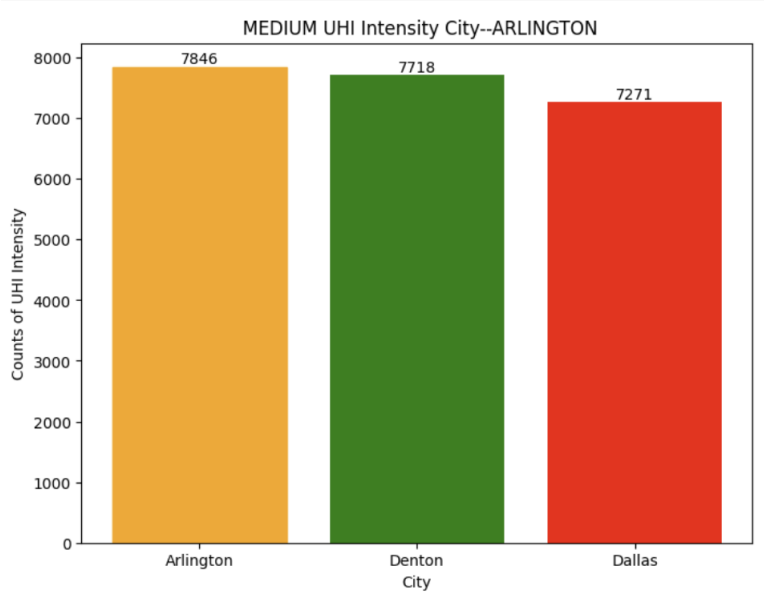
2. Arlington (Suburban Town):

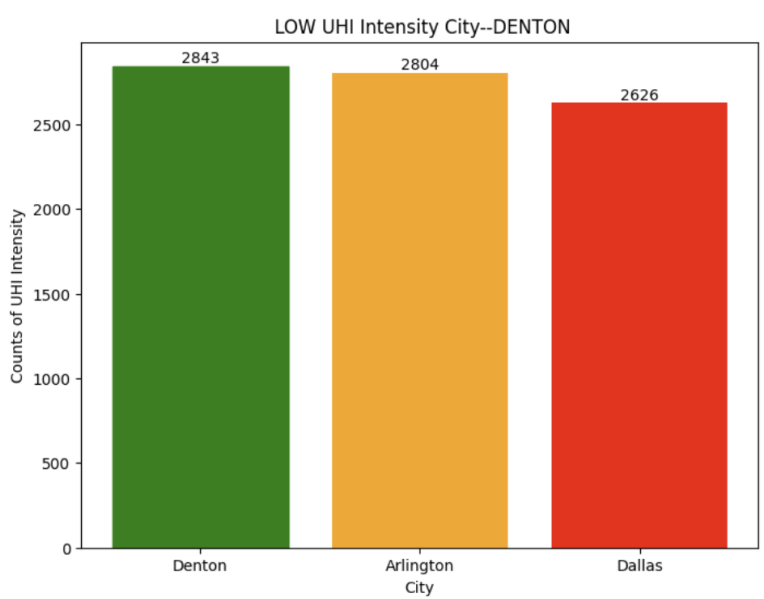
- Evaluating UHI in a **suburban** setting with **moderate** population density.

3. Denton (Rural City):

- Examining UHI in a **rural** city with **lower** population density.
- Considering factors like **reduced pollution** and different land use patterns.







MODEL SELECTION

Model 1: Decision Tree Classifier

Model 2: XGBoost Classifier

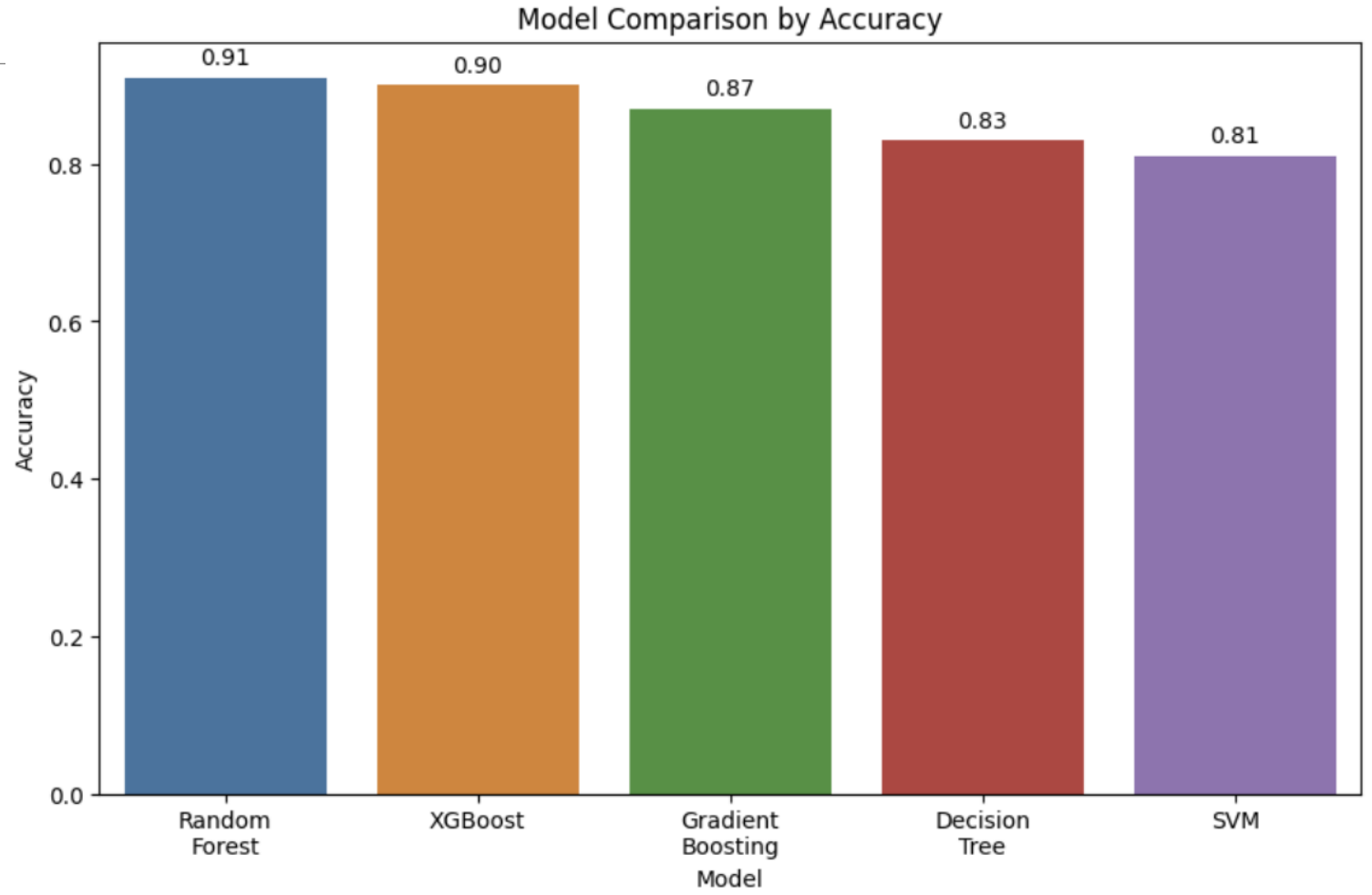
Model 3: Gradient Boost Classifier

Model 4: SVM Classifier

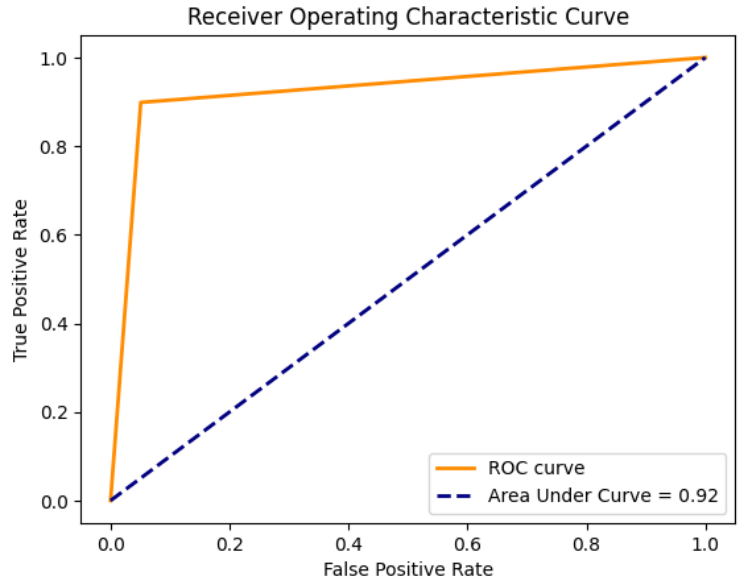
Model 5: Random Forest Classifier

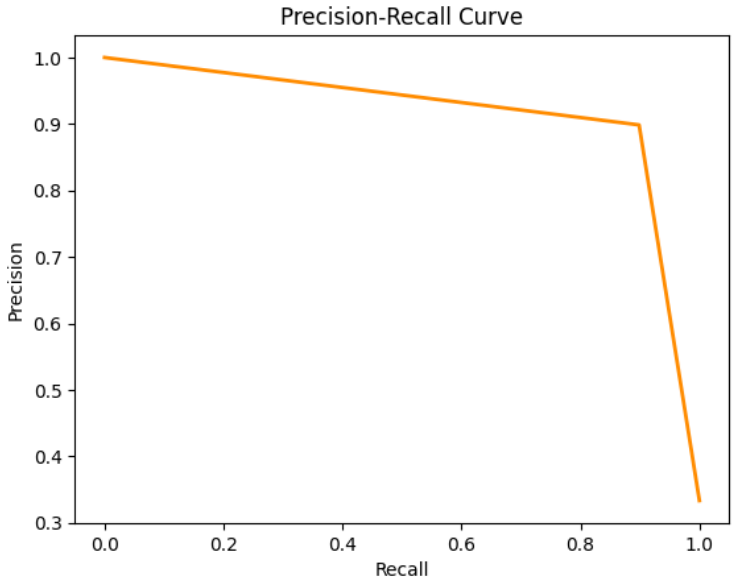
Model Training & Validation

Final Model – Random Forest

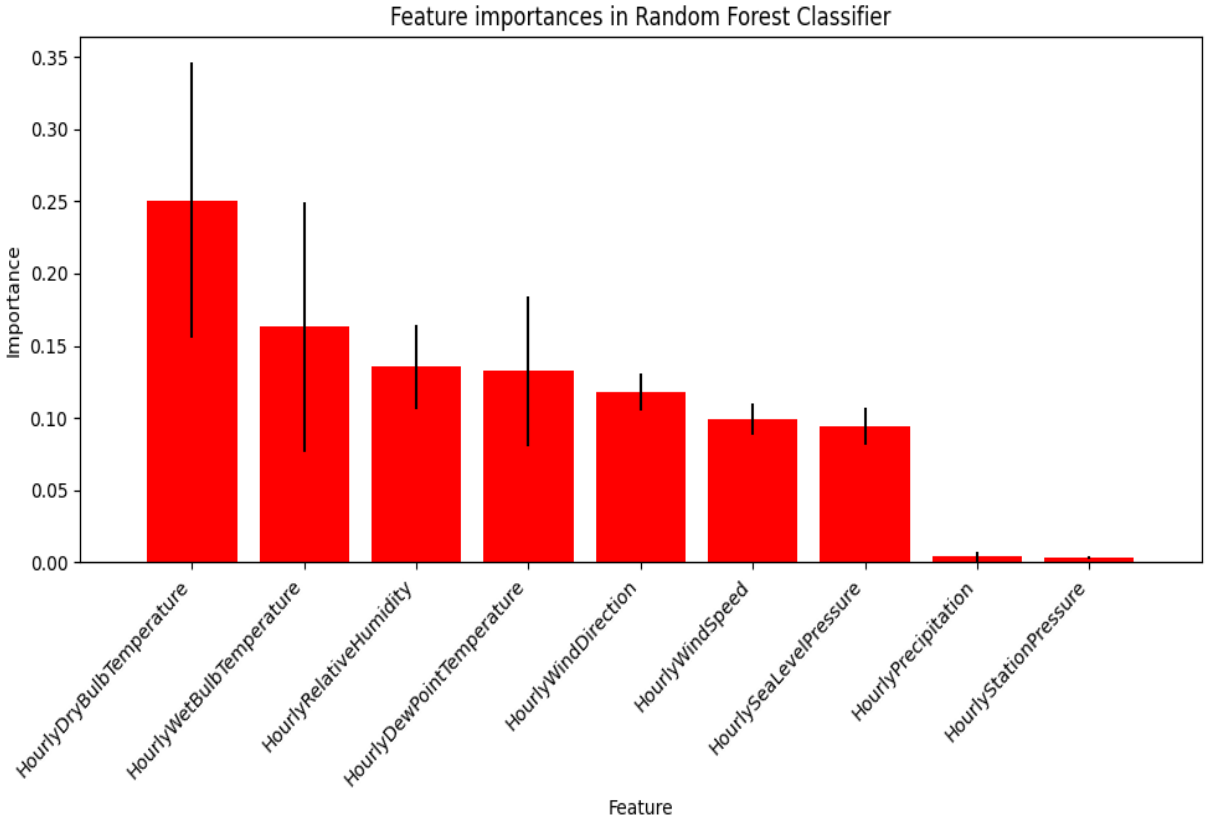


ROC and Precision-Recall Curves for RF

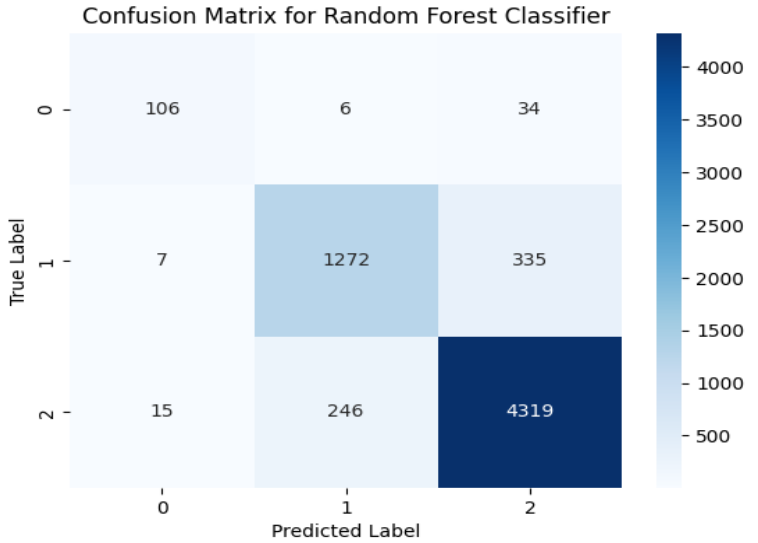




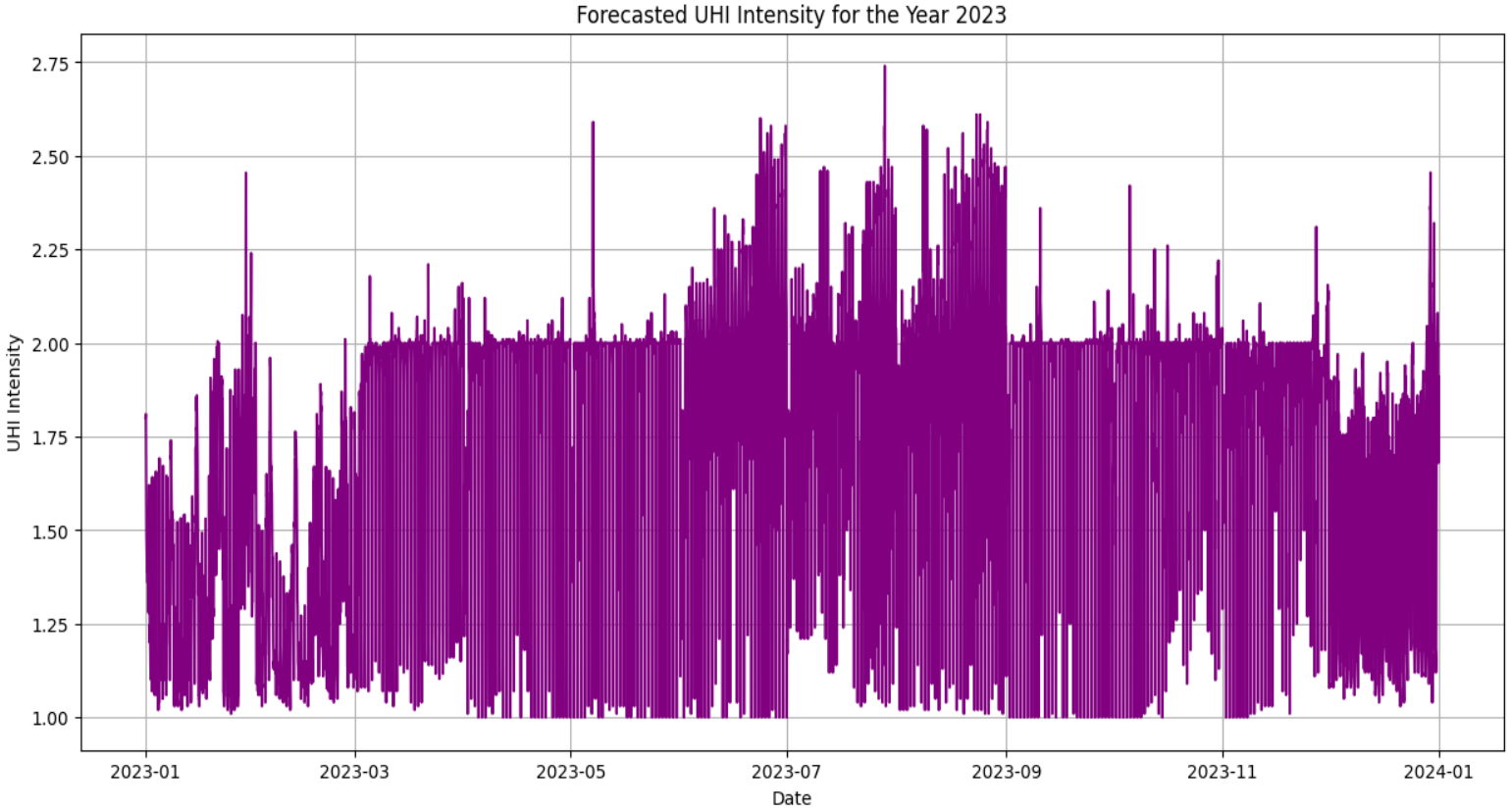
Feature Importance from Random Forest



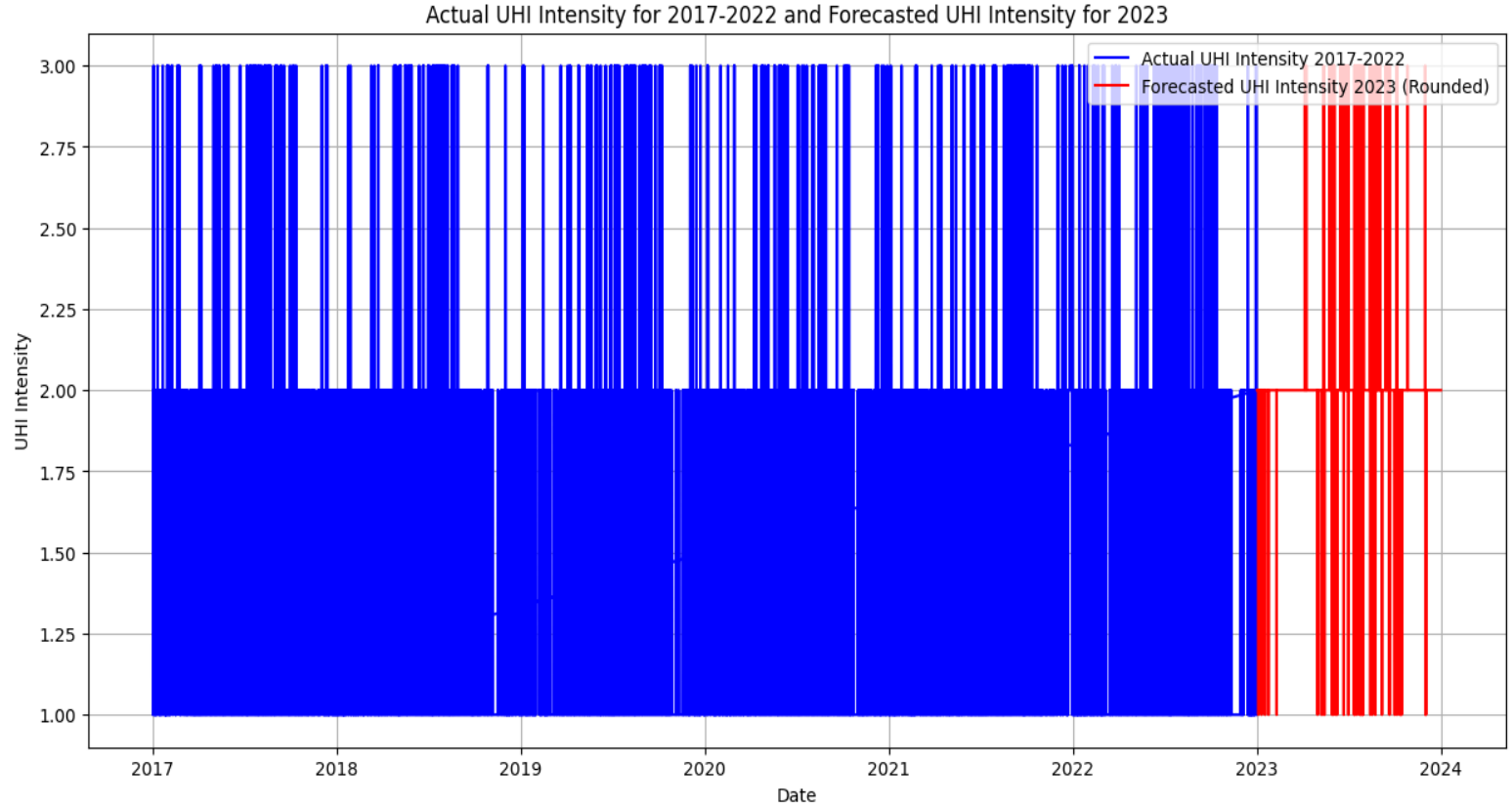
Confusion Matrix for Random Forest Classifier



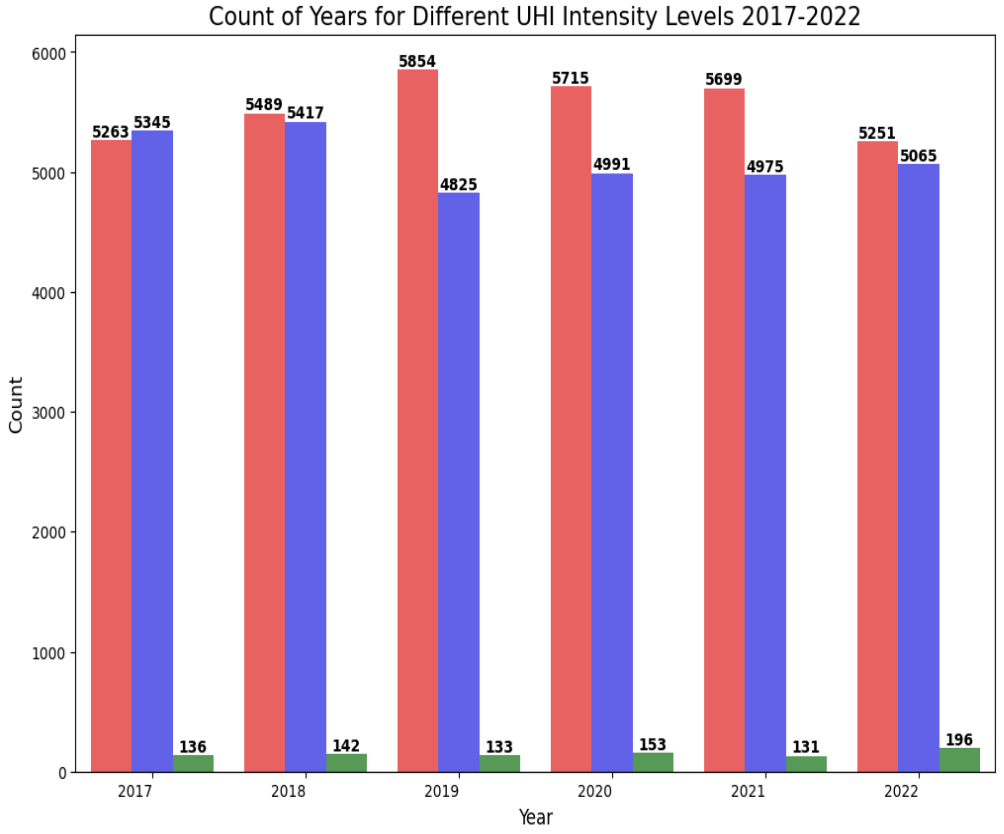
TIME SERIES ANALYSIS

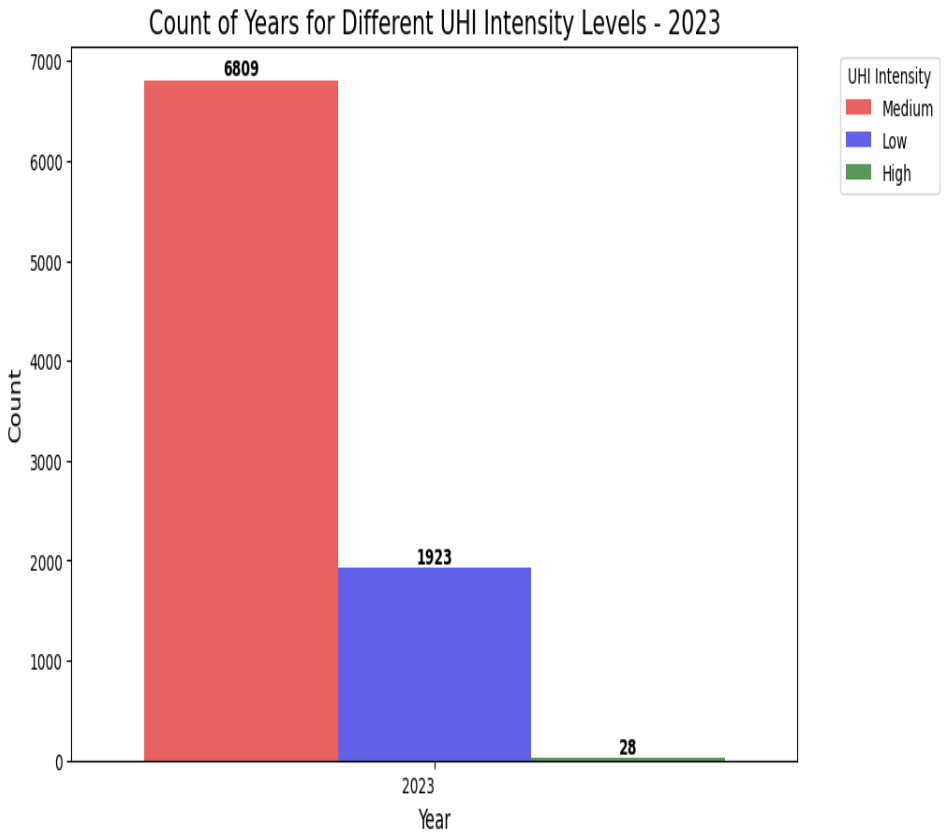


FORECASTING



COMPARISION





CONCLUSION