

Weather condition in Tehran 2023-2024

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Computer Based Research Tools and Applications
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Weather Data Overview

(1 October 2023 – 30 September 2024)

Dataset Details:

•**Total Records:** 366 daily weather data points from Tehran, Iran

Variables Included:

- date:** Date of the weather record
- tavg:** Average temperature (°C)
- tmin:** Minimum temperature (°C)
- tmax:** Maximum temperature (°C)
- prcp:** Precipitation (mm)
- wspd:** Wind speed (m/s)
- pres:** Atmospheric pressure (hPa)

Source: [Meteostat](#)

Hypothesis

- No normal distribution for average temperature, wind speed, and precipitation.
- No no linear correlation between average temperature and precipitation.
- Linear correlation exists between wind speed and precipitation.
- Removing outliers improves statistical results.

Temperature trend over the year

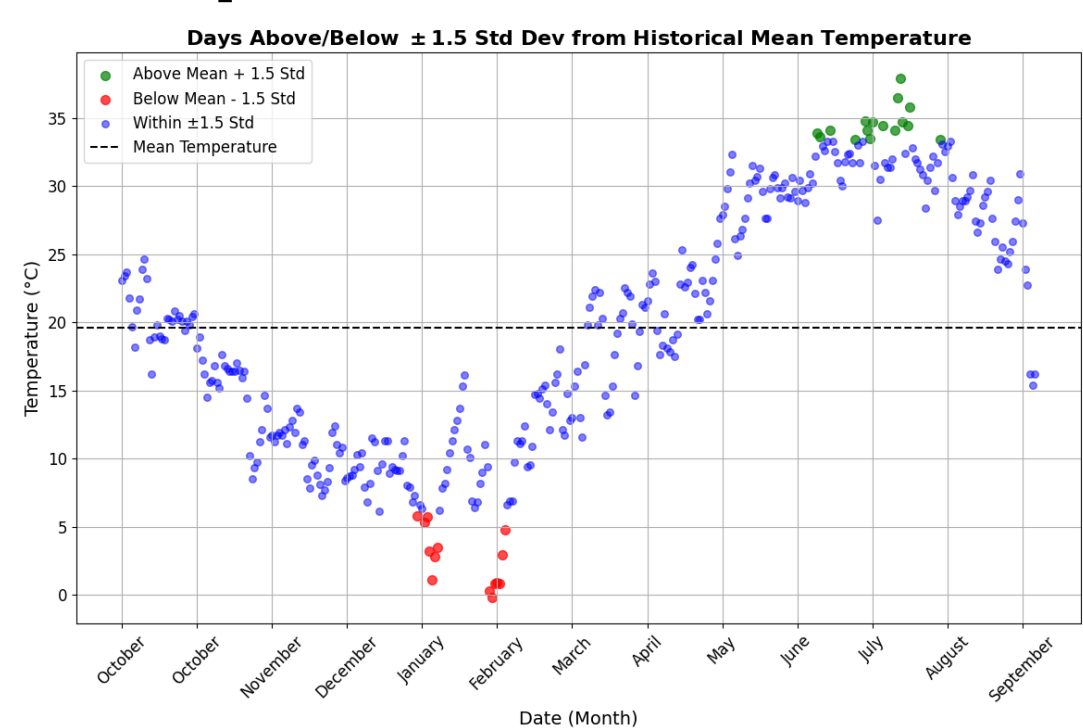


Figure 2 :This plot illustrates the temperature trends over time, showing days where the temperature is above or below the historical mean by ± 1.5 standard deviations. The green dots represent days with temperatures above the mean +1.5 standard deviations, the red dots represent days below the mean -1.5 standard deviations, and the blue dots represent days within the ± 1.5 standard deviation range.

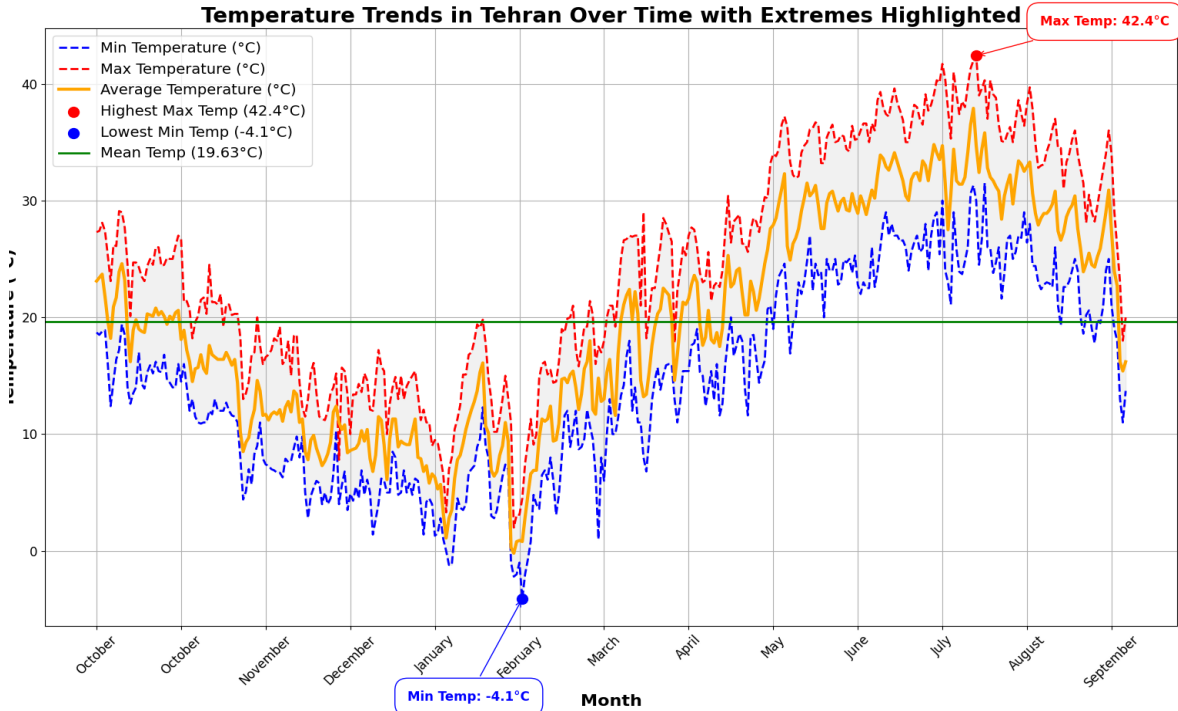


Figure 1 : This plot illustrates the trends in minimum, maximum, and average temperatures in Tehran over time. Highlighted are the extreme temperatures: the highest maximum temperature and the lowest minimum temperature, along with their corresponding dates. Shaded areas between the minimum and maximum temperatures represent the range of temperature variation on each day. The green horizontal line represents the mean temperature.

Table 1: Monthly Trends in Temperature Above/Below ± 1.5 Std

month	days_above	days_below	total_days	trend
January	0	3	3	below
February	0	9	9	below
March	0	2	2	below
April	0	0	0	below
May	0	0	0	below
June	0	0	0	below
July	9	0	9	above
August	7	0	7	above
September	0	0	0	below
October	0	0	0	below
November	0	0	0	below
December	0	0	0	below

Seasonal temperature

Calculate Z-Score and IQR outliers
The information of outlier removal data:

Season	Number of Outliers Removed	Percentage of Data Removed
Winter	17	18.68%
Spring	18	19.57%
Summer	11	11.96%
Fall	0	0.00%
Total	46	16.14%

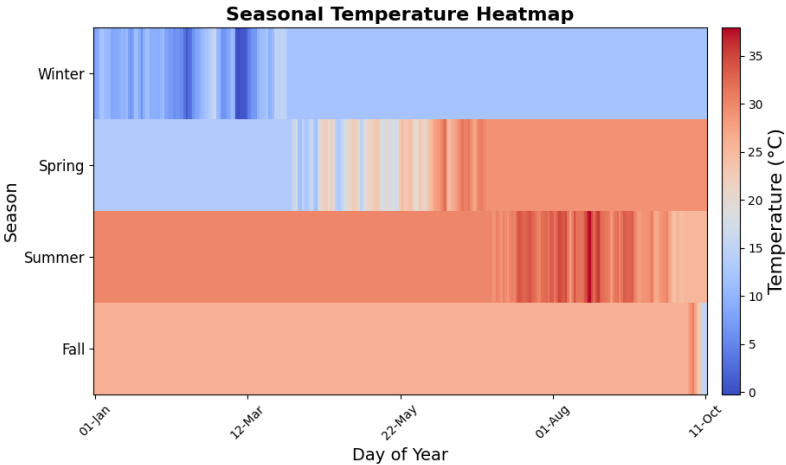
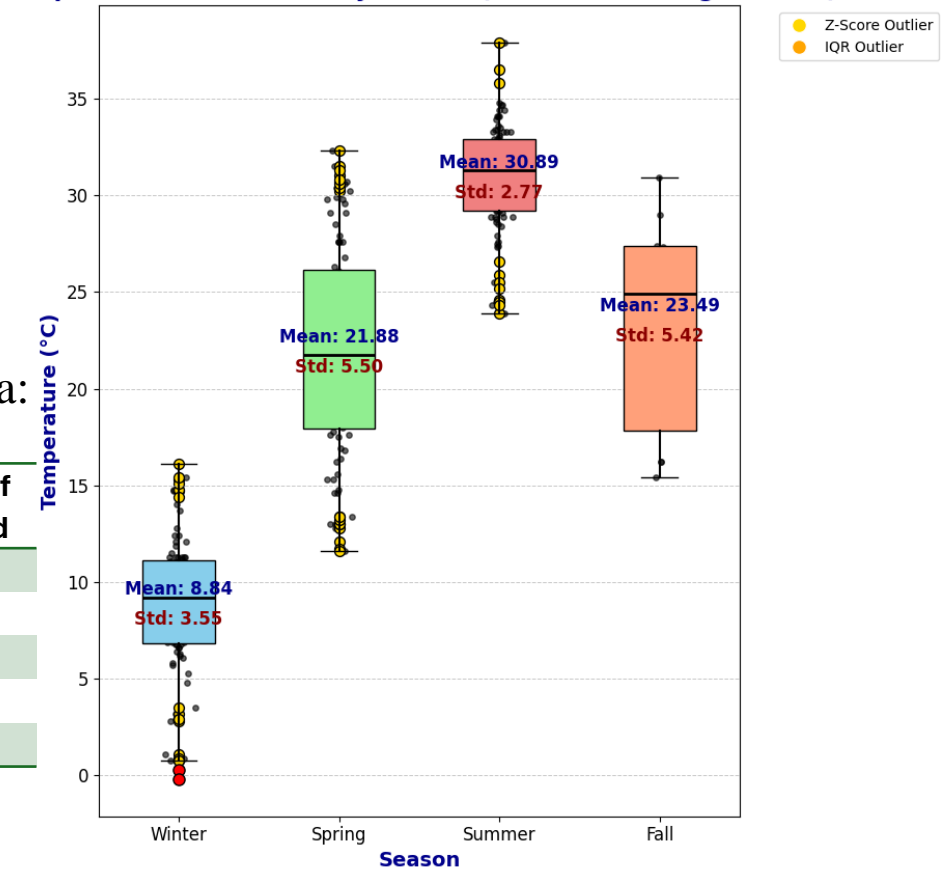


Figure 4 : This heatmap represents the average daily temperatures across seasons in Tehran for the year 2024.

Temperature Distribution by Season (Before Removing Outliers)



Temperature Distribution by Season (After Removing Outliers)

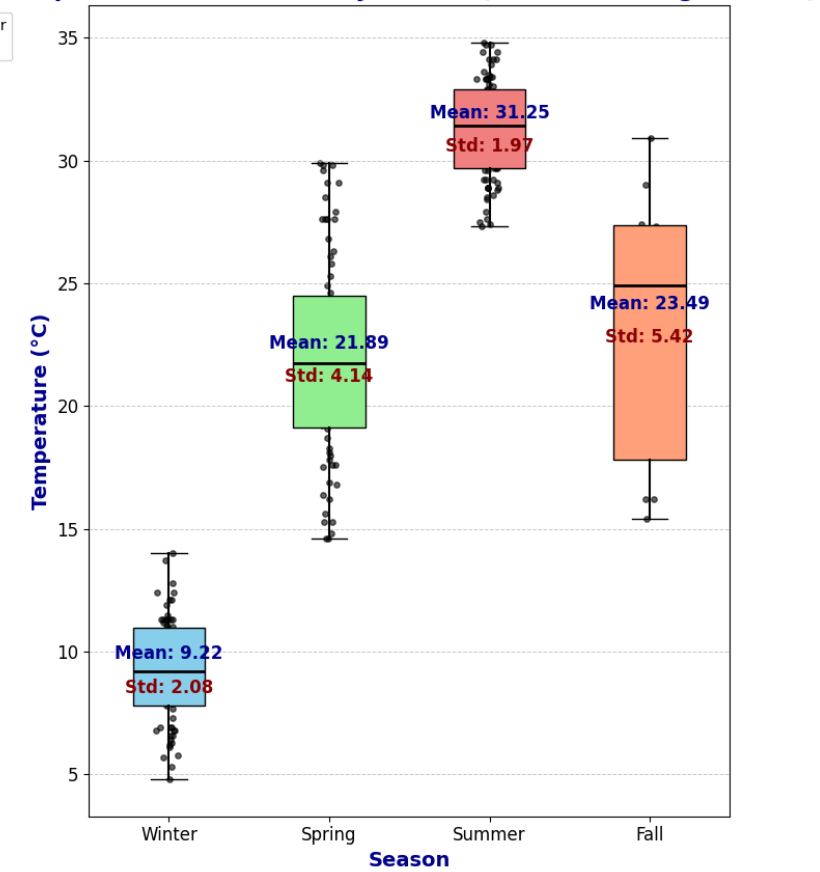


Figure 3: Comparison of temperature distributions across seasons.
The left plot shows the original data with Z-Score (gold) and IQR (orange) outliers highlighted.
The right plot shows the cleaned data with outliers removed for better representation of seasonal trends.

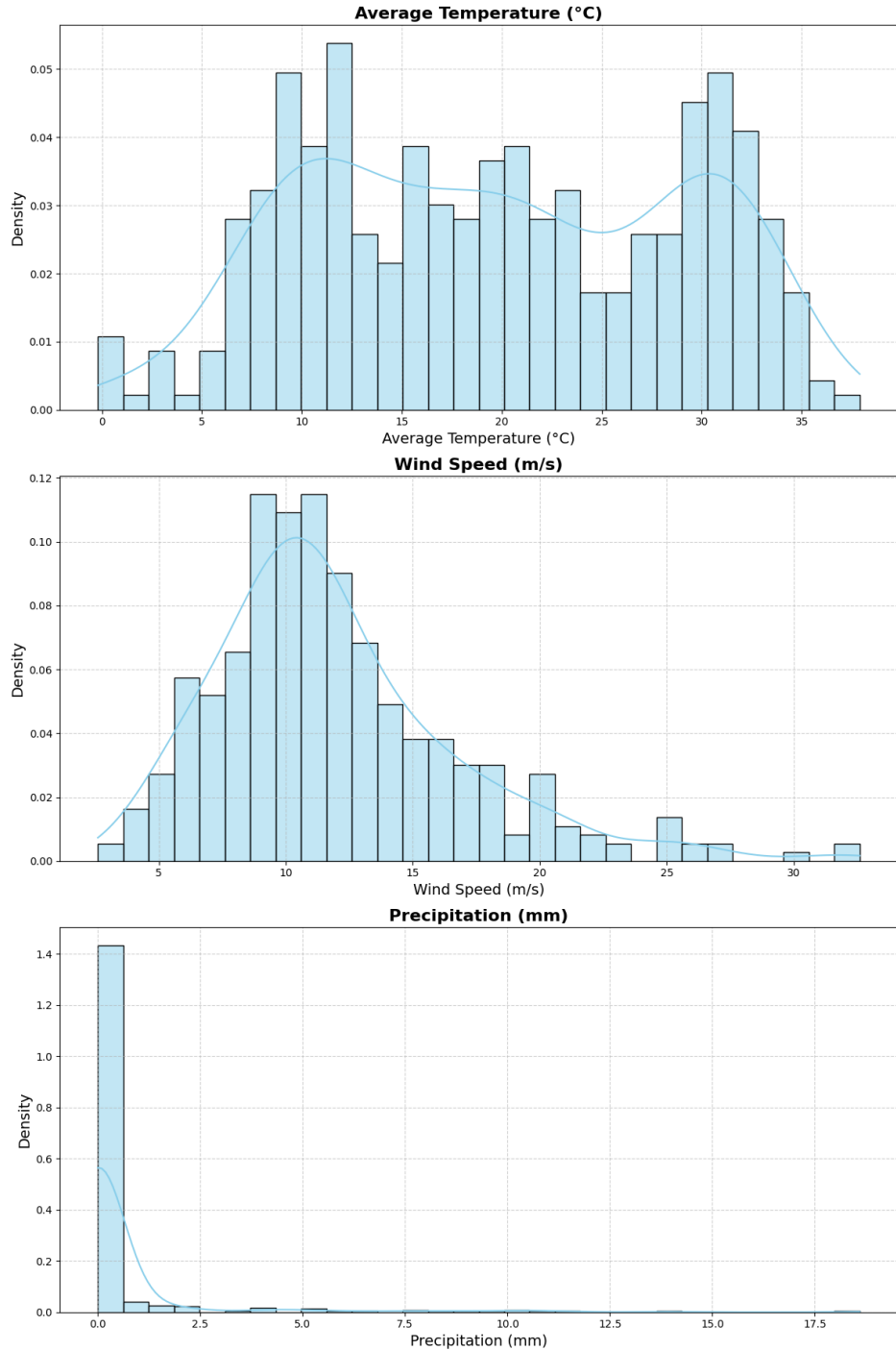


Figure 5: Distributions of temperature, wind speed, and precipitation with KDE.

Distribution of data

Statistical Analysis Table:

	Skewness	Kurtosis	Shapiro-Wilk Test Stat	Shapiro-Wilk P-value \
tavg	0.00983	-1.15549	0.956811	0.0
wspd	1.18579	2.034058	0.927751	0.0
prcp	5.042631	28.8941	0.29523	0.0

Normal Distribution

tavg	No
wspd	No
prcp	No

Temperature and Precipitation Trends in Tehran Over Time

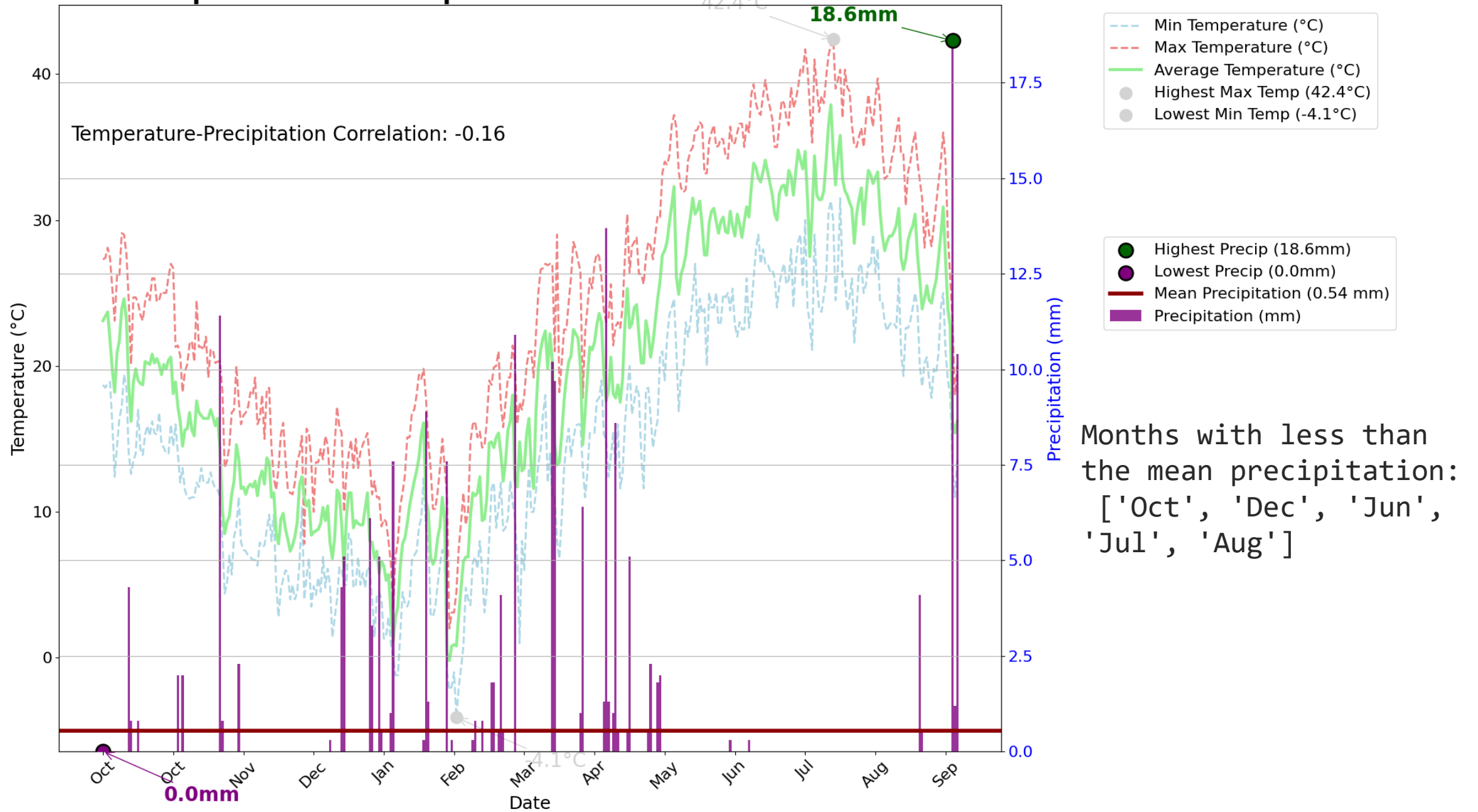
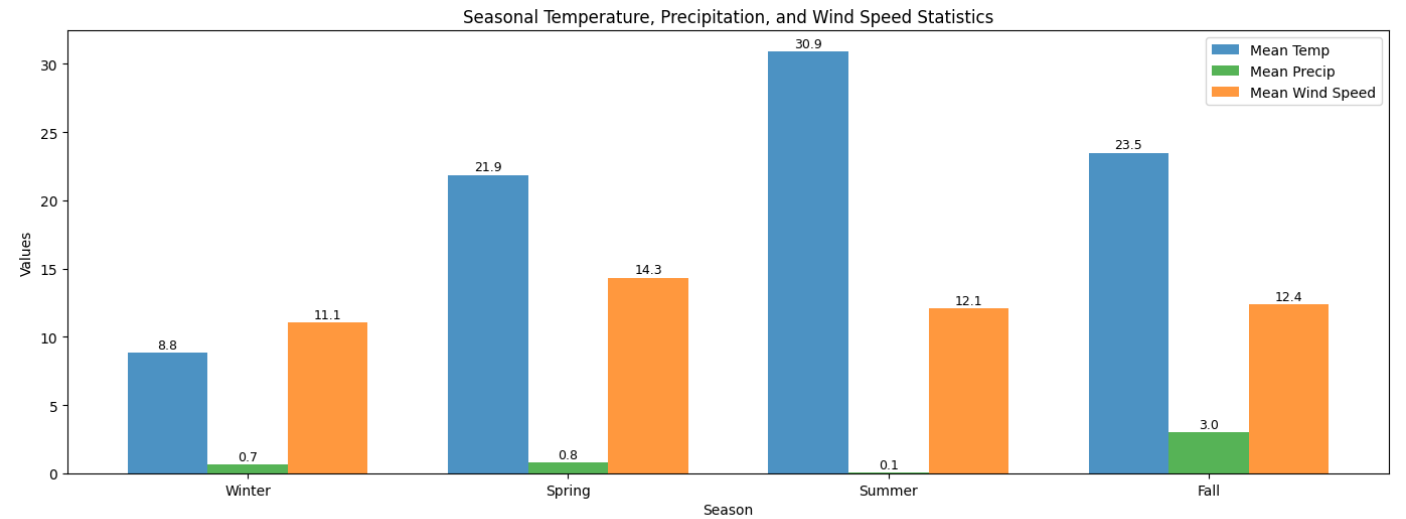


Figure 6 :This plot illustrates the trends in minimum, maximum, and average temperatures in Tehran over time. Temperature trends are shown in light colors, while precipitation is represented with darker purple bars. Extreme values for both temperature and precipitation are highlighted, and the correlation between temperature and precipitation is displayed in the top left corner.



	Min Temp (°C)	Max Temp (°C)	Mean Temp (°C)	Median Temp (°C)	Std Temp (°C)	Min Precip (mm)	Max Precip (mm)	Mean Precip (mm)	Median Precip (mm)	Std Precip (mm)	Min Wind Speed (m/s)	Max Wind Speed (m/s)	Mean Wind Speed (m/s)	Median Wind Speed (m/s)	Std Wind Speed (m/s)
Winter	-0.2	16.1	8.84	9.2	3.57	0.0	8.9	0.68	0.0	1.82	3.9	25.7	11.08	10.1	4.95
Spring	11.6	32.3	21.88	21.75	5.53	0.0	13.7	0.83	0.0	2.57	8.2	32.6	14.34	12.3	5.44
Summer	23.9	37.9	30.89	31.3	2.79	0.0	4.1	0.06	0.0	0.43	8.0	20.6	12.11	11.7	2.58
Fall	15.4	30.9	23.49	24.9	5.71	0.0	18.6	3.02	0.0	6.36	8.0	21.3	12.37	11.5	3.75

Figure 7 and Table 2: Seasonal Temperature, Precipitation, and Wind Speed Statistics
The figure shows the average temperature (°C), precipitation (mm), and wind speed (m/s) across seasons (Winter, Spring, Summer, and Fall) as grouped bar charts. The table below summarizes detailed seasonal statistics, including minimum, maximum, mean, median, and standard deviation for each variable. The data is derived from Tehran's weather dataset, highlighting seasonal variations in climate parameters.

Temperature shows a slight negative trend with wind speed and pressure

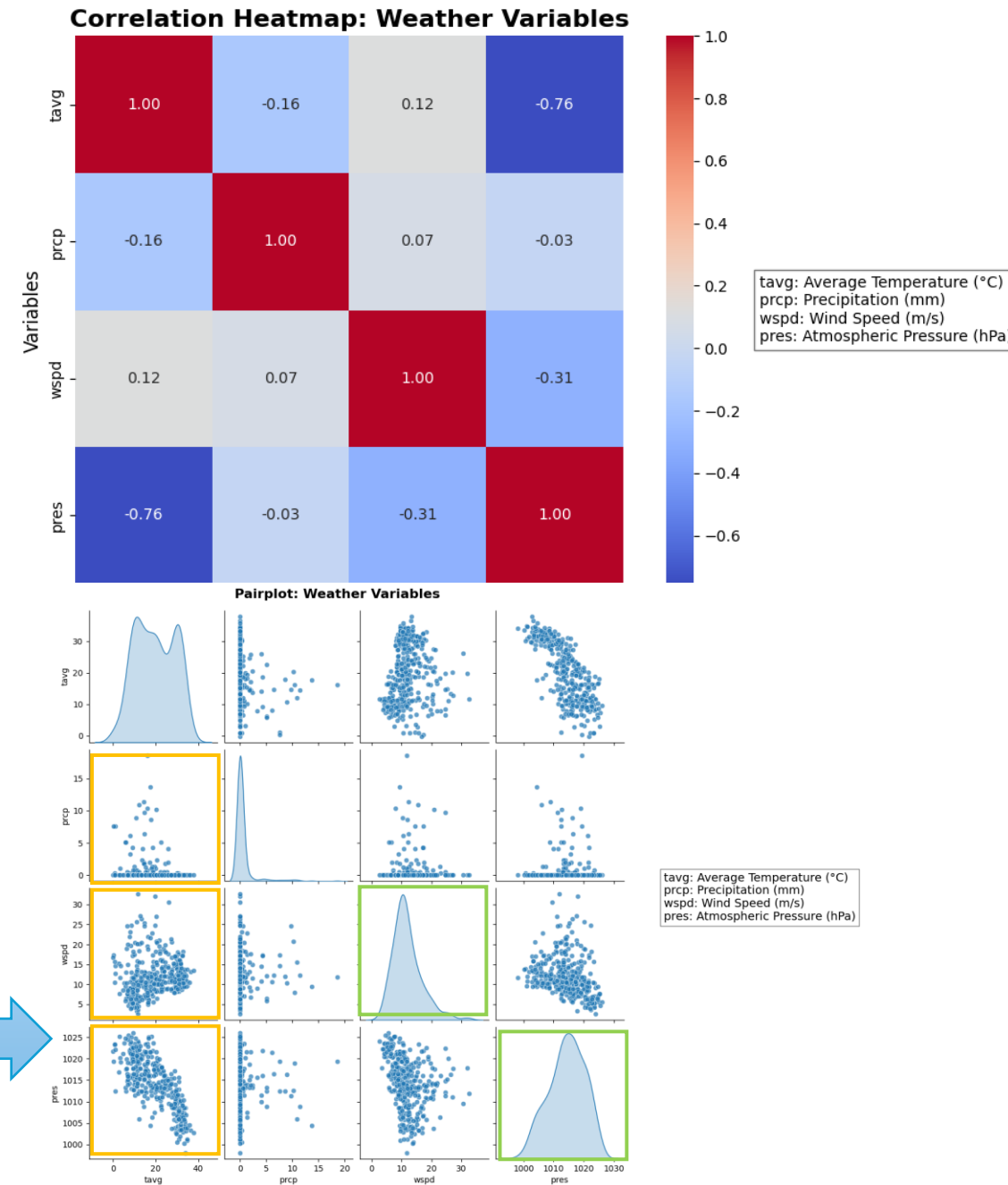


Figure 8: The correlation heatmap and pairplot illustrate relationships among selected weather variables in Tehran.



Conclusion

- Tehran is a relatively dry and hot city! 🥵