Climatic Analysis of Manipal

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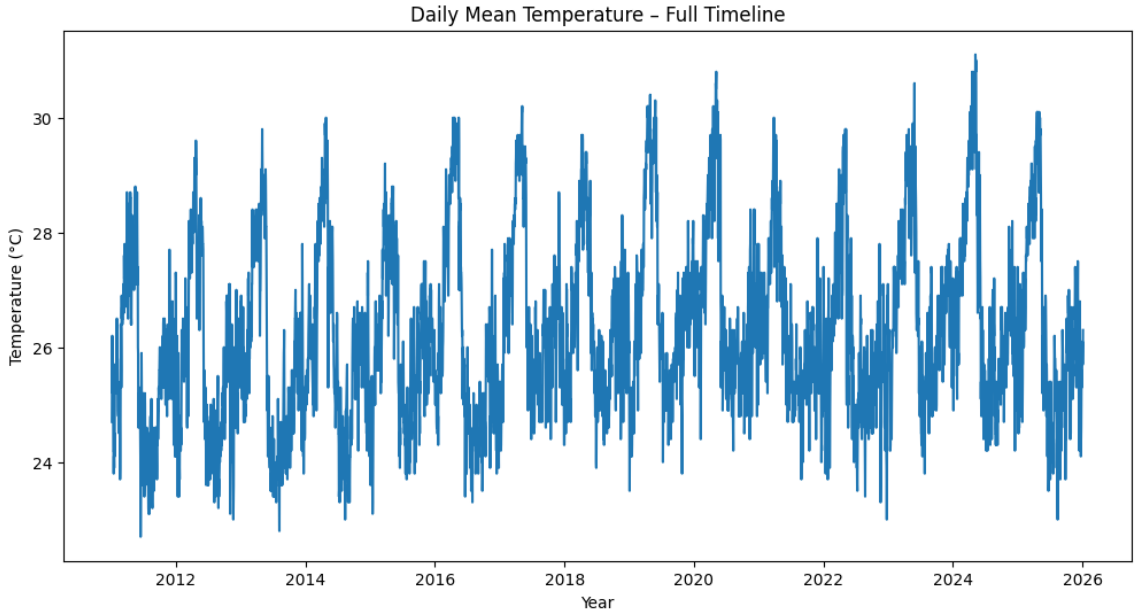
Dataset Description

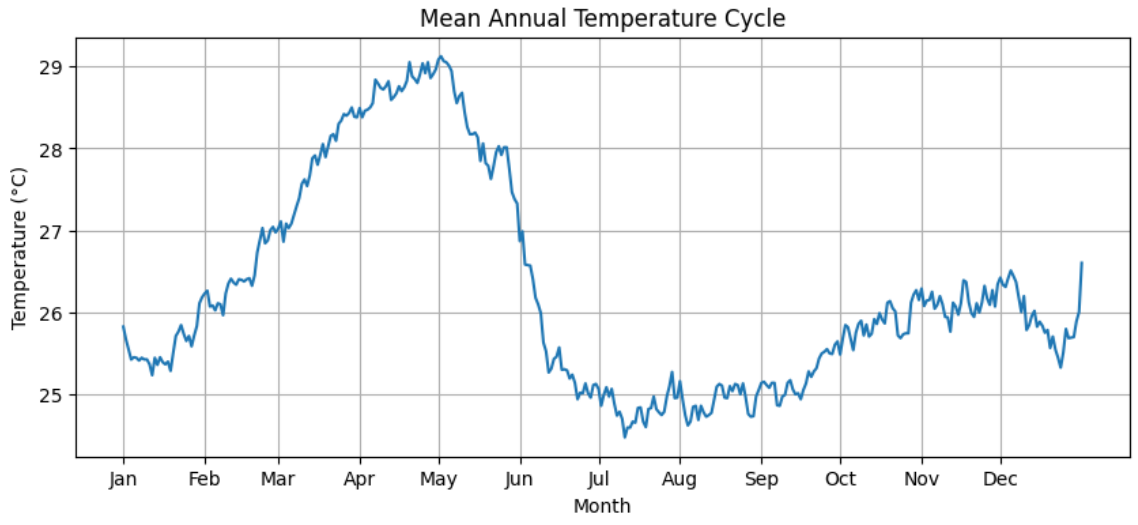
The dataset contains the weather statistics of Manipal for the years 2010 to 2025 with some data of 2026 as well which we will be using until the 4th of January. The dataset has 13 columns which act as parameters (except time that itself is the sequence) to predict. What we need to predict is also within these columns. The columns are:

1. Time
2. Mean temperature at 2 m (°C)
3. Daily precipitation sum (mm)
4. Shortwave radiation sum (MJ/m^2)
5. Mean apparent temperature (°C)
6. Maximum wind speed at 10 m (km/h)
7. FAO evapotranspiration (mm)
8. Sunshine duration (s)
9. Dominant wind direction (°)
10. Mean sea-level pressure (hPa)
11. Mean cloud cover (%)
12. Mean dew point at 2 m (°C)
13. Mean soil moisture (0–7 cm) (m^3/m^3)

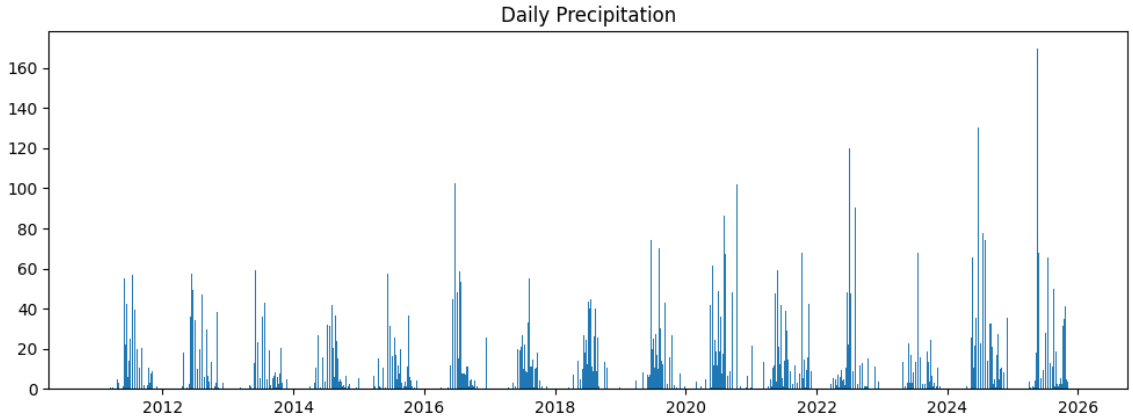
Exploratory Data Analysis

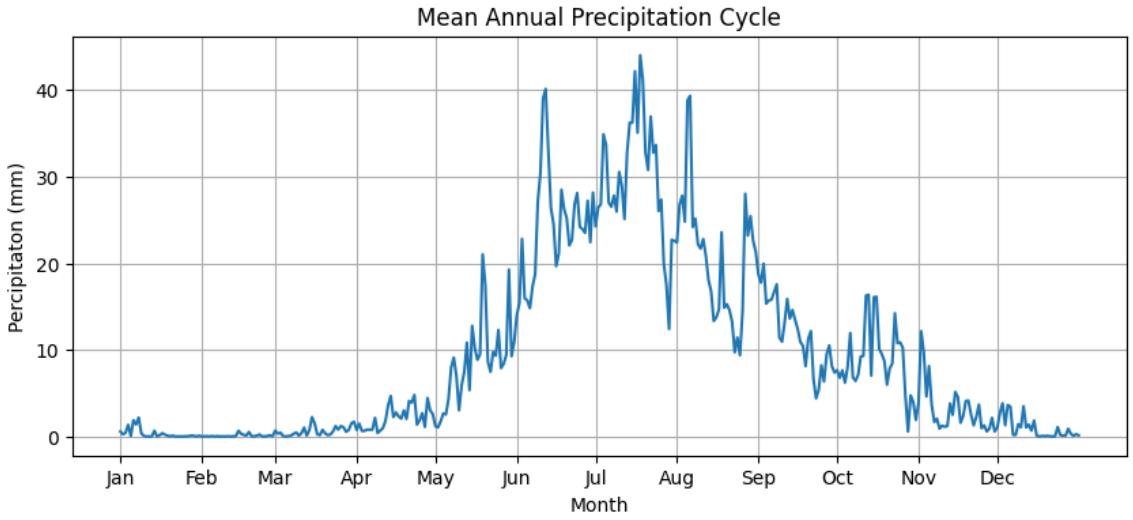


This is a graph of mean daily temperature with time over the course of 15 years. We can a repeating pattern with the distribution each year almost the same. To visualise this repeating pattern we go on to the next graph.



This graph shows the mean annual temperature cycle. It shows the average temperature of each day averaged over 15 years. It gives us a good idea about the annual temperature distriubution. The temperature is lowest during the peak monsoon seasons and the overall temperature is range is not that high due to Manipal's coastal location.





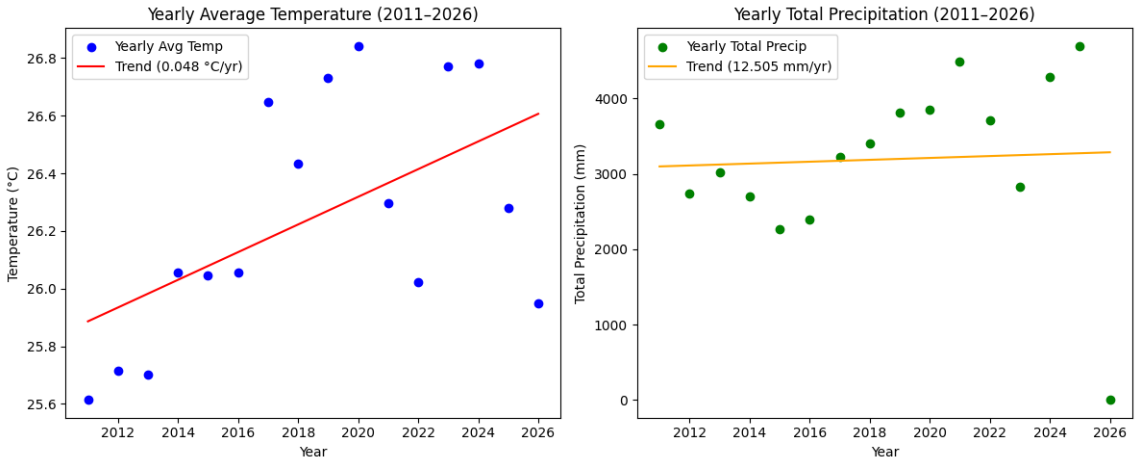
The two precipitation graphs are similar to the temperature ones. Even here we see no significant anomaly except a minute pattern of the precipitation increasing over the years. The precipitation is highest during the peak monsoon months.

Climate Change Trend Quantification

A linear regression model of the form

$$y = \beta_0 + \beta_1 t$$

was fitted to yearly-aggregated climate variables, where β_1 represents the long-term climate trend.



Temperature trend: 0.048 °C per year Precipitation trend: 12.505 mm per year Both temperature and precipitation have increased on average of the last 15 years indicating the effects of global warming.