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THE LINKAGE BETWEEN AIR TEMPERATURE, DEW POINT TEMPERATURE AND RELATIVE HUMIDITY IN DELHI, INDIA

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Abstract
The weather elements, such as air temperature, dew point temperature, and relative humidity, are important indicators of moisture in the air. The changes in these elements lead to various environmental and health impacts. Severe air pollution episodes also happen due to these changes, which enhance risk of disaster. A research study was conducted to determine the linkage between dew point temperature and relative humidity in Delhi for the year 2016. The results showed that the relationship between dew point temperature and relative humidity was linear, and a significant correlation (R^2=0.77) was confirmed between both weather elements during the study period. Knowledge of such elements and other atmospheric processes is helpful in weather forecasting.

Introduction

The term atmospheric weather refers to a phenomenon that affects our day-to-day activities. Weather conditions like hurricanes, and tornadoes causes massive destruction around the globe. Variations in temperature, humidity, wind, and other parameters can affect the climate and agriculture on a large scale. However, such changes happen over hundreds to thousands of years. Technological development has led to the creation of new methods and instruments for monitoring and analyzing weather conditions (Ukhurebor et al., 2017; Abu-Taleb, 2007).

Meteorology is a branch of science where data is collected and monitored to forecast weather. The air temperature, dew point temperature, wind speed, wind direction, relative humidity, etc. are calculated using atmospheric maps and ground-based measurements. The Geographical Information System (GIS) is mostly used for understanding the complexity of climate and to predict changes over a certain period of time. Weather is an unpredictable phenomenon; hence, weather satellites are considered reliable to collect information on weather elements, and patterns (Akhilesh et al., 2015; Lawrence, 2005; Ukhurebor et al., 2017).

The temperature measurement indicates the hot or cold weather and is usually measured in Celsius. Dew point temperature is an indicator of moisture in the air, it is the temperature at which air condenses into dew or frost at constant air pressure. Whereas relative humidity is the percentage of the degree of air saturation. Since dew point is directly related to water vapours, together with relative humidity, this helps in determining the moisture content of air. When dew point is higher, there will

be more moisture in the air. Monitoring of these elements helps in determining climatic disturbances (Yousif and Tahir, 2013; Elemo et al., 2021). The study was conducted to determine the relationship between weather elements in Delhi.

Methodology

Delhi is located in North India at 28°24′17″ and 28°53′00″ N Lat., 77°45′30″ and 77°21′30″ E long and approximately 216m amsl. Located in the subtropical belt, Delhi has intensely hot summers and cold winters. The data was directly accessed from the monitoring station installed at Safdarjung Airport, Delhi, from January 2016 to December 2016. Dew point temperature can also be calculated using the following equation (Ukhurebor et al., 2017):

$$Td = T - \frac{(100\text{-}RH)}{5}$$

Where Td is the dew point temperature, T is the temperature, and RH is relative humidity.

Results and Discussion

Results for average air temperature, dew point temperature, wind speed, and relative humidity are shown in table 1. The data was accessed from January to December 2016. The maximum temperature of 93.13°F was recorded in the month of June, and the maximum dew point temperature in the month of July (79.08°F). The relative humidity peaked at its maximum in the month of January (83.6%) and minimum in April 2016 (37.9%). Wind speed was on higher side in the months of April and May and at its lowest in the month of January.

Table 1: Average air temperature, dew point temperature, wind speed and relative humidity for the year 2016

Month and year	Avg. Temp (°F)	Dew point temperature (°F)	Wind speed (mph)	RH (%)
January 2016	58.19	52.54	2.28	83.6
February 2016	64.11	53.3	3.08	70.3
March 2016	75.59	61.26	3.82	64.7
April 2016	86.93	56.64	5.36	37.9
May 2016	91.29	67.26	5.36	46.86
June 2016	93.13	75.45	5.14	58.6
July 2016	86.66	79.08	3.21	79.7
August 2016	85.72	78.36	3.89	77.9
September 2016	86.39	74.83	4.4	68.7
October 2016	79.25	67.12	2.85	66.9
November 2016	68.4	55.15	2.68	67
December 2016	59.9	52.48	2.52	78.7

Correlation between Relative Humidity and Dew Point:

The relationship between dew point temperature (°C) and relative humidity (%) was measured for the whole year and is shown in figure 1.1. The results showed that the relationship was linear, and a significant correlation (R^2=0.77) was confirmed between both weather elements during the study (figure 1.2). A similar trend was observed by Lawrence, 2005 and Ukhurebor et al., 2017.

The findings also indicate that an increase in relative humidity led to increase in dew point temperature most of the time, except from January to February and November to December, which means both elements have a direct relationship. The dew point temperature was always less than 30°C, which indicated that the study place had no chances of thunderstorms (Yousif and Tahir, 2013).

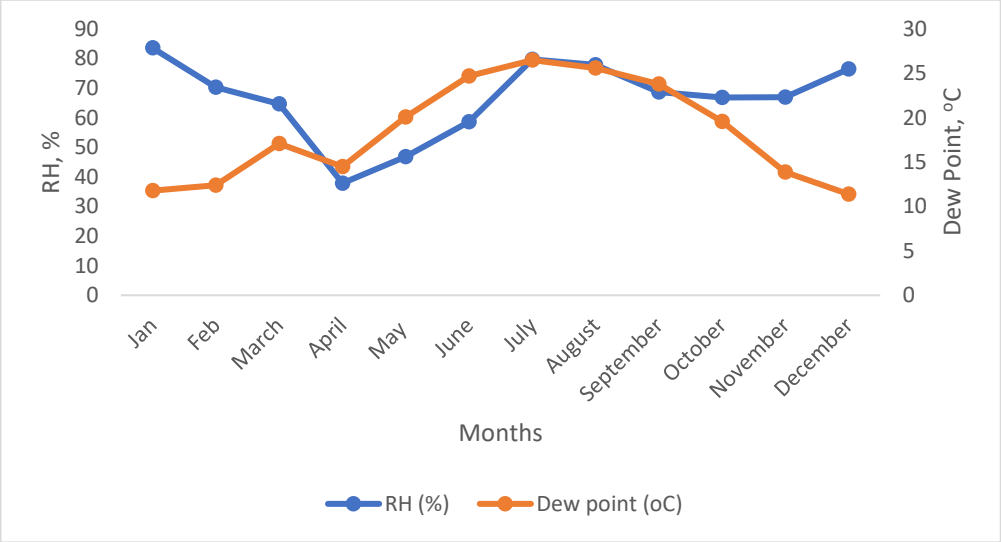

Figure 1.1: Trend graph between relative humidity and dew point temperature for 2016

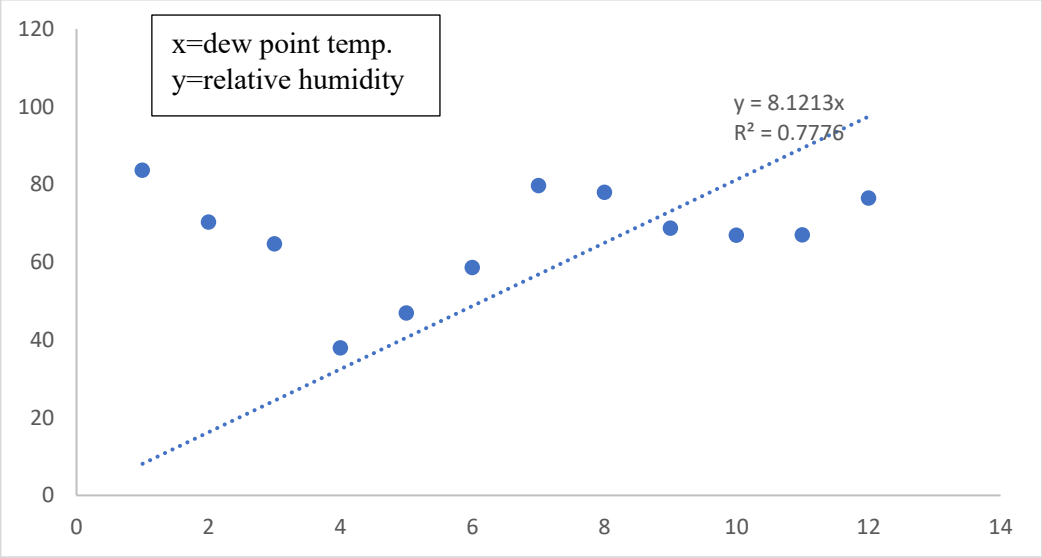

Figure 1.2: Correlation between relative humidity and dew point temperature for 2016

The data recorded for temperature, relative humidity, wind speed, and dew point temperature shows that all meteorological parameters are linked to each other. A change in one of the parameters can bring a change in another parameter as well. All the meteorological parameters interact strongly in the PBL (lowest layer of the troposphere).

Conclusions

The data demonstrated a correlation between the weather elements, which revealed that meteorological stratification plays an important role in atmospheric phenomena. Atmospheric features like wind speed, dew point, relative humidity, temperature, etc. were correlated. An increase in dew point temperature was correlated with relative humidity. The use of radar graphs for studying the dynamics of meteorological parameters help in understanding the behaviour of atmospheric elements; hence, extensive research may be conducted in the future to deeply understand the weather patterns.

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