Estimate of The Dynamical Change of Air Temperature, Relative Humidity and Dew Point Temperature for Some Selected Station in Iraq

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Abstract

Relative humidity can be inferred from the dew point values. When the air temperature and dew point temperatures are very close, the air has high relative humidity. The converse is true when there is a large difference between the air temperature and the dew point temperature, indicating the presence of low humidity air. To understand the expected changes in the climatic elements in the atmosphere, changes in temperature behavior, dew point, and relative humidity have been studied. This study used data obtained from the European Center (ECMWF), which includes monthly and annual mean temperatures, dew, and relative humidity during the period (1988-2018) for selected stations in Iraq. The highest values of temperature and dew were recorded in July and August, and they were accompanied by a decrease in relative humidity. The highest value of relative humidity was recorded in December and January, accompanied by a decrease in temperature and dew, as we note through the results that there is an inverse relationship between relative humidity, temperature, and dew point. Relative humidity changes when the temperature rises or falls, and the relative humidity may be higher in the morning when the temperature drops. The lowest amount of relative humidity during the day is when the temperature rises, the highest temperature value was recorded on 12 July 2017 (12:00 PM) for Basra Station, while the highest relative value is humidity in Basra Governorate. Mosul station on January 21, 2014 (12:00 AM), and the reason is due to meteorological factors and the nature of the geographical area.

Keywords: Relative humidity, Temperature, Dew point, ECMWF, Iraq.

1. Introduction

The relative humidity is one of the factors affecting the atmosphere [1]. Air temperature is related to relative humidity, which affects human comfort [2]. The temperature is considered one of the important factors in climatology, as it is calculated by taking two values, namely the maximum temperature and the minimum temperature, for 24 hours in weather stations [3]. The temperature of the dew point is not constant in time and place, regardless of where it is located, as it is important in various applications and is used in agricultural and water research [4]. Previous studies showed that many scientists studied the relationship between relative humidity, temperature, and dew, including the researcher [5]. As he showed that there is a large variation in the sensitivity calculated when using the air temperature in the atmosphere, while the dew point temperature in the atmosphere showed strong positive sensitivities, similar to what happened when using surface dew point temperature measurements. As for the researcher [6], use the trend estimation equation to express the amount of moisture in the air. This helps minimize climatic factors. Others, and from them proved [7].

By linking temperatures and dew degrees with solar radiation, he showed that they have a similar pattern. The researcher also conducted a study [8]. Using wooden poles to measure temperatures and dew on the wet ground to find out the consistency between these variables by recording continuous data for every hour. As shown by many researchers through several studies and from them [9]. Hydrological processes such as evaporation and transpiration can be affected by air humidity, known as relative humidity or the degree of dew, which is important in determining evaporation from water or soil surfaces from cultivated areas. Many scientists and researchers have also studied the effect of temperature and relative humidity on bacteria. Including the researcher [10]. Where he tested the survival rate of bacteria at different temperatures and relative humidity levels and their suitability as study materials for this purpose. On the other hand, relative humidity and temperature play an important role in our daily life, as many researchers and they are among them [11]. It has major effects on influenza activity and other health problems. It can address many problems that can be solved by relying on control devices that can be used inside buildings to control temperature and relative humidity measurements where the researcher explained [12]. There are many studies in which remote sensors have been used to control temperatures, relative humidity, and dew degrees. The prob-
lem of humidity, temperatures, and many climatic factors have contributed to the spread of the (Covid-19) epidemic, where many studies have been conducted [13]. Where the researcher analyzed the temperature and humidity to find out the extent of their impact on the spread of the Corona virus. A comparison of many scientific studies resulted in the entry of relative humidity and temperatures in the quality and calibration tests of many devices, where the researcher was able during a study he conducted [14]. It is possible to obtain low-cost appliances by minimizing the influence of relative humidity and temperature. As for the researcher [15], By improving green lawn grass by reducing outside heat through cooling and moisturizing throughout the seasons. As for comfort for people, the climate plays an important role in terms of how they adapt to a hot-humid climate. This was learned through the study presented by the researcher [16]. The impact of air pollution can be concluded through the study that the scientist undertook [17]. By knowing the fluctuations in the temperature of the air in the atmosphere and the degrees of dew. As for other changes that occur in the atmosphere, such as dust and dust storms, it can be determined by relative humidity. This study was previously investigated [18]. Where relative humidity is used to determine the dust that occurs in dry areas. This research aims to study the behavior of temperatures, relative humidity, and dew degrees for selected stations over Iraq to reach a relationship that can be used in agricultural and water research.

2. The Data and Study Stations

The Monthly data were used (the temperature at a height of 2 meters, dew point, and relative humidity. Data were taken from the European Center for Medium-Range Weather Forecast (ECMWF) [19] for the month and annual and seasonal averages for the period from (1988-2018) for selected stations over Iraq [20] to clarify the relationship between the variables taken for this study and the extent of their impact according to the nature of the geographical area.

3. Statistical Using

The data were taken from the European Center in the form of an NC file and converted to an Excel file using Matlab program, where the data is sorted for each area and converted from an unreadable file to a file that contains data that is easy to deal with, then the then Sigma plot [21]. Is used, which is a program that draws the charts required in this study according to the studied areas and to find the relationship between them [22] [23]. As for the geographical maps, seasonal data of temperature, relative humidity, and dew degrees were taken for selected stations for spatial analysis The Kriging method was used to configure fulfillment in ArcGIS version 10.4.1. The maps were drawn by converting the geographical coordinates of all sample locations into global Mercator Transverse Coordinates. However, the data is provided to display a connected surface as a visual display. Maps show spatial interpolation [24].

4. Results

4.1. The analysis Monthly temperature (ºC), Dew Point (ºC) and Relative humidity%

Figure 1, shows the monthly analysis of temperature, dew, and relative humidity for the period (1988-2018) for selected stations over Iraq. The results showed that the Basra station recorded the highest temperature values of 45º C, and the dew point reached 15º C in July and August. According to the geographical location of the region, which is dry or semi-arid, this leads to a rise or decrease in temperatures in this station. The low relative humidity% is due to the ability of air to carry large amounts of water vapor. As for the relative humidity, we note the highest value recorded at the Mosul station, which was 78% in December and January, This station is characterized by heavy rainfall and thus leads to a decrease in temperature, which leads to a high level of humidity in this region as a result of the inability of the air to carry a large amount of water vapor [24].

4.2. The relationship between the monthly mean temperature and relative humidity

Figure 4, shows the relationship to mean monthly temperatures and relative humidity for 20 years through drawings. The results show that the relationship between relative humidity and temperatures is an inverse relationship for all stations. As the highest temperature value was 50º C for Basra Station, which has a dry geographic character and the effect of solar radiation in it, as the lowest value of relative humidity was observed in this station, 60%, as it is characterized by high evaporation which leads to a decrease in the amount of relative humidity. As for Baghdad station, the highest temperature value was 45º C in July and August, and the highest relative humidity was 70% in December and January. The highest relative humidity value was 80% at the Mosul station, which is characterized by low evaporation and low temperature, which leads to high relative humidity. Finally, the Rutba station recorded the highest RH value of 75% and the highest temperature value of 35º C. These climatic factors change in conjunction with changes in the atmosphere.
Figure 1. Analysis monthly temperature (°C) for the period (1988-2018) for selected stations over Iraq.

Figure 2. Analysis monthly Dew Point (°C) for the period (1988-2018) for selected stations over Iraq.

Figure 3. Analysis monthly Relative humidity% for the period (1988-2018) for selected stations over Iraq.
4.3. The relationship of the average monthly mean Dew point (ºC) and Relative humidity

Figure 5, shows the relationship to mean monthly dew points and relative humidity. The results indicated that relative humidity and the dew point are inversely correlated with all stations, where the highest dew point monitoring percentage was 14.8º C for Basra station. The lowest value for relative humidity at this station was 60%. In Baghdad station, the highest dew point value is 14.5º C in August, and the highest relative humidity is 78% in December and January. The Mosul terminal recorded the highest value of 80% relative humidity. As for the dew point, the highest value is 13.5º C in August, and the last of the Rutba station, the highest value of the degrees of dew was 14.2º C and the highest relative humidity was 78%. Climatic factors change depending on the changes occurring in the atmosphere.

4.4. The relationship of the average monthly Temperature (ºC) and Dew point (ºC)

Figure 6, shows the relationship between monthly mean temperatures and dew degrees. The results showed that the relationship is positive for all stations, as the highest temperature values reached 50º C and 12º C of dew in Basra station in July and August the lowest observations were recorded at the Mosul station 35 for temperature and dew point 2º C in December and January. All these changes in temperature and dew point values are determined by the changes that take place in the atmosphere.

4.5. The relationship between the annual mean Temperature (ºC), Dew point (ºC), and Relative humidity

Figures 7, 8, and 9, Shows that the highest temperature value recorded in 2010 was 50º C for Basra Station, and Baghdad Station recorded the highest temperature in the same year at 45º C. The Mosul and Rutba station recorded 35º C in 2017 and 2011, respectively, for 20 years, because this region is characterized by large amounts of rain and lower temperatures compared to other regions. The relative humidity, the highest percentage was in 2013, 2014, and 2018 for the Mosul station and the Rutba station, which indicated that the annual behavior for 20 years was the highest percentage of relative humidity in the Mosul station and for the year 2014. From the drawing, it was found that the inverse relationship between temperatures and relative humidity, as for the dew point and temperature, that the annual behavior shows the positive relationship between them. The highest value of the dew point was in the years 2004, 2005, and 2013. Note that the annual behavior of temperatures and dew with relative humidity, that there is a variation in temperatures and dew point due to geographical conditions as well as solar radiation plays an important role in this difference [23].

Figure 4. The Relationship between Temperature and Relative humidity for the period (1988-2018) for selected stations over Iraq.

Figure 5. The Relationship between Dew Point and Relative humidity for the period (1988-2018) for selected stations over Iraq.
Figure 6. The Relationship between Temperature and Dew Point for the period (1988-2018) for selected stations over Iraq.

Figure 7. The relationship of the annual mean Temperature (°C) and Relative humidity for the period (1988-2018) for selected stations over Iraq.
Figure 8. The relationship between the annual mean Temperature (°C) and Dew point (°C) for the period (1988-2018) for selected stations over Iraq.

Figure 9. The relationship between the annual mean Dew point and Relative humidity for the period (1988-2018) for selected stations over Iraq.
4.6. The Analysis of temperature (ºC) Dew point (ºC) and Relative humidity (%) for four Stations in Iraq

Figure 10, shows that the highest temperature increase during the study period occurred on July 20, 2017 (12:00 PM). On the second day of July 21, 2017, the temperature rose to 50º C, at Basra Station. The reason is due to the geographical nature of Basra's dry and dessert station, lack of rainfall, the influence of solar radiation, and other climatic factors.

Figure 11, shows that there is an elevation of the dew point at the Basra and Baghdad stations on October 12, 2015 (12:00 PM), when it reached its highest values of 21° C, in conjunction with the difference in temperature and the influence of the atmosphere. We notice in Figure 12 that the highest relative humidity was at the Mosul station on January 21, 2014, at 12:00 AM, so the relative humidity rises early in the morning when the temperature is low and the air is unable to carry a large amount of water vapor, but when the temperature rises Daytime heat, the air becomes able to hold more water vapor and thus the relative humidity decreases.

Figure 10. The highest Temperature was on 21/07/2017 (12:00 pm) for Basra Station, where the increase began on 20/07/2017 and the maximum height was 21/07/2017.

Figure 11. The highest Dew point was on 21/10/2015 (12:00 pm) for Basra Station, where the increase began on 20/07/2017 and the maximum height was 21/10/2015.

Figure 12. The highest Relative humidity % was on 21/01/2014 (12:00 AM) for Mosul Station.
Table 1. Seasonal average for the period (1988-2018) for four Stations.

| Station | Season | Temperature (°C) | Dew point (°C) | Relative humidity (%) |
|---------|--------|-----------------|----------------|----------------------|
| Mosul   | Winter | 9               | 4.1            | 68.7                 |
|         | Spring | 19              | 8.55           | 46.9                 |
|         | Summer | 33              | 10.2           | 23.6                 |
|         | Autumn | 22              | 7.8            | 41.3                 |
|         | Winter | 12              | 4.53           | 61.4                 |
|         | Spring | 23              | 7.3            | 31.1                 |
|         | Summer | 35              | 10             | 17.2                 |
|         | Autumn | 24              | 8.87           | 33.5                 |
| Baghdad | Winter | 31              | 2.88           | 61.1                 |
|         | Spring | 30              | 5.18           | 34.1                 |
|         | Summer | 27              | 9.46           | 22.1                 |
|         | Autumn | 22              | 7.68           | 37.7                 |
| Rutba   | Winter | 15              | 6.5            | 57.4                 |
|         | Spring | 27              | 8.58           | 28.1                 |
|         | Summer | 38              | 10             | 15.2                 |
|         | Autumn | 28              | 9.6            | 30.8                 |

Conclusions

- The highest average monthly temperature and dew point in Basra Station were 50° C, while the highest monthly average relative humidity was 78% in Mosul Station.
- The highest value of the temperature increase during the study period occurred on July 21, 2017 (12:00 pm).
- The inverse relationship between temperature and relative humidity.
- The southern and central regions were characterized by an increase in (T) and (Td) in the summer season, while (RH %) the highest percentage was in the northern and western parts of the country in the winter season.

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