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# TREND OF TEMPERATURE AND RELATIVE HUMIDITY IN EAST SIANG DISTRICT OF ARUNACHAL PRADESH, INDIA

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**ABSTRACT**

A study was conducted in the East Siang District of Arunachal Pradesh for the time period from 2000 to 2018 in order to study the temperature and relative humidity parameters of climate change in the study area. The study was based on secondary data collected from the regional meteorological centre wherein official data was collected for the years 2000 to 2018 for temperature and 2006 to 2018 for relative humidity. It was observed that maximum temperature in the study area exhibited an increasing trend during the study period. A monthly temperature study also showed that maximum temperature for the study area exhibited a significant increase during the months of February, July and August. The average annual Relative Humidity for East Siang during 2006-2018 was found to be 76.72 and 77.04 at 0830 hrs and 1730 hrs IST respectively. The monthly study of the Relative Humidity showed significant increase for the evening hours of 1730 hours IST during the months of April, and a significant decreasing trend for the months of September and October.

***Keywords***: Climate change, temperature, relative humidity, East Siang.

## INTRODUCTION

Climate change is a change in the weather patterns that lasts for a long period of time that can span from decades to millions of years. The most general definition of climate change is a change in the statistical properties of the climate system when considered over a long period of time regardless of the cause (Reddy and Reddy, 1992). Climate change is a long-term change in the average weather patterns that have come to define Earth's local, regional and global climates. These changes have a broad range of observed effects that are synonymous with the term. Climate change can occur due to natural processes, including internal variability and external forcing as well as anthropological factors (Tanjang and Sharma, 2021b).

Changes observed in the earth's climate since the early 20$^{th}$ century are primarily driven by human activities, particularly burning of fossil fuels, which increases heat-trapping greenhouse gas levels in earth's atmosphere, raising Earth's average surface temperature. These human-produced temperature increases are commonly referred to as global warming (Tanjang and Sharma, 2021a).

### 1 Temperature

Temperature refers to how hot or cold something is and is measured by a thermometer (in Celsius ($^0$C) or Fahrenheit ($^0$F), or Kelvin ($^0$K). Atmospheric temperature thus is a measure of temperature at different levels of the Earth's atmosphere. It is governed by many factors, including incoming solar radiation, clouds, latitude, land surface, air, ocean currents, and water surface, humidity, altitude etc; Atmospheric temperature is a function of the modification of solar radiant energy by air, clouds, land, sea and other water surfaces (Macdonald, 2007).

The reason for the warmth and the coldness of the atmosphere is due to air temperature. The sun's rays or solar energy is the main reason why the atmosphere experiences coldness and warmness. The temperature of a place can vary in different locations within a day and also brings about seasonal differences (Nanzip, 2020).

### 2 Relative Humidity

Humidity refers to the amount of water vapour in the air. There are two types of humidity: specific and relative. Specific humidity is a measure of how much water vapour there is in relation to the total mass of water vapour and air combined. Relative humidity is the ration between the amount of water vapour in the air at a point of time and the amount of water vapour requited for saturation at a particular temperature and pressure.

Observations of humidity across the world indicate that the specific humidity has increased, however at the same time the relative humidity over many regions has declined.

While the average relative humidity has declined across the world, there are some areas such as India and some high-latitude regions, where it appears to be increasing. In order to understand the importance of changes in humidity and its impact at both the global and local level we need to understand that an increase in water vapour at the surface means more water vapour will eventually make its way up through the atmosphere where its role as a greenhouse gas becomes important. A higher level of moisture in the air also means more rainfall - especially in heavy rainfall events. The implications of a decrease in relative humidity are less obvious. Decreasing saturation will affect something called the vapour pressure deficit (Willett, 2020).

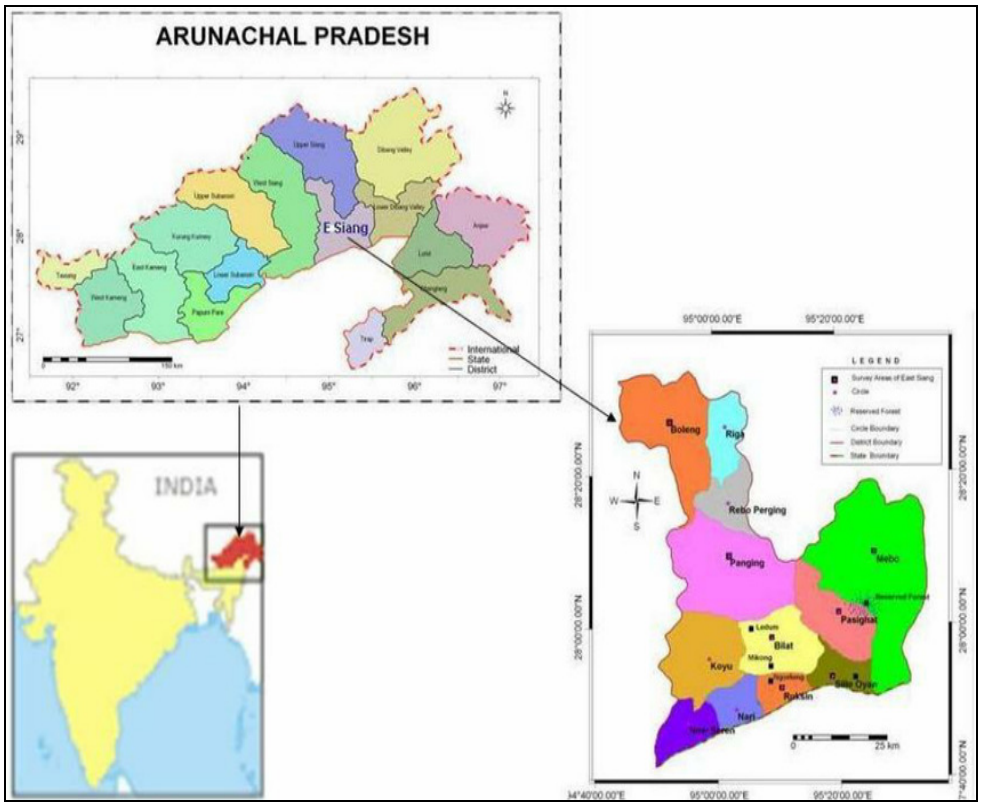
## MATERIALS AND METHODS

*A study was conducted* in the East Siang district of Arunachal Pradesh in order to study the trend pattern in temperature and relative humidity of the study area through the years 2000 to 2018.

### Selection Of The Study Area

The study was conducted in the East Siang district of Arunachal Pradesh, wherein two blocks were purposefully selected following which two villages from each block were then randomly selected.

The East Siang District is a wild mountainous area in the state of Arunachal Pradesh and it presents a remarkable topographical variety. The District has an area of 4,005 sq. km. and is lying approximately between 27º 43′ and 29º 20′ North latitudes and 94º 42′ and 95º 35′ East latitudes. The Name of the district is derived from the Mighty River Siang that, originating from Tibet, where it is called Tsangpo, transcends down and flows through the entire length of the area until it descends down into the plains of Assam south of Pasighat town, where it meets Dihang and Lohit and becomes the Brahmaputra (Yadav *et al*., 2021).




(Source: https://eastsiang.nic.in/about-distric/2020)

**Fig. 1 :** Map of East Siang district

The Pasighat town, the headquarter of the East Siang District, is situated at an altitude of 155 meters above main sea level and is the oldest town in Arunachal Pradesh was established in 1911 A.D. A political Officer was appointed in that year with a view to help the natives of the area to come down to the plains of Assam for trade and commerce. It would not be wrong to say, therefore, that the people of East Siang District were the first natives of the state to come in contact with the mainstream. Therefore, this district is called as 'the gateway to Arunachal Pradesh'. The mighty Siang river is the life-line of the East Siang District and in Pasighat, it calms down before entering Assam south of Pasighat. The town covers an area of 4005 sq. kms. and supports a population of nearly eighty thousand persons.

### Sampling Method

In order to make sure that the sample drawn for the study is a proper representation of the population from which the sample is drawn, it is required that the sampling method followed be efficient and as unbiased as possible. For that,

the total numbers of households in the selected villages were obtained by contacting the village elders out of which, three per cent of the total village households were selected from each village by following the simple random sampling technique (Tangjang, 2021).

**Data Collection**

The research work was based on secondary data wherein the required data was collected from the meteorological department and other concerned organizations and institutions functioning in the state.

**Analytical Framework**

Collected data was scrutinized, tabulated and processed systematically according to the objectives laid down for the study. Tabular and functional analysis was used to meet the objectives of the study as and where needed. The collected data was then made to undergo statistical analysis in order to identify the trends in monthly, seasonal as well as annual patterns of rainfall along with the trend in crop yield during the study period.

## RESULTS AND DISCUSSION

**1. Trend of temperature in East Siang from 2000-2018**

Table 1 reveals that during the study that the maximum annual temperature of East Siang exhibited a significant trend coefficient of 0.06. It can thus be concluded that the maximum temperature observed in East Siang exhibited an increasing trend during the study period of 2000 to 2018.

Table 2 reveals a monthly study of the temperature trend in East Siang for the years 2000 to 2018 resulted in significant observations for maximum temperature at 5 per cent for the months of February and August and 1 per cent for the month of July. These observations tell us that the maximum temperature for the study area exhibited an increase during the months of February, July and August.

**Relative Humidity of East Siang from 2006 to 2018**

Table 3 reveals the average annual Relative Humidity for East Siang during 2006 to 2018 was 76.72 and 77.04 at 0830 hrs and 1730 hrs IST respectively. The trend coefficient was observed to be 0.07 and -0.29. The Relative Humidity was observed to have increased during the morning and decreased in the evening throughout the study period. However, the changes were not significant.

Table 4 reveals the monthly study of the Relative Humidity showed various increasing and decreasing trends for both morning and evening hours. However the changes were significant for the evening hours of 1730 hours IST during the months of April, September and October where the Relative Humidity showed an increasing trend for the month of April and exhibited a decreasing trend for the months of September and October.

**Table 1 :** Trend of Temperature (maximum and minimum) for East Siang from period 2000-2018

| Average temperature | | Trend Coefficient | | CV (%) | |
|---|---|---|---|---|---|
| **Maximum** | **Minimum** | **Maximum** | **Minimum** | **Maximum** | **Minimum** |
| 28.03 | 19.75 | 0.06** | 0.02 | 1.80 | 1.69 |

(Note: ** indicates significance at 0.01)

**Table 2 :** Trend for Temperature of East Siang (2000 to 2018)

| Month | Average Temperature (ºC) | | CV (%) | | Trend coefficient | |
|---|---|---|---|---|---|---|
| | **Maximum** | **Minimum** | **Maximum** | **Minimum** | **Maximum** | **Minimum** |
| January | 23.53 | 13.14 | 5.61 | 5.28 | 0.05 | 0.03 |
| February | 24.22 | 15.14 | 6.16 | 5.68 | 0.13* | 0.05 |
| March | 26.09 | 17.48 | 4.53 | 4.26 | 0.09 | 0.04 |
| April | 27.09 | 19.52 | 3.68 | 2.53 | 0.05 | 0.02 |
| May | 29.57 | 22.01 | 3.16 | 2.20 | -0.03 | -0.02 |
| June | 30.60 | 23.89 | 3.55 | 2.00 | 0.06 | 0.02 |
| July | 30.62 | 24.24 | 3.75 | 1.92 | 0.12** | 0.01 |
| August | 31.08 | 24.59 | 5.52 | 1.96 | 0.15* | 0.02 |
| September | 30.89 | 23.71 | 3.43 | 2.03 | 0.01 | 0.03 |
| October | 30.04 | 21.38 | 3.92 | 3.29 | 0.07 | 0.04 |
| November | 27.61 | 17.43 | 3.39 | 4.40 | -0.01 | 0.00 |
| December | 25.02 | 14.43 | 4.29 | 4.12 | -0.03 | 0.04 |

(Note: * and ** indicates significance at 5 and 1 per cent respectively)

**Table 3 :** Annual trend of Relative Humidity (morning 08:30 hours and evening 17:30 hours IST) for East Siang from period 2000 to 2018

| Average RH | | Trend Coefficient | |
|---|---|---|---|
| **Morning (08:30 hrs IST)** | **Evening (17:30 hrs IST)** | **Morning (08:30 hrs IST)** | **Evening (17:30 hrs IST)** |
| 76.72 | 77.04 | 0.07 | -0.29 |

**Table 4 :** Trend for Relative Humidity of East Siang (2006-18)

| Month | Average Relative humidity (%) | | CV (%) | | Trend coefficient | |
|---|---|---|---|---|---|---|
| | Morning (08:30 hrs IST) | Evening (17:30 hrs IST) | Morning (08:30 hrs IST) | Evening (17:30 hrs IST) | Morning (08:30 hrs IST) | Evening (17:30 hrs IST) |
| January | 69.10 | 69.46 | 4.98 | 5.99 | -0.49 | -0.31 |
| February | 71.49 | 70.02 | 8.25 | 6.79 | 0.48 | 0.32 |
| March | 71.04 | 74.34 | 6.58 | 7.15 | 0.05 | 0.56 |
| April | 76.16 | 78.03 | 7.64 | 6.34 | -0.03 | 0.74* |
| May | 78.77 | 80.49 | 5.15 | 4.97 | 0.30 | 0.30 |
| June | 86.59 | 83.38 | 3.66 | 3.42 | -0.01 | -0.16 |
| July | 89.28 | 84.21 | 4.96 | 2.83 | -0.45 | -0.14 |
| August | 86.62 | 83.51 | 5.68 | 2.18 | -0.38 | -0.22 |
| September | 84.17 | 80.87 | 4.32 | 4.58 | 0.57 | -0.78** |
| October | 72.90 | 76.14 | 5.15 | 6.44 | -0.33 | -0.98** |
| November | 66.06 | 73.83 | 6.38 | 6.63 | 0.07 | -0.51 |
| December | 67.74 | 71.86 | 3.34 | 4.55 | -0.24 | -0.41 |

(Note: * and ** indicates significance at 5 and 1 per cent respectively)

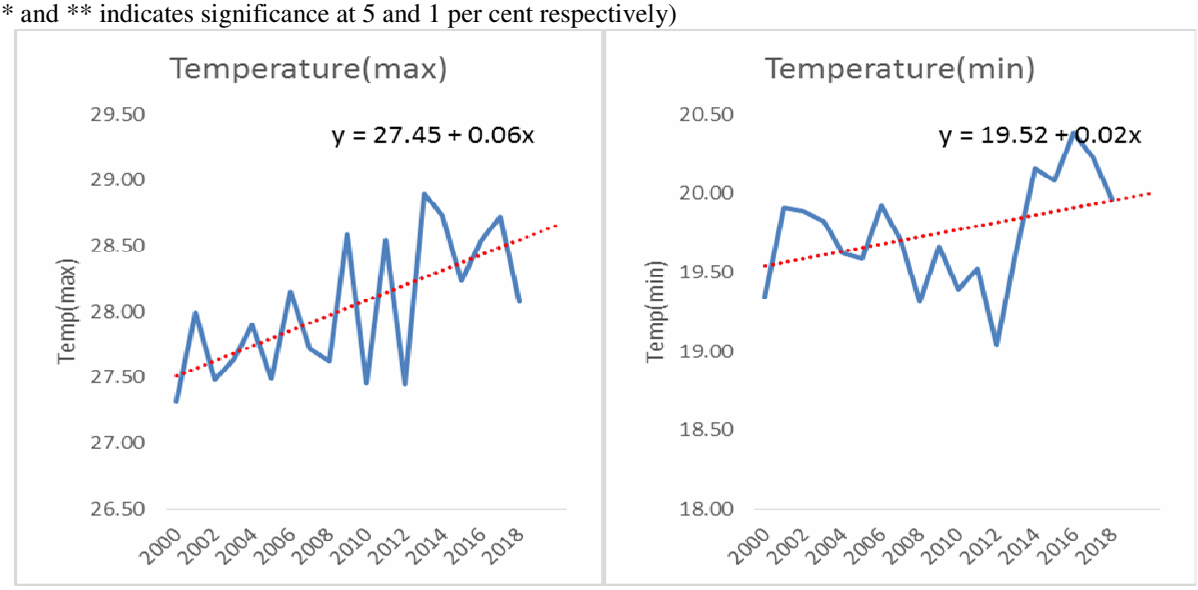



**Fig. 2. :** Annual trend of Temperature of East Siang from 2000 to 2018

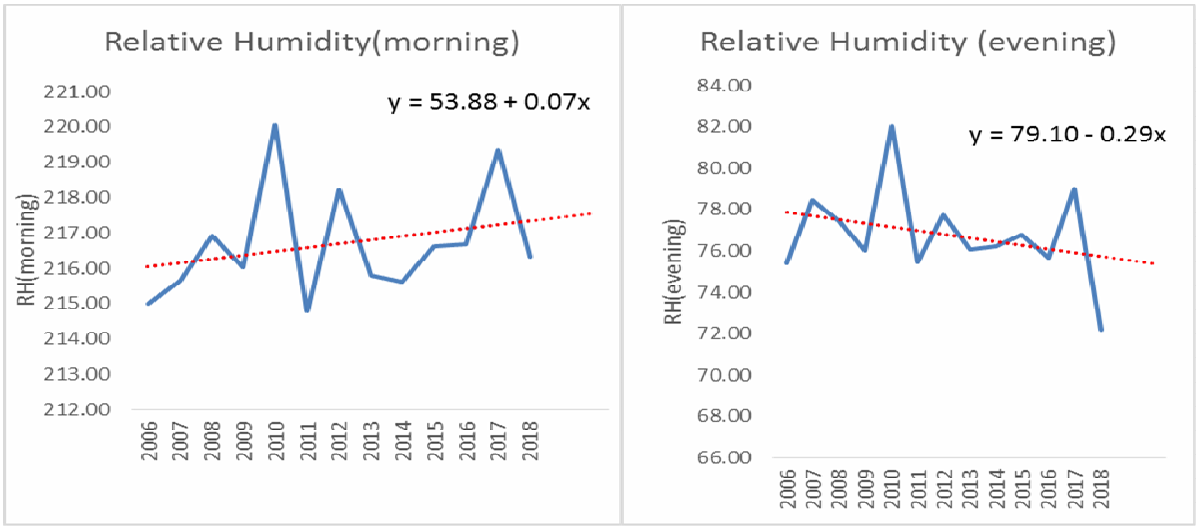



**Fig. 3 :** Annual trend of Relative Humidity of East Siang

## CONCLUSION

The study clearly showed that the maximum annual temperature of East Siang exhibited a significant trend coefficient of 0.06 indicating that the maximum temperature observed in East Siang exhibited an increasing trend during the study period of 2000 to 2018. A monthly study of the temperature trend in East Siang resulted in significant

observations for maximum temperature at 5 per cent for the months of February and August and 1 per cent for the month of July. These observations tell us that the maximum temperature for the study area exhibited an increased during the months of February, July and August. The average annual Relative Humidity for East Siang during 2006-2018 was 76.72 and 77.04 at 0830 hrs and 1730 hrs IST respectively. The trend coefficient was observed to be 0.07 and -0.29. The Relative Humidity was observed to have increased during the morning and decreased in the evening throughout the study period. However, the changes were not significant. The monthly study of the Relative Humidity showed various increasing and decreasing trends. However the changes were significant for the evening hours of 1730 hours IST during the months of April, September and October where the Relative Humidity showed an increasing trend for the month of April and exhibited a decreasing trend for the months of September and October.

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