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Variation of Abiotic Climatic Factors of district Sonipat in state Haryana (India)

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Abstract: An abiotic factor is a non-living part of an ecosystem that shapes its environment. In a terrestrial ecosystem, examples might include temperature, light, and water. In a marine ecosystem, abiotic factors would include salinity and ocean currents. Abiotic and biotic factors work together to create a unique ecosystem. The climate of Haryana is very hot in summer and cold in winters. The hottest months are May and June and the coldest being December and January. Rainfall is varied, with the Shivalik Hills region being the wettest and the Aravali Hills region being the driest. About 80% of the rainfall occurs in the monsoon season during the months of July and September. Rainfall is varied with Shivalik Hills region being the wettest and the Aravali Hills region being the driest. Haryana is very hot in summer and cold in winters. The temperature falls to the lowest in January and reaches upto 50 ^{o}C during the months of May and June. Winter months have average temperatures in the range 3 ^{o}C to 9 ^{o}C and the summer months temperatures are higher in the range of 48 ^{o}C to 35 ^{o}C.

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Keywords: Humidity, Dew point, Wind, Pressure, Temperature (high and low), rainfall/day, visibility, Sonipat.

Introduction:

The IPCC scenarios provide a mechanism to assess the potential impacts on climate change. Global emission scenarios were first developed by the IPCC in 1992 and were used in global general circulation models to provide estimates for the full suite of greenhouse gases and the potential impacts on climate change. Since then, there has been greater understanding of possible future greenhouse gas emissions and climate change as well as considerable improvements in the general circulation models. The IPCC, therefore, developed a new set of emissions scenarios, published in the IPCC Special Report on Emission Scenarios (IPCC SRES November 2000). These scenarios provided input into the Third and Fourth Assessment Reports and were the basis for evaluating climatic and environmental consequences of different levels of future greenhouse gas emissions and for assessing alternative mitigation and adaptation strategies. These scenarios refer to the predictions made for future conditions mainly related to precipitation, sea level rise and temperature changes based on 'storylines' of the alternate greenhouse gas emissions.

Gradients in climactic factors create physiological barriers to dispersal. All species have limits of tolerance to abiotic factors, which can lower their survival and reproductive success and limit range expansion beyond the edge. Changes in temperature may cause a species to change its geographical distribution. With increasing temperatures resulting from global warming, species have been seen to expand their range northward due to increased survival and reproduction as a result of warming. Precipitation can also be a key determinant in limiting the geographic range edges of species. This is often seen in organisms with high water demands, whose survival and reproduction would decrease beyond the edge due to dry conditions, limiting expansion. Moisture of soil or air is also seen to limit range expansion. In terms of soil moisture, limited range expansion for species that forage on soil organisms or for species that reside in soil and rely on it for nutrients are seen. If moisture requirements are not met beyond the species range, they will not be able to expand due to resulting reductions in fitness. There are many other abiotic factors that can determine a species range, including dissolved oxygen, canopy cover, conductivity, alkalinity and pH.

Data for many different variables (physical quantities, Rainfall, Temperature, Solar Radiation, Relative humidity, Wind speed) at a variety of different timescales; Daily, monthly are used for the study area. All model data represent grid cell averages, i.e. an average quantity over a 2500 km^2 (50 km X 50 km) and are available in binary format.

The PRECIS data on precipitation, maximum and minimum temperature have been analysed for Haryana. Preliminary inferences on the variations of these entities have been presented in Figure 19. Mean maximum temperature is projected increase by 1.3 ^{0}C and mean minimum temperature by 2.1 ^{0}C towards mid century. The increase in mean maximum temperature is projected to be 4.2 ^{0}C and mean minimum temperature 4.7 ^{0}C towards end century respectively. Decrease is projected for average annual rainfall by 3.0% for mid century scenario and increase by 17% for end century scenario.

Haryana receives most of its rain during the monsoon season, which starts in late June. Data are presented for four seasonal periods: JF -January, February; MAM -March, April, May; JJAS -June, July, August, September; OND -October, November, December. Projected changes to mid and end-century is also presented.

Under the A1B scenario, mean annual rainfall is projected to decrease marginally for Haryana by about 63 mm (3%) by mid century and increase by about 347 mm (17%) by end century. Monsoon months, JJAS show marginal to 14% increase in mid and end century scenarios respectively. Due to less and scanty information are available on geographical parameters related to abiotic climatic factors in Sonipat, particular. So the present study was planned in geographical parameters related to abiotic climatic factors, i.e., temperature (maximum and minimum), rainfall/day, humidity, dew point, wind, pressure and visibility in district Sonipat, Haryana (India).

Materials and Methods:

The climate of Haryana over most of the year is of a pronounced continental character. It is very hot in summer and markedly cold in winter. The rainfall in the region is low and erratic except in parts of the Karmal and Ambala districts. The rainfall is unevenly distributed during the year except for two well marked seasons. One is the monsoon period lasting from the middle of June to the end of September on which autumn crop and spring sowing depend and the other is the winter rains which occur from December to February, benefiting rabi crop. Rainfall is meager, particularly in the districts of Mahendragarh and Hissar. Haryana is extremely hot in summer at around 45 °C (113 °F) and mild in winter. The hottest months are May and June and the coldest December and January. The climate is arid to semi-arid with average rainfall of 354.5 mm.

Sonipat is located at 28.98°N 77.02°E.It has an average elevation of 224.15 meters above sea level (735.4 feet). Sonipat borders Delhi, the national capital, to the south, Panipat district to the north, Uttar Pradesh state to the east and Rohtak And Jind district to the west. The total area of Sonipat district is 2,260 km The location is going to be very good in future as two expressways: The Easter Peripheral expressway & The Western paeripheral expressway are going to meet on the outskirts of the city. Sonipat District is one among 21 Districts of Haryana State, India. Sonipat District Administrative head quarter is Sonipat. It is Located 228 KM North towards State capital Chandigarh . Sonipat District population is 1480080. It is 6th Largest District in the State by population.

Topographically, Sonipat district is divided into three regions, the Khadar, Upland Plain and Sandy Region. Sonipat city lies on the upland plains, which are covered with old alluvium, which, if properly irrigated, is highly productive. Broadly speaking, the district is a continuous part of the Haryana-Punjab Plain, but the area is not level in some parts. Sonipat District has fine loamy soil with a rich color. However, some areas have sandy soil. Khanda, Sonipat village is Famous for Brick Factories there are 100+ Bhattas (Kiln) in this village.

Monthly geographical parameters related to abiotic climatic factors, i.e., temperature (maximum and minimum), rainfall/day, humidity, dew point, wind, pressure and visibility in district Sonipat, Haryana (India) was observed from January, 2020 to December, 2020. To record above mentioned geographical parameters, direct observation method (Dagar et al., 2001) was followed.

Fig. 3.1. Location of state of Haryana and of district Sonipat, Haryana (India).

Results and Discussion:

In the present study, monthly variation in high temperature was varied from a minimum 27^{0}C (in the month of December, 2020) to a maximum of 41^{0}C (in the month of June, 2020) with an average±S.E. of 33.92±1.08 while in low temperature it was varied from a minimum 17^{0}C (in the month of January, 2020) to a maximum of 34^{0}C (in the month of May, 2020) with an average±S.E. of 27.75±1.97 was observed (Fig. 1). Also, rainfall/day was observed from a minimum 2day/month (in the month of January and May, 2020) to a maximum of 11days/month (in the month of July, 2020) with an average±S.E. of 2.5±0.02 was observed (Fig. 2). As far as, during the present study, humidity was varied from a minimum 35% (in the month of June, 2020) to a maximum of 78% (in the month of August, 2020) with an average±S.E. of 64.16±2.81 was observed (Fig. 3). Similarly, dew point was varied from a minimum 9^{0}C (in the month of January, 2020) to a maximum of 29^{0}C (August 2020) with an average±S.E. of 18.09±2.99 was observed (Fig. 4). Also, wind (Km/h) was varied from a minimum 1.5Km/h (in the month of January, 2020) to a maximum of 7 Km/h (in the month of May, June and July, 2020) with an average±S.E. of 4.11±0.05 was observed (Fig. 5). Pressure was also varied from a minimum 847 mbar (in the month of June, 2020) to a maximum of 1031 mbar (in the month of June, 2020) with an average±S.E. of 1092.41±2.48 was observed (Fig. 5). Also, visibility was varied from a minimum 4/Km (in the month of August, November and December, 2020) to a maximum of 4.5/Km (in the whole month of year 2020) with an average±S.E. of 3.41±0.18 was observed (Fig. 5).

Sudesh and Mamta (2018) observed monthly variation in high temperature was varied from a minimum 21^{0}C (in the month of January, 2017) to a maximum of 38^{0}C (in the month of April, 2017) with an average±S.E. of 32.83±1.08; low temperature it was varied from a minimum 7^{0}C (in the month of January, 2017) to a maximum of 28^{0}C (in the month of June, 2017) with an average±S.E. of 18.75±0.97; rainfall/day was observed from a minimum 1day/month (in the month of January, March, April and May, 2020) to a maximum of 7days/month (in the month of July, 2020) with an average±S.E. of 2±0.00; humidity was varied from a minimum 37% (in the month of May, 2017) to a maximum of 72% (in the month of January and august, 2017) with an average±S.E. of 60.16±1.81; dew point was varied from a minimum 8^0C (in the month of January, 2017) to a maximum of 25^0C (in the month of July and August 2017) with an average±S.E. of 16.08±0.99; wind (Km/h) was varied from a minimum 1Km/h (in the month of October, 2017) to a maximum of 4 Km/h (in the month of May, June and July, 2017) with an average±S.E. of 3.83±0.01; pressure was also varied from a minimum 997 mbar (in the month of July, 2017) to a maximum of 1018 mbar (in the month of January, 2017) with an average±S.E. of 1007.66±4.48 and visibility was varied from a minimum 3/Km (in the month of January, November and December, 2017) to a maximum of 4/Km (in the whole month of year 2017) with an average±S.E. of 3.25±0.11 was observed.

A numbers of coworkers like De and Mukhopadhyay, 1998; Lal, 2003, Rao *et al.*, 2009 recorded the Indian climate has undergone significant changes showing increasing trends in annual temperature with an average of 0.56°C rise over last 100 years (IPCC, 2007; Rao *et al,*. 2009; IMD, 2010). Warming was more pronounced during post monsoon and winter season with increase in number of hotter days in a year (IMD, 2010). Even though, there was slight increase in total rainfall received, number of rainy days decreased. The rainfed zone of the country shown significant negative trends in annual rainfall The semi arid regions of the country had maximum probability of prevalence of droughts of varying magnitudes (20-30%), leading to sharp decline in water tables and crop failures (Samra, 2003). By the end of next century (2100), the temperature in India is likely to increase by 1-5 0C (De and Mukhopadhyay, 1998; Lal, 2003; IPCC, 2007; IMD, 2010).

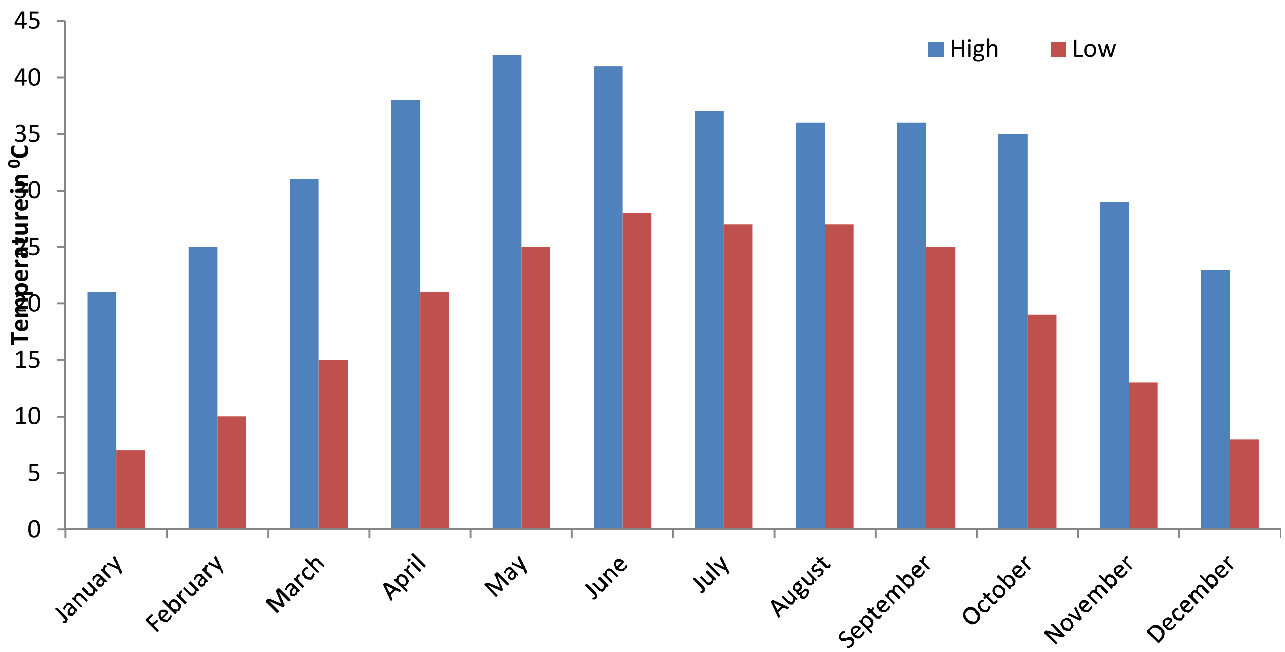


Fig. 1. Temperature variation (high and low) in district Sonipat, Haryana (India) from January, 2020 to December, 2020.

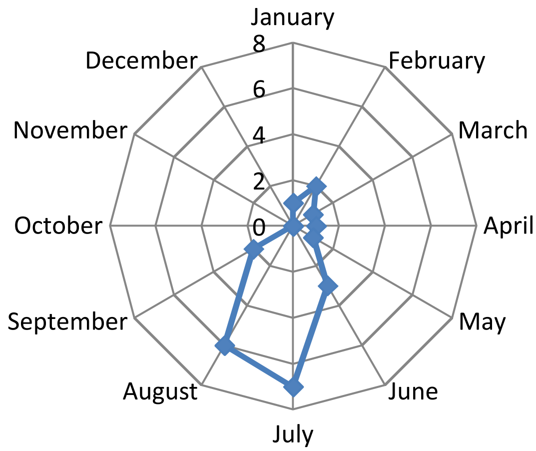
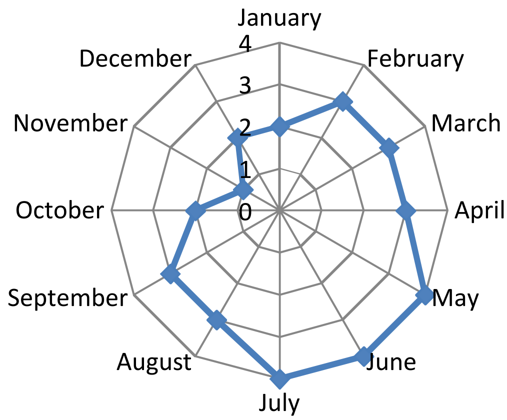


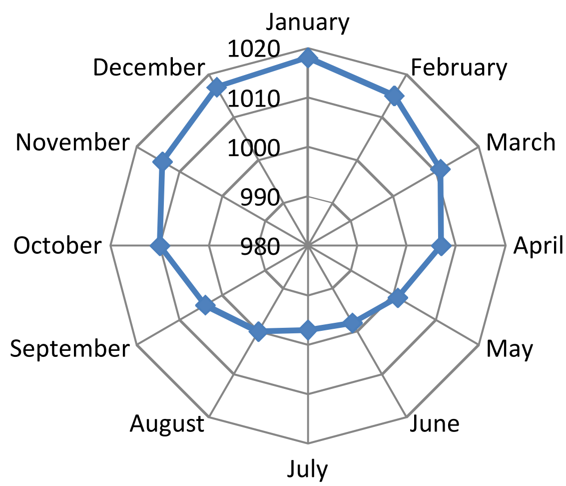
Fig. 2. Rain/day in district Sonipat, Haryana (India) from January, 2020 to December, 2020.

Fig. 3. Humidity (%age) in district Sonipat, Haryana (India) from January, 2020 to December, 2020.

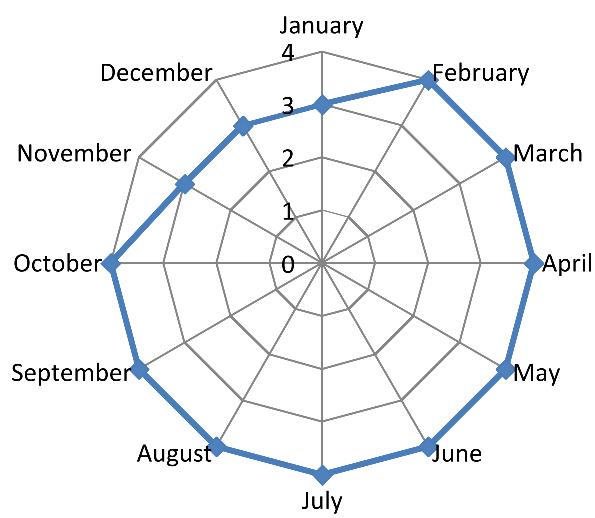
Fig. 4. Dew point (^{o}C) in district Sonipat, Haryana (India) from January, 2020 to December, 2020.



(a)



(b)



(c)

Fig. 5. (a) Wind (Km/h), (b) pressure (mbar) and (c) visibility/Km in district Sonipat, Haryana (India) from January, 2020 to December, 2020.

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