

TEMPERATURE TRENDS IN THE WINTER SEASON OVER THE KATHUA DISTRICT, INDIA

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ABSTRACT

This paper studied the trends of maximum and minimum temperature in the winter season over the Kathua district of Jammu and Kashmir. The variability of minimum and maximum temperature in Kathua district was analyzed on the basis of the climatic data of 102 years. Results stated that an increasing trend in mean maximum and mean minimum temperature in the winter season over the study area was observed

KEYWORDS: *Climate, Maximum Temperature, Minimum Temperature*

INTRODUCTION

Climate is a vital element for living beings. Change in climatic conditions over an area affect the human health and well-being in one way and also affect the other ecosystems. Many human and natural systems are susceptible to climatic change (Fussel, Hans-Martin, and Klein 2004). Climate Change is one of the defining issues of this time. It is now definite than ever, based on scientific evidences that humans are changing Earth's climate. Climate change is likely to increase health threat in various parts of the world. Climate change reinforces existing threat and shape new risks for natural and human systems (Cicerone and Nurse 2014).

From the last few decades research on climate change has become a warming topic. Many attempts have been done on global scale to study the change in climate such as trend detection in temperature and precipitation time series is one of the attention-grabbing research themes in the field of climate science. Changes in temperature and precipitation are not uniform, regional variations can be seen. Significant spatial and temporal variations may exist between climatically different regions (Roy and Balling 2005). A number of studies have evaluated the trends in temperature on different spatial and temporal scales (Malhi and Wright, 2004; Kiladis and Diaz, 1989; Klein-Tank and Konnen, 2003). According to the IPCC third assessment report of the observed global warming over the 20th century reached $0.6 \pm 0.2^{\circ}\text{C}$. This change was accompanied by rise in maximum and minimum temperatures (IPCC 2015). The present paper studies the change in

maximum and minimum temperature over the winter season in Kathua district of Jammu and Kashmir in the 20th century.

METHODOLOGY

For this study climatic data from 1901 to 2002 was used and the data is retrieved from Indian Water portal website. For the identification of outliers, methodology given by Zhang et al. (2005) was used to identify the outliers. Meteorological seasons in India are winter season which (January and February) second season is Pre Monsoon season (March to May) followed by Southwest Monsoon season (June to September) and Post Monsoon season which includes the months of October, November and December (IMD 2019). This study focuses on the winter season of Kathua districts.

TERMINOLOGIES

Maximum Temperature: It is the highest temperature attained during a day. It often occurs during the afternoon hours. (IMD 2019)

Minimum Temperature: It is the lowest temperature recorded which usually occurs during the early morning hours. (IMD 2019)

Study Area: District Kathua is situated at $32^{\circ} 17'$ to $32^{\circ} 55'$ North Latitude and $75^{\circ} 70'$ to $76^{\circ} 16'$ East longitude. It is surrounded by Himachal Pradesh in North-East, Punjab in the South-East, District Udhampur and Doda in the North-West and Jammu in the North. The district also shared international boundary with Pakistan in the South-West. District Kathua has total geographical area of 2651 Sq Kms.

It can be divided into three different Agro-climatic regions the first one is the area falling South of NH-44 consists of deep alluvial soils. This small region touches Pakistan and Punjab border areas and popularly known as Border Area, this region is mostly irrigated and very productive from agriculture point of view. The second region fall in north of NH-44 extends up to the foothills of Shivalik range and is also known as Kandi belt, this region is characterized by shallow soils full of boulders. The area also faces water scarcity. Block such as Hiranagar, Barnoti, Ghagwal and some parts of Billawar and Basohli fall in this region. The third region which falls beyond Shivalik range and extends up to Pir Panjal range is characterized by steep mountains and gorges. Azonal soil which has less potential for cultivation is found in this region. Area experiences a wide range of climate from sub-tropical to temperate and even alpine in higher reaches. In the months of May and

June where temperature in the summer rises as high as 48 degree Celsius in the plains and winter temperature in the high altitude areas fall below zero degree Celsius. Higher reaches of Billawar and Basohli also experiences snowfall. Area received rainfall from western disturbances and monsoon rains during the months of July and August. The annual rainfall in the district is approx. 1672 mm (Govt. of Jammu & Kashmir 2021). The area has sub-tropical type of vegetation in the Kandi belt such as *Beri* (*Zizyphus nummularia*), *Granda* (*Carissa carandas*) are dominant thorn bushes, *chir* (*Pinus longifolia*) is dominant at high altitude, *Drenk* (*Cedrela serata*), *Tamman* (*Grewia spec*), *Kemal* (*Lannea grandis*), *Kher* (*Acacia catechu*), *Sri* (*Albizia odoratissima*) are the important tree species of this region. During the monsoon time, a wide variety of epiphytes grow. The terrain is extremely liable to erosion and often disintegrated into pebble and cobbles

Figure 1-Trends in Maximum Temperature in January: 1901-2002

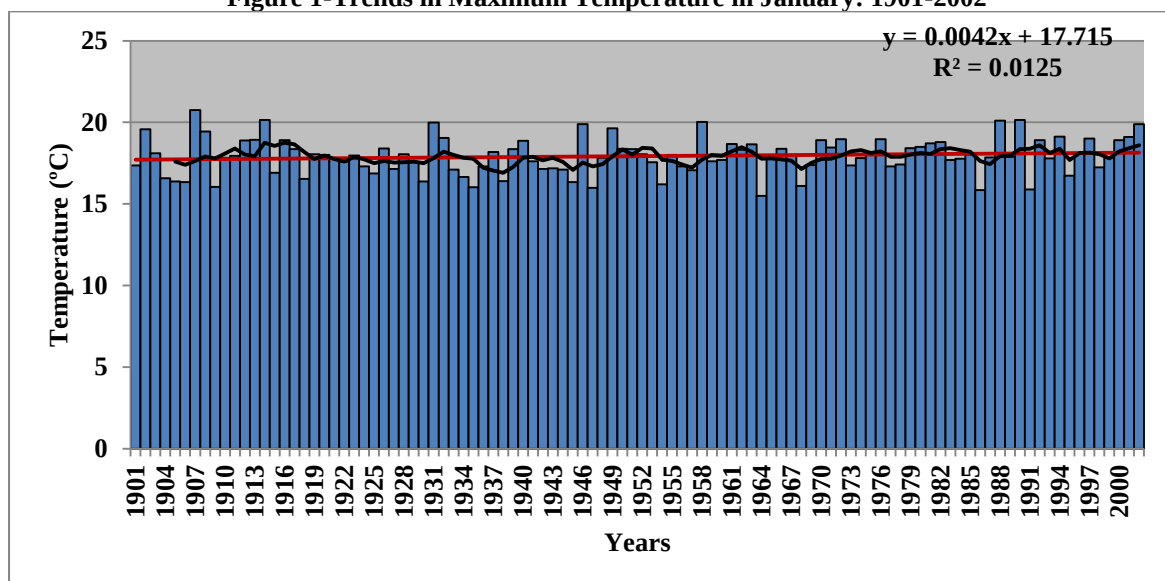
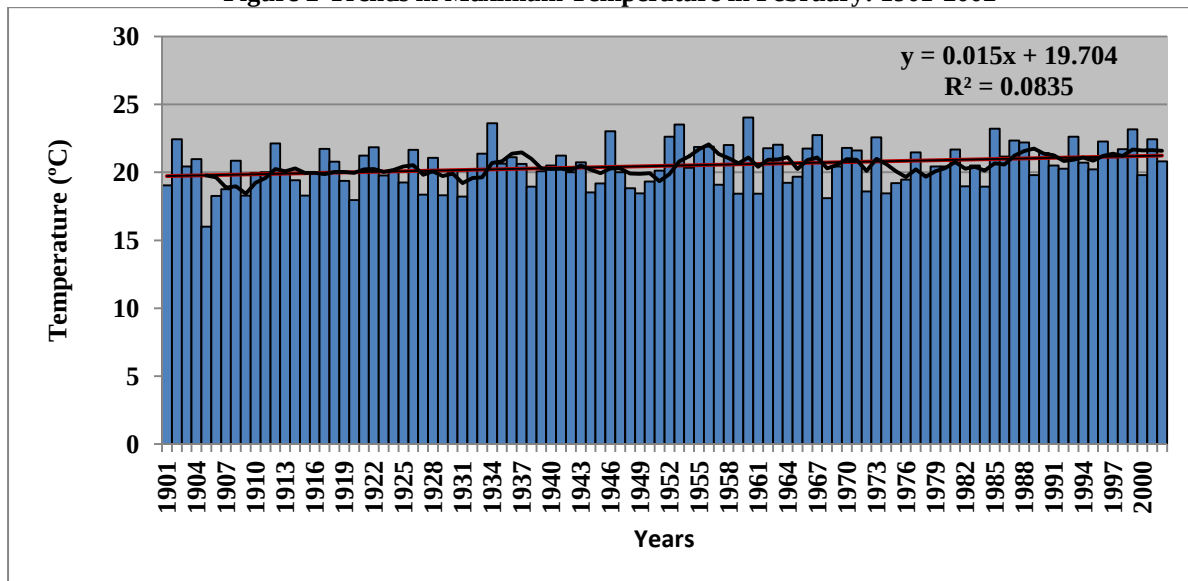


Figure 2-Trends in Maximum Temperature in February: 1901-2002

**The maximum temperate for January**

In this analysis (Figure 1) the maximum value recorded for the period 1901-2002 was 20.77°C in the year 1907. Kathua experienced about 17.93 °C as the long term average time maximum temperature during the month of January which is the peak month of cold weather. The highest temperature recorded was 20.76°C in the year 1907 followed by 20.11°C in the year 1988 and lowest was 15.49 °C in the year 1964. The trend line shows that overall change in maximum temperature over Kathua district in the

month of January during the twentieth century was not much visible.

The maximum temperature for February

The trend line (Figure 2) shows that maximum temperature has been increased from 1901 to 2002. The average maximum temperature for the February month was 20.48 °C. The lowest value recorded for the maximum temperature was 16 °C in the year 1905 and highest values recorded for the February month was 24.04°C in the year 1960 followed by 23.62°C in the year 1934.

Figure 3-Trends in Minimum Temperature in January: 1901-2002

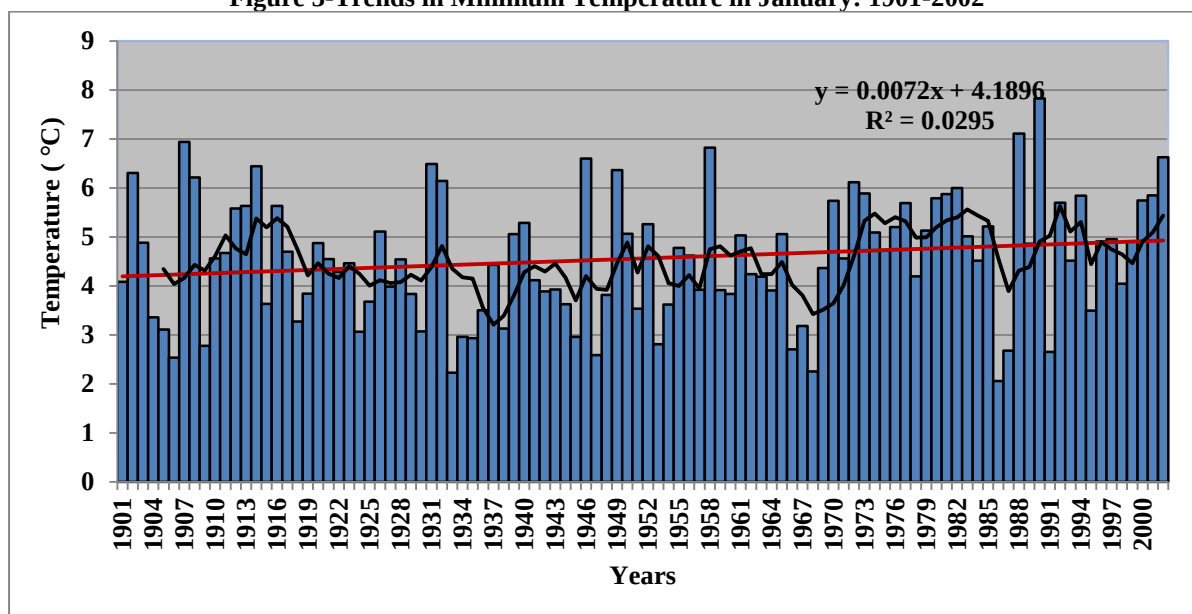
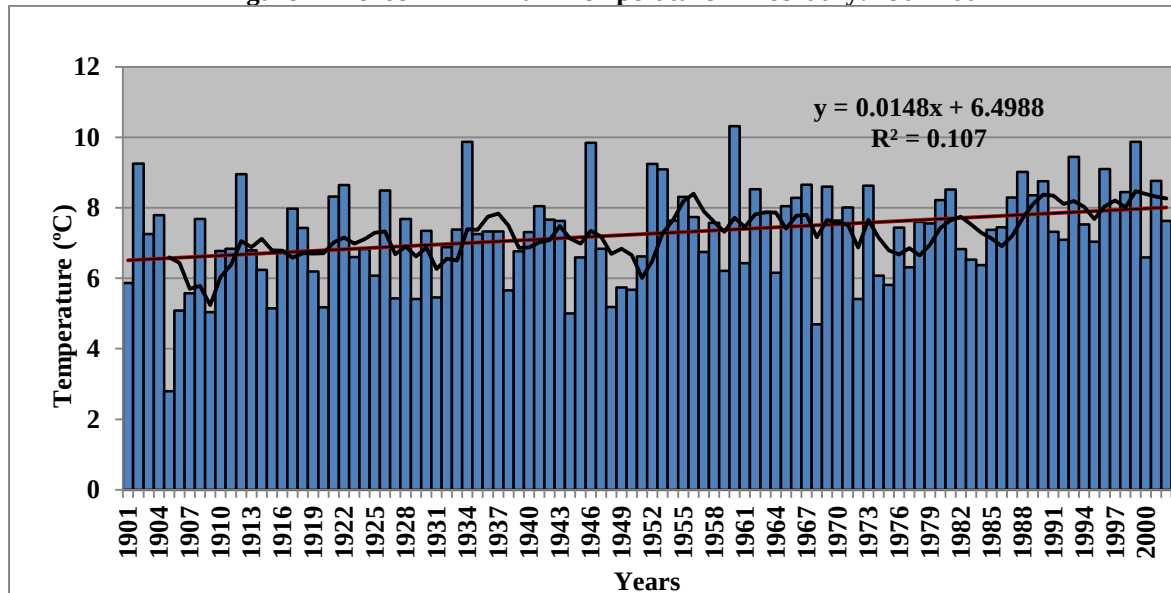


Figure 4-Trends in Minimum Temperature in February: 1901-2002



MINIMUM TEMPERATE

For the month of January (Figure 3) the average mean minimum temperature was 4.56 °C, the lowest value recorded was 2.05 °C in the year 1986 and highest value recorded was 7.82 °C in the year 1990. The overall change shows mean minimum temperature has been increased since 1901 but there are also some exceptional years where minimum temperature again declined and recorded below 3 °C such as in the year 1906, 1924, 1953, 1966, 1968, 1986, 1987 and 1991.

An overall increasing trend during 1901-2002 was observed (Figure 4). The average temperature recorded was 7.26 °C. The minimum value recorded was 2.8 °C in the year 1905 and highest value recorded was 10.32°C for the year 1960. The trend line depicts that temperature increased since 1901.

CONCLUSION

The overall summary of direction of change and inferences drawn are as follows: the increase in temperature varied from year to year and decade to decade. There were some episodes when decline in Mean Minimum and Maximum Temperature was observed. The highest value recorded in the winter season was 20.76 °C and lowest temperature recorded was 2.05 °C. The overall temperature change trend shows that warming has been increased in the winter season over the Kathua district. If we compare the 1901 climatic data with 2002 climatic records we found that in terms of change in Mean Temperature there was an increase

of 0.6°C in January and 1.5°C in February was observed. Whereas change in Mean Minimum Temperature was 0.72°C in January and 1.47°C in February was noticed. If we talking about change in mean maximum temperature, there was an increase of 0.42°C in January and 1.52°C in February was recorded.

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