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Asian Resonance

Core-Winter Temperature in Kashmir Valley (1950-2010) as an Indicator of Climatic Change

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Abstract

Mountainous regions and high altitude areas of the world act as the barometers of the geo-environmental changes. They abode highly fragile and sensitive ecosystems which provide vital clues about the impact of global warming and other man induced ecological imbalances. Kashmir valley which lies in the lap of north-western Himalayas also exhibit the impact of global environmental changes as has been reported by a number of studies. The present study analyses the core-winter (January) temperature of last 60 years to ascertain the impact of global warming on the winter season in Kashmir valley. January is the coldest month and most of the precipitation is received in the form of snow. Cold winter temperature is beneficial for the glaciers as it helps in fern formation which gives the glaciers enough strength to resist the spring and summer heat and combat the recession. Cold winter temperatures are also essential for various temperate fruits and rabi crops in the valley of Kashmir. However present study reveals that during last few decades there is a considerable increase in the mean minimum and mean maximum winter temperature which could prove detrimental for the economy and ecology of the Kashmir Himalayas if appropriate mitigation measures are not taken on time.

Keywords : Geo-Environmental Changes, Fragile Ecosystem, Ecological Imbalances, Core-Winter, Glacial Recession, Fern Formation, Mitigation

Introduction

Global climate change has been a burning problem for environmentalists since the middle of 20th century and has caused great discussion among the researchers even in the contemporary scientific community. A bundle of literature has been produced regarding the nature and causes of global warming and also impact assessment studies have been carried out at large scale .Mans advertent or inadvertent role has been investigated by various researchers (Lal *et al*., 1993b). The gist of all these studies provides a clear indication that climate is indeed poised for a change. The impact of global warming is much pronounced at high latitudes and uplands as compared to low latitudes on global scale as revealed by Inter- Government Panel for Climate Change (IPCC-TAR, 2001). Regional manifestations of climate change is a key geographic concept because global trends in environmental change have not been experienced uniformly throughout the globe; different regions have different experiences (Kates et.al. 1990).Mountains and uplands are often considered to comprise some of the worlds extreme environments. However they are of immense value to humankind as sources of food, minerals and water. Mountainous regions are often perceived to be isolated and inhospitable: in reality they are fragile regions who's welfare is related to that of neighboring lands (Ray. S. Bradly,1991). In this backdrop Kashmir being an upland surrounded by mountains is an ideal unit with fragile environment for studying climatic variability which will provide vital clues about highly sensitive western Himalayan region.

The Valley of Kashmir is nestled in the north-western folds of Himalayas. The mountain ranges rise to a height of about 5550 m in the north-east and dip to about 2700 m in the south. Valley stretches between 32^0 22' – 34^0 43' north latitudes to 73^0 52' – 75^0 42'east longitudes (Hussain, 1987). Despite being located in subtropics the Valley has got a sort of sub-Mediterranean or modified sub tropical climate (Mehor- Homji, 1971). It has also been defined as irregular climate as it does not show any

coherence with standard climatic divisions of the world. The climate of the valley is extremely delicate and highly sensitive to the variation prevailing at the regional, continental and global levels. The basic aim of the present paper is to study the nature and magnitude of climatic variability in Kashmir valley during the winter season. The present study analyses the core-winter (January) temperature of last 60 years to ascertain the impact of global warming on the winter season in Kashmir valley. January is the coldest month and most of the precipitation is received in the form of snowfall. Cold winter temperature is beneficial for the glaciers as it helps in fern formation which gives them enough strength to resist the spring and summer heat and combat the recession. Cold winter temperatures are also essential for various temperate fruits and rabi crops in the valley of Kashmir.

The study reveals the precarious climatic scenario which exhibits unprecedented increase in the both mean maximum and mean minimum temperatures. Similar attempts have been made to study the aspect of temporal variability in temperature at hemispheric level by Kalinky (1974) which reveals the prevalence of warming trend from 1890-1950 and cooling trend from 1950-1980. Anthony and Sherwood (1979) in their studies discovered that atmospheric pollution has a significant effect on global climate. Hingane et al (1985) in their studies indicated a significant warming of 0.4^0C/ 100 years in mean annual temperatures in India on the whole. Pant *et al* (1993) in their study of 73 stations found that 30 stations show a significant warming trend, while as only 6 stations showed a cooling trend. Roop Kumar and Hingane (1988) in their study based on 100 years data of various Indian cities discovered a warming trend in Bangalore, Mumbai and Calcutta while as Delhi exhibited a cooling trend. On the basis of mean surface temperature records over India from 1901-1988 an increasing trend in three epochs has been noticed (1905-1925) (1932-1956) and 1972 onwards. (M.Lal *et al* 1993a). IPCC-TAR (2001) reveals that mean surface temperature increased by 0.6±0.2°C over the 20th century. Land areas warmed more than the oceans. Northern hemisphere surface temperatures increased over the 20th century greater than any other century in the last 1000 years. Diurnal surface temperature range decreased from 1950-2000 over land areas. Average number of hot days increased along with the decrease in frost days for nearly all land areas during the 20th century. Continental precipitation increased by 5-10% over the 20th century in Northern hemisphere, although it decreased in some regions of northern and western Africa and in some parts of Mediterranean. Hamamalni and Nagalakashmi (1994) has used trace rainfall as an indicator of climate change in Vishakhapattanam .Ram Mohan and Nair(1991) studied annual rainfall variability over Kerala State. Hussain (1970) tried to study rainfall variability in relation to agricultural practices in Ganga-Yamuna Doab. Ramakrishna and Shastri (1980) investigated the incidence of drought over Western Rajestan. Chourasia and Mavi (1985) attempted to examine the trends in precipitation Ludhiana

Methodology and Data Base

Valid conclusions regarding the climatic variability in a particular region can be drawn to some extent after long term study of influential climatic variables. Therefore the present study is based on the sixty years instrumental record (1950-2010) of meteorological station Srinagar, located at the central part of valley of Kashmir. Besides time series analysis, relevant statistical techniques have been used to study the variability with respect to time and space. The trend analysis helps to develop rough preliminary idea about the existence of any upward or downward trend. Moreover several relevant cartographic techniques have been used to give inferences a desired visual effect.

Results and Discussion

The study is based on data received from meteorological station Srinagar, which is the only station with available instrumental record from 1950-2010. This is because the rest of the stations were established in mid seventies by IMD. Winter season is the ecologically most important season in the Kashmir valley as it recharges the water resources in otherwise rainfall deficient region of Kashmir Himalayas. The extreme cold of Kashmir is beneficial for most of the temperate fruits of the valley as they need 150-200 days of chilling period for healthy growth and sustained productivity. The figure 1 reveals that there is abnormal increase in winter temperature during the last 60 years. Mean maximum temperature has increased more than one degree centigrade which is clearly felt in the region on various fronts. In the recent decade frequently it has been observed that precipitation in the winter occurs in the form of rainfall instead of snowfall, flowering phenology of various plants has been effected along with the arrival of different migratory bird species.

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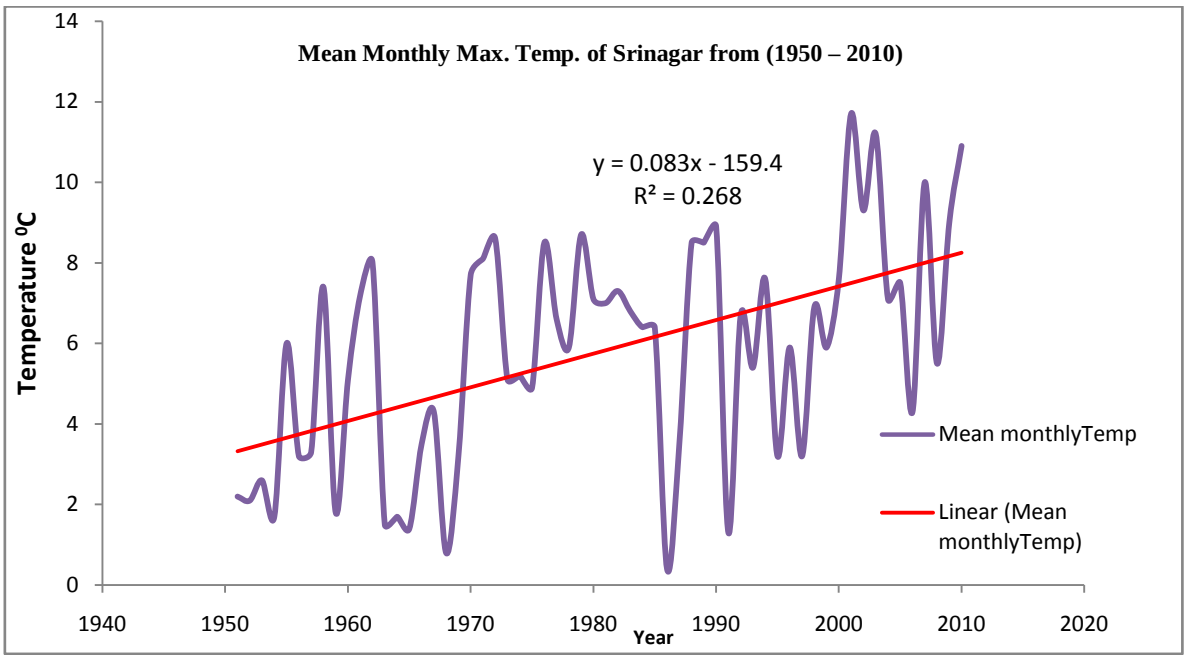
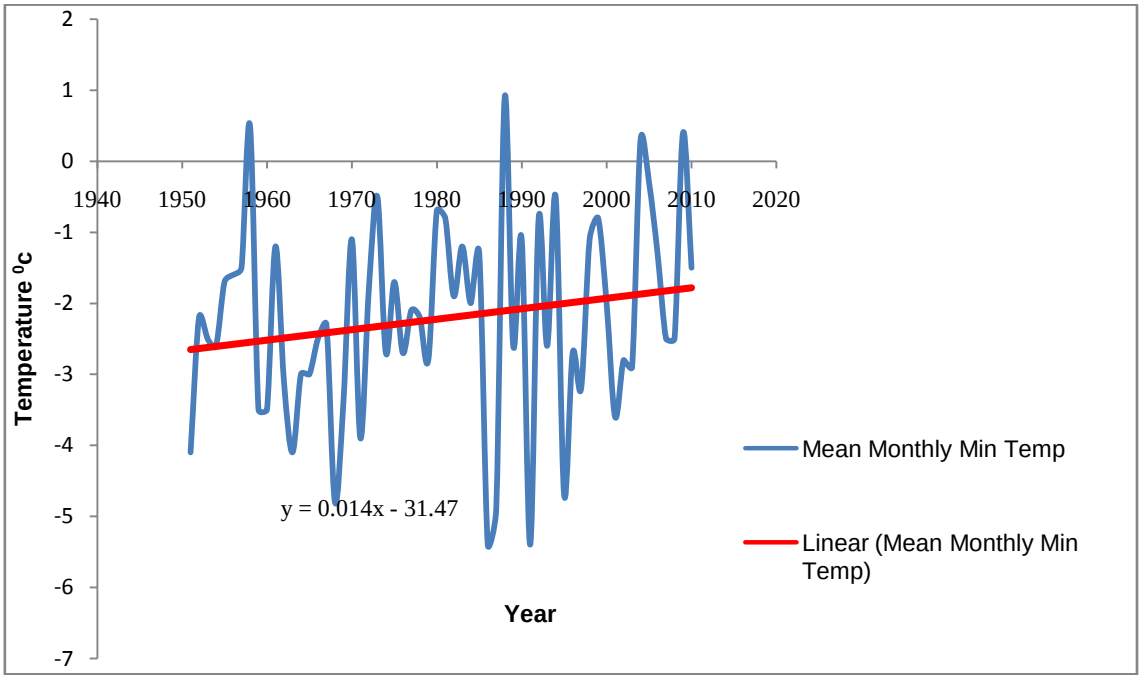
Figure 1: Core-Winter Mean Monthly Maximum Temperature of Srinagar from (1950 – 2010)



Source: Regional Meteorological Centre, Srinagar

Along with the mean maximum temperature, there has been a steady but less robust increasing trend in the mean minimum temperature in Kashmir valley during core winter. During the study period it has been observed that mean minimum temperature has registered around 0.8 degree increase in the study area. The mean monthly core winter precipitation has also shown a considerable decreasing trend in Kashmir valley during the last sixty years. Figure 2 gives a clear indication about the increase in mean minimum core winter temperatures which could have far-reaching ecological and economic implications on the economy and ecology of the region.

Figure 2: Core-Winter Mean Monthly Minimum Temperature of Srinagar from (1950 – 2010)



Source: Regional Meteorological Centre, Srinagar

Table 1: Decadal analysis of Mean Monthly Maximum, Mean Monthly Minimum and Monthly Precipitation in Srinagar from (1950 – 2010)

Decade	1950-60	1960-70	1970-80	1980-90	1990-2000	2000-2010
Mean Max. Temperature ^{0}c	3.5	3.6	6.9	6.5	5.5	8.6
Mean Min. Temperature ^{0}c	-2.3	-2.9	-2.1	-2.0	-2.3	-1.6
Precipitation Cm	7.2	4.7	5.7	5.0	5.5	4.2

Source: Regional Meteorological Centre, Srinagar

The Decadal analysis of Mean Monthly Maximum temperature shows that the temperature has more than doubled (3.5^0C -8.6^0C) from the decade of 1950-60 to 2000-2010. Similarly the mean minimum temperature has also decreased from -2.3^0C in 1950-60 to -1.6^0C in 2000-2010. At the same time the monthly precipitation has also shown a decreasing trend. It has registered a declining trend from 7.2 cm in1950-60 to 4.2 cm in 2000-2010. With the available climatic data it is clearly visible that by far the first decade of twenty first century 2000-2010 has been the warmest and driest decade in the Kashmir region.

Conclusion

The contrasting trends in core winter temperature and precipitation which dominated the second half of the 20th century in Kashmir valley have further aggravated the fragility of the ecosystems in Kashmir Himalayas. From the global research insights, it is evident that trends on hemispheric and continental level have got positive correlation with those prevailing in the Valley of Kashmir. Similar trends in temperature have been reported by Lal, *et al* (1993b) in Indian subcontinent and Beniston, *et al* (1985) in Northern Hemisphere. Another interesting observation of the present study is the differential increase in mean maximum and mean minimum temperatures in the Valley. Very likely, this differential warming could be attributed to the sharp decline in the efficiency of dominant precipitation regimes in the respective regions which has also been testified by the Third Assessment Report (2001) of Inter-Governmental Panel for Climate Change. The valley has registered an increase of above 1^0c in mean maximum temperature and 0.8^0c in mean minimum temperature during core winter season from 1950-60 to 2000-2010. The decline in core winter precipitation in Kashmir Valley is around 2 cm. The abnormal increase in temperature and decrease in winter precipitation has serious economic and ecological implications, which manifest in the form of glacial recession, reduced flow of rivers, severity of droughts, drying-up of springs, adverse affects on winter tourism, negative impact on hydel-power generation, changes in cropping and disease patterns and many more socio-economic repercussions.

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