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Rainfall Trends in Kashmir Valley and Their Impact on Atmospheric Climate

Dr. Gowhar Bashir Vakil* & Dr. Gowher Bhat**

***Associate Professor, Department of Physics, University of Kashmir, Srinagar.*

****Associate Professor, Department of Physics, University of Kashmir, Srinagar.***

ABSTRACT:

Under the threat of global warming it is vital to determine the impact that future changes in climate may have on the environment and to what extent any adverse effects can be mitigated. In this research Paper an assessment was carried out on the impact that climate trends may have on some parts of Kashmir valley. Historical rainfall data from 30 years were analyzed and long term trends were assessed for various aspects of some parts of Kashmir climates using suitable statistical techniques. Results indicated that intra-region variability for extreme seasonal rainfall is large and mostly exhibited a negative tendency leading to increasing frequency and magnitude of rainfall deficit and decreasing frequency and magnitude of rainfall decreases almost everywhere in Kashmir Valley.

INTRODUCTION

Climate Change is the change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and /or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may due to natural internal processes or external forcing, or to persistent anthropogenic changes in the composition of the atmosphere or land use. Both, “Global Warming” and the opposite phenomenon “Global Cooling”, result in different patterns of Climate Change. Today when we talk of Climate Change we refer to the patterns caused by human induced Global Warming and hence, the terms “Climate Change” and “Global Warming” are used interchangeably. The global warming is nothing but increase of surface temperature due to emission of greenhouse gases, thereby increasing global atmospheric temperature over a long period of time. Such changes in surface air temperature and rainfall over a long period of time is known as climate change. If these parameters show year-to-year variations or cyclic trend, it is known as climate variability.

According to the IPCC's Assessment Report of 2007 it has been estimated that during the last century the global mean surface air temperature increased on average by 0.74oC, however, that increases varied from place to place. The various theoretical models have projected global rise in temperature around 3°C by the end of 2100 A.D. It has been estimated that the annual mean surface air temperature is projected to rise by 1.7 to 2.0 °C in the 2030s and that temperature increases are more pronounced at higher than at lower elevations. The impact of climate change is that the rainfall and even wind patterns are likely to shift with climate change. The monsoons may be delayed and unpredictable rains and heavy downpours are likely to be the rule rather than the exception Like global, Jammu and Kashmir State has reasons to be concerned about climate change where related effects are being felt, including warmer temperatures for longer periods and long dry spells during the cropping season. The increasing warming and the change in rainfall pattern in the region are expected to affect the economy of the region adversely as vast population depends on climate -sensitive sectors like agriculture, forestry and tourism for livelihood. The adverse impact on water availability due to recession of glaciers, decrease in rainfall and increased flooding in certain pockets would threaten food security, extinction of natural ecosystems including species that sustain the livelihood of rural households.

At continental numerous long-term changes including widespread changes in rainfall amounts, wind patterns and aspects of extreme weather including droughts, heavy rainfall, heat waves and the intensity of tropical cyclones have also been observed. Change in rainfall affects annual river runoff and water availability. Areas in which runoff is declining are likely to face a reduction in the value of the services provided by water resources. On the other hand, increased rainfall variability and seasonal runoff shifts may also have negative impacts on water supply, water quality and flood risks. The frequency of heavy rainfall events has also increased over most land areas and particularly since about 1950, even in those regions where there has been reduction in total rainfall amount, which is consistent with warming and observed increase in atmospheric water vapour. Increases have also been reported for rarer rainfall events (1 in 50 year return period), augmenting flood risk (Rosenzweig et al., 2007). Changes in rainfall variability also affect agriculture, forestry and ecosystems, hydrology and water resources, human health, tourism and energy supplies. Rainfall has much larger spatial and temporal variability than temperature, and it is therefore more difficult to identify the

impact it has on changes in many systems. Rainfall is a primary source of energy for soil erosion problems in many locations in Kashmir valley, which leads to environmental damage through on and off-site effects. Erosion by water has been considered as the most serious soil degradation problem in the Kashmir valley (Bhattacharyya et al., 2007).

The aim of the work presented in this paper is to study 30years of rainfall data to look at their trends and effects atmospheric changes. This work evaluated past changes of various aspects of Indian climate considering trends and variability of rainfall and temperature at different regional scales. Observational records at various lengths were employed with rainfall record beginning as early as 1871 and temperature from 1901. Changes of extremes of climate were given a particular interest, and observed changes in extreme events were elaborately described. To study the changes in daily extreme seasonal rainfalls in various gridded

regions in India using newly available data that permit improved insights into the changes in extreme events such as daily heavy rain falls in the last 50 years (1970-2010) at shortest possible gridded scales (regions of 50km × 50km grids).

RESULTS AND DISCUSSIONS:

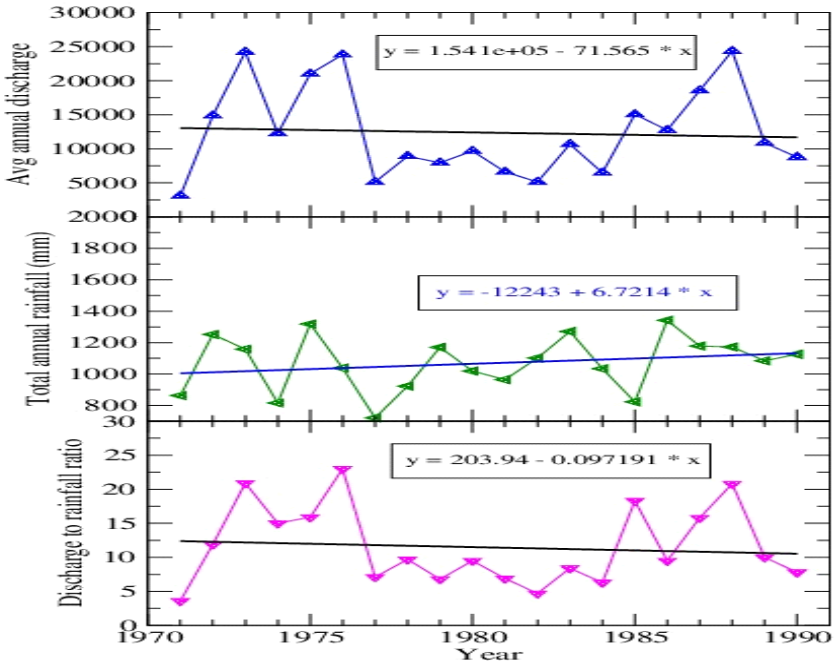

Fig. 1 shows rainfall trends in Kashmir valley from 1970-1990

Figure 1, displays variation of the average discharge (upper panel), total annual (middle panel) and discharge to rainfall ratios (lower panel) which occurred in the 20-year interval starting in 1970, which indicates large seasonal variations. As noted in Figure 1, average discharge rainfall deficits a negative slope (-71.565) has a steady decrease in the decades after 1976 to 1985, while 1987-1990, the discharge rainfall increases abruptly with positive slope. Total rainfall shows positive slope (6.72) from 1970-1990 indicating increase in monsoon rainfall excess frequency since 1970s and until the current decade and discharge to rainfall ratio shows negative slope indicating decrease in the ratio. Furthermore, annual peak discharge has been going through a continuous increase in monsoon rainfall excess frequency from 1970s to 2010 and then a slight drop in the 2010, as in Figure 2. Further the 5-year moving average rainfall shows overall positive slope indicating increase in year wise rainfall in Kashmir valley from 1970-210 as shown in Figure 2 of lower panel.

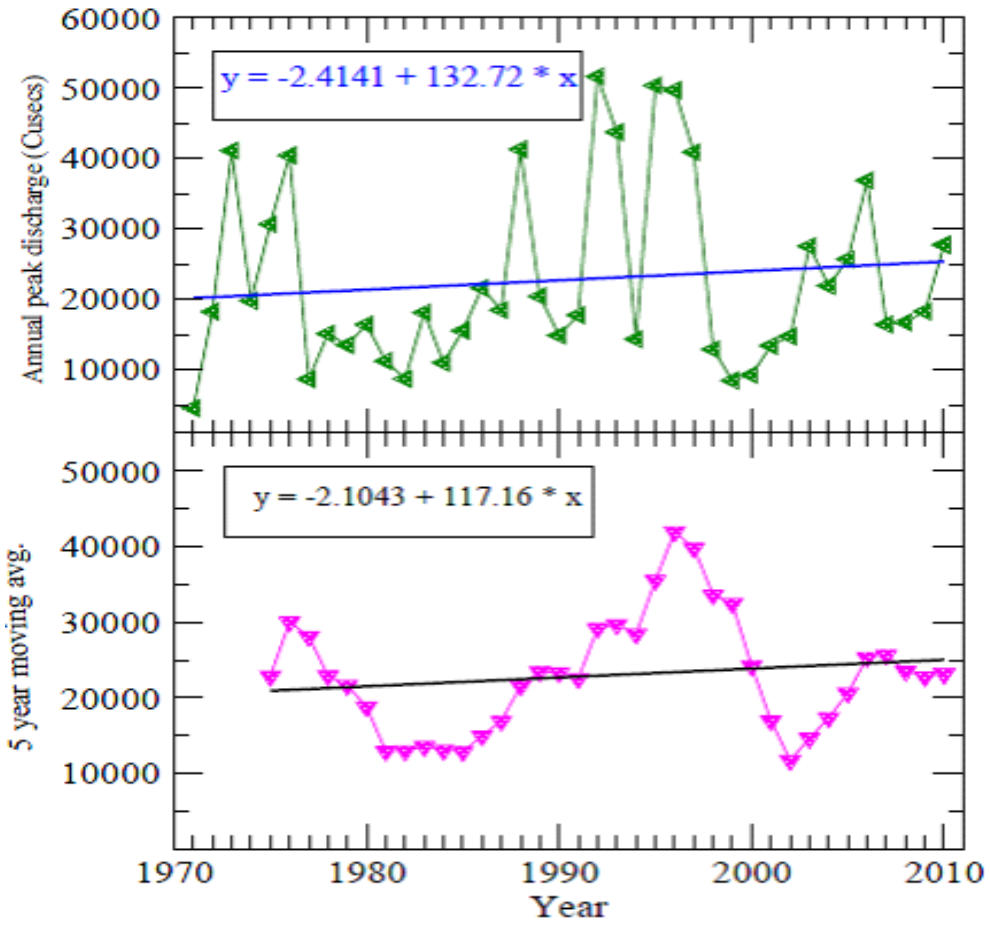

Fig. 2 shows rainfall trends in Kashmir valley from 1970-2010 in 5 year wise

The results above also confirm that, decadal (10-year) changes are much more versatile and statistically significant than the shorter time i.e. half decadal (5-year) changes. So, it is now clear that, although in Kashmir valley average rainfall shows a statistically significant decreasing trend and virtually provides a comprehensive overall generalization of rainfall, it does not at all reflect the regional variability. Therefore, a region-specific study is always important and essential in order to better understand the locale climate that is vital for various local developments requiring local climatologically information. The quantities of total rainfall are decreasing in all the regions of Kashmir valley. All the trends are statistically significant indicating negative slope of rain fall in Kashmir Valley. In conclusion, rainfall is indeed decreasing and this is true for every region in Kashmir Valley, which is also consistent with the decreasing trend of rainfall in the Indian region (Goswami et al., 2006) and rest of the world.

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