
Climate Change In Kashmir Himalayas

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Introduction

The Climate Change with its disastrous consequences on the human habitat including economy and society has invited a sharp global response and concern. The environmental degradation which is impacting living conditions is a matter of grave concern for human beings the world over. The human footprint is quite visible in this disaster and change.

The earth's climate is now clearly out of balance and is warming. Evidence from most oceans and all continents except Antarctica shows higher levels of warming which are attributable to human activities. Many components of the climate system—including the temperatures of the atmosphere, land and ocean, the extent of sea ice and mountain glaciers, the sea level, the distribution of precipitation, and the length of seasons—are now changing at rates

and in patterns that are not natural and are best explained by the increased atmospheric abundances of greenhouse gases and aerosols generated by human activity during the 20th century. Global average surface temperatures increased on average by about 0.6 C over the period 1956—2006. Looking at the ice cores, the levels of Co₂ have been 35% greater than they have been for at least last 0.65 Million years. From the chemical composition of these gases, we know that this is mainly due to the burning of fossil fuels, production of cement and the widespread burning of forests in the tropics. These results enabled International Panel on Climate Change (IPCC) to pronounce that “..... *most of the observed warming over the past 50 years is likely to have been due to the increase in greenhouse gas concentrations*”. The IPCC thus concluded that most recent warming, observed globally, is due to the human activities.

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The potential consequences of the Climate Change have been established beyond any doubt at the global level. The experts may disagree about how climate might change in future but they do generally agree that climate change shall have an impact, not only on environment, but on every sphere of the human activity.

Kashmir Scenario

The impact of climate change in Kashmir Himalayas is expected to be considerable. Climate change is likely to affect a number of sectors, particularly irrigated agriculture, horticulture, and hydropower capacity in the state. Changes in flow magnitudes are likely to raise tensions between India and Pakistan, in particular with regard to reduced water flows in the dry season and higher flows during the wet season, posing increased risk to hydropower development and higher frequency of floods in both parts of the Kashmir.

We have been observing the clear and louder indications of the climate change in the region particularly the recession of glaciers, erratic and scanty precipitation, change of growing seasons, change in the species composition, shifting of vegetation to higher altitudes and

shrinking of wetlands. The 12 of the last 15 years have been hottest since the recording of temperature in 1850. The analysis of the vast repository of meteorological data for Mean Annual Temperature from 1893 up to 2009 in Kashmir shows a statistically significant increasing trend. Both, mean minimum and maximum temperatures are also showing an increasing trend during the observation period. For the last 100 years, the mean minimum temperature of Srinagar has increased by 1 degree centigrade. While as the mean minimum temperature of Srinagar for winter and summer has increased by 1.2 And 0.2 centigrade respectively. The average annual temperature has also increased by about 0.8 degree centigrade. For winter the annual increase in temperature recorded at Srinagar is 1.1 and for the summer, there is an observed increase in temperature 0.2 degree centigrade. Similarly, the mean maximum temperature has increased by 1.7 degree centigrade. For the winter and the summer, the mean maximum temperature has increased by 1.3 and 1.0 degree centigrade respectively. If we look at the daily weather data over the entire Northern hemisphere, it is a similar trend all over the hemisphere and we have observed that the last 12 years have been hotter in the entire hemisphere compared

to the mean of temperature observed in the hemisphere (1960-1999). Just to mention here that our weather system is very much controlled by the northern westerlies originating from the mid and higher latitudes in the northern hemisphere. I believe that by 2050, we will have much hotter summers than we have been experiencing for the last few years now, if the current global greenhouse gas emission scenario is not drastically brought down.

The Receding Glaciers

The receding of glaciers in Kashmir Himalayas gives us one of the most important indications that climate change is impacting us here in more than one way. Glaciers are receding at a faster rate in the state compared to other glacial regions in the world. In Suru basin alone, we have lost about 15% of glaciers for the last 40 years. There are more than 360 glaciers in the basin and we have been monitoring ten benchmark glaciers for detailed glaciological studies. *During the observation period, we have found that many of the smaller glaciers have been completely lost during the last forty years. Overall, larger glaciers are showing lesser recession rates compared to the smaller glaciers. Similarly, we have lost 18% of the Kolhai glacier, the main source of*

drinking water and irrigation in valley, during the same period.

We have observed decreasing precipitation trends including snow over the Kashmir region by observing the data and model simulations since 1893-2009. From the analysis of the precipitation data for the last 100 years, it is evident that, both, snow and liquid precipitation are showing decreasing trends all over the region. As the precipitation in Kashmir is predominantly in the form of snow, the snow and glaciers determine the availability of water resources for societal needs in summer and spring seasons. Looking at the snow depletion curves developed over the Kashmir region, the decreasing trends in the snow cover distribution are quite discernible all over the Pir Panjal and the Himalayan ranges. *The decreasing trend in the snow cover and the increasing trends in the winter and summer temperatures observed over the area have serious ecological and economic consequences for this mountainous state.* As a result of scanty and erratic snowfall, most of the tributaries of the Jhelum are showing lower discharge and will, therefore, affect livelihoods at both local and regional scale through effects on agriculture and energy production. Reduction in the discharge of rivers flowing out from

the Kashmir Himalayas could have serious implications for the political stability of the entire South Asian region in the long run and should be a cause for serious concern to all of us.

Water Scarcity

This reduction in snowfall together with the fast receding glaciers has resulted in water scarcity for irrigation and hydropower generation in recent years. Glaciers and snow are important for water resources in the Kashmir region. Snow- and glacier melt runoff continuously feed the rivers and water bodies, thus making them perennial. A decrease in the glacier extent and mass, due to climate change, presents a serious problem to a number of economic sectors in J&K that depend on the glacier melt runoff. Long term viability of any existing and potential developmental schemes in the fields of irrigation, agriculture, horticulture, hydropower, tourism and drinking water supplies in the state of Jammu and Kashmir are intimately dependent on the viability of snow, glacier and water resources. There is no doubt about the adverse impacts of climate change on these resources; the Kashmir environment, economy and the society in general is going to be hit hard, if, no adaptation

strategies are planned well in time.

The Flood Menace

If the recurrent flooding in the region is any indicator, the climate changes are already bothering us here. We had a flood here in the March last year with large areas of the city inundated by few hours of snow precipitation. The data shows that the frequency of flooding has increased in the valley during the last few decades. Coupled with the unplanned urbanization and mismanagement of the Jehlum floodplains, the situation is going to be alarming in near future. One can well imagine the future scenario, with most of the wetlands that used to act as sponge during flooding, being urbanized and converted into concrete landscape. Though, we have been fortunate that the valley has not been recently hit by an extreme weather event but, with an increasing temperature coupled with increasing discharge in the rivers, an extreme rainfall event of the size observed in Mumbai (2005) and Bihar (2008) and Karnataka (2009), shall result in one of the worst floods in the history of Kashmir and may unleash havoc in the plains of the valley. The planners and policy makers need to prepare for flood control measures right from today including construction of an alternate

flood channel on war footing.

Impact on Wetlands

Climate change is also going to impact our wetlands adversely. Most of our water bodies are already fighting a losing battle for their survival. Wetland habitat, productivity and processes, being linked to the hydrological cycle, are getting adversely affected due to seasonal changes in the precipitation and runoff. Most of the wetlands have less biodiversity in terms of fauna and flora compared to the situation, say only 50 years back. In the process, obnoxious weeds and other aquatic life has succeeded the more productive and useful biota. *A number of wetlands, we are monitoring for the last forty years, are showing a remarkable shrinking in their extent and water spread. Some wetlands in the valley, particularly Hokarsar, Anchar, Khushal Sar have undergone drastic shrinkage in their water spread area.*

The Snowline

We have also observed that the snowline is moving up in the Kashmir Himalayas due to scanty snowfall and higher temperatures during the last 12 years as observed in the region. This has implications for the faunal and floral biodiversity.

Less snow in Kashmir also means no skiing and thus the winter tourism, that the Government is earnestly promoting, may get affected if the trend continues. Even there are some indications that the less snowfall in the region is affecting the wildlife habitats, particularly it seems to have disturbed the snow leopard and the black bears.

The Need for a New Approach

It is of utmost scientific and economic importance to study the different climatological, hydrological, vegetation and land surface processes of Kashmir vis-à-vis that have a direct bearing on the economy and livelihoods of the population. This knowledge can be used to make long term plans to cope up with the economic impact of such climatic changes. Every society needs to examine which policies and management practices need to be promoted to respond to the climate change impacts to different natural resources, health, economy etc. The adaptation policies and measures must be adopted for different sectors to slow down the impact of climate change on these sectors. Impacts can not altogether be stopped but their pace can be slowed down by better planning and policy.

In Jammu and Kashmir state, we need to address such questions as, how is our environment changing? How does the environment respond to the natural and human induced climate changes? What are its consequences for the people? How are people adapting or can better adapt to the climate change? The answer to these questions would facilitate the solution of our environmental problems. But the answers would not come in vacuum. We would have to utilize all the available tools employing scientific methods to look for the answers. If, we understand the processes leading to the environmental changes occurring in the state, we can help ourselves to mitigate the effects through improved planning, improved response and more efficient adaptation strategy. There is a need to analyse the trends in environmental, economic and social indicators over the last few decades to link the climate change to the socio-economic development of the state. We have a culture and history of quick reactions and this is also applied while prescribing the environmental mitigation initiatives. We are always in a hurry to suggest and execute remedial measures (having been tested in a different environmental set up), without first thoroughly researching and understanding our own problems for

working out alternative and befitting solutions. This needs to be done away with.

Lack of Data

We, in Jammu and Kashmir, do not have any coordinated and established practice of data observations on any of the natural resources; whether it is water, soil, forests, glaciers, agriculture, meteorology, geology or other related disciplines. Mountainous regions require much greater density of observations in comparison to the neighboring flat lands to achieve same reliability of area estimates. It should be a matter of concern to all of us that the state lacks a long historical time series of hydrometeorological observations. Though, modern scientific data analysis and climate models do allow us to simulate hydrometeorological observations based on the past and existing time series but the opportunity to observe such variables in the past has been lost forever. At least now, we should rise to the occasion and build, on priority, an adequate network of observations for environmental variables related to primary processes of atmosphere, land, water, snow etc. throughout the state. We should deliver a functioning system for distribution of data and information resulting from these

observations.

It is highly relevant that we should promote the climate change education and awareness among the masses. One of the recommendations of the National Workshop on Water Resources in India: Concerns, Conservation and Management (WRIIN2009), held at the University of Kashmir, was that "in light of the loud and clear indicators of climate change in the Himalayas, it is important to undertake research on assessing the impacts of climate change on water resources".

Accordingly, various aspects of the climate change mitigation strategy were discussed at several meetings of the Working Group on Climate Change Research (WG-CCR) under the chairmanship of Prof. Riyaz Punjabi, the then Vice Chancellor of the University of Kashmir, constituted for the purpose, with membership from the academia, government and the civil society, so that the outcome from the past and ongoing research is used for developing a robust strategy for the mitigation and adaption to the climate change in the region. It is expected that the collective efforts and research collaborations would contribute to the better understanding of the Climate Change linkages to the local environmental problems and

ultimately lead to the development of a strategy to mitigate and adapt the climate change in the region.

In Liue of a Conclusion

I am tempted to observe that the efforts being made to mitigate climate change at the global level are also not encouraging. Looking at the future temperature prediction scenarios generated over the Kashmir region using General Circulation Models and a region climate model, where an increase of 2-5 degree centigrade has been predicted, I believe that by 2050, we will have much hotter summers than we have been experiencing for the last few years now, if the current global greenhouse gas emission scenario is not drastically brought down (that seems to be remote possibility at present keeping in view the current stand of China, India and the developed countries led by US and UK). Though, the future Conference of Parties (COP) meetings are going to push a challenging scenario of capping carbon emissions that will stabilize temperatures to 2 degree centigrade. Even if the agreements are reached (it would be not less than a miracle), the temperatures shall still keep on rising at the current trend for some time as the climate system takes

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longer time to respond to the changes in the green house gases but by 2100 we may see a reduction in the temperature if serious efforts are made to bring down the emissions at the global level.. ■