

*A [Discussion Paper](#) on the state of Himalayan Glaciers, prepared by Mr V K Raina, ex Deputy Director of GSI, was released by the Minister for Environment & Forests, Mr Jairam Ramesh. The Paper presents a detailed historical review of the research to date spanning more than 50 years, and includes a perspective on the impact of climate change on the glaciers. The Ministry invites comments on the Paper.*

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### **Comments on the Himalayan Glaciers Discussion Paper (Report by V K Raina)**

*By Dr. Madhav Khandekar*

This is a comprehensive and a well-researched report on the Himalayan Glaciers, its history & geology and the present state of the glaciers in the context of the current debate on global warming. The author is a geologist by training and has attempted to provide an excellent overview of the state of some 50 glaciers ( out of a total of about 10,000 in the Indian region of the Himalayas) which have been studied during most of the 20<sup>th</sup> century, with an accelerated study and monitoring since the IGY ( International Geophysical Year) of 1957. Among many important conclusions drawn by the author, the following statement best describes the present state of the glaciers:

*“Glaciers in the Himalayas, over the past 100 years, behave in contrasting ways. Some glaciers ( ex, Sonapani) have retreated by as much as 500m in the last 100 yrs, while others ( ex, Kangriz) have retreated just by an inch or so during the same period”*



The author concludes further that *“It is premature to make a statement that the Himalayan Glaciers are retreating abnormally because of global warming”*

It must be realized that the Himalayan Mountains are the world's tallest and perhaps the most difficult mountain chains to monitor and study adequately to assess the impact of recent warming. Among many weather & climate parameters are the mean temperature and the precipitation (snow during the winter season and rainfall during the Indian summer Monsoon –June-September). Available observations suggest some warming (perhaps significant warming in some areas like The Tibetan (Qinghai-Xizang) Plateau) of the Himalayas, however it is difficult to link the recent shrinking and retreat of many Himalayan Glaciers to warming alone. The total annual precipitation and its inter-annual variability seems to play an important role in the shrinking of the Himalayan glaciers just as it does elsewhere ( ex, Mount Kilimanjaro, see Kaser et al Int'l J of Climatolgy 2004).

Another recent paper (Dahe et al 2006, J of Climate ) makes a climatological analysis of snow depth over western China (including the Tibetan Plateau) from 1947 thru 1997 using (NOAA) satellite SMRR data. It is instructive to read the following quotes for Dahe's conclusions:

*“Snow cover is far from a pervasive feature over the Tibetan Plateau. Only in the peripheral mountains is any appreciable snow cover noted. In the vast interior, snow cover is rare or thin, patchy and of a short duration. .The annual cycle of (Tibetan) snow is characterized by an early peak in January, a very slow snow decay and a long snow dissipation progress from February to June”*

In recent years, there appears to be an increasing snowfall accumulation in the foothills of the Himalayas (esp in the Kashmir Valley region), while snow accumulation may have decreased in the regions where most of the glaciers are located.. The decrease in snow accumulation over higher elevations may be due to changes in the large-scale circulation patterns (ex, southward displacement of the sub-tropical Jet Stream), which could be linked to inter-annual variability of the Indian summer Monsoon.

In summary, the most plausible explanation of shrinking of the Himalayan glaciers at present is the lack of adequate snow accumulation during the winter season. It is premature to link the recent shrinking of the Himalayan glaciers to observed warming of the earth's mean temperature in the last 30 years.

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