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Global Warming And Glacier Melt-Down Debate: A Tempest In A Teapot?" – A Guest Weblog By Madhav L Khandekar

Dr Madhav Khandekar is a former research scientist from Environment Canada and is an expert reviewer for the IPCC 2007 Climate Change Documents. Khandekar has been in the fields of weather & climate for over 52 years. He has agreed to write this very informative guest weblog.

### **Global warming and glacier melt-down debate: A tempest in a teapot?**

#### **Madhav L Khandekar**

The debate over global warming & “rapid” melting of world-wide glaciers and in particular the Himalayan glaciers is once again heating up. There were a flurry of reports, a few weeks ago, in the media and in particular on the BBC (UK) world-wide news service about the Himalayan glaciers melting rapidly in the face of global warming. As this debate was raging, a comprehensive report by Dr V K Raina (Himalayan glaciers: A state-of-the art review of glacial studies, glacial retreat and climate change) was released by the Indian Minister of Environment & Forestry in New Delhi , India.

Vijay Kumar Raina, a senior glaciologist and an avid mountaineer himself, has carefully analyzed some 20 glaciers to document retreat as well as advance of some of the glaciers and has cautiously concluded that it is premature to make a statement that the Himalayan glaciers are retreating abnormally because of global warming. The Indian Minister of Environment Mr Jairam Ramesh hailed the report as an excellent latest study on glaciers and tacitly agreed with the conclusion.

Predictably, the IPCC chair Rajendra Pachauri reacted angrily citing the IPCC 2007 climate change reports which asserted that the (Himalayan) glaciers are receding faster than in any other part of the world and if the present rate ( of melting) continues, the likelihood of them disappearing by the year 2035 and perhaps even sooner is very high if the earth keeps warming at the current rate. Several other Indian scientists and glaciologists have got into the debate now with some of them criticizing the Indian Government with an ostrich-like attitude in the face of impending disaster.

What is the reality? Let us take a closer look:

First, where did this number 2035 (the year when glaciers could vanish) come from?

According to Prof Graham Cogley (Trent University, Ontario), a short article on the future of glaciers by a Russian scientist (Kotlyakov, V.M., 1996, The future of glaciers under the expected climate warming, 61-66, in Kotlyakov, V.M., ed., 1996, [Variations of Snow and Ice in the Past and at Present on a Global and Regional Scale, Technical Documents in Hydrology](#), 1. UNESCO, Paris (IHP-IV Project H-4.1). 78p estimates 2350 as the year for disappearance of glaciers, but the IPCC authors misread 2350 as 2035 in the Official IPCC documents, WGII 2007 p. 493!

So we have a raging debate about impending glacier melt-down because of sloppiness of some IPCC authors! Further, according to Kotlyakov, the present glacier area of some 500,000 km<sup>2</sup> could shrink to 100,000 km<sup>2</sup> and this could happen NOT in 2035 but in 2350, if the current rate of warming continues. Also this estimated glacier area and its shrinkage does not include internal drainage basin of central Asia with an estimated area of some 40,000 km<sup>2</sup> .

Let us now look at the statement that Himalayan glaciers are receding faster than in any other part of the

world. How true is this statement?

Prof Graham Cogley (Trent University Peterborough Ontario Canada ) who has analyzed shrinkage rates of many glaciers also refutes the IPCC claim that Himalayan glaciers are shrinking faster than in any other part of the world. A recent news item from Science ( V 326 13 November 2009, p.924) cites Prof Jeffrey Kargel's ( University of Arizona USA) study which suggests that many glaciers in the Karakoram Mountains ( straddling India and Pakistan) have stabilized or undergone an aggressive advance in recent years.

Among many important conclusions drawn by Raina in his comprehensive report, the following statement best describes the present state of the Himalayan glaciers: Glaciers in the Himalayas, over the past 100 years, behave in contrasting ways. Some glaciers (e.g. Sonapani) have retreated by as much as 500m in the last 100 years, while others ( e.g. Kangriz) have retreated just by an inch or so during the same period.

What is the cause for some glaciers to retreat while others to advance, sometimes in adjoining areas?

Not an easy question to answer. Many local and regional features like strong local winds causing erosion, small-scale temperature and precipitation differences and most certainly large-scale atmospheric circulation changes come into play in determining glacier retreat and advance. Most glaciologists now agree that it is the moisture depletion, not temperature increase that is the primary cause for glacier retreat. The depleting ice cap on Mt Kilimanjaro (in east Africa, near equator) is often cited as an "evidence" of global warming, however an excellent paper by Kaser et al ( 2004, Int'l J of Climatology) documents how the peculiar geography of the Mountain together with gradual decline of moisture at mid-tropospheric level since the late nineteenth century has resulted in depletion of its ice cap. These authors discount recent temperature increase as the cause of ice cap shrinking. In case of the Himalayan glaciers, precipitation patterns, especially snow precipitation and its intra-seasonal variations, seem to be an important parameter. Heavy late winter snow precipitation seems to improve the health of some glaciers in the Himalayas (Koul & Ganjoo Climatic Change 2009).

Finally two glaciers in the Himalayas deserve special attention: The Siachen glacier (second largest outside of polar latitudes) is about 75 km long and advanced 700 m between 1862 and 1909, then retreated 400 m between 1929 and 1958. In the last 50 years, the Siachen has stayed about same. The Gangotri glacier, the source of water for the Holy River Ganga was retreating at 20 m per year up to 2000, but then slowed down. In the last two years, the glacier is at a standstill.

In summary, the glaciers in the Himalayas are retreating, but NOT any faster than other glaciers in the Arctic and elsewhere. The two large and most important glaciers of the Himalayas show very little retreat at this point in time. The primary reason for retreat of some of the other glaciers seems to be lack of adequate winter snow accumulation. This depletion of winter snow could be due many factors like inter-annual variability of winter precipitation or possible southward displacement of the sub-tropical jet stream which straddles the Himalayan Mountains over a long 1500 km path.

It is premature at this stage to link global warming to the deteriorating state of Himalayan glaciers at this time. The Indian Environment Minister MR Jairam Ramesh has correctly observed "let us not write an epitaph on Himalaya glaciers at this time"

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