EXTREME WEATHER TRENDS VS. DANGEROUS CLIMATE CHANGE: A NEED FOR CRITICAL REASSESSMENT

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ABSTRACT

The ongoing debate on global warming and increasing concentration of atmospheric greenhouse gases (CO_2 in particular) highlights the possibility of increased incidences of extreme weather events world-wide, as the earth's mean temperature is expected to rise steadily in future. Several recent technical and scientific conferences have focused on the general theme of "dangerous climate change" and on avoiding or reducing this danger. However, a careful analysis of observed data on world-wide extreme weather events does not reveal any increasing trend in these events, thus suggesting a mismatch between reality and the hypothesis of dangerous climate change. There is a definite need to critically re-examine the hypothesis of dangerous climate change in the context of observed trend (or lack of it) in the extreme weather events worldwide.

Key words: extreme weather, dangerous climate change, reassessment

INTRODUCTION

One of the main objectives of the UNFCC (United Nations Framework Convention on Climate change) is the *stabilization of greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.* The theme of a recent conference (1–3 February 2005) in Exeter, UK was on *Avoiding Dangerous Climate Change and on Stabilization of Greenhouse gases.*

The phrase 'dangerous interference' is meant to highlight the possibility of increased incidences of extreme weather events and their catastrophic impacts on human societies and infrastructure of various nations in the world. The IPCC (Intergovernmental Panel on Climate change) document Climate Change 2001 [1] identifies several extreme weather and climate events which are expected to be observed with increased frequency during the 21st century. Some of the extreme events (e.g. heavy precipitation, hot spells in summer, thunderstorm/tornado activity, summer

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continental drying and associated risk of drought) are projected to have been observed and detected with increasing frequency during the latter half of the 20th century.

The present debate on climate change has fostered an intimate link between global warming and extreme weather. However, a careful analysis of observed extreme weather events as discussed below does not appear to support such a link.

EXTREME WEATHER EVENTS: CANADA, USA AND ELSEWHERE

In a report on *Trends and Changes in Extreme Weather Events* published by the Government of Alberta [2], some of the commonly observed events in Canada like heat waves, thunderstorms/tornadoes, rainstorms, Prairie droughts, winter blizzards and ice storms are carefully analyzed using available data of last 25 to 50 years. It is found that none of the events mentioned above show any increasing trend at this time. In fact, some of the events like winter blizzards on the Canadian Prairies are definitely on the decline while events like ice storms in central Canada and winter storms in the Canadian Atlantic do not show any increasing trend at this time. A careful analysis of mean temperature over various regions of Canada reveals that it is the winter mean temperature that has increased in last 50 years, while summer mean temperature which was highest during the 1930s (the Dust Bowl years on the Canadian Prairies) showed a decline in the 1990s, these years being adjudged by IPCC as the warmest years. According to Bonsal et al [3], *Canada as a whole is not getting warmer, but less cold.* The total precipitation over Canada as a whole has increased in last 50 years, but this increase is mainly due to increased number of low- to moderate-intensity precipitation events. The report concludes that the likelihood of increased incidences of extreme weather events in the next 10 to 25 years remains very small at this time.

A recent study by Balling and Cerveny [4] surveys extreme weather events over conterminous USA and concludes that there is no increasing trend for thunderstorms, intense tornadoes or hurricanes and tropical cyclones. Another study by Changnon [5] documents that shifting economic impacts from weather extremes in the conterminous USA is a result of societal change and not global warming. A comprehensive study [6] on extreme precipitation reveals that extreme precipitation events have increased in the latter part of the 20th century over conterminous USA. The study also shows a similar increase in extreme precipitation at the turn of the 20th century (i.e.1890s), thus suggesting that recent increase in extreme precipitation events could be due to natural variability and not necessarily due to global warming.

Elsewhere, available studies do not show an increasing trend in any of the extreme weather events identified by IPCC. Large-scale climate events like ENSO (El Nino-Southern Oscillation) do not show any increasing/decreasing trend at this point in time. The IPCC Climate Change document states that *warming associated with increasing greenhouse gas concentration will cause an increase in Asian summer monsoon variability.* A recent study on Indian/south Asian Monsoon rainfall variability [7] shows the summer Monsoon over India and south Asia to be primarily governed by large-scale atmospheric features like ENSO and Eurasian winter snow cover while showing no increased inter-annual variability in the Asian Monsoon as a whole. Another recent study on rainfall variability and changes in Southern Africa [8] shows that The South African rainfall is primarily governed by ENSO events while

showing significant modification in its variability in recent decades; the South African rainfall does not show any increasing/decreasing trend at this point in time. For Australia as a whole, there is no increase in "heavy rainfall" events in recent years [9]. An analysis of extreme rainfall events for China [10] suggests no increasing trend for 1 to 3 day extreme rainfall events.

MEAN TEMPERATURE VARIATION OVER EARTH'S LAND AREAS

The mean temperature variation over earth's land areas is shown in Figure 1. The Figure shows monthly temperature anomalies (relative to 1971–2000) for Global, Northern and Southern Hemisphere land areas and reveals several interesting features of temperature variation. The early 1990s show a gradual warming of the earth's surface, reinforcing the global warming argument. According to IPCC, the 1990s have been identified as the warmest decade with 1998 as the warmest year in 1000 years. Since January/February 1998, the two consecutive warmest months in Figure 1, the mean temperature over the earth's land areas appear to be slowly declining despite increasing concentration of CO_2 in the atmosphere. According to the most recent WMO statement of 27 December 2004 (http://www.wmo.ch), the year 2004 has been identified as the fourth warmest year, following 1998, 2002 and 2003. In a recent study, Kumar *et al*. [11] show that the sustained North American warming of 1998 was primarily due to the 1997 El Nino which produced and maintained high SST (Sea Surface Temperature) values over the Pacific basin as well as over other ocean basins through the middle of 1998. The North American warming of 1998 contributed significantly to make 1998 as the globally warmest year of the 1990s. Since mid-1998, the SST values are slowly declining suggesting that the earth's mean temperature may be governed more by worldwide SST distribution and less by enhanced greenhouse gas warming. Further, increased urbanization and land-use change over various regions of the earth are now considered to be significant contributors to the earth's surface warming in recent years [12,13].

CONCLUDING REMARKS

An analysis of available data on extreme weather suggests no discernible link between global warming and extreme weather at this point in time. The link appears to be more perception than reality (Khandekar et al [14]). The earth's land area mean temperature appears to be declining following the intense El Nino event of 1997/98. These and many other observational studies strongly point out a need for critical assessment of the UNFCC and the hypothesis of a dangerous climate change. The greenhouse gas emission control strategy must be commensurate with the present state of our knowledge on climate change.

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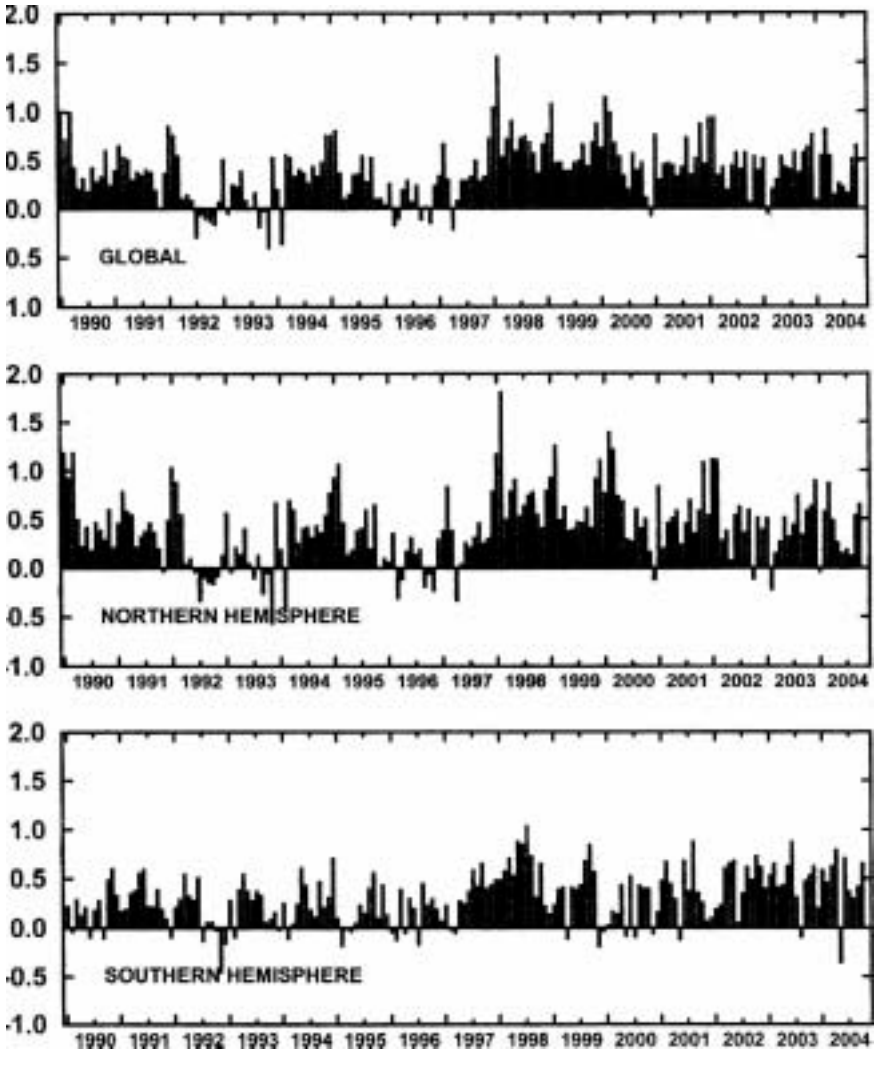

Figure 1. Monthly global (Top), Northern Hemisphere (Middle) and Southern Hemisphere (Bottom) temperature anomalies (land-areas, °C), from January 1990–present. The anomalies are computed relative to 1971–2000 base mean period (*Climate Diagnostics Bulletin*, October 2004: NOAA, USA).

References

[1] IPCC, *Climate Change, 2001: The Scientific Basis*. Cambridge University Press, 881 p.

[2] Khandekar, M.L. 2002: *Trends and changes in extreme weather events: An assessment with focus on Alberta and Canadian Prairies*. Report No:ISBN;0-7785-2428-0, Alberta

Environment, Edmonton, Alberta, 56 p. (Available on website:www.gov.ab.ca/env/info/infocentre/publist.cfm)

[3] Bonsal, B.R., Zhang X., Vincent L.A. and W.D. Hogg, 2001: Characteristics of daily and extreme temperatures over Canada. *J. of Climate*, 14, 1959–1976.

[4] Balling, Jr. R.C. and R.S. Cerveny 2003: Compilation and discussion of trends in severe storms in the United Staes: Popular perception v. climate reality. *Natural Hazards*, 29, 2, pp. 103–112.

[5] Changnon, S.A. 2003: Shifting economic impacts from weather extremes in the United States: a result of societal change, not global warming. *Natural Hazards*, 29, 2, pp. 273–290.

[6] Kunkel, K.E. 2003: North American trends in extreme precipitation. *Natural Hazards*, 29, 2, pp. 291–305.

[7] Kripalani, R.H, Kulkarni, A., Sabde, S.S. and M.L. Khandekar 2003: Indian Monsoon variability in a global warming scenario. *Natural Hazards*, 29, 2, pp. 189–206.

[8] Fauchereau N., Trzaska, S, Roulault, M. and Y. Richard 2003: Rainfall variability and changes in Southern Africa during the 20th century in the global warming context. *Natural Hazards*, 29, 2, pp. 139–154.

[9] Hennessy, K.J., R. Suppiah and C.M. Page, 1999: Australian rainfall changes, 1910–1995. *Australian Met. Magazine*, 48, pp.1–13.

[10] Zhai, P., Sun, Ren, Liu, Gao and Zhang 1999: Changes of climate extremes in China, *Climatic Change*, 42, 203–218

[11] Kumar, A., W. Wang, M.P. Hoerling, A. Leetmaa and M. Ji 2001: The sustained North American warming of 1997 and 1998. *J. of Climate*, 14, pp. 345–353.

[12] Pielke, Sr, R A *et al.*, 2002: The influence of land-use change and landscape dynamics on the climate system: relevance to climate–change policy beyond the radiative effect of greenhouse gases. *Phil. Trans. R. Soc. London*, A, 360, 1705–1719

[13] de Laat, A.T., J. and A.N. Maurellis, 2004: Industrial CO_2 emissions as a proxy for anthropogenic influence on lower tropospheric temperature trends. *Geophy. Res. Letters*, 31, L05204, doi:10.1029/2003GL019024

[14] Khandekar, M.L., T.S. Murty and P. Chittibabu 2005: The global warming debate: A review of the state of science. *Pure & Applied Geophysics* (PAGEOPH), Sp Issue, in press