Climate Change – There is no Need for Concern

by WJR Alexander*

There is no evidence to support the view that climate change could cause appreciable environmental damage or increase the frequency and magnitude of floods and droughts in South Africa within the foreseeable future. On the contrary, the beneficial consequences of increased global warming will be greater than the adverse effects.

In the 1940s DF Kokot, a civil engineer in the then Department of Irrigation undertook a comprehensive study to determine whether or not there had been recent climatic changes that could have had an effect on rainfall and river flow. The results of his study were published in 1948 in a 160-page Irrigation Department memoir titled *An Investigation into Evidence Bearing on Recent Climatic Changes over Southern Africa*. It contained 418 references, including reports by early travellers and missionaries.

He discounted many of the theories that had been advanced for climate changes. He noted for example, that an elaborate theory had been built up to connect known climatic changes with assumed changes in the percentage of carbon dioxide present in the atmosphere, but he remained sceptical.

His final conclusion was: *The rainfall record is too short to be of much value in disclosing rainfall trends. It shows, however, that if we take South Africa as a whole there is little evidence of any change. Whilst rainfall in some areas seems to have diminished, in others it appears to have increased.*

Today, more than 50 years later his conclusions remain valid. There is still no concrete evidence of large-scale adverse effects of climate change on the environment in South Africa. This observation on its own, is sufficient to demonstrate that future adverse changes are unlikely.

CLIMATOLOGISTS

Nevertheless, within the last three decades South African and international climatologists have become increasingly concerned about the possible damaging effects of global warming on the environment. More researchers have spent more money on climate change research than in any other research activity. Dire predictions have been made over the years but few have been fulfilled. The emphasis has now shifted from changes in the average conditions to changes in the extreme conditions, which are even more difficult to demonstrate – or to refute. Both the USA and Russia have refused to ratify the Kyoto Protocol, which requires signatories to take action to control greenhouse gas emissions. Practitioners who would have to implement any measures to counter the undesirable effects, are waiting for solid evidence of changes taking place before reacting to them. A stalemate position has been reached. However, the issue is too important to ignore. Climate change predictions will continue to have no practical meaning until such time as credible numerical linkages have been established between climatic processes and hydrometeorological responses on a catchment scale. The systems are far too complex to permit the establishment of these relationships theoretically. There is a way out of this difficulty that has not yet been attempted by South African researchers. It is generally agreed that

global warming has been present for many decades and is increasing. If this is so, then the signals should be present in long hydrological and meteorological records.

TIME SERIES

This is a time series analysis problem, but there are differences of opinion relating to the appropriate statistical methodology. The basic reason for the difficulty is that the signals are not always regular and are often very faint. Those who denigrate graphical methods as being 'subjective' are unable to detect the changes by direct mathematical analysis, and then assume that they are not there. Efficient time series analysis therefore has to be carried out in two stages – the graphical analyses to determine the presence or absence of the characteristics, and mathematical analyses to determine their strengths and relationships.

With this objective and methodology in mind, I assembled the largest and most comprehensive set of meteorological and hydrological data yet analysed in South Africa. It consisted of a total of 11 804 years of data from 183 gauged sites and eight processes: open-water surface evaporation, concurrent rainfall, areal rainfall, dam inflow, river flow, flood peak maxima, ground water levels, and the southern oscillation index.

SURPRISING RESULT

A surprising result, in that it had not previously been reported by others, was that the mean annual rainfall over South Africa has increased steadily from 497 mm at the beginning of the record in 1921 through to 543 mm at the end of the record in 1999. This is a substantial increase and is in close agreement with the 10% increase reported for the USA since 1910. There were corresponding increases in river flow, open-water surface evaporation and ground water levels. As open water surface evaporation is a function of solar radiation, air temperature and wind, all at water surface, this identifies global warming as the probable cause of the increases in evaporation, and consequently rainfall, river flow and groundwater levels as well. There were no indications of increases in the severity and magnitude of droughts and floods.

The conclusion must be that additional global warming will have a greater beneficial effect than detrimental effect on the natural environment. This is directly contrary to current views by South African climatologists and environmental scientists.

It is unlikely that any other data sets or calculation methods will lead to different conclusions.

DATA

All the data used in the analyses were from the official databases operated by the Department of Water Affairs and Forestry, and the South African Weather Service. The data were not smoothed, filtered or otherwise manipulated before or during the analyses.

CONFIRMATION

- The general view of climatologists is that global warming has been present for many decades and is increasing.
- There is also a general, but not unanimous view that global warming increases rainfall.
- My studies based on the largest database yet assembled in South Africa, demonstrated that open water surface evaporation is increasing. This is consistent with an increase in air temperature attributable to global warming.
- My studies also demonstrated that the rainfall, river flow and groundwater levels are increasing. This is consistent with reported increases in rainfall associated with global warming.
- There was no discernable evidence of increases in floods and droughts. However, this is inconclusive due to the large natural variability of these phenomena. It does indicate, however, that if such increases are present, they will not have any practical significance.
- Most importantly, there is no credible evidence of large scale increasing damage to the environment that can be attributed to global warming. This is despite the claims of many climatologists and environmental scientists that global warming will cause environmental damage.
- The general conclusion, therefore, is that global warming has not caused any environmental damage in South Africa in the past, and that future increases in global warming are more likely to be beneficial than damaging.

It is appreciated that these conclusions are contrary to widely held beliefs as expressed in research activities, funding and reports to government departments and other institutions. Nevertheless the analyses and conclusions are soundly based. The results are from different processes at different sites hundreds of kilometres apart and located in different climatic regions. The conclusions are also consistent with international studies that show concurrent increases in rainfall with global warming.
I have presented the methodology and conclusions at three conferences and discussion groups, and have had extensive email correspondence with professional colleagues and others during the past year. Although there are some differences of opinion, to date nobody has challenged my conclusions when using the same data set, nor, as far as I am aware, has anybody in South Africa undertaken similar or parallel studies on this subject.

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