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"Climate Change 2007: The Physical Science Basis" – an Australian perspective

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Bio Note

He is a Lead Author for Chapter 8 of the Working Group 1 contribution to the IPCC's Fourth Assessment Report, looking at climate models and their evaluation. He was a contributing author on both the second and third assessment reports (1995 and 2001), and has also acted as a reviewer on the three reports.

Rob has worked in climate change research since 1989, and published more than 100 papers on various aspects of climate change science. His principal areas of research over this period have included building, testing and assessing climate models, and the use of models for projecting future climate change. A particular focus of his research has been on understanding the physical processes which determine the magnitude of expected climate change under greenhouse gas increases and evaluating and comparing them in models. Such processes include the interactions between the changing climate and distributions of water vapour, sea ice, and cloud cover – the basic 'feedbacks' in the climate system.

Abstract

Climate models play a central role in the IPCC 4th assessment report. They are used for understanding climate variability and change, for attributing the causes of observed climate change, and for projecting future climate.

The report concludes that there have been significant advances in models since the last IPCC assessment report in 2001. For example models now have higher resolution, and represent more important physical processes (e.g. interactive atmospheric aerosols).

The report finds that the latest models do a better job representing the present climate, including patterns of temperature, rainfall and surface pressure, than the models reviewed in previous assessments. They also do a good job representing past climate changes (which increases confidence in their use for projections), for example the overall degree of cooling that occurred during the last ice age, and the climate change observed to have occurred over the instrumental record.

There is also better understanding of some fundamental processes controlling global warming, such as expected increases in water vapour (itself a strong greenhouse gas). There is now greater confidence in the way models handle water vapour, which again increases confidence in the model-based projections of climate change.

Climate models are also used for attributing climate change, that is determining what is causing climate change. Improvements in the models have helped increase the level of certainty that greenhouse gases are behind most of the warming over the past 50 years.

When we compare what models say would have occurred over the 20th century had greenhouse gas increases not occurred, with what was observed, we find that the only way to account for the observed warming is to include all the major greenhouse gases in the models. Without the input of greenhouse gases, models find that natural variability, even combined with volcanic or solar changes cannot explain the observed global warming.

This model-based evidence strongly underlines the report's conclusion that most of the observed warming over the last 50 years is very likely to have been caused by human greenhouse gas emissions.

The report also concludes that it is likely that there has been significant human anthropogenic warming over the past 50 years averaged over all continents except Antarctica – i.e. including over Australia.

It also finds a human impact on changes in atmospheric circulation and concludes that human influences have likely contributed to changes in storm tracks, winds and temperature patterns in both hemispheres. It also concludes that temperatures of the most extreme hot nights, cold nights and cold days are likely to have increased due to anthropogenic forcing, and that such forcing may have increased the risk of heatwaves.

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