SENATOR THE HON KIM CARR

MINISTER FOR INNOVATION, INDUSTRY, SCIENCE AND RESEARCH

Mr Scott Morrison MP
Member for Cook
PO Box 1306
CRONULLA NSW 2230

01 NOV 2011

Dear Mr Morrison

Thank you for your letter of 21 October 2011 concerning correspondence of 28 June 2011 on behalf of your constituent Mr Laurie Cummings of Gymea Bay, concerning CSIRO's Global Climate Model (GCM).

As referenced in your letter, the CSIRO wrote a response to Mr Cummings which I provided to you in a letter of 8 August 2011. I apologise if you did not receive this correspondence and enclose a copy for your information.

I trust this addresses your concerns.

Yours sincerely

Kim Carr
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PO Box 1306
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08 AUG 2011

Dear Mr Morrison

Thank you for your letter of 28 June 2011 on behalf of Mr Laurie Cummings of Gymea Bay, NSW, concerning CSIRO's global climate model (GCM).

CSIRO has considered the three questions posed by Mr Cummings about the CSIRO GCM and advises me the GCM used by the organisation provides robust simulations of Australia's past and future climate. The CSIRO GCM is based on known laws of physics, equations, and observational data that describe the functioning of the atmosphere, ocean, sea ice, snow cover, land surface, and other elements of the Earth system. Validation tests of the CSIRO GCM against the evidence from observation data indicate that it does a good job of reproducing and explaining the climate of past years.

CSIRO's response to the three questions posed by Mr Cummings is attached and I commend it you. Further information about the global climate models in general, including CSIRO's GCM, can be found on CSIRO's website at http://www.csiro.au/news/Reliability-Climate-Models.html.

Yours sincerely

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Response by CSIRO to the questions posed by Mr Laurie Cummings about the CSIRO Global Climate Model in his letter of 6 June 2011 to Mr Scott Morrison

Questions

1. When replicating the earth's recent climate history, for the 'base case' scenario, does the CSIRO's global climate model increase or decrease the period of the 'historical' virtual global hydrological cycle as the earth's 'historical' virtual temperature increased, and by approximately what percentage? (e.g. the 'historical' virtual period lengthens by say 4% for each 1 degree increase in 'historical' virtual temperature.)

2. When projecting the earth's future climate history, for the 'base case' scenario, does the CSIRO's global climate model increase or decrease the period of the virtual global hydrological cycle as the earth's virtual temperature increases, and by approximately what percentage?

CSIRO Response

All global climate models (GCMs), including CSIRO's, are mathematical representations of the climate system based on established physical laws, such as conservation of mass, energy, and momentum, along with a wealth of observational data. These equations are solved to simulate the response of the Earth's climate to external factors such as increased greenhouse gas concentrations, and this includes the response of precipitation and evaporation that constitute the hydrological cycle.

CSIRO has not published any research that addresses whether the global hydrological cycle, as diagnosed from the global precipitation and evaporation simulated by the CSIRO GCM in past and future climate simulations, accelerates or slows down in response to global temperature changes.

One of the phenomena affected by temperature sensitivity of the global hydrological cycle is patterns in precipitation, though such sensitivity is not the sole driver of precipitation patterns. Regional precipitation patterns (e.g. for Australia) are influenced by many factors, including the effect of global circulation systems, phenomena such as the El Nino Southern Oscillation, (ENSO), and cloud and atmospheric processes such as convection and atmospheric particles (aerosols). GCM simulations, including CSIRO's, include these factors that influence rainfall, and global rainfall patterns are generally simulated well, including subtropical dry zones and the position of mid-latitude storm tracks (CSIRO and Bureau of Meteorology, 2007[1]). The fact that GCMs reproduce such documented patterns indicates that the various drivers of rainfall are captured satisfactorily by the fundamental model dynamics.

Projections of future rainfall from GCMs indicate that some regions of the world will receive more, and others less, precipitation due to anthropogenic global climate change. CSIRO recently concluded that "Drying is likely in southern areas of Australia, especially in winter, and in southern and eastern areas in spring, due to a contraction in the rainfall belt towards the higher latitudes of the southern hemisphere. Changes in summer tropical rainfall in northern Australia remain highly uncertain[2]." Research in CSIRO, along with the Bureau of Meteorology and the

[1] CSIRO and Bureau of Meteorology (2007) Climate change in Australia. Technical report. see: http:www.climatechangeinaustralia.gov.au

[2] Climate Change: Science and Solutions for Australia. Eds Battaglia, Harris and Cleugh, CSIRO Publishing. 2011.

Universities, is actively addressing ways to improve projections of rainfall across Australia under climate change.

The validation of the CSIRO GCMs by CSIRO and other scientists includes analyses of many aspects, including how well the model simulates the global temperature record over the last century. The CSIRO Mk 3 GCMs were used to deliver CSIRO's climate simulations for the IPCC Fourth Assessment Report. Studies[3] evaluating the IPCC Fourth Assessment GCMs report that CSIRO's GCMs performed as well as, and often better than, most in terms of simulating the present climate.

CSIRO's website provides a more detailed discussion on model reliability and evaluation (see http://www.csiro.au/news/Reliability-Climate-Models.html and http://www.csiro.au/news/Reliability-Climate-Models--ci_pageNo-2.html).

As described on the CSIRO website, the IPCC Fourth Assessment showed that the GCMs, including CSIRO's, were able to reproduce the temperature record of the 20th century by including all climate drivers, including aerosols and the long-lived greenhouse gases from both anthropogenic and natural processes.

The available observational record provides clear evidence of global warming. Global air temperatures have been observed to increase by more than 0.7°C over the last century and this is consistent with a wide range of observations of other parts of the climate system, including ocean temperatures, sea levels and changes in the cryosphere. The close match between observed empirical data and GCM simulations demonstrates that the predictions from global climate models are not exaggerating the observed trend in future global warming.

Question

3. Could CSIRO please cite the reference to a published peer reviewed climate research paper that provides observational data, which clearly shows the global hydrological cycle slows down (i.e. the period lengthens) as global temperature increases?

CSIRO Response

CSIRO has not asserted that the global hydrological cycle is slowing down as global temperatures increase. We are therefore unable to provide a reference as requested.

We also refer you to CSIRO's web sites about climate science and climate science facts at:

http://www.csiro.au/science/Changing-Climate.html

http://www.csiro.au/resources/Climate-questions-science-facts.html

[3] Reichler, T. and Kim, J. (2008), How well do coupled models simulate today's climate? Bulletin of American Meteorol. Society, 89, 303 – 311

Gleckler, P.J., Taylor, K.E. and Doutriaux, C. (2008), Performance metrics for climate models, Journal of Geophysical Research, Atmospheres, **113**, D06104, doi:10.1029/2007JD008972

Watterson, I.G. (2008), Calculation of probability density functions for temperature and precipitation change under global warming Journal of Geophysical Research, **113**, D12106, doi:10.1029/2007JD009254