Minister for Climate Change and Energy Efficiency
Minister for Industry and Innovation

C12/3963

22 OCT 2012

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

Dear Mr Morrison Scott

Thank you for your personal representation of 26 September 2012 on behalf of Mr Laurie Cummings concerning the treatment of the hydrological cycle in global climate model (GCM) simulations.

In my letter to the Hon Greg Hunt MP, I responded to Mr Cummings' concerns on water vapour feedback and the global water cycle, and noted that the Australian Government's climate change policies are based on peer reviewed scientific research. I wish to reiterate that if Mr Cummings wishes to challenge the scientific research referred to in that letter and used as the basis for global climate model development, that he does so by making a submission to a peer-reviewed journal. This will enable his theories to be reviewed and assessed by experts in the field.

In the letter you have forwarded, Mr Cummings requested that I advise whether the CSIRO had undertaken some modelling or estimates for a situation where the evaporation (E) and precipitation (P) response was around 8 per cent per degree of warming. The following information has been prepared by the Department of Climate Change and Energy Efficiency, with input from technical experts.

- When developing the most recent set of national projections to inform government decision-making in 2007, CSIRO and the Bureau of Meteorology (BoM) drew on the full range of global climate models (GCMs) available to inform their analysis. The CSIRO and BoM approach is outlined in '*Climate Change in Australia: Technical Report 2007*', available at: www.climatechangeinaustralia.gov.au. Projections of future change used to inform government policy are not derived from a single GCM.

- Mr Cummings requests that GCMs are reconfigured to simulate a planet in which global mean E-P increases by 8 per cent per degree. It is not possible to 'reconfigure' a GCM to prescribe a particular E-P response in order to undertake 'what if?' simulations. The E-P response is not a model input that can be configured. The E-P response generated by GCMs is an outcome of a large number of complex, interacting physical processes. Models represent these processes as mathematical equations based on the laws of physics such as the conservation energy, momentum and mass.

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- Mr Cummings should note that an intensification of the regional differences in E-P can occur without a change in global mean E or P. Durack et al (2012) found that wet areas are becoming wetter while dry areas are becoming drier. This intensification of the E-P pattern does not say anything about a change in global mean evaporation or precipitation. Mr Cummings' calculations assume a large change in the global mean evaporation. These calculations appear to have incorrectly inferred that an intensification of the E-P pattern is equivalent to an increase in global mean E-P.

- A recent paper by Li et al (2011) 'The recycling rate of atmospheric moisture over the past two decades (1988-2009)', finds that the observed changes, including in the inferred global mean P (and by implication E), are consistent with the relatively small changes found in models.

- The radiative forcing due to a doubling of carbon dioxide concentrations (quoted in Mr Cummings' letter as the 'generally accepted' 3.5 W/m^2), is estimated at the boundary between the troposphere and the stratosphere, not at the surface. This difference is critical, because what matters for the maintenance of stable temperatures on Earth is that the flow of incoming solar energy is balanced by an equal flow of heat to space at the edge of the atmosphere. What happens at the surface, and indeed throughout the atmosphere, is dictated by the need to achieve this balance at the edge of the atmosphere. It is therefore inappropriate to discuss surface processes in isolation, and incorrect to assume that surface processes are responsible for directly restoring the Earth's energy balance.

- Surface processes are a complex interaction of upward and downward long and short wave radiation, evaporation, 'sensible' heat transfer, and exchange with the underlying surface. These interactions are functions of influencing factors such as latitude, atmospheric stability, wind strength, season, time of day, surface type, and water vapour content. All these surface processes are likely to change under climate change. There is no evidence that evaporative changes would simply offset radiative changes at the surface, without changes to all these other processes occurring.

- The determination of trends in global mean precipitation and evaporation and hydrological sensitivity remain as considerable areas of focus for current research.

Thank you for bringing Mr Cummings' concerns to my attention.

Yours sincerely

GREG COMBET