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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observed and model simulated 20th century Arctic temperature variability: Canadian Earth System Model CanESM2" *by* P. Chylek et al.

Anonymous Referee #2

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Review of "Observed and model simulated 20th century Arctic temperature variability: Canadian Earth System Model CanESM2" by Petr Chylek, Jiangnan Li, M. K. Dubey, Muyin Wang, and Glen Lesins

General comments:

This is a concise, well constructed, and well-reported comparison of several Canadian climate models' performance in reproducing the arctic temperature record of the last century. The interesting aspect is that models used for the last IPCC report are compared to more modern and improved models that better handle aerosols, land surface changes, ocean circulations, and known multi-decadal climate modes. The tempera-

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ture measurements to which the models are compared are those released by NASA GISS and are generally accepted as truth by the entire climate research community. The fact that the modern models reproduce the reality of temperature variations of the past century better than the models used in the last IPCC report is a significant result. The fact that those IPCC models show 2-3 times the warming trend as the measurements is also significant. In my opinion, this paper could be published as is with only a few cosmetic changes. The fact that the authors do not look into relative contributions of various model components and improvements to the better results should not deter its publication. They make the point in the conclusion that identification of the processes responsible for the noted improvement is left to future research. However, there are two points that I hope the authors would address before publication.

First, differences among the various models are an important part of this study. Section 3 describes CanCM4 and the changes that were made to that model to produce CanESM2. However, there is no reference by which to gauge the new models' attributes because the CanCM3 is not described at all. For example they state that the ocean component of CanCM4 differs from that of CanCM3 in that it has 40 levels. . ., but they never say what how the ocean component of CanCM3 is structured. This problem can be remedied by inserting a table that lists the pertinent attributes of the four models used, or just list comparative attributes of the lesser models when describing those of the more modern models.

Second, when discussing Fig. 1, the authors make the point that CanCM4 and CanESM2 reproduce the observed temperature record better than the other models, and they rely on the variance of the difference of the observed and modeled temperature anomaly to prove their point. However, after examining Fig. 1 I believe that the identical variance of 0.13 computed for the CanCM4 model may be fortuitous. My conjecture is based on the apparent behavior of the individual CanCM4 model runs that were used to compute the average (bold red line) in Fig. 1b. The individual model run results of CanESM2 in Fig. 1c appear more tightly packed and correlated than those

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11, C8353–C8355, 2011

in Fig. 1b. In fact, some in Fig. 1b seem anticorrelated, especially from 1900 to 1960. Perhaps besides variance you should also look at the correlation.

Specific comments:

p. 4, l. 15 What is the source of the volcanic aerosol data used in the simulations? Which models include these effects?

p. 6, l. 19 Change “somawhat” to “somewhat”.

p. 7, l. 23 Change “1970-200” to “1970-2000”

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 22893, 2011.