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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.

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This reviewer comments will lead to an essential improvement of the manuscript. We appreciate the help. Reviewer's basic comments are in quotation marks; our response follows.

"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."

Here we fully agree with the reviewer. Temperature variation is one of the basic characteristics of climate change. Comparing simulated temperature variability and temperature trends with the observed data identifies models that may be better suitable for study of the Arctic. In our case, the comparison clearly demonstrates improvements of CMIP5 compared to CMIP3 CCCma models.

"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."

Additional information concerning basic structure differences between CanCM3 and CanCM4 will be added to the text in the revised version as recommended.

"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 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."

We have looked into correlations as suggested. The correlations between an annual NASA GISP Arctic temperature data and annual simulated ensemble averages of the CanCM3, CanCM4, and CanESM2 models are 0.36, 0.41, and 0.49, respectively. Thus indeed the Earth system model, CanESM2 is better correlated with the observed Arctic temperature year to year variability than the atmosphere-ocean coupled general circulation model alone, CanCSM4. A vegetation cycle leads to a closer agreement between observed and simulated year to year temperature variability. This is an impor-

tant feature and the submitted manuscript will be modified accordingly in the revision stage.

Suggested minor corrections will be incorporated in the revised manuscript.

Petr Chylek and co-authors

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