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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 #1

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The paper presents results of the 20th century Arctic temperature simulation by a new generation of the Canadian state-of-the-art climate models, CanCM4 and CanESM2, with interactive ocean and terrestrial carbon cycle, better vertical resolution and several new parameterizations. Both models show considerable improvement in ability to reproduce the recent Arctic warming and to some extent to capture the cooling phase of the early 20th century warming.

The results of new models are encouraging, but the problem is that a simple intercomparison of the single temperature time series in models and observations does not bring us any further in understanding Arctic climate change or model performance. It

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may rather lead to confusion because, for example, some other models of CMIP3 ensemble already simulate the recent Arctic warming very well (see Wang et al. 2007) without having interactive carbon cycle/land vegetation or improved stratospheric representation.

Climate models provide all data at hand. Some kind of analysis (such as quantifying GHG and aerosol direct/indirect radiative forcing) may not be straightforward and may require additional simulations (as the authors noted). However, some additional analysis of the already performed simulations can readily produce important indications.

The Figure 1 shows that different realizations of the new model ensemble are very similar thus implying that the climatic temperature trends are due to external forcing and/or different response to it.

The question WHY the new models' results are different needs to be answered or at least to be addressed in order to make a step forward in our understanding of climate change mechanisms and to make this study suitable for publication.

I recommend addressing the following issues in the revised manuscript.

1) If the new models have an interactive carbon cycle, what are the atmospheric GHG concentrations? How do they compare to the 20C3M forcing data?

2) If the indirect aerosol forcing is involved, one may consider cloudiness and vertical temperature profiles for getting an insight on the impact.

3) Was the effect of interactive vegetation visible in albedo, soil properties or snow cover?

4) Is the improvement of the model performance in the Arctic accompanied by better simulated global/hemispheric trends?

5) The patterns of the temperature changes/trends (in and between the different models for the ECW and recent period) could also give an indication of underlying mecha-

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nisms.

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