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Interactive comment on “Near-surface meteorology during the Arctic Summer Cloud Ocean Study (ASCOS): evaluation of reanalyses and global climate models” by G. de Boer et al.

Anonymous Referee #1

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This paper exploits the observations from the Arctic Summer Cloud Ocean Study (ASCOS) to evaluate different reanalysis products and different climate models. To be close to the synoptic situation during the one month observational campaign and to allow "deterministic verification", the climate models are run in short range forecast mode from reanalyses or are relaxed towards them. Interestingly, most of the observations were not assimilated in the reanalyses, so the verification is really independent. This aspect makes the paper particularly valuable as it provides independent verification of reanalysis in an area where data is very sparse, and where reanalysis is very popular because other data sources are very limited.

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The paper is very well crafted, makes many sensible choices (e.g. on interpolation, averaging, spinup, sampling) and presents a nice collection of tables and figures. The study goes beyond the computation of basic error statistic in the sense that it tries to give a physical interpretation of the errors by relating different observables. A key result is the relation between cloud liquid water, radiation and near surface temperatures. I am sure the paper will become an important reference for any study of the Arctic that uses reanalyses.

A few suggestions for improvement and correction:

1. At a few locations, the spectral truncation of models is mentioned. It would be good to add the associated grid point resolution.
2. On page 19429 line 19, reference is made to YOTC as a reanalysis. Strictly speaking the ECMWF YOTC data is not a reanalysis. The ECMWF/YOTC data is from the ECMWF operational analysis (i.e. at the highest resolution) supplemented by products that are not available operationally (e.g. process tendencies from short range forecasts).
3. Models can show spinup in the first few days in short range forecasts, particularly when the model is different from the one that was used in the data assimilation system. With CAM5, this problem was addressed by selecting concatenated 24-48 hour forecasts. The GISS model was kept close to realistic synoptic conditions by nudging of wind towards the R2 reanalysis, which can potentially push the model into a continuous state of spinup, i.e. it can influence the systematic errors. My question is: what is the time scale of the relaxation towards analyses and is anything known about the consequences for systematic errors?
3. The description of the observations is short as it has to be in a paper of this type. However, it would help the reader to have a feel of the level of accuracy that can be expected from some of the observations. Most readers will be familiar with standard observations like temperature, humidity and wind, precipitation, but accuracy of more

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advanced observations like surface energy fluxes and cloud liquid water path is less obvious. Questions are: to what extent does the surface energy balance close? Was Q_{sfc} "observed" directly or derived as a residual of the surface energy balance? What are typical errors in the energy fluxes? What are typical errors in liquid water path observations; is it 100%, 50% or 10%?

4. The authors make a very good point about the relation between cloud liquid water, radiation and near surface temperature, which is very relevant and interesting. I was wondering whether wind speed is another factor that could have some control on near surface temperature through turbulent mixing processes? The early strong wind period has indeed high temperature, but there are perhaps too few strong wind periods to draw any conclusions?

5. Figure 3b does not seem to have an insert as advertised in the caption.

6. Figures 2, 3, 4 and 6 have right hand panels with distributions of errors. The captions refer to these errors as "differences between observed and simulated values". It should be "differences between simulated and observed values".

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