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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Uncertainties in future climate predictions due to convection parameterisations" *by* H. Rybka and H. Tost

Anonymous Referee #1

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This paper presents a modeling study about the impact of using different convection schemes on the simulated climate response to doubling of CO2. Sensitivity studies are carried out using an atmospheric model with climatological SST under current and 2xCO2 conditions. Changes/differences in temperature, humidity, a radioactive passive tracer, cloud forcing, and cloud types are analyzed. The authors conclude that, the uncertainty caused by using different convection schemes is discernible, and regionally it can be significantly large. Findings in this study will help to estimate the uncertainties in future climate predictions due to convection parameterizations.

Overall the paper is well written and it's suitable for the ACP journal. I recommend the paper can be published after some minor to medium revisions.

Major comments:

1. Title. The current title does not accurately reflect the content of this paper. The authors didn't present results from a coupled simulation with transient external forcing, so it's better not to use "future climate predictions". In my opinion, the expression "alternative (2xCO2) climate conditions" used in abstract is better.

2. Abstract. The introductory part "In the last ... e.g. sampled treatment of the cloud microphysics." is almost half of the whole abstract. Consequently, a few useful conclusions are not included or not provided in sufficient detail. For example, the sentences with "affect the amount", "highly ambiguous", and "uncovering a shift" could be more specific.

3. Inter-annual variability and significance. It would be nice to include the inter-annual variability (one standard deviation) for the numbers shown in table 2 and table 3. Are the differences between simulations using various convection schemes statistically significant? Where are the statistically significant and insignificant regions? A Student's t-test or Kolmogorov–Smirnov test would be helpful.

4. Previous studies. In the Results section, when the authors discuss their findings, it would be helpful to add comparisons between the present work and other related work. The simulated climate sensitivity (&ts_2xco2) and the change of water vapor profile and cloud forcing can be compared to previous studies (e.g. Bitz et al., 2012; Klocke et al., 2011).

5. Humidity and Radon. In section 4.3 the simulated change of specific humidity and Radon is discussed, with a subtitle "4.3 Transport of ... ". The model result clearly shows that Q increases at all altitudes (Fig 5.) while Radon decreases between 300hPa and 600hPa. In my opinion, this suggests that, for changes in water vapor response, transport may not the dominant factor. Changes in evaporation (caused by using different convection schemes) can play a more important role.

Minor comments (L- line, P- page):

P26898L10: What is the corresponding time step used for those two resolutions?

P26905L18-20: Even though the model layer height in PBL is smaller than those at other levels, the high concentration near surface should still result high radon ratios. I think the problem might be that you averaged radon concentration over land and ocean areas. If only the concentration over land were selected, the ratio would be much larger. So for figure 7, it would be better to show the ratio over the land and over the ocean separately.

P26909L22-23: I didn't see a clear stronger cirrus reduction from the figure.

References:

Bitz, C. M., K. M. Shell, P. R. Gent, D. A. Bailey, G. Danabasoglu, K. C. Armour, M. M. Holland, J. T. Kiehl, 2012: Climate Sensitivity of the Community Climate System Model, Version 4. J. Climate, 25, 3053–3070. doi: http://dx.doi.org/10.1175/JCLI-D-11-00290.1

Klocke, Daniel, Robert Pincus, Johannes Quaas, 2011: On Constraining Estimates of Climate Sensitivity with Present-Day Observations through Model Weighting. J. Climate, 24, 6092–6099. doi: http://dx.doi.org/10.1175/2011JCLI4193.1

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 26893, 2013.