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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Pre-industrial to end 21st century projections of tropospheric ozone from the Atmospheric Chemistry and Climate Model Intercomparison Project (ACCMIP)" *by* P. J. Young et al.

Anonymous Referee #2

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General comment: The paper describes a multi-model exercise aiming at assessing the past and future changes in tropospheric ozone using the IPCC-related Representative Concentration Pathways (RCPs) emission scenarios. This is a very nice piece of work, well written and documented, that clearly makes the necessary links to previous similar exercises. However, I do find that the paper suffers from a certain lack of quantitative information about the extent to which different processes contribute to past and future tropospheric ozone (e.g., changes in stratospheric-tropospheric ozone vs. change in lightning NOx, methane, etc.), especially since this is probably the first model

inter-comparison that includes such a number of models with stratospheric chemistry. In other words, I find it a bit surprising that none of the groups involved in this study have archived the necessary diagnostics to further discuss the past and future ozone budget, and that even if these diagnostics are not entirely consistent throughout the model suite, it is not possible to further discuss the relative contribution of these key processes.

Minor comments: Page 21620, lines 21-24: It is written that the isoprene flux depends on climate but that whether future climate changes will drive isoprene increases or decreases is not clear. Are the Authors only talking about the climate changes or also about changes in CO2 concentrations (which may counteract the changes due to climate change to some extent)?

Page 21623, paragraph starting lines 17: It appears that some models do not include NMVOCs (e.g., isoprene) in their simulations. I wonder to what extent it makes sense to include such models in the assessment, since there is now a clear recognition that NMVOCs do impact tropospheric ozone burden. The global ozone burden from the specific model that does not include NMVOC does not seem to be completely different from the others but I wonder whether there are compensating effects that make the global budget "artificially" correct, and whether this could have an impact on the projections of future ozone changes. I understand that the Authors may not have all the ozone budget data available but could they comment on this?

Page 21624, lines 4-16: I understand that the RCP scenarios are very "popular" and are being used in many studies, but still I think it would be useful to briefly present the underlying hypotheses that were used for deriving these RCP scenarios and result in decreasing ozone precursor emissions. A similar remark could be made for the lines 13-16 pages 21620: why do more recent emission projections include reduced anthropogenic precursor emissions? Do they assume strict air quality regulations?

Page 21628, lines 9-11 and lines 25-28: It is said that "An increase in LNOx from

2000 to 2100 (RCP8.5; strongest warming) is generally robust across the ACCMIP models, and ranges in magnitude from 10–75%". Another "robust" result appears to be an increase in total VOC emissions for many models because of a climate-driven increase in isoprene. Are those results "robust" because all models include the same parameterization for LNOx and isoprene emissions, or does that say something about the "robustness" of other processes?

On Figure 1, it would also be nice to include an additional plot to illustrate the changes in anthropogenic versus biogenic VOC emissions (similarly to what was done for LNOX), also to give information on whether the changes in VOC are driven by the RCPs or the changes in biogenic emissions.

Page 21633, lines 16-17: Bias and correlation appear to be improved in comparison to the ACCENT mean for the NH tropical mid and upper troposphere. Do the Authors know why there is an improvement upon the ACCENT results?

Page 21637, lines 8-10: I am not sure I understand what is meant there.

Typo in the legend of Figure 1: respectively.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 21615, 2012.