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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Comment on "Tropospheric temperature response to stratospheric ozone recovery in the 21st century" by Hu et al. (2011)" *by* C. McLandress et al.

Anonymous Referee #1

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Reviews on the commentary manuscript by McLandress et al.

General comments:

This manuscript comments on the paper of "Tropospheric temperature response to stratospheric ozone recovery in the 21st century" by Hu et al., which showed that stratospheric ozone recovery may enhance greenhouse warming in the troposphere and on the surface, based on IPCC-AR4 simulations for the 21st century. To compare with Hu et al.'s results, the authors performed two sets of simulations with a coupled atmosphere-ocean GCM (also with interactive ozone chemistry): one has both increasing GHGs and time varying ODSs, and the other one has increasing GHGs. They found

that the difference of tropospheric temperature trends between the two sets of simulations is weaker than that in Hu et al. and has opposite sign. They thus suggest that the results in Hu et al. are likely due to different climate sensitivities of AR4 models, rather than real signals of stratospheric ozone forcing.

The magnitudes of temperature trends differences between their two groups of models are certainly debatable (it could be due to different model sensitivities to both GHGs and ozone, different forcings in AR4 models such as black carbon, and so on), as pointed out by Hu et al. themselves. Therefore, I think that the paper is acceptable for publication. On the other hand, it will be more convincing for the present manuscript to address the following questions.

Specific comments:

1. The sign of stratospheric ozone forcing: According to previous results in radiative-convective models (e.g., Ramanathan and Dickinson, 1979, Forster and Shine, 1997, Hu et al., 2011), the radiative forcing of stratospheric ozone on the troposphere is positive. That is, ozone depletion causes cooling in the troposphere, and increasing ozone leads to positive forcing. The sign of tropospheric temperature trend differences in Hu et al. is consistent with that in radiative-convective model for both periods of 1965-1999 and 2001-2050 (see Figure 2 in Hu et al.), although the magnitudes are debatable. Then, the question is why the coupled GCM simulations here generate opposite signs against that in these radiative-convective models. Are there any negative feedbacks that reverse the sign of ozone forcing in the GCM?

2. I feel that the results in Hu et al. cannot be simply attributed to climate sensitivity of models to GHG forcing. From Table 1 in Hu et al., one can find that the two groups of models are almost the same for both 21st and 20th century simulations (except for two GISS models). If the group of models with ozone recovery has greater model sensitivity to GHGs, it would also cause greater warming trends for 20th century simulations. However, Figure 2b in Hu et al. shows weaker warming trends over the period of 1965-

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1999. How to explain this? In addition to model sensitivity to GHGs, model sensitivity to stratospheric ozone may also be important, I think.

3. I agree with the authors of the manuscript that multi-model simulations are necessary to clarify the issue here.

4. Figures are not clear enough.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 32993, 2011.

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Interactive Comment