Atmos. Chem. Phys. Discuss., 11, C2230–C2232, 2011
www.atmos-chem-phys-discuss.net/11/C2230/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Global multi-year O_3-CO correlation patterns from models and TES satellite observations" *by* A. Voulgarakis et al.

Anonymous Referee #2

Received and published: 23 April 2011

Review of "Global multi-year O3-CO correlation patterns from models and TES satellite observations"

Voulgarakis et al. present the global distribution of O3-CO correlations observed from the TES satellite instrument, and compare with two chemistry-climate models to evaluate the ozone chemistry in the models. The authors investigate the sources of the O3-CO correlations by conducting sensitivity simulations with different emissions shut off, and also attempt to explain the different correlation patterns simulated from the two models (G-PUCCINI versus UKCA). The study is well conducted, well fit the scope of ACP, and the methods are sound. I have some comments that would suggest the authors to address to improve the manuscript before publication.

My main comment comes from Sect. 5 of Discussion. In this section the authors dis-

cussed possible factors that could cause the different correlation patterns from the two models. Although the paper does not conclude which factor cause the differences in the models, I understand that needs a further study, and the paper is focus on documenting the global O3-CO correlation patterns observed from the satellite instrument and simulated from the models. However, I found the section is difficult to follow. The authors discussed a few factors, but it is not clear to what extent and how quantitative these factors could cause the differences. I suggest the authors re-organize or shorten the section.

Specific comments:

1. Sect. 2.1, Page 5085, Line 1: A latest validation of TES version 4 ozone measurements with ozonesondes is presented by Boxe et al. 2010. Boxe, C., et al., Validation of northern latitude Tropospheric Emission Spectrometer stare ozone profiles with ARC-IONS sondes during ARCTAS: sensitivity, bias and error analysis, Atmos. Chem. Phys., 10, 9901-9914, 2010.

2. Page 5093, Line 25-26: Can you briefly explain why there are positive O3-CO correlations in the Southern Ocean for the raw model outputs? We often expect negative O3-CO correlations over the remote ocean region where ozone is destructed. Can any of the sensitivity simulations explain the correlations over the Southern Ocean?

3. Sect. 5, Page 5097, Line 26: It is not clear to me why "intrusions of upper tropospheric air into the middle/lower free troposphere cause correlations to strengthen in G-PUCCINI". Intrusions of upper tropospheric air bring air with high ozone concentrations and low CO concentrations which would dampen the O3-CO correlations. Please clarify.

4. Sect. 5, Page 5098, Line 10: Although the horizontal winds are different in the two models, it is not convincing to me that it causes the differences over South America. Other factors, such as different ozone production tendency over this region (Fig. 10) can be more important. A specific causal relationship could not be determined without

additional sensitivity simulations. Overall, I think this section can be shortened by listing the different processes in the two models, and state further analysis are needed to explain the differences between the two models.

5. Sect. 5, Page 5099, Line 1: The year to year varying biomass burning emissions may not be a factor causing the differences in correlations between the two models, as the authors have tested and stated in the text (Page 5095, Line 13) that the correlation results do not depend much on the choice of year.

6. Page 5095, Line 25: Should "biogenic emissions" be "biomass burning emissions"?

7. Fig. 8 and 9: For panel b)-e), I suggest the authors plot the correlations in the base run minus the perturbed runs instead of perturbed runs minus the base run. In that way, it allows a direct comparison with the panel a), and shows the influence from each emission type.

8. Fig. 11: The wind vectors are difficult to see from the figure. I also suggest add a label showing the size and unit of the wind vector.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 5079, 2011.