**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.

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Received and published: 21 May 2011

We wish to thank the 1st referee for the positive response. Below we describe the minor changes we made, following to the reviewer's suggestions:

1st bullet–point: We believe that it is clear as it is already in the abstract:"It is noteworthy that the correlations look very different in the two models, even though the ozone distributions are similar. This demonstrates that this technique provides a powerful global constraint for understanding modeled tropospheric chemical processes."

It is clear that both mean ozone and CO are not very different in the two models, while the O_3–CO correlation is. This highlights the possibility that at least in one of the models, the ozone and CO concentrations are captured fairly well, but probably for the

wrong reasons. Underlying time-dependent processes are the likely cause of different correlations.

2nd bullet–point: We would not completely agree on this comment: the distribution of O_3–CO correlations is very similar in 3d and 6g (3d: winter G–PUCCINI correlations with the full TES processing, including the application of observational error; 6g: winter G–PUCCINI correlations from the raw model output). The main thing that changes is the magnitude of the correlation, but as explained in the text this is due to the fact that in 3d we include the observational error in the G–PUCCINI model processing. On the other hand, the main difference between 6a and 6c is in the Southern Ocean, while in the rest of the globe the correlations remain very similar, which is rather encouraging. The differences in the Southern Ocean are associated with a very low covariance of O3 and CO (see Fig. 4 c,d and discussion), and thus are not important. We add a sentence ("However, as seen in Fig.4 c,d...") to make this clearer. We also now avoid using the word "benchmarks" in the abstract and conclusions, as it may seem too strong.

3rd bullet–point: We agree that, although the method is currently valuable to indicate underlying problems, we still do not fully understand the specific drivers of O3–CO correlations, and more work can be done (e.g. as a follow-up) to examine this. We add the last sentence in the conclusions in order to make this current limitation clearer.

Also, we have made Section 5 clearer and less extensive, following the suggestions of the 2nd Referee (see comment 4), something that will hopefully also satisfy Reviewer 1, who found this section rather vague.

4th: bullet–point: Done.

5th: bullet–point: Switching off all the emissions would probably lead to a very unrealistic situation, where there would be only ozone of stratospheric origin in the troposphere, but hardly any CO, since there will be no direct or indirect sources. An experiment with only 2 emission types switched off at a time (e.g. anthropogenic + biogenic) would in-

deed be interesting. However, due to time restrictions, it will not be possible to perform it and include results in this manuscript. It could, however, be an interesting addition to the analysis that we intend to do in the future, which will hopefully result in a follow–up paper.

6th: bullet–point: a) We agree that there should be a comment in the conclusions about the somewhat less good agreement between the G–PUCCINI and the TES O_3–CO correlations in the winter. We thus add a sentence ("This is especially true for...") in the last paragraph of the conclusions. Note that, we would not say that the performance is "not good" in the winter. It is less good, but the model still does fairly well in e.g. the northern Atlantic and northern Pacific.

b) We believe that the following sentence in the conclusions section sums up the different advantages of using observed or G–PUCCINI correlations: "The observed correlations (Fig. 3a, b) are in principle the most reliable, while the G–PUCCINI correlations from raw model output (Fig. 6c,g) can also provide a straightforward benchmark for comparison with other models (especially since raw model correlations have not been degraded by the observational error)."

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

C3763