

Interactive comment on “Simulations of preindustrial, present-day, and 2100 conditions in the NASA GISS composition and climate model G-PUCCINI” by D. T. Shindell et al.

D. T. Shindell et al.

Received and published: 13 September 2006

We thank Bill Collins for his constructive and thorough review.

General comments:

We had written that STE probably had little impact on radiative forcing (RF). However, prompted by the comment on this and the suggestion of this and another reviewer to discuss in more depth how much the STE was affected by high-latitude biases, we have investigated this topic further and revised our assessment of the results (in the abstract, STE section, and conclusion). In fact, the RF is strongest in the extrapolar tropopause region, and the bulk of the STE also takes place at extrapolar latitudes. Thus it has the potential to substantially affect UTLS ozone at middle and subtropical

latitudes, and hence RF. While we cannot diagnose from our simulations the RF from altered STE alone, we see that the influence of climate change on ozone does cause a substantial RF, which takes place at least partially through STE. Thus we feel that the most important conclusions are that climate change can affect both STE of ozone and RF from ozone, and have revised the paper accordingly.

We felt that the A1B scenario added little over the results from the A2 scenario, and was confusing as it had a different setup, so we've deleted it in the revision (which also shortens the paper).

As noted above, we now state how much of the STE takes place in the polar regions where the model biases are large, and also discuss how much of the STE changes result from increases or decreases at high latitudes. We believe that this makes it clear that the STE values in the model are rather more realistic than the obvious high-latitude transport biases might have otherwise suggested. We note, however, in the text that an exception to this is that the high latitude transport is important in the PI-to-PD difference when Antarctic ozone depletion takes place, so that those STE results are likely somewhat less reliable.

Specific comments:

- 1) Revised as suggested.
- 2) We now include dry deposition changes compared with surface ozone changes, and show that for the most part the flux changes with a constant deposition velocity as concentrations increase.
- 3) We agree with the reviewer's implicit point that climate can affect the RF. As noted above, we now make this point in the paper in several sections.
- 4) We've deleted this statement, and do not claim that polar ozone is well simulated in any way.
- 5) We've added a discussion of the discrepancy between the model and the TRACE-

A data as third paragraph of section 3.3, linking the differences to biomass burning emissions.

6) No, the lightning source simply follows the parameterization and is not tuned.

7) The GISS results for nitrogen deposition discussed in Lamarque et al were from modelE, and hence did include the liquid tracer budget. However, it's true that much of this material was presented previously and that it doesn't figure later in this paper, so we've cut the bulk of this discussion.

8) We felt this short paragraph might be useful to some readers, so it was retained (see 10 and 11 below, most suggestions to cut were followed), but shortened.

9) The spin-up (18 yrs) is now given. The model methane is stable, and no offsets were applied in the comparison with observations (we were careful to indicate the one case in which an offset was applied, for stratospheric water).

10) We agree, and this portion was substantially shortened as suggested. We appreciate the suggestion of places where the text could be reduced without loss of important material.

11) We agree, and section 3.6 and its accompanying figure (#13) were removed with a few key sentences moved elsewhere.

12) PI biomass burning set to 10%. Added to text in section 4.1

13) Agreed, the setup for the A1B runs was rather unsatisfying, contributing to our decision to remove discussion of these runs.

14) Added suggested discussion to section 4.3.1.

15) We've added a clearer description to the caption of what is included in the ozone budget terns.

16) We thank the reviewer for pointing out that this was probably an incorrect explana-

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tion of the results. We concur, and this has been removed.

17) The former Figure 21 has been cut.

18) This section was rewritten to make it clearer. We'd meant that it recovers past its earlier state, a super-recovery in effect, and hence doesn't return to PRECISELY where it was rather to AT LEAST where it was.

19) Agreed. As noted previously, A1B was a peculiar setup with some emissions changing but not others, and has hence been deleted.

20) Altered as suggested.

21) We thank the reviewer for pointing out that we'd incorrectly characterized the simulations of Zheng and Pyle. We've now revised the description, as well as that of Sudo et al.

22) This paragraph discussing the influence of the different setup configurations was one of the potentially interesting things about the differences between the A2 and A1B runs. However, as the reviewer points out, other factors were probably much more important, so this whole discussion was removed from the paper. This was another factor that led us to conclude that the A1B simulations added comparatively little to the paper.

23) We thank the reviewer for noting this apparent discrepancy. We've clarified the text to state that the NH extratropical flux changes, while the fluxes elsewhere actually show little variation.

24) We've clarified that this discussion referred to mass fluxes, as distinct from ozone fluxes, in order to isolate circulation changes from composition changes (and hence does agree with Table 7).

25) We've now added in specific calculations for how much of the STE is affected by the high-latitude biases, and fortunately in most cases it's only a very minor fraction.

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26) We thank the reviewer for pointing this out. The models are thus different in both the future projections and their present-day starting points, which we now discuss in the text.

Technical corrections: All suggested changes were implemented.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 4795, 2006.

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