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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Net radiative forcing and air quality responses to regional CO emission reductions" *by* M. M. Fry et al.

Anonymous Referee #1

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Review of "Net radiative forcing and air quality responses to regional CO emission reductions"

Fry et al. present the air quality and radiative forcing effects of halving regional CO emissions, exploring the impacts on CH_4, O_3, and SO_4 aerosols. The net result is an annual global mean net radiative forcing of 36.1mWm^{-2} and modest changes to surface ozone and aerosol concentrations. A global halving of CO emissions has comparable effect to the sum of individual regional changes. The global warming potential of such reductions in CO is also found to be relatively independent of source region and somewhat smaller magnitude than previous studies.

The manuscript is well-written and uses a straight-forward method of modeling

to estimate the radiative forcing and air quality effects of CO. I have only minor concerns and comments. I recommend that this manuscript be published after the authors address the comments below.

General Comments

- The authors provide a brief evaluation of the model, with much greater detail buried in the supplemental section. As the paper currently reads, I think the authors are not adequately describing the model's successes and failures. For example, "...average bias of 4.5 ppbv O_3 across all sites compared to CASTNET." But Figure S1 shows that some sites have a bias of almost 20 ppb in the summer months, which are when ozone and sulfate are at their maximum and their perturbation may be most important.

- In order for this work to be reproducible and fully compared to other models, it is important to list and quantify the relevant "natural" and unperturbed anthropogenic emissions that additionally affect oxidant levels. For example, the authors should include such quantities as lightning NO_x, which strongly influences tropospheric ozone (especially in the tropics, a region of focus of this work).

- The authors should at least briefly mention the seasonality of these effects, which are shown in Supplemental Figure 11 for O_3. I would imagine that seasonal changes in air quality and radiative forcing, while still small, are larger in magnitude and perhaps more relevant.

- Seemingly significant changes occur to NH_4NO_3 and SOA, but little discussion is presented and these species are neglected in the radiative forcing calculation. The authors, at the very least, should add remarks as to the relevance or irrelevance of these species in the ultimate radiative calculations. This is somewhat dealt with in the Conclusions, but could be further elaborated upon and mentioned in Sections 3 and 5.

Specific Comments

Page 33445, Lines 18-20: It is interesting that the uncertainty decreases as more components are added into the calculation. This issue is outside the control of the authors, but it stands out.

Page 33454, Lines 3-4: Doesn't this contradict the statement in Page 33453 Lines 14-15?

Page 33454, Lines 7-8: 93% is very large, has such an influence been previously noted?

Page 33455: Additional discussion regarding nitrate and SOA is warranted. Looking at Table 3, the change in SOA is almost as large as SO_4. Also, do changes in methane affect aerosols?

Page 33455: The changes in aerosols for a global change in CO listed Table 3 differ from the sum of the regional changes.

Page 33459, Lines 1-6: Why is there such a difference? 0.2 Wm^{-2} vs. 0.07 Wm^{-2}

Page 33463: Line 3-5: I am left with the impression that altering CO does not greatly affect air quality or anthropogenic climate forcing. Can the authors add some perspective (1 or 2 sentences) before mentioning international agreements?

Table 3: I do not understand the units of Tg/yr and Gg/yr since the text and caption presents these quantities as strict changes in burden.

All figures with multiple maps: The maps are small, and details, especially at

the regional scale, are hard to make out. Please make sure the figures are large and clear in final version. Especially Figure 7.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 33443, 2012.