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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Global and regional temperature-change potentials for near-term climate forcers" *by* W. J. Collins et al.

Anonymous Referee #2

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This paper develops GWPs and both global and regional temperature change potentials for 7 short-lived climate forcers from 4 different regions. This paper provides two very useful contributions:

1) GTP and GWP calculations for some less commonly addressed species such as SO2, POM, NOx, and VOCs.

2) Regional temperature potentials for all 7 species.

There are a couple of key limitations. The most important is the lack of indirect effect or snow albedo calculations. The paper acknowledges this, and at the present time, this is an understandable limitation. However, sometime in the next few years I expect that papers on this subject will really need to take indirect and snow albedo into account to

be credible.

The other limitation is the dependence on the HTAP regions, which make it difficult to determine what aspects of the regional differences are latitudinal vs. longitudinal (or might change for southern hemispheric sources).

I agree in part with the previous commenter that the paper could be a little bit more clear in terms of its policy implications, and the underlying causes of some of the patterns. I will make a few suggestions below in the technical edits.

Technical Suggestions:

pg 23262, line 18: First use of ARTP should be spelled out.

line 19: this is an example of the problem with using HTAP regions. I wonder whether the pattern would change at all if the NOx were emitted in the Southern hemisphere rather than the Northern hemisphere. At least for a GTP-sustained I would expect the temperature change to be a balance of warming ozone produced locally and cooling methane destruction globally, which would imply warming in the hemisphere of emissions and cooling in the other hemisphere. I would be a little surprised if the GTP-100 was similarly explained because 100 years seems like a long time for the system to retain any memory of where the emissions originated...

Perhaps this could be rephrased, "NOx emissions have a cooling effect globally (even when nitrates are not included), but NOx emissions from some regions can have a warming effect in northern mid and high-latitudes at some timescales." (since EU and SA NOx do not have any warming effects at the 100 year timescale).

pg 23266, line 25-27: B-CH4 is not used uniformly in this paper in terms of whether the CH4 is a subscript or superscript (see equation 1 as well). I'm guessing it is meant to be a superscript. This should be fixed. I also wonder if, since F-CH4-CH4 is "the methane forcing diagnose from the methane change experiment" if B-CH4-0 should be B-CH4-CH4 - e.g., "the change in methane burden from the methane change experiment".

pg 23267, line 15: i'd reorder to make more clear that delta-alpha-CH4-i is the change in methane lifetimes and that the perturbed emissions are i. E.g., "from the change in methane lifetimes, delta-alpha-CH4-i, resulting from the perturbed emissions of species i." (also, a brief sentence about how these changed lifetimes are calculated could be useful)

pg 23268, equation 3: I think that alpha-i in the denominator after the second sum is supposed to be alpha-CO2-i.

pg. 23270: line 5-8: the paper notes that the fractional contribution to GTP due to the methane response is higher at 20 years than at 100 years: this seems surprising to me, and would be worth explaining. It might play into some of the temporal and spatial temperature change patterns for NOx.

pg. 23273, line 10: instead of saying "only in the northern mid-latitudes" I'd say "except for SA emissions, which cools in the northern high latitudes as well". (I had to check for a second and make sure that NOx from SA was cooling in the southern hemisphere based on the wording of the sentence).

pg. 23274, line 7: typo: there should be an "of" between "results" and "Bauer".

pg. 23276, line 20: put the word "globally" in there somewhere (e.g., "a single globally averaged metric".

pg. 23277, line 13-15: this sentence needs work. Maybe, "For NOx emissions from some regions, the temperature response in the northern mid-high latitude are negative after 20 years but positive after 100 years."

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 23261, 2012.