**Atmospheric
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Discussions

Interactive comment on "Stratospheric ozone depletion from future nitrous oxide increases" *by* W. Wang et al.

Anonymous Referee #2

Received and published: 6 January 2014

General: This paper analyses the various ways in which increases in N_2O affect ozone and stratospheric temperature, by conducting sensitivity simulations using a chemistry-climate model. I think the general approach to this problem is fine, and I don't doubt the results presented by the authors. Embedding the results in the existing literature can be improved. I agree with reviewer 3 that the term "ozone depletion potential" has been used – rightly so – several times in the paper but has neither been defined nor quantified. This could be changed – Ravishankara et al. (2009) have done so. The total ODP of N_2O should be determined, and the various contributions to it (chemical, radiative, dynamical) can be quantified. Also the impact of N_2O increases has been modelled before; the findings of this study should be compared to these earlier studies. The language of the paper is mostly adequate expect for a few instances when the

formulations come across as overly complicated, see below.

Specific comments:

P29448L16: Replace "reverse" with "opposite".

P29449L10: Please also discuss the papers by Revell et al. (2012) in GRL and ACP. Both contain results that have to be compared to what is found here.

P29L21: "ODS" (singular)

P29450L7: "a series"

P29451: In describing your scenarios, please avoid use of terms such as "1%/year". This would imply exponential growth when you mean linear growth. How about "In run E1, N_2O is increasing linearly from 344 ppbv in the year 2000 to 517 in 2050"?

P29453R4 and R5: Please provide references for the reaction rates.

P29453L26: Replace "reversed" with "opposite".

P29454L8: Break sentence into two.

P29455L18: "increasing". The question of whether tropical total column ozone will decrease in the future depends on the GHG scenario; in your case, the prescribed SSTs may well be the dominant factor in determining this.

P29456L10: I can't discern from figure 4 that in the Arctic, ClO_x is increasing in the beginning of the simulation despite total Cl coming down.

P29457L18: replace "short of significant" with "insignificant".

P29458L12ff: The discussion of feedbacks involving CH_4 and H_2O appear out of context and unmotivated. You probably need to discuss what's understood about these in the introduction. I suspect that CH_4 changes found in your simulations are useful as tracers / indicators of changes in transport but their chemical and radiative importance is likely very small. Please quantify or state so. If indeed these effects are minor com-

pared to the other ways in which N_2O is affecting ozone and climate, you could choose to drop the entire paragraph, shorten it considerably, or state that the changes are indicative of differences in transport. H_2O changes may well be dominated by trends in the cold-point temperature caused by changes in upwelling and ozone. If that's the case, please state so.

P29460 eq (1): Please state that the coefficients c_j are determined through a least-squares minimization of ϵ; this involves introducing a metric which you should mention. Also the goodness of the fit needs to be considered: If ϵ is substantial, or has a systematic component to it, this would suggest that your model is not ideal. For example, coupled effects, involving products of the explanatory variables, do not figure in the expansion. You mention this at P29461L16 without quantifying it.

P29463L17: "less halogen"

Figure 1: Use of colour would make the figure more intelligible. Same for the other contour plots.

Figure 3: Consider using smoothing in the right column to make the different lines easier to identify and distinguish. Same for figure 4.

Figure 5: Some of these patterns are quite complicated. I wonder how robust they would are. If you performed ensembles of simulations, this could be determined.

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 29447, 2013.

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