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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of uncertainties in inorganic chemical rate constants on tropospheric composition and ozone radiative forcing" *by* Ben Newsome and Mat Evans

Ben Newsome and Mat Evans

mat.evans@york.ac.uk

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Reply to reviewers of ACPD paper: "Impact of uncertainties in inorganic chemical rate constants on tropospheric composition and ozone radiative forcing" by Ben Newsome and Mat Evans

We thank the reviewers for their constructive comments. We address the comments below and identify changes we would make to the paper considering their comments. Where indicated we have already run the appropriate new simulations.

Review by R Saunders. Major comments: My only major concern is that apparently in

all sensitivity studies the rate coefficients were increased but never decreased. Unless a certain reaction is the rate-limiting step inside a reaction cycle, making it faster has only a small effect on the overall rate of the cycle. However, making it slower could make this particular reaction rate-limiting and then the effect becomes large. Why was it never tested what effect a decrease of k by 1 σ has? *** We had tested this previously and found that the differences were small but didn't include this in the original paper. We would suggest that we include these results in the text and show a comparison between the results of increasing and decreasing the top ten reactions to show that although there are some differences between the conclusions from increasing vs decreasing the rates the impact is small compared to the overall conclusions of the paper.

Minor issues and technical comments Abstract: "Expert panels synthesise laboratory measurements. "Chemicals are "synthesised" but not laboratory measurements. I think it would be better to say: "Expert panels evaluate laboratory measurements". ***We have updates the text to reflect this suggestion.

In the introduction you describe both the JPL and the IUPAC evaluation and then you provide Eq. (1) to decribe the uncertainty. It should be noted, however, that IUPAC does not use this definition. Instead, IUPAC defines uncertainties via Δ log k and ΔE/R. I think it would be helpful for the reader if you show how to convert between these different ways to express uncertainties. ***We have included a discussion of both methodologies in the text.

In your manuscript you refer to the JPL evaluation from 2011. Have you checked if the uncertainties are still the same in the more recent JPL Evaluation Number 18 from 2015? ***We have updated our simulations to reflect the JPL18 evaluation and refer to that in the text. There were some minor changes which has marginally changed the order of the uncertainties of the reactions.

Page 2, line 20: Change "larger uncertanties then quoted here" to "larger uncer- tanties

than quoted here". ***We have corrected the text.

Page 3, line 2: Change "www.goes-chem.org" to "www.geos-chem.org". C2 ***We have corrected the text.

Anonymous Referee #1 The authors have used an out of date version of the NASA/JPL data recommendations in their analysis. There does not seem to be any reasonable explanation for this oversight given in the present version of the manuscript. Although the conclusions from the present work are likely to remain unchanged the authors should highlight any differences with the 2015 NASA/JPL data recommendations in their paper in Table 1. ***We have updated our simulations to reflect the changes made between versions 17 and 18 of the evaluation. This has made small changes to the absolute value of a couple of reactions but there is no overall change to the conclusions.

The treatment of the uncertainty in the atmospheric parameters, or lack of, is unsatisfying. A thorough treatment of photolysis uncertainty may be beyond the scope of the present work, but making an across the board percentage uncertainty assumption is surely not correct. It may have been better to not include photolysis uncertainty in the present analysis. ***We agree that our analysis of the photolysis rates is simplistic but we believe it provides a useful context for understanding the relative role of photolysis uncertainty compared to reaction rate constant uncertainty. We think that leaving these simulations in the discussion make a useful contribution and helps to motive future work in this area. We would update the text when we are discussing this to identify the need for future improved assessments of photolysis rate uncertainties.

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