

Interactive comment on “The Influence of Temperature on Ozone Production under varying NO_x Conditions – a modelling study” by J. Coates et al.

Anonymous Referee #2

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General comments: This paper presents a modelling study of ozone production under varying NO_x conditions, concentrating on the temperature influence of the processes. Generally the paper is interesting, within the scope of ACP and should be published; however there are a few ways I feel it could be improved and these are detailed below. Generally the paper is very short. I realise that keeping things brief and to the point is sometimes a good thing and can help the reader concentrate on the salient points, however I would suggest in this case that some of the supplementary material be moved to the main text. In particular I think the model setup section would benefit from having more description in the main text rather than most of it being in the supplementary. This is important information for the paper and in this case I believe it would

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assist the reader to expand the model description.

Specific comments: In section 2.1 (page 3 line 30 – page 4 line 4), several statements are made about the setup of the model that would benefit from expansion. The authors state that isoprene emissions from vegetation are the most important BVOC emissions on a global scale, however if the study was to be used for mechanisms in regional as well as global models, then could other BVOCs and other isoprene sources become important? For example in moderate to high NO_x conditions of large cities could anthropogenic isoprene be important? And could monoterpene emissions (which have a potentially large effect on O₃ chemistry due to their reaction rate with OH and O₃ itself) also be significant? In general this seems to be a big statement to make without further discussion. The authors also state (page 4 line 3) that BVOC emissions can be affected by increased temperature due to increase evaporation but then have no further discussion as to how omitting this temperature dependence from the study may affect the results.

On page 4 line 30 it is described how isoprene emissions with varying temperature using MEGAN2.1 lead to different isoprene mixing ratios in the model, and this is then compared to isoprene measured at different temperatures during a campaign over Essen, Germany. This needs expanding. I presume MEGAN was run in the model for the particular area that the campaign took place over but this needs stating explicitly. Could the authors check their model with other campaigns that have measure isoprene (of which there are numerous worldwide in the literature)?

On page 5 line 30 a description is given that the increase in ozone due to chemistry is large than that due to increased emissions. The results are shown in figure 3 and table 2, however the paper would greatly benefit from a summary of the results in the text. On page 7 line 16, there is a paragraph describing how faster reaction of VOCs with OH with increased temperature can increase ozone production. This is backed up by references to other studies that have seen this effect. Why have the authors not included the results of their study here? Could they include some description of which

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VOC + OH reactions are most dependant on temperature, which would assist readers in coming to a conclusion about which reactions and their temperature dependence should be included in any given model?

In section 3.3, a description is given of how the box model simulations in this study compare to real-world observations and the output of various 3-D models. I must admit I am a bit confused what this section is trying to say. It seems that the result is that mixing in the box model is more important to ozone formation than the choice of mechanism (which is not surprising) and I am not quite sure how any useful comparison can be made between the different mechanisms in this study and a few real world and 3-d model studies. Maybe the authors could better explain what they are trying to achieve with this section. Would a better approach be to assess what mechanisms were used in the various studies they look at and then give some steer as to whether it is the temperature dependence of the chemistry or of the emissions that is the key driver in these different cases?

Minor comments: Page 1 line 22: Could more references be added here – especially with respect to the many studies of the 2003 European heatwave ozone events? Page 3 line 13: What was 'broadly representative of urban conditions of central Europe' mean. Please be more specific with the conditions the model was run at. Page 3 line 27: The Stockwell 1990 reference seems very old. Has there been more recent advances in the knowledge of ozone production chemistry that might make this obsolete? Page 8 line 25: The authors should consider showing the actual production and consumption budgets in the main text rather than the supplementary.

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