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Atmospheric Chemistry and Physics Discussions

Interactive comment on "An MCM modeling study of nitryl chloride ($ClNO_2$) impacts on oxidation, ozone production and nitrogen oxide partitioning in polluted continental outflow" *by* T. P. Riedel et al.

Anonymous Referee #1

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The paper presents the results of a detailed model analysis of nitryl chloride chemistry in polluted continental outflow. This chemistry has been proposed as one of the main activation pathways for chlorine in the troposphere and is certainly a subject that falls within the scope of Atmospheric Chemistry and Physics. The authors discuss in depth the impact of ClNO2 chemistry on the oxidation processes of VOC, on the formation of ozone and other pollutants (such as acyl peroxy nitrates); interestingly, they also suggest that chlorinated VOC secondary products (such as acid chlorides) may be important Cl sources in polluted regions. The results from this study provide many new

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insights into our understanding of Cl chemistry and I recommend publication after the authors have addressed a few minor questions.

GENERAL AND SPECIFIC COMMENTS

I have a few questions regarding the initialization of the model. Re the scaling of VOC measurements described in Sec 2: was the scaling applied only to ethanol and acetone? From line 11 it seems that all VOC were scaled. If so, it would probably be easier to just use the Atlantis dataset, I think. Has the aircraft dataset been used at all? It is mentioned only in the introduction of the paper. How were the data from the Atlantis selected? The text only says that the data in the LA region were used, which is bit vague. Were the data filtered for distance from the coast and/or from the ground site? How accurate is the assumption of a constant 25C temperature?

It would be useful to the community if the authors could make publicly available the expanded Cl+VOC mechanism they have developed. Was the MCM protocol, as defined in the Jenkin/Saunders papers, strictly followed (the protocol sets rules on how to exclude minor reaction channels and treat peroxy radicals) or was the mechanism based on the expert judgement of the authors?

The authors tested the response of the model versus the reaction probabilities of ClNO3 and HOCl. What about gamma(N2O5) and ClNO2 yield? And the total aerosol surface area? It also seems to me that the estimated ClNO2 photolysis rate as shown in Fig. S7 differs from the observed rate in the period 6-11 am. How sensitive are the results to this parameter?

One of the largest uncertainties in this analysis seems to be HONO. Was it measured at any site during CALNEX and how? How does modelled HONO compares with measured HONO? Heterogeneous HONO formation in the model is mentioned in the summary but not really addressed earlier in the discussion.

TECHNICAL CORRECTIONS

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page 28981, line 27: "surface area"

page 28990, line 14: "dominates"

line 16: "sum of"

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 28973, 2013.