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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Atmospheric OH reactivities in the Pearl River Delta – China in summer 2006: measurement and model results" *by* S. Lou et al.

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Response to Comments by Tom Karl

Comment

It is interesting to see that the RACM model predicts OH reactivities that are close to measurements, given that a very similar model and measurement technique reported a significant under prediction of OH reactivity in an isoprene dominated environment (see di Carlo et al., Science, 2004). The cited RACM model (Stockwell et al., 1997) is a highly lumped scheme. It would be interesting to see how RACM was actually modified according to Karl et al., 2006, since neither Rohrer et al., 2006, nor Hofzumahaus et al.,

2009 (the two cited references) reported the actual mechanism that is used to model OH reactivity. We have recently compared more (e.g. Mozartv4) and less explicit (e.g. RACM) lumped schemes with respect to isoprene and found that the original RACM mechanism predicted lower VOC OH reactivity in isoprene dominated environments compared to more explicit schemes.

Response

We thank Tom Karl for the valuable comment and agree that additional details regarding the implementation of the modified isoprene chemistry in the RACM model should be given. As we mentioned in the paper, our model is based on the original RACM by Stockwell et al. (1997) and has been upgraded by Karl et al. (2006). A detailed documentation of the isoprene chemistry implemented in the RACM mechanism has been published by Karl et al. (2006) and will not be repeated here. However, for better understanding we have added the following description of the chemical model to the revised paper:

A zero-dimensional chemical model was used to calculate concentrations of radicals and photochemical products of nitrogen and carbon compounds. The underlying chemical mechanism (Karl et al., 2006) has been used before by Rohrer and Berresheim (2006) and Hofzumahaus et al. (2009). It is based on the Regional Atmospheric Chemical Mechanism (RACM) (Stockwell et al., 1997) which was upgraded with the isoprene degradation scheme by Karl et al. (2006). The latter scheme is a modified version (26 reactions) of the mechanism by Geiger et al. (2003), who prepared a condensed version of the Mainz Isoprene Mechanism (MIM, 44 reactions) (Pöschl et al., 2000). The isoprene chemistry by Karl et al. (2006) replaces directly the complete isoprene scheme of RACM and differs from the preceding mechanisms (Stockwell et al., 1997; Pöschl et al., 2000; Geiger et al., 2003) by treating MVK (methyl-vinyl ketone) and MACR (methacrolein) as separate species rather than lumping them in a single species. Furthermore, it introduces CAR4 as a substitute for the group of C4 and C5 hydroxy carbonyl compounds plus 3-methyl furane. The isoprene degradation scheme

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is fully documented by Karl et al. (2006) and listed in Table 4 of their paper.

We agree with Tom Karl that it would be interesting to test other mechanisms for their ability to predict the measured OH reactivity in the Pearl River Delta. However, since we lack measurements of OVOCs, we can only compare total OH reactivities (modelled vs. measured) which are highly lumped quantities. Such comparisons give only very limited insight into mechanistic details. Therefore, future experimental studies should definitely include speciated measurements of major OVOCs, if the goal is to test and improve mechanisms of photochemical VOC oxidation.

References

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