Atmos. Chem. Phys. Discuss., 13, C13139–C13143, 2014
www.atmos-chem-phys-discuss.net/13/C13139/2014/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Mapping Asian anthropogenic emissions of non-methane volatile organic compounds to multiple chemical mechanisms" *by* M. Li et al.

M. Li et al.

qiangzhang@tsinghua.edu.cn

Received and published: 28 March 2014

This paper discusses issues regarding processing of emissions of volatile organic compounds (VOCs) for air quality models in use different chemical mechanisms. Although the focus of this paper is on the emissions inventory for Asia, the issues they bring up are applicable for emissions and modeling everywhere. The speciation profiles used to determine model species for representing VOCs are important to model predictions of the effects of the VOCs on air quality, and they have significant uncertainties. They are also processed in inconsistent and undocumented manners when used to derive model-ready inputs for different chemical mechanisms, introducing additional

uncertainties in the model predictions. In this work the authors examine and update a number speciation profiles representing important VOC sources in Asia, derive the model species for the profiles in a consistent manner for representative mechanisms, and show that the updates have significant effects on emissions input and are likely to have significant effects on model predictions. The effects of the particular updates used in this work may not be as great when examining emissions in the United States or Europe, but I suspect that there are similar issues with other profiles that would affect modeling in these regions. The issues discussed in this paper are something that modelers, and those that use model outputs, should better understand and appreciate. I believe that this paper makes an important contribution in this regard.

The paper is generally clearly written and informative, and I have only a few questions, comments or suggestions. These are given below.

Response: We appreciate the insightful and constructive comments from Dr. Carter. We deal with individual comments as below.

The high contributions of glyoxal and methyl glyoxal are surprising to this reviewer, who more used to U.S. emissions inventories. They give a reasonably good discussion of what caused this increase. But the large decrease for acetylene, which Figure 6 indicates was previously one of the two most important VOCs in terms of mass emissions, is also significant. The discussion suggests that it is due to the same changes that caused the large increases in the glyoxals, but it looks like the decrease in acetylene mass is quite a bit greater than the increased mass for the glyoxals. It might be helpful if they specified specifically why acetylene is so high in the INTEX-B inventory compared to the updated inventory in this work. Figure 9 indicates that the acetylene contribution in INTEX-B is huge for all regions except for "Other East Asia".

Response: The decrease of acetylene emissions and increase of glyoxal emissions are mainly due to the change of residential biofuel combustion profile. As can be seen from Fig. 4, the profile used in the original INTEX-B inventory is taken from Tsai et al.

ACPD
13, C13139–C13143, 2014

(2003) (P2 and P8), which contains high mass fraction of acetylene (27.4% for P2 and 27.0% for P8, respectively) in contrast to the composite profile. This work estimated lower emissions for acetylene (-5.43 Tg compared to INTEX-B), but higher emissions for glyoxal (+0.862 Tg), xylene (+1.63 Tg), and "unknown" (+3.05 Tg).

Table S1 or perhaps a separate table in the Supplementary Materials should indicate which profiles were updated or modified for this work and perhaps have some sort of indication of whether the modifications were potentially significant (e.g., by giving their OFP's or OVOC fractions). Or were all the profiles listed in Table S1 modified? Were the ones with only one profile listed not modified?

Response: We list the profiles used in the original INTEX-B inventory in Table S1 of the revised paper.

It would be helpful to people interested in this work if the updated profiles developed in this work were available in the supplementary materials or at least at a web site that is cited in this work. By this I mean profiles in terms of chemical compounds or Speciate 4 chemical categories, not in terms of model species. I couldn't find them at the web site they gave, though maybe I didn't look in the correct place.

Response: The composite profiles for each source used in this work are now available from the following URL: http://mic.greenresource.cn/intex-b2006. We add the link in the revised paper.

Simon et al (2010) is the only reference citation given regarding the SPECIATE database, which appears to be the primary profile database used in this work. However, the current version of SPECIATE is 4.3, which is dated later. Which SPECIATE version did they use in this work? Would using the latest version affect any of the results or have any profiles that would be better? The reference citation for the SPECIATE database should be given when it is first mentioned, which is not the case in this manuscript. That citation, and the SPECIATE version, should also be given in Table S1.

ACPD
13, C13139–C13143, 2014

Response: The version of SPECIATE database used in this work is 4.2, which is added in Table S1 and main text of the revised paper. Using SPECIATE 4.3 would have limited effect on the conclusion of this work as few measurements from Asia were added. More reliable local profiles measured with standardized sampling and analyzing method will be very helpful to improve the quality of profiles in the future.

A number of chemical categories in the SPECIATE database do not have model species assigned to them by Carter (2013). How important were they to the total mass of emissions and the profiles in this work?

Response: Emissions of five species are omitted during the mapping process as shown in below. It can be seen that emissions of those species are small and have little effect on the final emissions. Norfarnesane e (2.05 Gg), Norpristane (1.35 Gg), COAL TAR (0.18 Gg), COPPER NAPHTHENATE (0.18 Gg), and PARAFFINS (C16-C34) (6.76 Gg).

Part of this work involves estimations of ozone formation potentials (OFP's) of the profiles and emissions sources, which is useful. However, many chemical categories used in SPECIATE and presumably the other profiles do not have MIR values assigned to them. How were these treated? In this regard, they state that they ignore OFP's of unidentified mass. Isn't this introducing a bias in the analysis, by assuming poorly characterized profiles are necessarily less reactive? But this is not a major issue if the objective is to see which of the identified compounds attribute to OFP's, as done on Figure 5.

Response: Species with no MIR values were ignored during the calculation of OFPs. We agree that this treatment will introduce uncertainties in evaluating the magnitude of OFPs. As pointed out by the referee, the objective of OFP comparison in this work is to compare the differences of identified compound. We added the statement in the revised manuscript.

It might be an interesting comparison to see a version of Figure 5 for the INTEX-B

ACPD
13, C13139–C13143, 2014

speciation inventory, given the differences shown in Figure 6.

bf Response: Agree. We added the comparison in the supporting information of the revised manuscript (Fig. S5), as we feel that the current manuscript is lengthy already. In the original INTEX-B inventory, ethane and xylene are still the largest two contributors to OFP, but with different absolute contributions (50 Tg-O3 and 14 Tg-O3 respectively).

The only comment I feel absolutely needs to be addressed concerns the need to indicate the SPECIATE version used. However, I hope they can consider the other suggestions when finalizing this paper.

Response: Thanks again for constructive comments. We believe that we have addressed all comments raised.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 32649, 2013.