

***Interactive comment on* “Speciation of anthropogenic emissions of non-methane volatile organic compounds: a global gridded data set for 1970–2012” by Ganlin Huang et al.**

Anonymous Referee #1

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General comments: The paper presents a global inventory of speciated non-methane volatile organic compounds for the period of 1970 to 2012 based on EDGAR v4.3.2 at a resolution 0.1 x 0.1 degree. This work provides important dataset for global chemical transport model simulation, and give indications on sources and regions where more specific reliable profiles are needed. The manuscript was generally written in a clear way, but more analyses on emission characteristics of other regions except Europe are needed. Detailed emission inventory dataset and profiles used for speciation should be provided, and the large discrepancies of NMVOC emissions with previous studies (especially China) should be illustrated. The manuscript should be carefully checked for figures and text and mistakes should be corrected. I recommend the manuscript to

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be revised considering the following comments.

Specific comments: Sect. 2.1: 1. Emissions are grouped into 14 emission sectors, including power generations, industrial combustions etc., which is inconsistent with Table S1 (19 sectors). Please specify the reasons of the sources grouping, since the specification of source classification is key to the profile mapping in the next step. 2. You give detailed description on comparisons between different versions of EDGAR dataset, I don't think it's necessary in the text and there are no relevant discussions in other parts of the manuscript. On the other hand, please give more information on the sources of the raw emission factors, technology assumptions by regions, and abatement measures considered in EDGAR v4.3.2 among world regions. 3. Line 20: please be cautious on the use of "underestimation" when comparing emission inventories. Please check this through manuscript. 4. It's unreasonable that power generation contributes the large differences between EDGAR and HTAP. I think the author means the "relative differences" instead of "absolute differences" because emissions of power generation really small compared to industrial, residential and transportation sectors. The "relative differences" is misleading to readers since the emission contribution of power generation is not important on global scale. Please revise the sentences accordingly. 5. In Figure 1, the emission differences in industry and residential is large and cannot be neglected for DEU, GBR, POL, please explain the reasons and discuss more in the text. 6. How about the emission differences for other countries and regions except Europe, such as Asia and the US? Please add more discussions on comparisons of emissions in Asia and US.

Sect. 2.2: 1. Emission profiles are really important in NMVOC speciation. Please list the mass fractions of the specific profile for each sector for each region. If the table is too large to present, please add an external data link for download. 2. Profiles were measured and developed in various years. Please specify how you apply the profile to sectors in different years and why. Have you considered the trend of the profiles because of the technology evolution? When you assign the quality code in the profile

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mapping, have you considered the year when the profiles are measured?

Sect. 2.4: 1. It should be noted that the 25 species groups cannot be directly coupled with CTMs, since individual species are lumped to different chemical mechanisms following different mapping rules. For example, the CB05 mechanism is developed by lumping species according to carbon bond type, while SAPRC-99 is on functional groups. Please specify this clearly in the text. 2. “Where a species contains more than one functional group, priority was typically given to the suffix of the species name since this functional group is generally the most relevant for ozone formation”. Please specify clearly what the “suffix of the species name” means. Giving an example here will be better.

Sect. 3.1: 1. Please double check the figure numbers in the manuscript. The figure numbers in the text are inconsistent with the figures. 2. Line 12: “represents” should be “presents”; Line 14: “attribyted” should be “attributed”. 3. Please list the Euro standards implemented from 1970 to 2012 as a table in the supplement. 4. Line 24: you mentioned “in addition to aromatics (alkanones, dimethylbenzenes and benzene). . .”, but alkanones are not aromatics group. Please specify this in the sentence. 5. In the figures, species are grouped to 8 categories: alkanols, alkanes(C2-C5), alkanes(C6+), alkenes, alk(adi)enes/alkynes, aromatics, alkanals, and other. It’s not clear how the 25 species mapped to these categories. Please list the mapping process as a table in the text or in the supplement.

Sect. 3.2: 1. The title of Sect. 3.2 is “Case study on the impact of reduction measures on speciated NMVOC emission”, but only studies in Germany and the United Kingdom are presented. A paragraph illustrating why you choose Germany and the UK as a case to illustrate the impact of reduction measures is needed. In Asia, I think there are no national control measures implemented before 2010. How about the trend of US? 2. In each case, only residential and road transport results are presented. Please enrich the analyses to include all sectors (power, industry, residential and transport) to give more detailed illustration on the effect of different reduction measures in different

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sectors. 3. In the UK case, please explain more on the trend by species groups. Why the emission fraction of alkanes increased rapidly, while aromatics decreased? It's the same reason of the trend in Germany? Please specify clearly in the text. 4. You mentioned "Approximately 90% of NMVOC emissions from road transport attributed to petrol vehicles". Please specify the year of this emission fraction.

Sect. 4.2: 1. The SWD (solid waste disposal) emissions of China are quite high, while SOL (application of solvent) and REF (oil refineries) are incredibly low compared to previous studies in China (INTEX-B, Li et al., 2014, acp). Please specify the reasons of such huge differences.

Sect. 4.3: 1. It surprises me that hexanes, chlorinated hydrocarbons contribute so high to the emissions in Europe, China and North America. Please specify the sources and profiles that relevant with the high hexanes and chlorinated hydrocarbons emissions to these three regions. 2. The emission fractions of the species group differ significantly compared to other studies in China (Li et al., 2014, acp and references therein). Please illustrate the reasons of such differences.

Figures and tables: 1. Figure 4: specify the spatial resolution in the caption. Specify the mapping table from 25 species groups to the 8 categories in the caption. 2. Combining Fig. 6 and Fig. 7 into one figure as (a) and (b) will be better, the same to Fig. 8 and Fig. 9 for UK. 3. Figure 10: the color scale of the quality level is difficult to recognize for reader, especially to distinguish between level 3 and level 4. Use one more distinct color scale. 4. Figure 11: the color legend is not complete. 5. Figure 15 and Figure 16: the Y-axis label (the species name) is not complete.

References: Li, M., Zhang, Q., Streets, D. G., He, K. B., Cheng, Y. F., Emmons, L. K., Huo, H., Kang, S. C., Lu, Z., Shao, M., Su, H., Yu, X., and Zhang, Y.: Mapping Asian anthropogenic emissions of non-methane volatile organic compounds to multiple chemical mechanisms, *Atmos. Chem. Phys.*, 14, 5617-5638, 10.5194/acp-14-5617-2014, 2014.

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