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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effect of different emission inventories on modeled ozone and carbon monoxide in Southeast Asia" *by* T. Amnuaylojaroen et al.

Anonymous Referee #1

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<General Comments>

This manuscript applies five different anthropogenic emission inventories with WRF-Chem to examine surface CO and O3 for Southeast Asia. The authors compared the simulations with observation data, and concluded that none of the emission inventories are better than the others. While most current studies have focused on East and South Asia, this manuscript provides some insights about Southeast Asia. The underlying work in this manuscript will be a useful contribution to the literature.

While this manuscript provides detailed comparisons and long discussion, I suggest the

authors summarize the major innovations besides the study region in the introduction sections to emphasize its significance and give the readers a sense of “big picture”.

<Specific Comments>

1. Section 3.1, for each emission inventory, it is better to state whether it includes shipping emissions, whether it includes non-combustion sources, and whether it includes four sectors (residential, industry, power and transport). I feel that such kind of clarification will make the comparison in section 3.2 is more meaningful, and show the readers whether these emission inventories have consistent emission sources

2. Line 15 on page 9352: can the authors give more details about “what was developed for Europe”? It is not quite clear how the RETRO seasonal cycle is developed.

3. Lines 23-26 on page 9353: be specific about “other emission inventories”. How can the emission inventory in 2000 be used to make the conclusion about inventory in 2010? It is better to provide more references.

4. Line 18 on page 9354: be specific about ship emission. Does it include both international and domestic shipping?

5. Lines 24-25 on page 9354: as the authors introduced, “both the RETRO and MACCity emission inventories have monthly temporal variability”, why only RETRO is chosen to estimate monthly emissions in INTEX-B and SEAC4RS. How much uncertainty would be introduced to the final simulations with the assumption that these three emission inventories follow the same monthly allocation? Besides, will this assumption affect the following discussion that different emission inventories make little variation in modeled surface mixing ratios?

6. Equations (1)-(3): is the monthly estimate based on each grid or total emissions of over the entire model domain? What is the difference between “monthly emissions” defined here and “monthly-average emissions” defined in line 10, page 9366?

7. Lines 13-14 on page 9355, how to make the conclusion that biomass burning

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sources dominate the emissions of NOx in March? Based on Table 1, NO emission from biomass burning is less than that from anthropogenic sources.

8. Lines 1-3 on page 9356, from RETRO in 2000 to SEAC4RS in 2012, there should be emission reductions.

9. Lines 4-13 on page 9356, authors made comparison between different emission inventories, and mentioned that less NO emissions in SEAC4RS are due to lack of ship emissions. How much contribution do ship emissions make to the total emissions? Is it possible that some of the emissions have been reduced by applying emission control technologies?

10. Lines 14-29 on page 9356, suggest authors show emissions in Ohara et al. (2007) and REAS v2.1 inventory in Table 1. It is hard to follow this paragraph without any numbers.

11. Section 5.1, Figure 5 and 6, it is difficult to make comparison with current figures, I suggest the authors to add figures about the differences between modeling and observation.

12. Lines 3-5 on page 9362, how to separate the influence of biomass burning and anthropogenic emissions?

13. Lines 11-19 on page 9362, what is the definition of "variation" in the predicted monthly-average surface mixing ratios across the five simulations? The authors listed ranges of variation for difference pollutants, but what kind of information we are supposed get from the values of variation? What cause the variations? While the high variations of NOx were explained by differences in ship emissions, what are the reasons for high variations over land?

14. Lines 23-24 on page 9362, Saraburi is missing in this sentence.

15. Fig. 9 (g)-(l) and Table 3, if I understand it correctly, figures show that the model underpredicts most of December CO except some points at Chiang Mai and Saraburi.

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But Table 3 only shows positive bias at Chonburi, and the authors stated that higher emissions are modeled at Chonburi and Suratthani (line 8 page 9363). The authors are better to clarify these statements and explain the underestimates of CO (in both March and December) by model simulations.

16. Fig. 10 and 11 (also Fig. 14 and 15), I suggest the authors plot the ratios between observations and model simulations, instead of absolute values.

17. Lines 3-8 on page 9366, I am curious why the model predict different peak values and regions from observations? Also why all five simulations predict relative low NO2 column (lines 15-17) over Burma in December?

18. Lines 8-11 on page 9366, it seems that shipping emissions explain a lot of variations among model simulations with different inventories (also lines 1 and 10on page 9356, line 18 on page 9362, and line 22 on page 9365). I am wondering whether it is necessary to separate shipping emissions in each inventory and show them in Table 1.

19. Section 5.2.2 and 5.2.3, the authors compared monthly-average correlation coefficients and biases across model results with five different emission inventories, and then concluded that "none of the anthropogenic emission inventories are better than the others" (lines 25-26 on page 9346). I am wondering whether it is possible to do some paired difference tests and show the significance level if the modeled results are independent on the type of emission inventory?

20. Section 5.2.4, how do the model results compare to each other when different emission inventories are used to predict NO2 columns?

<Editorial Comments>

1. Use carbon monoxide or CO (ozone or O3) consistently

2. Is the abbreviation for Chonburi CB (line 23 page 9362) or CBR (Fig. 9)? Be consistent.

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3. Line 9 on page 9364, Table 4, instead of Table 5, shows correlation coefficients.

4. Line 10 on page 9364, Table 5, instead of Table 6, shows O3 biases.

5. Show units in Tables 3 and 5.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 9345, 2014.