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Interactive comment on "**Global atmospheric carbon monoxide budget 2000–2017 inferred from multi-species atmospheric inversions**" *by* **Bo Zheng et al.**

Anonymous Referee #3

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General Comments:

The authors provide a detailed analysis to constrain CO emissions with multi-satellite measurements in the period of 2000-2017. They demonstrated decreasing trends of anthropogenic and biomass burning emissions, and noticeable influences from the assimilation of HCHO on the estimation of oxidation sources. I found their paper is interesting and helpful for people in this field. I recommend the paper for publication after consideration of the points below.

Specific Comments:

1. Abstract: I am not sure whether the biased trends in the bottom-up inventories are

still "surprising", as the bias has been found with inverse analysis several years ago.

2. Section 3.2.2: Will INV #1 and INV #2/3 have better agreement in wintertime, when the contribution from NMVOCs is smaller?

3. Figure 2b: As the largest difference is in China, it will be helpful to check whether the a posteriori simulations of INV #2/#3 match better with surface measurements in China outflow regions than that of INV #1.

4. Page 9, Line 17-18: "Therefore, it is reasonable to think that Inversion #3 has a more realistic representation of the global CO budget than Inversion #2 does, and Inversion #2 is better than Inversion #1."

It may not be as obvious as mentioned here. I agree the observations of HCHO/CH4 will be helpful to distinguish the sources from combustion and oxidation, however, why they will improve the global CO budget? The assimilation of HCHO/CH4 will affect OH, but the ability of global models to simulate OH chemistry is still weak.

5. Figure 5b: the trends are generally positive in India and negative in the rest of SEA, which is surprising. I have assumed that they will be similar.

6. Page 12, Lines 29-32: The validation with independent surface measurements is an essential part in this work. These figures should be included in the main text rather than supplement.

I found the numbers for different periods are compared directly, which will affect the reliability of the validation: INV #1 Figure S4c, 2000-2017 INV #2 Figure S6c, 2005-2017 INV # 3 Figure S8c, 2010-2017

In addition, the distributions of data points are very noisy. I cannot see any noticeable difference among those figures by my eyes.

7. Page 14, Line 24: The author name in the citation.