

AMT Review Round 2

While this manuscript is much improved, and many things that were unclear in the first manuscript are addressed, I still find many sections to be confusing and unclear. While I feel that the scientific value of this work is important, I also feel that a reader unfamiliar with the material and notation would not be able to follow this manuscript as written. The style of the presentation frequently makes statements that may be clear to the authors, but were not clear to me, and I believe will not be clear to many readers. As such, I do not believe this revised manuscript is suitable for publication until additional revisions are made that clarify the confusing aspect related to notation and equations (some of which are included in the Detailed Notes below).

In particular, while the notation and text has been improved, there are still inconsistencies in the notation that inhibit a reader's ability to follow the text and equations as well as many typos (some examples of these are noted in the Detailed Notes below). There are also many asides and tangents (such as the parenthetical in Section 9.1, L895-897 and the 8th point in Section 6.3) that, while interesting, detract from the overall message of this manuscript.

Additionally, some of the language in this manuscript lacks specificity. The word "appropriate" is used many times without much indication of what appropriate means (L19, L87, L493, L527, L537, L705, L871, L874). Similarly, the word "reasonable" is used (L190, L424, L476), but there is no discussion of what "reasonable" means in the context. On L178, the phrase "attempted very careful estimate" is confusing, and I'm not sure what was attempted and what criteria was used. There are other examples throughout the manuscript that I found confusing rather than clarifying.

Detailed Notes

L13: "US." should be "U.S."

L55: What do you mean by "Illustrations show that the theory is robust."? Why is this text a different color?

L89-101: The notation is inconsistent and confusing. Both C_{tot} and ΔC_{tot} are used, and C_{burn} has different definitions (L89: " $C_{\text{burn}} = \Delta \text{CO}_2 + \Delta \text{CO} + \dots$ "; L93: " $C_{\text{burn}} = \text{CO}_2 + \text{CO} + \dots$ "). The terminology in this manuscript is already complex, so inconsistencies like this make it very hard to follow.

L164: The shift to x and y notation is also confusing. Here the authors define x as C_{tot} , while earlier in L89 Δx is defined as C_{burn} . Is this intentional?

L175-182: I still don't understand the $a_{j \leftarrow \text{CO}}$, $a_{\text{CO} \leftarrow (\text{fire-added } C_{\text{burn}})}$, and $a_{\text{CO} \leftarrow (\text{fire-added } \text{CO}_2 + \text{CO})}$ notation, and feel that this section is still not clear. It seems to rely heavily on previous knowledge of the notation and material and does not present it clearly enough for someone new to the material to follow or understand.

Figure 2: The grey line should be labeled or mentioned in the caption. Otherwise readers are left to infer its meaning.

L313: “and the much greater similarities of the such changes of tracers” – A typo?

Figure 6: The x-axis is labelled as C_{tot} , but in L474, it is referred to as $x = C_{\text{burn}}$. Which is it?

L516: There is no Equation 13.

L516: The term y_a is used here, but is not used anywhere else, nor is in the Table of Symbols, so even one following the notation and equations closely is likely to get lost here (or at least confused and left to their own interpretation).

L543-545: The sentence that starts with “A term c_j is included...” doesn’t provide enough information as to why c_j should be zero, and mentions “inadequacies in our assumptions” but doesn’t explore these. This is confusing and needs further explanation.

Figure 7: This figure still confuses me. I’m still not clear what the dashed lines mean. From an initial glance, it looks like the points on the CO_2 , CH_3CN , Toluene = 0 line were established, and then lines to each of the CO, CH_3CN , and Toluene points drawn. I understand this is not the intention, but it’s difficult to understand. Additionally, x^0 is mentioned in the caption, but is not located in the figure. The caption mentions an “idealized example” but gives no explanation of what this example is, leaving readers to struggle to understand on their own. Also, what’s the “ $x = C_{\text{tot}}$, ppm” label at the top?

L676: The parenthetical that starts on this line does not close with a “)” anywhere.

Section 6.3: This 8 step list summarizing MERET is not clear and I’m not sure someone trying to duplicate your method would be able to follow it. Specific notes are below:

- Step 3: the notation “I” in “for each plume I” is never used again. How many are “enough samples”? Why do you select a plume “of > 4 points”? You say “subtract this from the x_i values,” but in this summary you have not stated x_i yet. This is confusing and unclear.
- Step 4: How do you normalize the tracers? Not enough detail here.
- Step 6: What’s $a_{\text{hat}_{ij}}$? is that a typo? There are multiple typos in this step. And this step includes unnecessary asides (indeed, it’s longer than the previous 5 steps). I don’t think this is necessary and hinders clarity.
- Step 7: The final sentence (with the explanation mark) has a tone that feels out of place.
- Step 8: This isn’t really a step, it’s more of a note.
- I think a flow chart or some sort of process diagram would be more helpful here.

L702: What are the impacts of the regression being “very over-determined”? This is concerning, as over-determined models are useful for specific situations and not at all for others. This needs to be addressed.

L723-725: ξ is not defined (nor used outside of this section), again leaving the reader with the responsibility on inferring meaning. In general, I found this discussion of the “effective time between independent observations” unclear.

Figure 8: Much of the text of this figure is still too small to read (e.g., what’s in the lower right corner?), and the figure overall I don’t feel is of publication quality. There are typos e.g. the upper panel legend includes “Consensus (initial est”. Also, there unexplained details: What are the numbers at the top and how do they correspond to the vertical lines? Why are there thick and thin vertical lines? How to they correspond to the horizontal lines separating the upper and lower panels, and what do these horizontal lines indicate? What is “Abs_5”? What is “Scat_5?” Why does the left-most axis extend all the way to the top of the figure?