

One remaining issue needs to be addressed before the publication of this revised version of the manuscript: the explanation of why the bulk concentrations of O₃, VOC etc. are found quite different between CMAQ and CAMx is not specific but more like a guess, and hence not convincing, though the concentration difference seems can explain the difference of apportionments between OSAT and ISAM.

I list some of the related such weak explanations as below:

Line 402-407 Given that the difference is present in the total concentration, **this is unlikely caused by different source apportionment formulation between CMAQ and CAMx**. As CAMx only gives pre-lumped VOC, it is challenging to compare individual VOC species between CMAQ and CAMx to explain this difference at current stage. Another possible reasons to cause **it could be that models have different internal treatments for advection and diffusion**, which can impact surface-level concentrations and indirectly impact chemical reactions.

Line 424-428: In Fig. 6, OSAT exhibits the same spatial distribution of MDA8 O₃ total concentrations as other CMAQ-based simulations (OP1, OP2, OP3, OP4, OP5, and CMAQ-BF), with the exception of OSAT's relatively high marine and offshore total concentrations (> 5 ppbv), which could be explained by the difference in planetary **boundary layer dynamics** or different marine chemistry configuration between the two parent models.

Line 452-454: As CMAQ and CAMx both use the same BEIS inventory data, the difference in total VOC concentrations may result from other differences between two models, like **chemistry** or deposition, accordingly, leading to higher biogenic sources in CAMx (BIO).

The actual confusion to the audience is that on one hand the authors claim that “all base meteorological and emissions inputs for CAMx were identical to those for CMAQ”, and from the Table2, it shows that the inputs of ic and bc seem the same as well. The only known explicit difference is the halogen and DMS chemistry in the mechanisms, but as the authors stated that the resulted difference should be small over the land which has been demonstrated by other studies. On the other hand, significant differences in concentrations and hourly performances are found between the two models. For example, the Tables 5 and 6 (NMB and R of hourly NO₂ and O₃), and the following statement:

Line 359-361: In Fig. 3, CMAQ and CAMx predict 360 similar O₃ concentrations during the day, but differences appear at night, with a maximum difference of 5 ppb. This disparity was discussed in Section 4.1 and can be mitigated by employing the MDA8 O₃ metric.

Such differences in performances and in the simulated hourly concentrations, plus some unexpected differences in spatial patterns of the results, it seems there are differences existing in the meteorology used in the simulations. Suggestions:

- (1) Compare the simulated spatial fields of hourly concentrations for a couple of inert species, such as EC (or even CO if no other inert species can be found), especially look for differences during the night. The purpose is to check or demonstrate if the input meteorological fields are really identical between the two models' simulations. If significantly different (most likely), then
- (2) Compare the Kzz values between the two models. In CMAQ, KZMIN is a default option for setting Kzz cutoffs to limit Kzz values over different landuse during the night. In CAMx, there is no such runtime choice, but it provides a KVPATCH program to implement such fixes to the WRF-CAMx outputs. Were KVPATCH outputs used as inputs to CAMx?

Other comments:

Table 2: It would be better to also list the model options in the table 2, such as advection, diffusion, and deposition schemes, chemistry solver, aero modules etc. In the addition, are the BC identical? It is only stated that the BC are from 12km simulations, but it doesn't say it is from the same CMAQ (or CAMx) 12km simulations or each from their own model's 12km simulations.

Line 64-65: Further, to separate the contributions and interactions of "n" sources, Stein and Alpert (1993) showed that BF would require two to the power of the number of sources (2^n 65).

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Line 263-265: As for OTHR, there is no suitable way to retain an appropriate chemical state of the troposphere after subtracting necessary emission categories, initial and boundary conditions from an original CMAQ simulation.

What is exactly OTHR? Does it mean the apportionments of IC, BC and all emissions categories don't add up to 100%? Why not?