

Interactive comment on “Modeling of HCHO and CHOCHO at a semi-rural site in southern China during the PRIDE-PRD2006 campaign” by X. Li et al.

Anonymous Referee #1

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This manuscript describes their box modeling work constrained by the measurements acquired during PRID-PRD2006 campaign. They focused on the importance of source and sink mechanisms to reconcile the observed and modeled HCHO and CHOCHO concentration. The authors claim that fresh emission, vertical and horizontal transport, and aerosol uptake processes are the major reason in the overestimation of HCHO and CHOCHO with respect to the observation. Also, they argue that care needs to be carried out in RGF factor analysis due to its complicated dependence on NMHC composition, OH, NO, NO₂, and physical/chemical processes.

I generally agree with the authors basic claims but to keep the reader motivated and

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make this manuscript more interesting, I suggest re-organizing the flow along with re-visiting the points addressed below.

Specific Comments:

I suggest discussing the result of sensitivity analysis related with missing sinks (section 4.3) first and then describing the time of day dependence in production and loss rate of HCHO and CHOCHO later. Readers may likely get lost their interest somewhere in section 4.1 and 4.2, since it is not convincing to talk about the diurnal pattern of controlling mechanisms when the model cannot reproduce neither the diurnal pattern nor the magnitude of those species.

Also, the discussion associated with night time process undermines the importance of this manuscript since the MAX-DOAS deployed on PRIDE mission did not provide any of the data during night time. I suggest keeping the analysis focuses on day time results.

Some model run comparisons by constraining HO₂ vs OH and NO vs NO₂ along with current scenario would be also interesting to explore since HCHO and CHOCHO are very sensitive to these radical precursors. Moreover, if the authors can provide some results showing a comparison of oxidation product between model and measurement, will make this paper more logical (i.e. MVK, MACR as a secondary product of isoprene, etc.).

Authors keep mentioning G1 and G2 throughout the manuscript, however, the importance of grouping them only shows in RGF analysis. For example, figures 1 & 2 and their corresponding descriptions do not show discrepancy among those days. The measured data looks more likely daily variability; the measured CHOCHO does not show any systematic difference and the measured HCHO only shows some possible difference in the morning time which may due to the influence of previous night. If authors claim the importance in grouping, I suggest making figure 2 clearer to address this point.

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In section 4.2, I suggest re-organizing the flow. The general description about RGF should come first (p. 33028 line 9 – line 14) to guide the readers who are not familiar with RGF. P. 33027 line 27, it would be interesting to describe why RGF varies with the amount of OH. Is it due to the difference in production rate or the loss process matter? How does it change with OH recycling processes?

Authors also mentioned about the sensitivity of PAN which is an indication of inhomogeneity of PRD site. Due to this reason, the importance of advection may need to re-visit. Instead of using one deposition rate throughout the whole day, it is more realistic to have diurnally varying dilution rate which reflects the physical mixing due to the boundary layer changes, horizontal advection, and dry deposition. I suggest using concentrations and emission rates of some chemical species with long life time or black carbon, as used to describe the influence of vertical mixing, to estimate the time of day dependence in physical loss term. By that way, authors can merge M1, M2 and M3 to one scenario and can emphasize the importance in aerosol uptake loss of CHOCHO and HCHO with respect to the.

Technical comments

1. P.33015, line 24: Correct “Filed” to “Field”
2. A site map represents the geographical features with major wind direction would be helpful to understand where the site is and how it is characterized for the readers who are not familiar with geography of China. Accordingly, authors may be able to add clarity to the p. 33020, line 25 – p. 33021. line 8.
3. P. 33018, line 20. Describe more about the systematic error in concentration retrieval.
4. P. 33019, line15 - line17: How does the estimated OH using JO1D differs from the measured OH during the time when measured OH concentration is available? If the estimated OH differs from the measured OH, how does it affect HCHO and CHOCHO

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modeling?

5. P. 33019, line 28: Correct “trance” to “trace”
6. P. 33028, line 19-line21: Add a reference related.
7. P. 33028, line 26: Add a reference.
8. P. 33031: I suggest changing the orders either the figures in supplement or the text description to match each other for the reader’s convenience.
9. P. 33050: the figure 2 is hard to read and the labels “a”, “b”, “c” and “d” is not noticeable.
If the grouping of G1 and G2 has some meaning in this figure, even though I missed it, try to simplify these figures using the advantage of grouping them.
10. Figure S4, figure S5 and figure S6, all the bottom figures does not matching with legend. The some of the tracers in figure S4 and figure S5 might overlay each other and that might be the reason but double check that. For the bottom figure in figure S6, it has a missing or miss-colored marker; the graph contains yellow marker which is not shown in legend.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 33013, 2013.

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