

Interactive comment on “Forecasting Carbon Monoxide on a Global Scale for the ATom-1 Aircraft Mission: Insights from Airborne and Satellite Observations and Modeling” by Sarah A. Strode et al.

Anonymous Referee #2

Received and published: 19 April 2018

General Comments

A very unique set of measurements obtained during the ATom-1 mission was analyzed throughout this study. Comprehensive data sets, both from in-situ and satellites, and a state-of-the-art global chemistry model were utilized. The analyses methods used here were reasonable and the results are presented in logical manner. However, it is not clear to me that what the scientific backgrounds are and what scientific questions the authors try to answer. What new and unique findings are discussed in this study? What can we learn from the results presented here? Specifically, why is it important

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for GEOS-5 to be able to simulate and forecast CO over the ocean? And why ATom-1 (and also the future deployment phases) was planned and how is it different from the previous campaigns, for instance, HIPPO? I think including more scientific background and contexts, and specific goals will make this article far more interesting.

Specific Comments

P1 (Abstract) – I think the abstract can be rewritten in order for it to serve as a brief summary of this study. The simplest way is to rearrange it. 1) What is the goal of ATom-1, 2) What are the observational findings shown in this study, 3) Why is the modeling study performed and 4) What the conclusion is.

P2 (Introduction) – This section can be rewritten to add clarity as well. It should include 1) Scientific background and goals of the ATom-1 (and other phases) mission, 2) What are the scientific questions ATom-1 aimed to answer? 3) What did ATom-1 sample and accomplish? 4) What is the goal of this study? In addition, the information in the third and the fourth paragraphs (lines 42-53) provides general overview, instead of specific to this study. I would also like to know what the ATom-1 specific references are. Is Prather et al. (2017) the only reference relevant to ATom-1?

Technical Comments

P3 (Section 2.1) – What are the vertical ranges of ATom-1 measurements? The accuracy or precision of the species measured during ATom-1 should be provided here.

P3 (Section 2.2) – The vertical range of MOPITT and MLS and their overlap have to be mentioned specifically. What pressure ranges do they overlap? How often did ATom-1 sample stratosphere? Are there any ground-based measurements to compare? It has to be mentioned why only the satellite data are used in the comparison. Also, why was the MODIS AOT used?

P3 (MOPITT) – I believe the current version of MOPITT is 7 not 6.

P4 (Section 2.3) – It has to be mentioned why the model is used in this study. What are

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the questions that can be answered through modeling? Is a global model the sufficient tool for this study?

P4 (L125) – What could be learned from the chemical forecasts during a field campaign, such as, ATom-1? How many pollution or non-pollution events occurred during the ATom-1 period?

P5 (L160) – Is the bias in the emissions responsible for the underestimation in the model? What about the spatial resolution of the model?

P5 (L167) – ‘As expected from the basic chemistry and seen in previous observations’ can be replaced by ‘In the stratosphere’.

P5 (L169) – ‘Underestimating the observed decrease’ can possibly be replaced by ‘showing higher CO’ or something similar.

P6 (L184)- The meaning if this sentence is unclear. So, using analysis and forecast wind fields makes no difference? Does this mean that the wind fields are the same or the results are not sensitive to the winds? And what is the reason for this?

P6 (L193 & L203) – What determines the placement of the plumes in the model? Do models misplace the plumes often?

P7 (Figure 4 description) – It is not easy to compare the data and the model simulations in this figure. I wonder what the differences (data-model, or %) would look like if it's plotted like Fig. 4a and 4b.

P9 (L306) – Full name for GFED version 4 and a citation should be included.

P9 (L312) – ‘its relative variability’ – what does this mean?

P10 (L320) - A reference is needed for Siberian biomass burning here.

P11 (L353-354) – Is this expected? And why?

P11 (L366-367) - I wonder if and how the MOPITT V6 bias drift is accounted for in this

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study.

P12 (L402) – A general website for the ATom mission will be useful to include here.

P12 (references) – Formatting of the references should be corrected to be consistent with the publication standard.

P17 & 18 (Tables 1 & 2) – A map showing all the geographical regions (with specific latitude and longitude) used in Tables 1 & 2 might be useful. I am also curious to know if it would be easier to compare the observations and the model in a form of a bar graph instead of a table (Table 2).

P18 (Fig. 1) – I wonder what would Figs. 1d-1f and Figs 1g-1i would look like if they have the same vertical ranges. The current plots give a false impression that CO is higher between Kona-Pago Pago-Christchurch than the first leg.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-150>, 2018.

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