Atmos. Chem. Phys. Discuss., 14, C9782–C9785, 2014
www.atmos-chem-phys-discuss.net/14/C9782/2014/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Uplifting of carbon monoxide from biomass burning and anthropogenic sources to the free troposphere in East Asia" *by* K. Ding et al.

Anonymous Referee #1

Received and published: 2 December 2014

Reviewer's comments on 'Uplifting of carbon monoxide from biomass burning and anthropogenic sources to the free troposphere in East Asia' by K. Ding et al.

General Comments

This work by K. Ding et al exploits satellite and aircraft-based in-situ observations of carbon monoxide (CO) along with model simulations to analyze three specific episodes of high CO concentrations observed over East Asia between 2003 and 2005. A focus of the work is on the dynamical mechanisms driving vertical transport of CO, particularly topography and meteorological effects. The manuscript is generally well written and

organized and includes a proper balance of text and graphical material. Scientifically, the paper proceeds logically and draws reasonable conclusions from the data. The use of two different types of models to track the movement of CO is quite useful. I recommend publication of this manuscript after the following issues are addressed.

Specific Comments

1. p. 28024, l. 19. The word 'contaminated' or 'contamination' (also appearing on p. 28029, l. 24; on p. 28046, l. 7; and on p. 28049, l. 12) does not seem like the best choice here; the actual point seems to be that the MOPITT vertical resolution is typically quite coarse. This is typical for satellite remote sensing products and is well understood by most users of MOPITT data. MOPITT and other CO-measuring satellite instruments can not directly measure the volume mixing ratio at a specific pressure level, but they can accurately measure average mixing ratio over a thick layer.

2. p. 28025, l. 17. The meaning of ' ... a swath of 29 pixels ...' is not clear. One cross-track scan of the MOPITT instrument actually generates 29 x 4 = 116 pixels.

3. p. 28025, l. 21. The meaning of 'complete global coverage' is not clear, since persistently cloudy areas (such as areas of the Amazon Basin) might not be observed at all in a continuous period of 16 days. Is there a reference for this statement regarding complete global coverage?

4. p. 28026, l. 6. In addition to the MOPITT version number, this paragraph should state which level of MOPITT data was used. Level 2 (individual retrievals) or Level 3 (gridded)?

5. p. 28024, l. 23. Add reference to MOPITT Version 5 validation paper (Deeter, M. N., et al (2013), Validation of MOPITT Version 5 thermal-infrared, near-infrared, and multispectral carbon monoxide profile retrievals for 2000–2011, J. Geophys. Res., doi:10.1002/jgrd.50272).

6. p. 28026, l. 4. Since MOPITT V5 data are used extensively in this paper, there

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should be some discussion of (and reference to) the results presented in the MOPITT V5 validation paper. For example, results in that paper indicate a retrieval bias in the upper troposphere. Would that explain some of the features of the MOPITT/MOZAIC comparisons shown in Fig. 2?

7. p. 28026, l. 19. Important details seem to be missing in this section (and in the captions to Figures 2 and 3) concerning the method used to identify MOPITT observations corresponding to a particular MOZAIC flight. MOZAIC vertical 'profiles' are actually produced by observations made over a slant path with varying latitude and longitude. For each MOZAIC flight, was the MOPITT collocation radius (1.5 degrees) applied to a single MOZAIC lat/lon location at a specific altitude or to all of the MOZAIC lat/lon values within some altitude range? Also, are the results presented in Figures 2 and 3 sensitive to the chosen collocation radius?

8. p. 28032, l. 22. The meaning of 'some degree of vertical sensitivity' is unclear. Does this statement refer to the ability to detect enhanced CO at a particular level, or to the vertical resolution?

9. For all case studies, what criteria were used to determine the locations and shapes of the MOPITT boxes shown in Figure 4 determined?

10. p. 28046, l. 5. Suggest replacing 'smooth MOZAIC profiles' with 'averaging kernel-smoothed MOZAIC profiles.'

11. p. 28047, l. 16. 'MOPITT satellite' should be 'MOPITT satellite instrument'.

12. p. 28048, l. 17. 'frontal activates' should be 'frontal activity'

13. p. 28049, l. 19. The last sentence of the Conclusion is unclear and seems to imply a bias in the MOPITT data. The statement 'MOPITT substantially underestimates CO in high CO episodes' really seems to be referring to the fact that remote sensing instruments like MOPITT can not resolve sharp peaks in the CO profile. This is an issue of vertical resolution and does not imply a bias.

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14. p. 28066, Fig. 4. In addition to showing the location of the airport in each panel as an indicator of the location of the MOZAIC profile (i.e., the red dots), the figure should show a series of points indicating the actual latitude and longitude of the MOZAIC data at various altitudes or pressures (e.g., at 1 km or 100 hPa intervals).

15. p. 28073, Fig. 11. In this figure, why does latitude decrease from left to right? This will certainly confuse most readers.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 28019, 2014.