

We are indeed grateful to the reviewers for their insights and critiques. The following is our point-to-point response to their questions.

Review 1:

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 cannot directly measure the volume mixing ratio at a specific pressure level, but they can accurately measure average mixing ratio over a thick layer.

Thanks for the points. These points are described in Discussion. Word "contamination" is not used.

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 $29 \times 4 = 116$ pixels.

Thanks. "4 pixels in a row" is added.

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?

The phrase is removed.

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)?

"Level 2" is added.

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).

This reference is added and discussed in this revision.

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

Yes, Deeter et al. (2013) compared MOPITT data with the NOAA aircraft measurements over North America and data from the HIAPER Pole to Pole

Observations (HIPPO) field campaign data (Wofsy et al., 2011). They found a positive bias in MOPITT V5 TIR/NIR data at 400 hPa (4%) and 200 hPa (14%). They also showed a latitude-dependent positive bias in the northern hemispherical upper troposphere in MOPITT V3 and V4 data. This study suggests an overall positive bias in the upper troposphere, agreeing with Deeter et al. (2013) in magnitude and sign, in MOPITT V5 data. We have added the discussion for 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?

The radius of 1.5° is applied to a selected MOZAIC profile at 500 hPa so that the MOZAIC slant path can be included. Only when the entire slant path is within the radius, the MOZAIC profile is selected. Because of adequate MOPITT samplings in the radius, the results in Figures 2 and 3 are not affected much by slight change in 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?

We clarified this in this version of the manuscript. The vertical sensitivity is demonstrated through (1) the strongest CO source among the three cases was captured by the largest magnitude of CO enhancement of 200-250 ppbv from the a priori, (2) the altitude of the maximum CO enhancement was detected around the middle troposphere, in contrast to the other two cases which show the maximum in the lower-middle and upper troposphere, respectively, and (3) the elevated CO was over a broad range of altitudes as the vertical resolution of MOPITT is rather coarse, i.e., the maximum DFS is about 2.5 (Figure 1).

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

The criteria are to ensure enough samplings of MOPITT measurements (no less than 30 data points) at the closest upwind direction of MOZAIC measurements. We have explained this in the caption.

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

Changed.

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

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

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 cannot resolve sharp peaks in the CO profile. This is an issue of vertical resolution and does not imply a bias.

This sentence is removed.

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).

Thanks for the suggestion. The geographic locations of MOZAIC data at 900, 600 and 300 hPa are now added in Figure 4.

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

Figure 11 and Figure 6 are re-plotted with increasing latitude from left to right.