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Atmospheric Measurement Techniques Discussions

Interactive comment on "Radiance-based Retrieval Bias Mitigation for the MOPITT Instrument: The Version 8 Product" *by* Merritt N. Deeter et al.

Anonymous Referee #4

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This paper describes version8 of the MOPITT CO retrievals and of its associated data record. Despite being short and technical, the paper deals with an increasingly important aspect of satellite remote sensing, which is the consistency and homogeneity in the time series at level 2. By targeting CO, a so-called indirect climate variable, and relying on the longest time-series available from satellites (almost two decades with MOPITT), this paper is a very useful reference. To achieve this consistency in the CO time series for version 8, an empirical and "dynamical" radiance correction scheme is proposed. The methodology is well described and the results give convincing evidence of its benefit in V8 over previous versions. New validation results using recent aircraft measurement campaigns (from ACRIDICON-CHUVA, KORUS-AQ and Atom)

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are given as well, and these provide an additional support for the proposed radiance-bias minimization scheme. The paper is extremely clear and very well written.

For these reasons, I recommend publication of the paper in AMT. I list below a few comments or questions that the authors may want to consider to possibly improve or clarify some aspects of the paper.

- Page2, discussion around Figure 1: the drifts compared to the measurement flasks are mostly positive below 500 hPA and negative above. In the total columns this results in almost no drift. This could be indicated from the start (around line 25).

- Page 2, line 30: To explain the latitudinal-dependent bias in the V7-TIR only CO, the water vapor field is suspected to be a cause. From Figure 3 it seems indeed obvious that water plays a role and this is one of the reason for the bias correction » suggestion to remove “perhaps” on line 30?

- Would a figure showing the (global? hemispheric?) averaged retrieved profile from v7 and V8 with the associated standard deviation not be insightful? Is this possible and does this add something?

- Page 5 top; it would be useful to see how to new way to calculate the averaging kernels in v8 affects the averaging kernel calculations. Also, is there an impact on the validation between V7 and V8 that could potentially be related to the AVKs calculations?

- Page 5, line 10. Remove parentheses for that sentence?

- Page 5, equation 5. Is x_true different than x_cmp from eq. (3)? I understand that x_cmp is more general but for this paper is the distinction useful?

- Page 6, last sentence before section 3.1; I would suggest to move this sentence earlier in section 2.3

- Figure 5 is similar to Figure 1 for the new version. When discussing Figure 5 on page

7 it would be good to refer the reader to Figure 1 for a useful comparison

- Figures 5 and 6 are convincing on what the dynamic bias-correction brings. Nice results; well done.

- Figure 8 compares the new CO profiles from V8 to more recent reference measurements from aircrafts. As said before, this is useful and again convincing. It would, however, be nice to show (or at least comment) how V7T performs compared to these reference dataset (in comparison to V8T).

- Page 8. The last sentence before section 3.3 refers to biases at high northern latitude but looking at Figure 8 one has the feeling that there are almost no measurements in the latitude band 60-90 N. Is that the case and could you please then indicate how significant this bias is?

- Comparing Figure 12 and Fig8 one sees that the biases in v8 are larger for the TIR-NIR retrievals than for the TIR only. Was this feature also there for v7? Is there a known reason for this?

- Check if the reference Worden et al., 2013 is cited in the text.

- Caption of table 2: correlation coefficients are given between retrieved quantities and corresponding a priori quantities. Is it a priori or reference?

- Would it not be possible to make a single table out if Tables 4-6? This would be nice and also helpful to easily compare the results from each validation set.

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