

Interactive comment on “On biases in atmospheric CO inversions assimilating MOPITT satellite retrievals” by Yi Yin et al.

M. Deeter

mnd@ucar.edu

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As listed below, the manuscript submitted by Yin et al. contains a number of errors with respect to the interpretation and treatment of the MOPITT data.

1. Section 2.1 includes several potentially serious errors. First, MOPITT total column values are not 'total column integrated dry air' values (line 135), since retrieved MOPITT total column values quantify all of the CO molecules in a vertical column (per unit area), regardless of the moisture profile. Does this error affect the way X_{co} is calculated? There are also several problems with respect to the authors' understanding of the MOPITT retrieval algorithm. Eq. 1 is not itself used in the MOPITT retrieval algorithm to calculate retrieved CO profiles or total column values, as the manuscript implies; really this equation just describes the expected relationship between the re-

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trieved profile, a priori profile, and true atmospheric state in a 'maximum a posteriori' retrieval method. Eq. 1 contains a term A' which should actually be the total column averaging kernel (a vector) and not the averaging kernel matrix (line 144). Did the authors use the total column averaging kernel or the averaging kernel matrix in their calculations? Also, the term in parentheses in Eq. 1 generally represents the difference between the true atmospheric state and the a priori profile (rather than the difference in a model profile and the a priori). The paper also suggests that the x_{mod} term in Eq. 1 (which should be replaced by x_{true}) is somehow based on information gained from a 'radiance transfer model' (line 141). This is also incorrect. Calculation of the total column averaging kernel depends on assumed delta-pressure values for the MOPITT retrieval grid. The level-layer scheme which defines the delta-pressure values for V6 is described in the V5 validation paper (and V5 User's Guide). The level-layer scheme used in V5 and V6 products is the same, but is different than the scheme described in the V4 User's Guide. Did the authors use the proper level-layer scheme? Finally, it is not reported exactly how X_{co} is derived from C , the MOPITT CO total column.

2. The manuscript cites the MOPITT V6 validation paper, but does not include a review of the validation results for the V6 TIR/NIR product, and does not make use of those results when interpreting the posterior simulations. These earlier results represent the most direct method for quantifying the MOPITT retrieval bias and are clearly relevant to the work presented in this manuscript.

3. In Section 4, posterior simulations based on MOPITT X_{co} observations are compared with MOPITT retrieved profiles. However, for these comparisons, it is not clear whether or not the posterior simulations have been transformed with the 'observation operator' (i.e., $x_{\text{sim}} = x_{\text{a}} + A(x_{\text{posterior}} - x_{\text{a}})$), which is necessary to make a proper comparison.

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