Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2017-166-SC1, 2017


Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "On biases in atmospheric CO inversions assimilating MOPITT satellite retrievals" *by* Yi Yin et al.

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Received and published: 6 April 2017

Comment by Helen Worden and Zhe Jiang, NCAR MOPITT team

We do not think the authors have demonstrated their conclusion that assimilating MOPITT total column CO is superior to assimilating CO profiles since they did not show results from both assimilation types. Rather, they show comparisons to MOPITT retrieved profiles and other correlative data after assimilating the column quantities. These comparisons show biases already noted in MOPITT validation (Deeter et al., 2013;2014) and other assimilation results (e.g., Gaubert et al, 2016, Jiang et al., 2015;2016).

The paper states: "the number of retrieved layers exceeds the number of independent information available vertically". While this is true, the MOPITT CO profiles still have degrees of freedom for signal (DFS) > 1, (Deeter et al., 2015), where DFS=1 is the



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most that can be obtained from a total column quantity. A method to assimilate only the independent layers (using singular value decomposition) along with the transformed full aposteriori error covariance is described in Mizzi et al., (2016).

In particular, the authors should demonstrate the following to substantiate their conclusion:

1) That assimilation results with MOPITT profile data, after bias corrections. are significantly worse than column assimilation as compared to independent CO observations.

2) That the vertical information (DFS $\sim$ 2.0 for profile vs. 1.0 for column) has no significant impact on the assimilation in correcting the vertical distribution of CO.

Added references: Deeter, M. N., D. P. Edwards, J. C. Gille, and H. M. Worden (2015), Information content of MOPITT CO profile retrievals: Temporal and geographical variability, J. Geophys. Res.-Atmos., 120(24), 12723–12738, doi:10.1002/2015JD024024.

Mizzi, A. P., Arellano, A. F., Edwards, D. P., Anderson, J. L., and Pfister, G. G.: Assimilating compact phase space retrievals of atmospheric composition with WRF-Chem/DART: a regional chemical transport/ensemble Kalman filter data assimilation system, Geosci. Model Dev., 9, 965-978, doi:10.5194/gmd-9-965-2016, 2016.

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Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2017-166, 2017.



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