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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Identifying convective transport of carbon monoxide by comparing remotely sensed observations from TES with cloud modeling simulations" *by* J. J. Halland et al.

Anonymous Referee #1

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General comments:

Halland et al. present a case study of convective transport of carbon monoxide from the surface to the free troposphere. A squall line that is similar to one occurring during the NASA INTEX-B mission is simulated in a cloud model. The authors further investigate the ability of Tropospheric Emission Spectrometer (TES) aboard EOS Aura satellite to observe the convective transport around the same time period. This is a nice attempt to test the possible ability of satellite to observe vertical transport. The paper is well organized, and well within the scope of ACP. I recommend that the paper be published after minor revisions.

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Discussion Paper

The largest concern I have is that the actual evidence of TES observed convective transport only relies on a single retrieval (profile 7 in Fig. 19a), but I understand finding more cases is difficult due to the cloud interference in retrievals and the sparse sampling of TES. The issue is that TES is using geographical variable a priori profiles averaged from MOZART model output (eg. refer to J. Logan et al. GRL 2008), which means the observed change between profile 7 and profile 10 in Fig 19a may largely result from the different a priori profiles. The authors need to confirm that this observed difference does reflect the convective transport in the real atmosphere, not from the a priori profiles.

Specific comments:

Page 19202, Line 14, The abstract states 'Maximum updraft speed is found to be unimportant in determining the net CO flux transported by a storm', and as well in the conclusions (page 19220, line 22) that 'Sensitivity tests revealed that although updraft speed was unimportant in determining the net CO flux transported by the storm'. However, no sensitivity test is described in the text (eg. in Sect. 3.2). Some additional text or modifications are useful.

Page 19205, Line 26, I think the statement 'TES utilizes a completely different technology than previous CO remote sensors'; is too strong. TES retrieves CO at the same spectral regions as MOPITT. They both use the optimal estimation method and comparable vertical information (refer to Luo et al., JGR 2007).

Page 19210, Line 24, The sentence that 'CO profiles then were made from the GEOS-Chem output at each TES footprint as discussed in Sect. 2.6' is not clear. Sect. 2.6 does not discuss how GEOS-Chem output is sampled, and the study uses a single profile from GEOS-Chem.

Page 19211, Sect. 2.6, This section needs to be clearer. For example, on Line 13, add 'using the Eq. (1)' after 'CO retrievals were calculated'. Also on Line 18, delete 'a priori background'; to avoid confusion with the a priori profile in Eq. (1).

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Page 19214, Line 17, How are the values in Table 2 calculated? This shall be explained here. Are they the total flux for the 8-h simulation period? If so, the unit in the title of Table 2 shall be metric tons.

Page 19217, Line 15, What is the thermodynamic profile? Should it be the a priori profile as in the equation (1)?

Technical corrections:

Page 19213, Line 28, Should be something like 'the longer the relatively clean downdraft air influences an area'

Page 19214, Line 4, Equation (2) would be better to be expressed with mathematical symbols. Also Dickerson, 2005 is not listed in the References.

Page 19233, Fig. 5 'W' in the title is not mentioned. I suggest change W to vertical velocity.

Page 19234, Fig. 6, 'Min' shall be removed from the title. Fig. 6 is not discussed in the text, so I think it can be removed.

Page 19235, Fig. 7, The labels shall be larger. They are hardly seen. This is also for the colorbars in Fig 10, 15, 16, 17, and 19. The Fig. 6 and 7 can be improved by removing the term 'Reference Vectors' in the legend box and reducing the margin between panels.

Page 19240, Fig 12, Increasing the font size of labels on the colorbar is helpful. Also '-' is missing for the first label.

Page 19242, Fig 14, I think Fig 14a and b have nearly the same information, and one of them is enough. This is also for Fig 19b) on Page 19247.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 19201, 2008.

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Interactive Comment