

Interactive comment on “Winter- and summertime continental influences on tropospheric O₃ and CO observed by TES over the western North Atlantic Ocean” by J. Hegarty et al.

Anonymous Referee #1

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ACP Review: Hegarty et al. 2009

This paper gives a comprehensive classification of winter & summer TES ozone and carbon monoxide measurements according to defined meteorological conditions. It is well referenced and clearly written. I recommend publication after minor corrections.

General comments:

- 1) The paper is well organized, but too long. Any compression of sections 5 and 6 would be helpful, but it is hard to make specific suggestions.
- 2) The authors refer several times to the climatological a priori used by TES as intro-

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ducing artificial structure. In fact, this variable a priori allows TES to retrieve O₃ more accurately, especially in the tropopause region, which changes significantly with latitude and is where TES has somewhat lower sensitivity (and therefore retrieved profiles have more contribution from the prior). Although I agree that a common prior should be substituted when an analysis is trying to examine spatial or temporal variability due only to measurements, it does not necessarily produce an optimal retrieval, especially over a large latitude range. I have tried to address this in the specific comments with changes to words such as “artifact”. Please plot or list the vertical profiles of the assumed universal priors that were used for CO and O₃ and say something about the assumed tropopause for O₃ (i.e., whether or not it is appropriate for these mid-latitude cases.) For CO, you could include the a priori profile in Figs 7b, 9b.

3) There is no discussion of the TES uncertainties that are reported with the data. In the case of seasonal averages (large N) the error could be assumed to be the error of the mean (σ/\sqrt{N}) and might be small enough, i.e., within a color bar, for the distribution plots. (If this is the case, it needs to be stated somewhere). However, for the O₃-CO correlation, retrieval errors can be important, as shown in Zhang et al., 2006. This could be referenced specifically.

4) Please add a list of acronyms and make sure all are defined at the point they are first used (e.g., WCB, DA, PCF).

5) Figure captions should refer to the tables where the map types are defined.

6) Global replace Ederling with Eldering.

Specific comments:

7) Abstract – lines 35,36. Change wording to: “...reprocessed to remove the influence of the a priori on geographical and seasonal structure, exhibited strong seasonal differences.”

8) Abstract line 43: Are the O₃-CO slopes 0.15-0.20 or 0.15-0.23? (as in Sec. 4).

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- 9) Abstract line 57: Include a short summary sentence at the end of the abstract, e.g., "For both seasons, we demonstrate clear associations of enhanced CO and O3 measurements with corresponding meteorological conditions."
- 10) Section 1 Intro: line 93 - define DA
- 11) Section 2.1 TES Data. TES CO data products after Dec. 2005 have higher sensitivity due to better optical alignment after a change to the optical bench operating temperature. This might not be that important here since you are not looking at interannual variability, but since you include specific cases from June 2005 (in figure captions, but not text), you might want to include this in the data description.
- 12) Section 2.1 lines 147-149: wording change to: "Because the climatological a priori adds spatial and temporal structure that could potentially obscure the real variability we would like to examine, (Zhang et al, 2006), we removed this a priori structure by reprocessing..."
- 13) Section 2.1, line 151, include reference to S. S. Kulawik et al., ACP 2008. (as already included in the online comments) on the validity of swapping the a priori.
- 14) Section 2.1, line 151, maybe in this paragraph, as mentioned above, please show or list the universal a priori O3 and CO profiles that were used.
- 15) Section 2.2, line 178 – edit "of the use of the use"
- 16) Section 2.2, Explain the GDAS and EDAS modes for HYSPLIT.
- 17) Section 3.2, line 289 – change "descending DA airstreams" to "descending dry airstreams"
- 18) Section 4: line 329 – give a definition of "significance level p". Do you consider measurement errors in this?
- 19) Section 4 line 331 – could add reference here to Zhang et al, 2006 about how TES retrieval errors will also tend to reduce the observed correlation.

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- 20) Section 4: line 340 – "one representing and active" should be "an active"?
- 21) Section 5.1 lines 415-418 – to examine the possibility of higher/lower sensitivity at 618 hPa, you could look at a map of the TES AK diagonal at this pressure. (just a suggestion - not a requirement for this paper)
- 22) Section 5.1 line 423 – "...instruments such as TES are less sensitive to CO" – Don't you mean "more sensitive"?
- 23) Section 6.3 line 664 – Text refers to June 2006, but figures 22,23 have June 15, 2005. Please make these consistent.
- 24) Section 7 line 699-702 change to "While the climatological a priori used in the TES retrieval process may add temporal and spatial structure to the retrieved distributions, the observations were reprocessed with a universal a priori to remove this effect".
- 25) Tables 1a, 1b, horizontal lines separating Map Types would be useful.
- 26) Tables 2 & 3. What is the significance if a or b is not given? Also, Tables 2 & 3 could be combined.
- 27) Figure 1. As in general comment, refer to table 1a for definitions. Also helpful to define WCB, PCF, DA, W2 in the figure caption.
- 28) Figures 3, 4 – Could use common color scale for CO (b, d) maybe saturating at 125 ppb.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 23211, 2009.

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