Comments to the authors

The authors make the subject worth of studying by laying groundwork to guide readers into the topic. The paper is written in a clear, concise and simple language. However, I have few comments that I would like the authors to consider.

Since Z_{Ld} is the lowest height at which the MP and PTP deeply diverge and it illustrates the penetration depth of the tropopause height as well as stratospheric air contamination, the partial columns in the height between Z_{Ld} and Z_{DT} (i.e., UTC(X, t)) sounds more like the tropopause layer column. Caution should be taken in determining Z_{Ld} with few data (for example, Figure 6: China in January, February, April, December as well as Uaemi in October, November) since lack of enough data cause a significant error in the calculation of the monthly-averaged Z_{Ld} height.

The PTP was calculated (if $z_{top} < z_s < z_{DT}$) using Mfit(X, $z_{\Delta f}$, s), the best-fitted line from MOZAIC data using a linear regression on $\overline{TP(X,z,s)}$, from 5 to 11 km for O_3 and from 8 to 11 km for CO. What is the reason for using different height ranges for O_3 and CO? Is there any particular reason for not using MP from the surface up to (z_{top}, if $z_{top} < z_{DT}$ and z_{DT}, if $z_{top} > z_{DT}$) ?

In calculating the monthly-averaged $PTC_m(X,t)$, the seasonal based Z_{DT} is used instead of the monthly-averaged Z_{DT}? Is it not possible to get the monthly-averaged Z_{DT}? It would also be better if the authors reason out why they prefer to use seasonally-averaged profiles but monthly-averaged columns and partial columns. Please include the reason in the introduction section to guide readers.

It would be great if the author could mention in the paper the percentage of the MP data with

1. $Z_{DT} < Z_{top}$
2. $Z_{top} < Z_{DT} < Z_s$
3. $Z_{top} < Z_s < Z_{DT}$

Please provide equation # for all equations in the paper

P14705L25 and P14706L1: "in USsouth and Uaemi between 1 and 4 km all over the months due to intense domestic traffic." This sentence needs clarification. I took me a while to understand what it meant. Did you mean that most of the data were collected using small aircrafts that flew well below the

tropopause? Please rewrite this sentence because it is really vague. Can you please mention what percent of data of other sites were collected using such domestic flights and international flights.

P14708L16-17: "Intense photochemical activity is detected there in spring" Who detected it? How detected it? Please cite reference

P14710L16-17: " Over all these sites, a sharp May–June CO depletion highlights the intense photochemical activity" How did you know? Please cite reference

P14710L16-17: " The July bump over USeast results from the impact of North American boreal fires, during the summer of 2004 (Turquety et al., 2007)". Is the July bump ONLY as a result of the fire in 2004? There were other intensive wild fires during the period of this climatology study, for example in 1995 and 2006. I expected a July bump in the USlake as well but I did not see it. Why?

The next section is to point out the minor error that I found on the manuscript.

Figure 3: Please put horizontal color bars that show the altitude at the bottom of each figure
Figure 4: Please put legend in one of the figures
Figure 5: Please put legend in of one of the figures

P14701L16: replace "]z_{top},z_{DT}]" with "[z_{top}, z_{DT}]"
P14701L19: replace "]z_{top}, z_s]" with "[z_{top}, z_s] "
P14701L19: replace "]z_s,z_{DT}]" with "[z_s, z_{DT}]"
P14703L23: replace "]z_{top}, z_{DT}]" with "" [z_{top}, z_{DT}]"
P 14704L13: replace" only in March " with "during all months except March"
P 14711L29: Replace "March" with "April".
P 14713L20: Insert "below 0.5 km" between "CO" and "is"
P 14719L13: replace "Tokyo [138.7–140.7^o N, 35.6–37.6^o E]" with "Tokyo [35.6–37.6^o N, 138.7–140.7^o E]"
P14723L28: replace " L_d" with " Z_{Ld}"
P14724L1: replace " L_d" with " Z_{Ld}"
P14724L2: replace " L_d" with " Z_{Ld}"
P14724L2: replace " overage" with " average"