Review:

This paper presented an improved tropopause-based (TB) ozone climatology and demonstrated that it provided better constraints to ozone profile retrieval in the UTLS from BUV radiances using OMI examples.

   The authors constructed this TB ozone climatology by mapping ozonesonde profiles in the altitude coordinate to the TB (i.e., height relative to local tropopause) coordinate, then binning by month and latitude band (10°) to derive a set of mean ozone profiles and their standard deviations. Different from the altitude-based (AB) climatology, the ozonesonde values at different altitudes may be mapped into the same relative height as the tropopause varies from time and location, and the resulting climatological profiles are shown in this paper to have better statistical characteristics to capture (represent) the climatological ozone variability in the UTLS region, compared to the traditional AB ozone climatology.

   However, since this advantage of TB climatology was confined to within a few kilometers (km) around the tropopause in the extratropical regions, the authors constructed the new ozone climatology in such a way that the ozone profiles smoothly change from TB means to AB means once the distance is beyond 5 km from the tropopause. This was accomplished using a variable shifting offset (Eqs. 1 and 2 of the paper) in mapping the altitude to TB coordinate, but in doing so the ozonesonde profile may be squeezed or stretched vertically (see figure below), depending on the relative difference between local tropopause height and the zonal mean tropopause height.
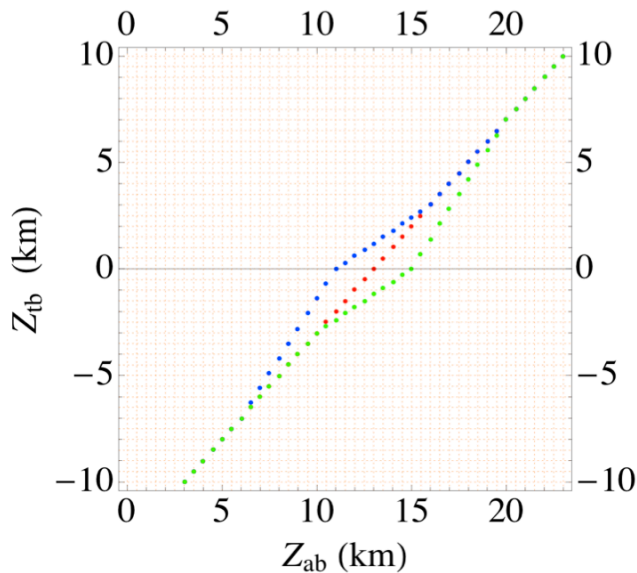
This figure illustrates the mapping from AB coordinate (Z_{ab}) to TB coordinate (Z_{tb}). The sample points for ozonesonde profile are shown at a 0.5 km interval. The mean tropopause height is $\overline{h_{tp}} = 13$ km, the red dots are for local tropopause height $h_{tp} = 13$ km, the blue dots $h_{tp} = 11$ km, and the green dots $h_{tp} = 15$ km. When $\overline{h_{tp}} = h_{tp}$, the mapping is uniform (red dots), without altering the spacing of the sample points; but when $\overline{h_{tp}} \neq h_{tp}$, the measured profiles are either squeezed or stretched (blue and green dots around $Z_{tb} = 0$) when mapped into the TB coordinate.

   An additional improvement of the new TB climatology included the separation tropical and extratropical ozone profiles at the thermal tropopause height of 14 km. The ozonesonde profiles with higher tropopause were used to derive the tropical climatology, and those with lower height went into the extratropical climatology. Consequently, this

TB climatology, with the knowledge of tropopause height, provides ozone profiles closer to the real ozone profiles than the AB climatology does, statistically.

Clearly their efforts have substantially improved ozone retrievals from BUV measurements, because an OE retrieved profile is a mixture (weighed average) of the true and the *a priori* (in this case the climatological) ozone profiles, and hence the closer resemblance of the *a priori* to the true profile yields a more accurate retrieval in general. This paper provided selected comparison results from OMI retrievals to illustrate the improvements achieved with the use of this new TB ozone climatology. I recommend publication of this paper on AMT.

Specific comments:

Page 4334, lines 21- 23, "The third improves the climatology above ozonesonde burst altitudes and in the stratosphere by using climatology derived from many more satellite observations of ozone profiles." Is this really an improvement or merely the same as the existing (LLM) climatology?

Page 4335, line 6, "demonstrated"-> corroborated?

Page 4337, line 12, "originate from the a priori information", probably it is more clear to state: originate from the mismatch between actual ozone profile and the *a priori* ozone profile

Page 4339, line 16, "troposphere" -> stratosphere

Page 4340, line 11, "local and time dependent" -> location and time dependent

Page 4341, lines 10 – 27, this paragraph describes the use of variable offset term Z_{offset}. The algebraic aspect is clearly written here. However, it probably needs a description to help visualize the coordinate mapping process. It may also need to emphasize in the paper that this elaborate mapping is done only during the climatology construction from ozonesonde profiles; on the other hand, a vertical shift aligned with the tropopause height is all that is required when using the climatological profile as an *a priori* in altitude coordinate.

Page 4336, lines 19 – 20, "reducing fitting residuals in the Huggins bands to 0.1–0.2%". This residual magnitude refers to the accomplishment of earlier works by Liu et al., but how do the fitting residuals change with the use of this improved ozone climatology? Do the improved profile retrieval comes from the better *a priori* knowledge only, or this also facilitates the extraction of more information from the measurements as well?

Page 4348, section 5: This section contains results of comparisons between retrieved profiles ($x_{retrieved}$) and ozonesonde profiles (x_t) before and after its convolution with OMI Averaging Kernels (A). Specifically, were the comparisons between $x_{retrieved}$ and $\{A \cdot x_t\}$ or $\{x_{a\ priori} + A \cdot (x_t - x_{a\ priori})\}$?

Comments on Figures

In general, the quality of figures is not high (resolution too coarse) in the draft. Especially for Figure 11, the thickness, the color scheme, and the overlapping of lines make it hard to distinguish from each other even when the figure is enlarged with a PDF viewer.

Figure 1: It may be helpful to put the size of latitudinal bands in the caption as well. Since only 3 bands on each hemisphere were plotted here, one may think the 3 bands cover the hemisphere.

Figure 6: Color lines over plotted on color images are really difficult to see from the background in Figure 6. Consider black or white lines with different plotting styles (e.g. dotted, dashed, dot-dash, labeled with symbols, etc…).