We thank the reviewer for his/her comments. Below are our responses in blue.

The main changes were:

- We added the main conclusion to the abstract
- We modified the symbol size for the ozonesondeds and lidar in figure 1
- We added a rationale for the period and datasets used.
- We added a rationale for the usage of "zonal" means.
- We added a brief discussion of the WMO multiple tropopauses and tropopause breaks
- We added several references as suggested by the reviewers.

Review by Reviewer 1

This study explores ozone variability in the upper troposphere and lower stratosphere using plenty of coordinates. The results show obvious differences in either ozone concentration its variability while choosing different coordinates. Such results give important hints in detecting changes in ozone on different time scales and in different regions, and support to the OCTAV-UTLS activity. The manuscript is well organized and written in English. I would recommend an acceptance after some minor revisions.

Comments:

Abstract: It would be better to summarize the main findings in this manuscript.

We added at the end of the abstract: Overall, the use of equivalent latitude-potential temperature leads to the most substantial reduction in binned variability across the UTLS. This coordinate pairing uses PV on isentropic surfaces thus following the transport of tracers in adiabatic frictionless flow.

1. L60-70: Here, the authors describe the 'geophysical variability' and its importance. However, it is not clear for how to distinguish the 'geophysical variability' and the true variability. In the analysis of this study, the authors evaluate different coordinates by comparing the relative standard deviation of ozone presented by different coordinates, but did not explain why reduced relative standard deviation is better. I think the relative standard deviation includes both 'geophysical variability' and the true variability, what is the scientific meaning of a reduced relative standard deviation?

The reviewer is correct. The relative standard deviation encompasses dynamical variability, atmospheric trace gas "chemical" variability, and 'geophysical noise'. The

purpose of reducing the relative standard deviation of the binned data is to minimize the geophysical noise contribution to study a more realistic representation of the dynamical and trace gas variability. Lines 75 – 79 of the original manuscript describe this (which has been slightly modified for clarity): *In other words, process-related coordinates can reduce binned variability* ***(i.e., reduce the contribution from the geophysical noise****), highlighting a more realistic representation of the geophysical and trace gas variability….*

2. Section 2.2.2: In this section, the authors want to examine the effects of different coordinate systems on the representation of geophysical variability. However, the descriptions to each figure are very simple. I would suggest the authors to describe in more details to help the audience to understand the 'geophysical variability'.

   In that section we introduce the coordinate systems using the mean values of ozone. In section 3, we discuss the RSTD (the variability) for the same coordinate systems in the same figure layouts. Thus, we don't think it is needed to add the discussion about the variability at this stage. That said, to introduce further the idea of the impacts of the different coordinate systems we added the following sentences:

   Figure 2 illustrates the redistribution of ozone across these three coordinates when plotted versus latitude as the horizontal coordinate. *While the ozone distributions share some broad similarities, notable differences are observed, showcasing the impacts of using different vertical coordinates. The impact of these coordinates on the ozone variability will be discussed in section 3.*

   An example of these relative coordinates is illustrated in Figure 3, which shows ozone plotted as a function of latitude and potential temperature relative to the three tropopauses used in this study. *Tropopause coordinates segregate measurements taken in the troposphere from those taken in the stratosphere, leading to strong gradients at the zero coordinate level (i.e., the tropopause). The usefulness of these coordinates in minimizing binned variability depends on how well the corresponding tropopause captures these ozone gradients, as well as the vertical resolution of the measurements in question.* The bounds of the vertical coordinate grids…

3. L274: it is evident that. Done

4. L398: the use of tropopause or subtropical jet 'vertical coordinates', should be horizontal coordinates? This sentence is confusing, please rewrite it.We want to

remind the reviewer that the subtropical jet can be used in the vertical, for example when referring to the altitude of the jet core, or in the horizontal, when referring to the latitude of the jet core. The sentence was changed to: Across all datasets, referring to the tropopause or STJ core in the vertical leads to greater binned variability in altitude based coordinates compared to potential temperature based coordinates, irrespective of the horizontal coordinate used.