Reply to comments by Reviewer #1

Thank you very much for useful suggestions which helped us to improve the manuscript.

In the followings, black letters show your comments and blue letters show our reply.

General comments:
This manuscript is very good and shows that much of the tropical SS-SR differences (or SSDs) in stratospheric ozone occultation measurements (SAGE II, HALOE, and ACE-FTS) can be explained by the related tidal and seasonal variations of the vertical winds. Among the possible causes of the observed SSDs are (1) systematic instrumental/ retrieval biases for SR and SS ozone, (2) natural diurnal variations, and (3) measurement sampling issues. Although item (1) was not addressed in any detail in this manuscript, items (2) and (3) were considered thoroughly and accounted for mostly with the aid of the SMILES (submillimeter) diurnal ozone dataset and with the model ozone output from SD-WACCM. I recommend that the manuscript be published, but I also urge the authors to correct the important omissions and respond to several of my questions as they relate to the occultation datasets themselves (see below).

Specific comments:

1. Data description: Of primary importance for all three datasets (SAGE II, HALOE, and ACE-FTS) is whether there could be any differences in how they acquire and track the Sun with altitude during SR and SS. As it stands, the reader must accept that all transmission profile measurements were taken, calibrated, and processed to ozone mixing ratios perfectly.

The following description will be added in the revised manuscript:

"Note that there is no systematic difference in the tracking procedure between SR and SS. SAGE II tracks the Sun by moving the field-of-view across the solar disk. As the field-of-view went off the edge of the Sun, the scan-mirror reverses direction. HALOE tracks the top edge of the sun, with the science FOV held a fixed angle below this. Extensive SR/SS comparisons have been carried out over the 14-year measurement record and no significant bias in tracking is perceivable. The ACE-FTS is aligned by a tracking system that keeps it pointed at the radiometric center of the sun. While there might exist a very small difference between SR and SS tracking, this has been examined carefully and no significant SR-SS bias exists."

2. SAGE II: SSDs from this experiment are larger than those of the others, particularly in the upper stratosphere (Figure 5), and the authors speculate as to why. With regard to one of your points in Section 5, can you say already whether there are any differences in the diurnal densities between the MERRA and SD-WACCM output?

Figure A1 shows the line plot of diurnal variations in temperature on pressure levels (N.B. on pressure levels, the density changes follow the temperature changes). It is seen that the results from MERRA and SD-WACCM are in good agreement. In this sense, this paragraph seems contradicting to the readers. Thus, in the revised manuscript, we will shorten it and avoid detailed discussion as,

"Another related issue may be the reproducibility of tides in SD-WACCM and reanalyses. Satellite measurements use, more or less, (re)analysis data for the altitude registration and/or the retrieval process. It is found that the amplitude of diurnal tide in SD-WACCM and reanalyses is up to ~50% smaller in the upper stratosphere compared to than in data from the Sounding of the Atmosphere using Broadband Emission Radiometry (SABER) measurements (version 2.0 data) (not shown; see Sakazaki et al. 2012 for the comparison between SABER and reanalyses). This could affect any of the satellite datasets, but a further study is needed for a more quantitative discussion."

3. HALOE: SSDs from HALOE agree well with those from SMILES and SD-WACCM in the upper stratosphere but not so well below about 35 km (Figure 5a) or above 55 km (Figure 8). Therefore, HALOE ozone has anomalies, too. No appropriate reference was given for its Version 19 ozone; refer to Randall et al. (Validation of POAM O3, JGR, 2003) for a more up-to-date and complete discussion. The lack of agreement at 55 km (Figure 8) must be due to photochemical changes at SR and SS rather than to tidal vertical winds and may be correctable in the HALOE algorithm (refer to Natarajan et al., JGR, 2005). Please include a comment about these two anomalies to give a more balanced and fair assessment of the datasets.

Thank you very much for the useful suggestions. Randall et al. (2003) will be added in the revised manuscript.

Because the results from HALOE are consistent with those from other satellite data (Figure 5), we think that the disagreement between the HALOE and SD-WACCM is attributed to any issue in SD-WACCM data. One possible reason is that for creating satellite-coincidence subset data, the altitude dependence of longitude, latitude, and time has not been considered (Line 21 of page 16054). This point will be described again in Section 4.1 in the revised manuscript. At the same time, we will

mention Natarajan et al. (2005) in the manuscript as a possible candidate. Thank you for the useful information.

4. ACE-FTS: Although seasonal sampling is a slight issue in the tropics for these data, I agree that ACE ozone profiles look very good based on the results in Figure 5.

Thank you very much for the friendly comments!

Thank you very much again for your suggestions. Please also refer our reply to Reviewer #2 for further revisions.

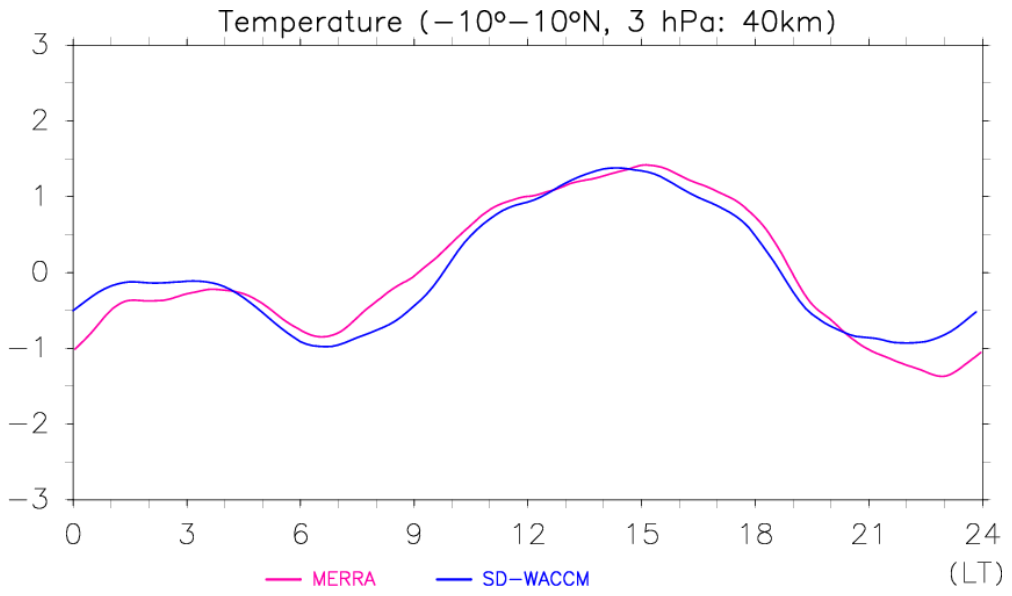

Figure A1: Diurnal temperature variations (K) averaged between 10°S and 10°N at 3 hPa level, as derived from (purple curve) MERRA and (blue curve) SD-WACCM during 2008-2010.