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Atmospheric Chemistry and Physics Discussions

Interactive comment on "On the detection of the solar signal in the tropical stratosphere" *by* G. Chiodo et al.

Anonymous Referee #1

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Review of discussion paper "On the detection of the solar signal in the tropical stratosphere" by Chiodo et al.

This paper accomplishes two goals: 1) presenting the response to the solar cycle in tropical stratospheric temperature and ozone as simulated by the WACCM model and 2) describing and applying an updated method for multiple linear regression (MLR). The paper provides quite a bit of detail about both these topics. The subject matter is appropriate for ACPD. The results provide new information about the possible solar cycle forcing of interannual variations in stratospheric temperature and ozone.

General comments

The paper is clearly written and contains sufficient details about the analysis. The topic

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is focused and the conclusions are well supported by the analysis.

There have been a number of previous studies that applied MLR to determining the response of the stratospheric temperature or ozone to the 11-year solar cycle using either numerical models or observations. The authors provide an appendix that carefully describes what is different about their method and why it can give more reliable results. It appears they also tested MLR without their new refinements (mentioned several times in Section 3.2 but indicated as "(not shown)"). This makes it hard for readers to compare the more familiar signals found in many publications with the current analyses. For example, how much of the difference between this and previous studies is due to using different data or period (WACCM versus other models or observations) and how much to the different analysis technique? There are words in the paper about this but, in my opinion, it would be much easier to grasp if the signals using the more commonly used MLR were directly shown and compared with the new results. This needs to be done carefully so as not to draw attention away from the current analysis but nevertheless to allow the reader to actually see the differences.

Specific comments

1. The axis labels are too small on the multi-panel figures.

2. Where did the SAD data used in the model come from? Were there observations available before SAGE II?

3. Is the ozone MLR analysis done on relative amounts (percentages) or on absolute amounts with the percent taken later? Does it make any difference?

4. Section 3.1 jumps around a lot and is hard to follow. Perhaps it would flow better to finish discussing the lag in each forcing term before moving on to the next. The limit to lags of one year is mentioned several times with different motivations. Also, the final values used were not clear except the zero lags for SAD and N3.4. It seems that the values in Figure 4 are used for UV although this is not stated explicitly. What lag was

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used for the QBO?

5. There are three volcanic eruptions indicated on Figure 5 but, in the discussion in Section 3.3 and Section 4, the SAD associated with the Mt. Agung eruption is ignored. The abstract mentions two major eruptions (El Chichón and Mt. Pinatubo) while the discussion of Figure 1 also mention two, but not the same (Agung and Mt. Pinatubo).

Editorial comments

1. Several abbreviations and acronyms are not defined: ECMWF, SST, GHG

2. 30099, line 16-19: This sentence is not clear. Propose: "It has been suggested that a solar cycle modulation of tropical upwelling may be the dynamical mechanism that is responsible for the response in the TLS in ozone (Hood, 1997; Hood and Soukharev, 2003) and temperature (Kodera and Kuroda, 2002)."

3. 30100, line 2: "assimilate" is too restrictive; how about "include" or "simulate"?

4. 30100, line 28: "claimed" -> "concluded"

5. 30102, line 21: "generic" -> "general"

6. Figures 2 & 3: minus signs are missing on the lag axis.

7. 30113, lines 19-22: The wording in this sentence implies that the regression procedure was done by Rienecker et al.

8. 30114, line 23: "Similar results for zonal mean ozone" -> "Results for zonal mean ozone similar to those in Figure 8"

9. 30116, line 16: delete "obtained"

10. 30120, line 21: "both windows around" -> "windows around both"

11. 30122, line 19: do you mean "We performed three sets of preliminary analyses using (i) . . ."?

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