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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Middle atmosphere response to different descriptions of the 11-yr solar cycle in spectral irradiance in a chemistry-climate model" *by* W. H. Swartz et al.

Anonymous Referee #2

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This manuscript is a timely assessment of the atmospheric response to two different solar forcing scenarios, one based on the NRL model and the other on measurements from the Solar Radiation and Climate experiment (SORCE). The authors implement two models in their analysis, the Goddard Earth Observing System (GEOS) 3-D chemistry–climate model (CCM) and Goddard Space Flight Center (GSFC) 2-D chemistry–radiation–dynamics coupled model, essential a 2-D CCM. The authors interpret their simulations in the context of several other recent papers that assessed the surprising trends from SORCE, some suggesting that the SORCE-based spectral response more closely matched ozone and temperature trends. The authors help to clarify some seemingly contradictory model results and to validate some of the previous studies. The results shown here imply that simulated solar cycle trends in ozone using the NRL SSI more closely matches observations that the simulations using SORCE. Comparisons between simulated and observed temperature response is perhaps slightly more ambiguous although the peak in the SORCE simulation is more than twice the amplitude of observations when using a model better suited for this analysis than that applied in previous studies.

There are two important statements made in this paper:

1. Using climate or chemistry-climate model output in comparison with a solar cycle inferred from a short data record is probably not the best way to validate the solar cycle inferred from SSI measurements. 2. . . . inferring solar cycle variations from part of a solar cycle is challenging

These statements alone make this a valuable paper. The authors' stress that SSI validation can come only from other irradiance measurements and by extending the current record into the present solar cycle. Furthermore, they question the validity of the extrapolation of the limited SORCE observations to obtain a full solar-cycle spectral trend and suggest that the real solar cycle spectral variability might be quite different.

This paper adds considerable insight into reconciling results from numerous recent studies. It is well-written, concise report on the role of SSI in governing the coupled ozone and stratospheric heating response to solar cycle variability, and helps understand the nature and limitations of the current data record and of the modles. I recommend publication.

Minor comments:

p. 5, l. 153. The irradiance values have been scaled for the present analysis by 0.9965 to match the SORCE/Total Irradiance Monitor (TIM) absolute scale, which has been verified by NIST to be more accurate.

The verification was provided by the Laboratory for Atmospheric and Space Physics

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Interactive Comment

(LASP) by comparison of ground-based TSI witness units with a NIST-traceable cryogenic radiometer. This statement reads as though NIST conducted the comparisons

p. 6, l. 175-176. These two particular months were selected because they were close to solar max/min conditions . . .

In light of the challenges in quantifying the solar-cycle difference spectrum, I think this statement requires additional details. What criteria were chosen to define solar max/min conditions? In addition, June 2007 is probably a little on the early side for cycle 23 minimum, although a minimum will vary based on the parameter of interest. Perhaps the authors can explain this choice.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 7039, 2012.