

Interactive  
Comment

## ***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.***

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We appreciate the constructive comments by S. Dhomse. The revised manuscript for ACP submission incorporates the following responses. Quotations from the revised manuscript appear below in *italics*.

### **Comments:**

1. We do not fully understand this comment. We are not referring to the correlation of ozone and temperature. The point we are making is that the total response (in ozone

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and temperature) to the solar cycle is equal to the sum of the response via photolysis only and the response via direct heating only. This is true for most of the stratosphere and lower mesosphere but not the lower stratosphere, below about 30 hPa, where dynamics is more important. To clarify this point, we have changed

*...the responses in both ozone and temperature from photolysis and heating are linear independent to first order.*

to

*...the responses in both ozone and temperature from photolysis and heating are linearly additive to first order.*

in Sect. 6. We have chosen not to delve into the differences among the various derivations of responses of ozone and temperature to the solar cycle from satellite or ground-based data. We have focused on the impact of different assumptions about the wavelength dependence of SSI variations with the solar cycle and how they impact calculations within our models. A discussion of the differences among the various derivations of the solar cycles in temperature and ozone from data would fill an entire paper in itself. Many of the derivations are uncertain for various reasons, including the shortness of datasets (14 years in the case of HALOE) and aliasing of other quasi-periodic forcings (e.g., volcanic).

2. Dhomse raises a good point about the importance of the lower stratospheric contribution to the total ozone. Based on this and comments by Referee #1, we have modified the following text in Sect. 5.2.

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*Because most of the total ozone column is in the lower stratosphere, however, note the limitations of time-slice simulations discussed above (Sect. 4.1) regarding details of lower stratospheric ozone. The total ozone maxima near 20° N and 20° S latitude in the observations in Fig. 6 are an indication of dynamical processes in the lower stratosphere (see also Hood and Soukharev, 2012) that are not captured in the time-slice simulations.*

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