

Interactive comment on “Response of middle atmospheric temperature to the solar 27-day cycle: an analysis of 13 years of MLS data” by Piao Rong et al.

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1 General comment

This paper reports on the 27-day (corresponding to one solar rotation) periodicities in temperature data from MLS covering 13 years of data and the vertical range 20-90 km. The authors use the super-epoch approach to identify the 27 day signal. Various sensitivity tests are made to demonstrate the robustness of their results. The scientific methods they use is is very clearly described and their work tracable for the reader. I recommend publication after some minor corrections. My main criticism is

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that an evaluation of the results obtained here with respect to other similar analyses on temperature data (many cited and summarised in the Introduction) remains somewhat vague. It is important to stress here which results are new (not seen by others) in addition to confirmation of agreement with prior work.

2 Detailed points

Page 2, l. 3: "While a significant number of experimental studies investigated solar-driven 27-day variations in stratospheric and mesospheric parameters, the physical/chemical mechanisms leading to these signatures are, in many cases, not well understood. Therefore, it has become a highly interesting subject to study atmospheric variations due to the 27-day solar activity cycle in middle atmospheric parameters." The expectation is raised here that additional studies (like this) will lead to a better understanding of the processes behind the 27d variability. However, this study is simply another study lining up with others on fingerprint detection, but falls short of identifying the processes behind these changes (except for some plausibility arguments that the processes may be dynamical rather than direct solar in nature)

p. 13: Conclusions: here it may be important to briefly summarise what are the new findings from this study with respect to earlier work (see general comment)

p. 3, l. 25: Here one should briefly mention why Mg II (and not F10.7 or Ly-alpha) is used here. Dudok de Wit et al. (2009) and others have shown that the Mg II best correlates with solar UV radiation variation particularly during solar minimum conditions. The translation of Mg II changes into equivalent F10.7cm flux and 205 nm irradiance is needed since other studies used the latter.

p. 3 l. 32: "derived from four data sets". Other satellite data were used to fill the gap.

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The fifth major dataset is the early SBUV record (before 1995, not relevant here).

p. 4, l. 11: "MLS version 4.2 temperature is" → "MLS temperatures are". Version 2.4 is already mentioned in the sentence before.

p. 5., l. 12: Figure 3 is mentioned before Figure 2 in the main text. Please check.

p. 6., l. 5: "Second" → "Secondly"

Figure 8, l. 29: Wouldn't it be better to invert the color scale in the significance plots (Figure 9 and other figures). That way those regions are highlighted (and more colorful) where the significance of the 27d signal is high! For the axis label I would use "(statistical) significance" rather than "fraction". It would be also useful to shade out regions where no statistical significance is given. This helps to focus on the relevant part in the plots. This applies to Figs. 9, 11, and 12.

Section 4.1.3 (p. 9) Discussion on the time lag plots (Figure 11) is missing.

p. 9, l. 32: Suggest to use "region of high significance" rather than "low fraction region" throughout the main text.

p. 10, l. 16: "different input parameters". Better say "different settings", as input data (MLS, Mg II) remain the same.

p. 11, l. 10: "When comparing the graph with the significance test results shown in Figure 9 (a), it is apparent that the larger sensitivity values appear in regions with lower fraction, i.e., higher significance." If obvious, why mention it here (can be omitted).

p. 11, l. 11: "determined time lag" → "time lag"

p. 11, l- l2: "Comparing the two panels of Figure 13 shows that large time lags tend to occur in latitude-altitude regions with small sensitivity". Why mention ii here (if greyed out in the plot because of no significance)

p. 12, l. 9: "obvious characteristics". What are they?

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p. 12, l. 27: "high significance fraction" → "high significance region"

Figure 6: Yellow curve is hard to see, suggest to plot first the unsmoothed curve and then overplot this with the smoother curves (order: red, blue, yellow). Then all curves may be visible. Yellow is hard to see, use another color for better legibility.

Figure 7: Show a vertical line in panel b, indicating the derived time lag.

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