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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Signature of the 27-day solar rotation cycle in mesospheric OH and H_2O observed by the Aura Microwave Limb Sounder" *by* A. V. Shapiro et al.

Anonymous Referee #1

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Review on

"Signature of the 27-day solar rotation cycle in mesospheric OH and H_2O observed by the Aura Microwave Limb Sounder"

by A.V. Schapiro, E. Rozanov, A.I. Shapiro, S. Wang, T. Egorova, W. Schmutz and Th. Peter

This manuscript reports on the first attempt to extract a 27-day solar rotational signal in Aura/MLS OH and water vapor data. Thus, they address a relevant scientific question wich fits well into the scope of ACP.

The authors use some widely accepted analysis methods such as harmonic analysis, wavelet analysis, cross-correlation and linear regression techniques which they clearly describe. They find a strong difference in the amplitude of the 27-day harmonic in OH and H_2O in a period of enhanced 11-year (and 27-day) solar activity compared with a period of low solar solar activity. The cross-correlation analysis yields an immediate and positive response of OH at about 80 km and a delayed and negative response of H_2O, respectively. The correlations loose strenghts but do not vanish completely in the 11-year solar minimum period. Relative sensitivities of OH and H_2O to a 1

The results may be useful to validate chemistry climate model (CCM) results, especially those with a model top above 100 km.

The authors refer to 41 publications related to the topic. Since measurements of OH in the mesosphere are only available starting in 2004, it is difficult if not impossible to compare to other observational results.

The text is concise and the seven figures are clear.

General comments:

2004/05 is not really solar maximum but rather the declining phase of solar cycle 23. It is indeed a period with pronounced 27-day variability. This should be stated more clearly in the text.

Is it possible to compare at least the H_2O results with other data covering the "real" solar maximum 2002?

Specific comments:

Page 28478: line 21/22 "The two most important cycles ...": Maybe it would be better to name the 11-yr cycle first as the spots and faculae associated with the 11-yr cycle create the 27-day variability when they appear on the "front side" or the "back side" of the sun.

Page 28479: line 20-21: Please explain the diurnal cycle of OH briefly after the Minschwaner et al reference, i.e. the OH concentration peaks at low solar zenith angles and declines when the sun approaches the horizon.

line 25: There is another reaction producing OH, which should also be mentioned here $H_2O + O(^1D) \rightarrow 2OH$

Page 28482: line 14: Please insert some introductory words after"The data for 2004 and 2006 are poorly correlated with the solar irradiance .", something like "To understand this the unfiltered H_2O data at 80 km are shown in the bottom panel of Fig. 2".

Page 20483: line 24: The pronounced 27-day cycle ceases in autumn 2005.

Page 28485: line 4: Which statistical test was used? "... the twosided statistical test" is somewhat unclear.

lines 10-11: It is interesting to see that there is still a period close to 27 days in the solar min correlations, and furthermore, that these correlations are statistically significant. What is the explanation for that?

line 14: The highest negative correlation appears at 90 km not in the range 85-90 km, so please reformulate the parenthesis "(up to -0.74 at 90 km)".

line 22: "... it makes the obtained correlations insignificant." This is somewhat misleading as Fig. 6, bottom, shows statistically significant correlations. Please, reformulate this sentence in a more precise way.

line 28: The value of the H_2O sensitivity of -1.2 % given in the text is not supported by the curve in Fig.7. At 90 km it shows about -0.95 % water vapor change per 1% change in Lyman-α irradiance.

Technical comments:

Page 28478: l 23 please write Lyman-α here as the term appears for the first time in the text.

Page 28479: lines 6-8: either you remove the sentence "So we still cannot ..." or you specify more precisely "Possible reasons for the high uncertainty in observations could be ..."

line 23: Typo rotational

Page 28480: line 13: The SSI abbreviation was already introduced on page 28478, so it is redundant here.

Page 28481: lines 1-4: Please turn around the pressure levels, i.e. start with the lower level, e.g. 32-0.0032 hPa (about 24-89 km) as you did with the height range.

Page 20483: line 4: Please reformulate "... to the solar minimum 2008-2009."

lines 13-14: "If the 27-day cycle in OH . . . weaker for periods of lower solar activity."

Page 28484: line 2: "... so the harmonic for the 2008-2009 period is barely visible in comparison with the 2004-2005 period."

line 12: "The OH spectrum reveals a clear 27-day cycle ..."

Page 28485: lines 27-28: Please, give the full unit of the response, i.e., "... is 0.93 % per 1% change in Lyman-α irradiance"

Page 28486: line 9: Please insert an article "... correlate negatively with a phase lag ..."

line 15: Please change "the" to "a" "... are needed for a better understanding ..."

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 28477, 2011.