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## ***Interactive comment on “A solar signal in lower stratospheric water vapour?” by T. Schieferdecker et al.***

### **Anonymous Referee #2**

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The manuscript is generally well written and is appropriate for ACP. While I think that it is in principle publishable because the idea seems at least plausible, I have to admit that I doubt that the solar cycle really is affecting lower stratospheric water vapor (at least to the extent claimed), and I think the question mark in the title is very appropriate. My reasons for doubt are threefold: (1) The proposed mechanism is that the solar cycle is changing the tropopause temperature, but there is no clear evidence of this; (2) the fit to the solar cycle introduces a large unexplained negative linear trend in water vapor and; (3) it is not surprising that fitting an additional  $\sim 11$  year quasi-periodic term, together with a phase shift can improve the fit, and that this phase shift itself shows a time lag which suggests that the signal is propagating from the tropical tropopause. Indeed, even at the tropical tropopause the phase lag is not zero, as the authors point

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out.

Given that the authors have shown a correlation, but by no means proven the existence of the effect that they claim, the abstract needs to include a few qualifications. I would be unwilling to recommend publication without these qualifications in the abstract.

Qualifications required: Abstract Line 13: “a solar signal generated at the tropical tropopause is imprinted” should be rewritten as “may be imprinted.” Abstract Line 16: “the final dehydration point of air is also governed” should be “may also be governed”.

Other suggestions: Pg. 12354 line 26: The word “Mainly” is unnecessary and awkward. Please drop it.

Pg. 12355 line 27: “get” should perhaps be “produce”.

Pg. 12357 line 3: “HALOE H<sub>2</sub>O measurements were frequently validated (Harries et al., 1996; Dessler and Kim, 1999).” Neither of these references help to establish the stability of the HALOE measurements, which is really the key here. A possible reference is Nedoluha et al., “An evaluation of trends . . .” JGR 2003.

Pg. 12360 line 9-11: “A possible drift due to detector-aging and resulting changes of its non-linear response was estimated at approximately  $-0.05$  ppmvdecade<sup>-1</sup> in the relevant altitude range.” This is good, but again, as for HALOE, a published reference showing MIPAS stability relative to other instruments would be useful. A possible reference is Nedoluha et al., “Variations in middle atmospheric water vapor from 2004 to 2013”, but there may be others which the authors find more appropriate.

Figure 1: This is an interesting figure. So is HALOE data below 15km not included in the convolution? Is there always HALOE data down to 15km? If not, what do you do?

Start of 4.2: It is not clear why two decreases, one in 1994 (and very temporary) and another 2001 (a seemingly more long-lasting decrease) would lead one to conclude that an 11-year solar cycle is relevant. Unless there was some other compelling reasoning (besides the one given) then I would just start this Section with “We decided to

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investigate whether the addition of a solar cycle would significantly improve the fit”.

Pg. 12362 line 26: “Anti-correlation (lowest water vapour for solar maximum) ...”. Given that there is a phase shift applied, this statement is not meaningful without specifying that shift. So it should say: “Anti-correlation (lowest water vapour for solar maximum shifted by XX months) ...”.

Pg. 12363 line 7: “but still visible.” should be “... , but it is still visible.”

Pg. 12364 line 25: “The systematic residuals observed when the solar component had not been considered largely disappeared when a solar cycle signal was considered.” This is a very awkward sentence.

Pg. 12365 line 11: “This indicates that, even if one does not believe the solar cycle effect in explanatory terms, it still is important in descriptive terms in order to avoid artefacts caused by the related systematic residuals.” I don’t understand what this sentence means.

Pg. 12366 line 27: “suggest that even two thirds of the observed solar component of the vapour variability can be explained by a 2K solar temperature variation.” I don’t understand the “even two thirds”. Does this suggest that a 3K solar temperature variation (which seems very large) is required to explain the full variation? Please make this explicit.

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Interactive comment on Atmos. Chem. Phys. Discuss., 15, 12353, 2015.

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