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Atmospheric Chemistry and Physics Discussions

Interactive comment on "MLS measurements of stratospheric hydrogen cyanide during the 2015–16 El Niño event" *by* Hugh C. Pumphrey et al.

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1 Reply to general comments

The reviewer is in general happy with the paper, but asks us to add more discussion about transport features into stratosphere related to warm ENSO events. We will endeavour to add a paragraph on this.

2 Reply to specific comments

- *The authors suggest the main driver of enhanced HCN is droughts in equatorial Asia during El-Niño. However, the connection between warm ENSO and transport in tropical UTLS is not mentioned. I suggest adding one paragraph to review the state-of- art about the association between ENSO and troposphere to stratosphere transport. For example, 1) the convective transport over Maritime Continents; 2) stronger TTL upwelling during El Niño winters (e.g. Randel et al. 2009, Calvo et al., 2010, Konopka et al. 2015).* This request is similar to that made by reviewer 1; we will endeavour to add a suitable paragraph. We thank the reviewer for the references.

- *MIPAS data shows a second maximum of HCN around 20-30° N on 100 hPa and 68 hPa firstly in boreal winter but not in MLS in Figure 5. The authors did not comment on this feature but only comment on the one in NH during summer. Could the author comment on this maximum from the third observation and from the possible source?* It is not clear to us what causes the feature that is noted by the reviewer. The feature appears in the 2006-7 NH winter, which is an El Niño winter, but the other time is is visible is the 2010-11 winter, at which time the ENSO index is negative. The 2006-7 NH maximum probably has the same source as the SH maximum: El-Niño-related fires in Indonesia. In 2010-11 there was unusually high levels of burning in South America (Glatthor et al., 2015). These are responsible for the SH high values and may be responsible for the NH values as well. We would prefer not to add any material on this to the present paper as the MIPAS data are already described in detail by Glatthor et al. (2015). The main reason for showing the MIPAS data in the present paper is to show the extent to which the MLS data are credible.

- *Still about the section 3.3, the author mentioned the boreal summer increased HCN in NH possibly links to ASM [Asian Summer Monsoon] suggested by Ran-*

del et al. [2010] and Ploeger et al. [2017]. But why this boreal summer enhanced HCN show clear increase in 2007 and 2016, which do not experience strong AM circulation? We do not know for certain, but a reasonable hypothesis is as follows. To observe enhanced HCN over the ASM requires a strong AM circulation and/or increased quantities of HCN in the troposphere. 2007 and 2016 may not have had a strong AM circulation, but they certainly had increased quantities of HCN in the troposphere, following the unusual biomass burning in late 2006 and late 2015. Although some of this HCN reaches the stratosphere very rapidly, as we show in this paper, much of it remains in the troposphere. Away from the oceanic boundary layer the lifetime of HCN is long enough for there to be high levels to be lofted by the monsoon circulation, 6-8 months after it was emitted by biomass burning.

3 Reply to technical corrections

- *Page 3 line 3, 'since 1950' instead of 'between 1950 and now'*. That is a better way to word the sentence; we will use it.
- *Page 13 line 10, 'droughts' instead of 'draughts'* We will make that correction.

References

N. Glatthor, M. Höpfner, G. P. Stiller, T. von Clarmann, B. Funke, S. Lossow, E. Eckert, U. Grabowski, S. Kellmann, A. Linden, K. A. Walker, and A. Wiegele. Seasonal and interannual variations in HCN amounts in the upper troposphere and lower stratosphere observed by MIPAS. *Atmospheric Chemistry and Physics*, 15(2):563–582, 2015. doi: 10.5194/acp-15-563-2015.

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