

Interactive comment on “First detection of ammonia (NH₃) in the Asian monsoon upper troposphere” by M. Höpfner et al.

Anonymous Referee #2

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In this paper, the authors present the retrieval of NH₃ from MIPAS/Envisat spectra using the averaging technique that has been used previously for BrONO₂ and SO₂. They have detected enhanced amounts of NH₃ (e.g. above the MIPAS detection limit) within the Asian monsoon on a three month average basis (June, July and August). These are the first upper troposphere measurement of NH₃ in the Asian monsoon. These results are discussed with respect to other measurements and model studies.

This is a useful and interesting contribution. I believe that it will be suitable for publication in ACP once the following comments have been addressed.

General comments:

In the introduction, I found that the discussion of previous measurements needs to be clarified and enhanced. The description of what has been done via in-situ and remote

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sensing techniques should be made much more distinct. These were somewhat mixed together in the text. Specifically, the platforms used (e.g. ground, balloon, satellite) and the altitude range for measurement sensitivity needs to be described more thoroughly. In particular, the authors should establish how far into the UT the nadir and balloon measurements reach to support their "first" measurement claim within the Asian monsoon.

Because different coordinate systems are used by the different measurements, when discussing altitude or pressure ranges for current or previous results, both *z* and *p* should be given to help the reader to make these connections clearly.

In the discussion of the definition of the detection limit, it would be useful to give further description of the impact of choosing 2-sigma versus 1-sigma as the limit. How frequently are the enhancements above 15 pptv (3-sigma)? Would this choice of limit impact detection in certain years or all years?

When discussing the model results, I missed a bit more detail on the type of model results used. This could be added to the introduction or put into the discussion section. Are there any dependences of results on the met. fields driving the models or any emissions included? In the conclusion, the term "locally resolved model" was used. This stated lack of model results needs to be supported better in the discussion

Specific comments:

L24-27 Could the authors clarify a bit further how this would impact clouds? Increase their presence?

L65-68 While the quote "tentative identification" was taken from Coheur et al., a profile was retrieved from the ACE measurements. This should be clarified in the introduction.

L89-91 Please provide the average number of spectra used in the monthly averages. Does this vary significantly by year (maybe based on cloud presence?) Also, what is the typical signal to noise ratio of the averaged spectra? Is it much better than the

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minimum stated? Are the spectra evenly distributed throughout each month?

L112-116 It seems that the spectral windows between the two periods differ by one spectral "grid point". Could the authors comment on why this seemingly small change was necessary?

L130-132 If MWs 2 and 3 show the "best fit", why is MW 1 included? Can it be omitted?

L154-155 It would be useful to state the vertical resolution also for the altitude levels used later on in the discussion. Is it closer to the higher or lower value?

L172-179 Are the same months used for the background as the Asian Monsoon average? To identify the grid boxes within the Asian monsoon, is the ERA Interim contour used or a fixed latitude-longitude box? If a box, does this change by year or month?

L241-242 This sentence seems to be overstating the results as the authors report that UT NH₃ measurements over Germany were made by Ziereis and Arnold. This should be clarified by the authors and supported by the text.

Data availability should be discussed in the paper at end of conclusions or in a separate data section.

Technical comments:

L8 aerosol should be aerosol.

L60 Are these transmission or emission spectra?

L75 Has UTLS been defined prior to this in the text? Also, the altitude range used for the UTLS should be specified in the text.

L78 Should be "in the horizontal" direction.

L102 "oder" should be "order".

L108 simultaneously with NH₃.

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L125 The pure NH₃ spectrum line should be mentioned here. Also, how it was calculated. Retrieved VMR?

L178&180-181 Is vmr defined? It does not seem to be used consistently throughout. This should be fixed.

L214 Do you mean over-estimated here?

Unused references for Kiefer et al., Kleinert et al., Hoepfner et al., 2007, Ploeger et al., von Clarmann et al.

Figures 4 and 5 The latitude and longitude markers should be included on the plots to make it clearer.

Table 1 There seems to be an assumed uncertainty missing for one line.

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