**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "TES ammonia retrieval strategy and global observations of the spatial and seasonal variability of ammonia" *by* M. W. Shephard et al.

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Authors responses to anonymous Referee #1 remarks for "TES ammonia retrieval strategy and global observations of the spatial and seasonal variability of ammonia" by M. W. Shephard et al.

First of all the authors would like to thank the Referee for taking time to review the paper and provide helpful comments that improved the manuscript. Provided below are detailed responses to the Referee's comments.

Specific comments:

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1. Page 16030, Line 28-29: It is not clear to me how the constraints were modified to reflect the sensitivity of TES. Please clarify.

Response: Ammonia concentrations in the atmosphere rapidly decrease with increasing elevation (decreasing pressure). In general, TES nadir observations are not sensitive to ammonia much above the boundary layer if ammonia concentrations are relatively small. Therefore, in the upper troposphere the constraints are modified (strengthened) in order to help provide more robust retrievals in this part of the profile.

2. Page 16031, Line 16: What are the three different simulated NH3 profiles? Are they for the polluted, moderate polluted, and unpolluted cases? Please clarify.

Response: This is a good comment as we were not clear on this point. The exact details are that for each atmospheric state we added three simulated ammonia profiles. The three ammonia profiles were randomly selected from profiles that fall in the ammonia concentration ranges of unpolluted, moderate, and polluted profile.

We modified the manuscript to address in the following manner:

Changed :" To each profile three different simulated NH3 profiles were added, forming a set of 540 cases."

To: "To each profile three different simulated NH3 profiles representing unpolluted, moderately polluted, and polluted conditions were added, forming a set of 540 cases."

3. Page 16032, Line 24: It is not clear from Fig 6 that thermal contrast increases detectability. Is that because for the polluted and moderate polluted cases, nearly all the SNR<1 ones are within 5 K thermal contrast? Response: We agree that it is not immediately obvious in Fig 6. As indicated by the Referee, the way to look at it is that there are an increasing percentage of retrievals with a SNR>1 as the thermal contrast increases.

4. Page 16036, Line 5-7: Please also describe the right panels of Fig 8.

Response: We actually do describe the right panels in Fig. 8 when we stated, "The colored curves are the rows of the averaging kernel (AK), the solid grey curve is the sum of the rows of the AK, and the dashed grey curve is weighting function that maps the retrieved profile into the RVMR (right)."

I think it might be a little confusing to the reader to put "(right)" at the end of the sentence. To make it more clear we changed the sentence to : "In the right panels the colored curves are the rows of the averaging kernel (AK), the solid grey curve is the sum of the rows of the AK, and the dashed grey curve is weighting function that maps the retrieved profile into the RVMR".

5. Page 16058, Fig 6: Please describe in the caption what the percentage numbers represent.

Response: Good point. These numbers are the percentage of cases for each polluted condition that meet the SNR>1 criteria. This was added to the caption as suggested.

6. Page 16069, Fig 17: Is it possible to convert the unit from ug/m3 to ppbv, as for a direct comparison with Fig 15 and 16? Are the TES RVMR values about 30

Response : Yes, it is possible to convert the units. However, the purpose of showing Figure 17 is to show the seasonal variability and not the absolute magnitudes. The absolute magnitude of the values between the two sets is expected to be different as one set of measurements are surface observations at a point, and the other set are representative mixing ratios for the boundary layer over the TES footprint. Therefore, we decided not to focus on the magnitudes in the paper.

7. Page 16074, Fig 22: Please describe in the caption what the bin size is for the probability distribution plots

Response : Added "histogram bin size is 1.0 to the caption.

Changed: "Density distribution of the TES RVMRs for each region and month; histor-gram bin size is 1.0; dashed lines indicate mean values for the corresponding month."

To : "Density distribution of the TES RVMRs for each region and month; histogram bin size is 1.0; dashed lines indicate mean values for the corresponding month."

Technical corrections:

1. Page 16026, Line 25: "initial comparisons results" should be "initial comparison results"

Response: Corrected in paper as suggested by Reviewer.

2. Page 16035, Line 10: "Sect. 3.3.1" should be "Sect. 3.1.1"

Response: It is now correct in the paper (must have been an auto numbering issue when originally submitted).

3. Page 16043, Equ. (A4): Missing the minus sign in the equation.

Response: Good catch. We did not see this when proof reading the translated manuscript.

4. Page 16043, Line 17: "Eq. (10)" should be "Eq. (A7)"

Response: Good catch. We also missed this when proof-reading. It has the original numbering scheme and not the updated A# method for the appendix.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 16023, 2011.