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Atmospheric Measurement Techniques Discussions

Interactive comment on "Comparison of nitric oxide measurements in the mesosphere and lower thermosphere from ACE-FTS, MIPAS, SCIAMACHY, and SMR" *by* S. Bender et al.

Anonymous Referee #2

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This paper presents a comparison of nitric oxide abundances in the upper atmosphere as measured by different remote sensing instruments. NO is an important measure for the quantification of solar activity in Earth's atmosphere. The paper is well written, and the methodology and the results are described clearly. I recommend publication of this work in AMT after a few major points and some minor points are addressed.

Major points:

Altitude resolution: The altitude resolution of the datasets presented in this study differs significantly; e.g. between 5-20 km (MIPAS) and 3 km (ACE-FTS). It is essential to dis-

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cuss the effect of the distinct altitude resolutions when comparing the datasets. Since most of the authors of this work are involved in retrieval activities of the instruments, averaging kernels (avk) and a-priori data should be available. The authors shall investigate the effect of the different altitude resolutions for some typical conditions, illustrated by one or two figures. Depending on the result, avk effects should be considered in the subsequent analysis or considered in the discussion, only.

Systematic uncertainties: On page 12747 (line 2) and page 12755 (line 4) the authors mention "error bars" equivalent to the "95% confidence interval of the daily zonal mean". Does this mean that error bars illustrate the variance of the mean, and not systematic uncertainties of the data, such as instrument calibration or forward model uncertainties? This should be made clear. Systematic uncertainties of the various datasets should be given for a few altitudes - either in the plots or in a separate table.

Diurnal variations: NO abundance is subject to a large diurnal variation - driven by photochemistry, dynamics, and particle precipitation. Since the various instruments measure at different local times, the expected variations should be given. The authors should estimate quantitatively, to what extent the harmonic fit is biased by the different local time sampling of the various datasets.

Minor points:

SMR data: Could the authors please give the altitude resolution of their data, as in the case of the other datasets?

Overview of dataset characteristics: I suggest to give dataset properties like altitude resolution, local time coverage, or systematic uncertainties (for 2-3 altitudes) in Table 1 as well.

Correlation of fitting parameters: The correlation (matrix) of the fit should be presented and/or possible dependencies of the fitting parameters should be discussed.

Fitting components: I would suggest to show a plot which illustrates the magnitude of

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the different fitting components, e.g. in one or two additional plots or, e.g., by showing the data in Fig. 15-17 and Fig 18+19 with the same color map and color range.

General statements like: 'the NO diurnal cycle also affects the retrieved number densities' (page 12748, line 14) 'the nitric oxide densities of all four instruments are consistent during the comparison period' (page 12754, line 24) 'the remaining differences can be attributed to the different MLT measurement schedules and latitude-time coverage of the instruments' (page 12755, line 5) should be made more quantitatively and confirmed by /compared to model data, other measurements, etc., if possible.

Error bars in Figures 3-10: The figures are somewhat overloaded with datapoints and error bars. I suggest to plot error bars every 10th datapoint or so, only

Altitude range in Figure 7-10: ...should be reduced

Fig 11-14: I suggest to plot the mean of all datasets (versus time) into the lower panel of each plot and skip the upper panel.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 12735, 2014.