**Atmospheric
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Techniques**
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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 #1

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General comments

In this work, the authors compare nitric oxide concentrations in the mesosphere/lower thermosphere (MLT) retrieved from four instruments: three limb sounders and one solar occultation spectrometer, using different spectral ranges: infrared, sub-mm, and ultra-violet. Tracing the NO concentrations in the MLT is important for distinguishing the roles of anthropogenic factors and solar activity impacts on the atmosphere. Continuous monitoring of the MLT is necessary for proper understanding of the observed effects, but difficult to achieve from the technical point of view, so the intercomparisons of NO retrievals in the overlapping periods are invaluable for estimating long term trends.

I think that the work fits the scope of the journal and is definitely worth publishing. However, the way the data is presented does not allow me to recommend publishing the paper "as is". At the moment, the manuscript is overloaded with figures (I counted 56 panels in the main text and 60 panels in the Appendix while the total volume of the paper is 23 pages including references). At the same time, certain comparison plots, which one can expect to see in this kind of study, are not shown. I believe that the readers will benefit from the changes suggested below. These should not take much time, but the results will be clearer, and the overall impression will be better.

First, it is obvious that the data are of the same order of magnitude and one does not expect large differences. In this case, showing absolute values on the majority of plots is not recommended since human eye can not tell 10% difference coded in the shades of red (or blue). From my point of view, difference plots or "anomalies" are much more representative. At the beginning, one can show a plot with spatio-temporal coverage of different datasets to illustrate the problems of finding a good area for one-to-one comparisons, but the rest should be done in differences. It is also difficult to make any conclusion when the plot like Fig. 3-5 is cluttered with points and their error bars. On the other hand, differences from the averages in the running mean will clearly show, which of the instruments do group and which ones do deviate from the mean. The same is true for vertical profiles: instead of showing 3x4 =12 panels with large error bars, one can present the same information on 3 panels in the form of deviations of running mean from average over 4 instruments. This will remove the redundancy and make the presentation clear.

Second, the manuscript lacks a discussion of the sources of the differences while the work is not supposed to be purely descriptive. The authors represent different groups and they know their retrievals from inside; it is not a third-party analysis of a "black-box data". I believe, a sentence or two can be added to each significant difference discussed in the manuscript (i.e. "we explain the differences of MIPAS by uncertainty/bias of the radiative input from below, which affects the non-LTE populations and, there-

fore, interpretation of the radiation" or "the SMR has large error bars in this area due to..."). The physical reasons like diurnal or day-to-day variation can also be added to the discussion. Partially, they are present in the manuscript, but this is not sufficient for creating a sound picture.

Third, seasonal variations are shown and discussed, but correlation coefficients for the series and correlation between NO concentration retrieved from different instruments, Kp index, and Lyman-alpha are not present while it would be interesting to see these links in a form of a table with correlation coefficients built separately for each instrument and for three latitude zones. If the coefficients appear to be negligible, this should be mentioned and explained.

May be, instead of showing the maps of regression coefficients, one can use the regressions to retrieve the comparable NO distributions for the same time and show difference maps for them. One-to-one probability density plots, typical for the intercomparisons of this kind are missing while they provide information both about the biases and about the spread of the retrieved parameter in the compared datasets.

Minor comments

Besides an excessive number of plots, which is discussed above, there is also a problem of technical organization of the information on the plots themselves: the columns in figures like Fig 1,2,15-19 share the same color scheme and OX axis that is absolutely logical. What is not logical is duplicating the color bar and OX axis labeling. I believe, the readers will benefit from larger plots and a single color bar at the bottom of a plot. If the scientific software does not allow this kind of changes, this can be done in any graphical software afterwards.

The color scheme used in the maps shown in Fig. 15-17 differs from the one used in Fig. 1,2 and Fig. 18,19. I understand that this is defined by the software used for building the maps, but I think it is worth using the same scheme for consistency (for example, both Fig. 17 and Fig. 18 show regression coefficients, while the representation

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differs, puzzling the reader).

The OY axis in Fig. 7-10 should be zoomed to 70-120 km. Otherwise, more than a half of useful space is lost.

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