

Review of the manuscript: Bender et al. (2013), “Retrieval of nitric oxide in the mesosphere and lower thermosphere with SCIAMACHY” submitted to Atmos. Meas. Tech.

by Anonymous Referee

General comments

This paper describes the retrieval of mesospheric NO from Envisat/SCIAMACHY limb measurements. The authors introduced a new retrieval algorithm that is a 3-D ray tracing using a two dimensional grid. Comparisons with the model and the NO data obtained from the Envisat/MIPAS infrared measurements are presented in order to validate the output.

The content of the paper well fits with the scope of the AMT journal, and indeed the retrieval approach the authors adopted is rather unique. However, the current manuscript significantly lacks detail explanations on its retrieval algorithm, its effectiveness compared to traditional 1-D retrievals, and the methodology of the comparison with MIPAS. I think such detail information is what this journal puts more importance. Therefore I recommend this manuscript to be published in AMT only after the authors improve Sect 3 (and other related Sections) and Sect 4.4.

For revising, I would like to ask the authors to consider following comments:

- Is there any motivation for employing the 2-D grid retrieval? i.e., did the authors compare the results from (traditional) 1-D vertical grid retrieval with spherically homogeneous layers?
- There are several parameters in calculating the emissivity (Eq. 1). If possible, I think it's better to put the values the authors adopted in their presented work (not only putting the references).
- For the retrieval algorithm description, it is unclear what kind of a priori value and its covariance were used. How did you determine R_{alt} and R_{lat} ? What value was used for S_y ? etc. It would make this paper more useful for readers if the authors provide these numbers within the text.
- Also I feel a weakness in the comparison with MIPAS NO. I would like to see the sensitivity of MIPAS NO product with its usable altitude range (as the basic

information) in the text (although the authors put the reference paper). Without such information, I consider it's difficult to judge the agreement between SCIAMACHY NO and MIPAS NO. Furthermore, are there any reasons not to compare vertical profiles?

Minor Comments

Title: For me the title "retrieval ... *with* SCIAMACHY" sounds a bit strange: I would prefer "from" instead of "with".

P 3612, Line 24: SCIAMACHY appears for the first time in the main text here. I would like to have the full spelling of SCIAMACHY here, and also one general reference for the mission or instrument will be useful.

P 3613, Line 3–24: Here the authors describe the development history of the SCIAMACHY since the Phase-A studies, but I'm not sure if such a detail is really needed in this paper. In my eyes, this paragraph can be much shortened.

P 3615, Line 17: "...to be excited *first*, restricts...", I think this "first" is unnecessary.

P 3616, Line 10: "The various gamma bands have different advantages and disadvantages" I think you are talking about the advantages/disadvantages "for retrieving NO in data analyses", but it's not clear. I would suggest re-writing the sentence.

P 3622, Line 24: Is there any difference between the MIPAS retrieved temperature and that used by the authors for the SCIAMACHY analysis?

P 3623, Line 13–14: "Here, the SCIAMACHY retrieval attempts...provided by the model" I could not follow this discussion. Please explain more.

Figures: I would like to have minor ticks on x and y axis, particularly for Figs 6 and 7.