

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2021-235

Anonymous Referee #1

Referee comment on "Level 2 processor and auxiliary data for ESA Version 8 final full mission analysis of MIPAS measurements on ENVISAT" by Piera Raspollini et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-235-RC1>, 2021

The publication describes an improved (the final) data product of MIPAS, ORM V8, which is available to a large user community. It should therefore be of great interest to the AMT readership. The improvements concern the forward model (horizontal gradients, new spectroscopic data), the inverse model as well as an improved inclusion of calibration data and improved cloud filtering and filtering for bad quality data. In addition, there is an improvement in the temporal stability by a reduction of instrumental drift. Discontinuities in the measurement series are reduced by a better exploitation of calibration data (daily gain factors). Overall, the paper is very convincing and should be published after some minor changes.

My main comment concerns the treatment of horizontal inhomogeneities. A first order model is used, which only accounts for linear variations using a horizontal gradient. Statistically, improvements are achieved, e.g. with regard to day/night differences (ascending/descending orbits). However, in situations of high (small scale) variability, e.g. due to wave breaking, using a linear gradient may even be counterproductive. For example, the authors state that closest coincidences of ERA-Interim ECMWF data for each MIPAS profile were used for computing the horizontal gradients of temperature, water vapour and ozone. How is the gradient then calculated? By simple linear interpolation? Since the horizontal resolution of the ERA-Interim data is higher than that of MIPAS (distance of the tangent points), the calculation of an effective gradient would make sense, which also accounts for smaller-scale variability along the line of sight. If a simpler procedure was chosen, the authors could briefly discuss this and state that essentially a statistical (climatological) improvement was targeted.

Other comments:

I.11 Introduce IG2 (Level 2 Initial Guess). The abbreviation is used a few times, but not explained until I. 318.

I.23 The effects are not limited to the region from the surface to the mesosphere. For example, solar activity also affects the thermosphere.

I.26. I find the Kidston et al. citation a bit too specific here. I would therefore also use another citation, e.g., from the IPCC.

- I.27 A citation for the air quality aspect is missing.
- I.30 ... period (Fischer et al., 2008).
- I.33 Indicate approximately how large the resolution is.
- I.42 The statement does not apply to every tangent point since a global fit procedure is used?
- I.78 I would put the Fischer quote at the end of the sentence.
- I.85 A sketch of the measurement geometry would be helpful for some readers.
- I.88 What is meant by revisit time of three days? It should be about a month.
- I.112 Both ... vary
- I.130 I would say what is meant. Horizontal gradients of temperatures and trace gases.
- I.140 ... and lower thermosphere?
- I.143 I assume that this sequential procedure is also iterated?
- I.165 Briefly state the purpose.
- I.171 Statistically, it shows an improvement.
- I.193 mean retrieved profiles
- I.221 in about >> about
- I.257 better "between observed and simulated spectral features".
- I.258 consistency check is o.k., but the 7.6 mm region should not be further included in the HNO₃ retrieval itself by just to account for HNO₃ interferences in the 7.6 mm region.
- I.268 ... improves the spectral simulations...
- Legend Figure 10: Perhaps spell out FR and OR again.
- I.331/332 The sentence is difficult to understand.
- I.333 If necessary, give some details for priority system.
- I.337 mb >> hPa
- I.357 Delete space after "range".
- I.364 What do you mean by 0 hPa?
- I.406 I don't understand this big difference between models levels and pressure levels right away.
- I.486 I would somewhat rewrite how you reduce outliers after the retrieval, e.g. ... after

the retrieval based on a more sophisticated quality flag.

l.620 long-term evolution

Figure 23: Improve quality of symbols and lines in the plot.

l.655 ... observed scene multiplied...

l.840 Remove the first parenthesis.