

Interactive comment on “Precision validation of MIPAS-Envisat products” by C. Piccolo and A. Dudhia

Anonymous Referee #2

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1 General

The paper validates the precision of the atmospheric profiles retrieved by the ESA Level 2 processor from MIPAS/ENVISAT limb-emission measurements. The validation is carried-out by comparing the profile precision with the standard deviation of ensembles of profiles obtained from measurements sampling approximately the same air-mass.

The method used is very interesting and powerful as it permits to avoid the smoothing errors existing when measurements from different instruments are compared for validation.

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This is a nice paper providing a very important contribution to the on-going efforts aiming at the characterization of MIPAS data quality, therefore I suggest publication also on ACP.

The only criticism I have is about the style that, at some instances, is very concise and some concepts might be hard to understand for people not belonging to the MIPAS community. I have also found a few errors but, as outlined below, these should be easy to correct as they have no impact on the presented results.

2 Specific comments

1. Page 912, line 7: 'decontamination events'. Although clear from line 11 I suggest to explain already here what is decontaminated from what.
2. Page 913, line 2: how 'complete' is the global coverage obtained in 24 hrs ? I suggest to specify the approximate lat. x lon. sampling grid obtained in 24 hrs or to provide some reference analyzing the coverage of MIPAS measurements.
3. Page 914, lines 5-8: here I share the related comment of Reviewer#1 (ACPD, 7, S89-S92, 2007).
4. Page 914, line 23: Figure 3. Looking at the labels on the vertical scale and at the numbers, it seems that this figure represents the T error, in contrast with the explanations in the text and in the caption.
5. Page 915, line 7: please explain what is 'L1b data'.
6. Page 916, Eq.(2) and lines 17-19: the concept that interpolation introduces a smoothing error is not trivial, at least a reference should be supplied here. Furthermore it is not clear to me why Eq.(2) allows one to avoid smoothing. Are you

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sure that the approximation error introduced by using Eq.(2) - instead of the usual $\log(P)$ interpolation of the ESA L2 code - is smaller than the avoided smoothing error ?

7. Page 916, Eq.(4): if both the mean and the standard deviation are determined from the measurements, then in Eq.(4) the term $1/N$ should be replaced by the $1/(N - 1)$ (unbiased estimator of the standard deviation). Although I believe this change will not have visible impact on the results, it is still important to use the correct formalism. Furthermore it should be mentioned also that this estimator can be used only for sets of differences z_i belonging to the same statistical distribution, i.e. all the z_i should have approximately the same specified precision.
8. Page 917, line 5 (Equation not numbered): some clarifications are needed here. As written now, the result of this equation is zero, therefore I guess the equation should be re-written as:

$$\sigma_z^2 = \langle (x_1 - x_2)^2 \rangle = 2\sigma_x^2 \quad (1)$$

Furthermore it should be mentioned also that you can use this result only if $\sigma_{x_1} = \sigma_{x_2} \equiv \sigma_x$.

9. Page 917, line 6: please define the acronym 'SD' the first time it is used.
10. Page 917, line 14: 'should be considered when considering' I suggest re-wording like 'should be taken into account when considering'.
11. Page 917, line 17: Raspollini et al. (1999). Please consider to complement or replace your reference with the following reference that should be easier to get: Raspollini, P. and Ridolfi, M.: Mapping of temperature and line-of-sight errors in constituent retrievals for MIPAS/ENVISAT measurements, Atmospheric Environment, 34 5329-5336, 2000.

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12. Page 918, line 1: what are these 'originally defined E matrices' ? Please either explain or supply a reference.
13. Page 918, lines 4-7: This paragraph is not very clear, I cannot understand what are these 'erroneous tangent pressures' assumed for Eq.(2). In the ESA L2 processor T and VMRs are retrieved at the (tangent) pressure levels obtained at the last iteration of p,T retrieval, therefore these can be considered 'fixed' levels with no error. The error on the retrieved value of tangent pressure is affecting only the forward model with wrong pressures being assumed along the line-of-sight of the instrument, however this effect is taken into account by the E matrices.
14. Page 918, Sect.4: Figure 6 is too small, the numbers can be hardly read. Furthermore, the size N of the samples used for the calculation of biases and standard deviations is never specified. It would be useful to report at least the order of magnitude of N to have an idea of the statistical confidence interval of these quantities (that are shown later in Fig.s 6-8).
15. Page 918, line 14: Info: this result is also in agreement with the findings of the on-going T validation activities.
16. Page 919, line 2: do you have any idea about the entity of the atmospheric variability ?
17. Page 919, lines 3,4: The error analysis is linear..... Maybe here you wanted to say that the precision is obtained from error propagation, that is a linear analysis, however the retrieval process is expected to be non-linear, therefore the precision could be underestimated.
18. Page 919, line 15 and ff: among the random errors other than the ones due to NESR and pT error propagation there could be also a small smoothing you have not considered. Namely, to process the dataset you are validating, the ESA L2

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algorithm used a Levenberg-Marquardt (LM) algorithm with convergence criteria stopping the retrieval iterations while the LM damping factor is still different from zero. Since the LM factor influences the averaging kernels, differences in the final values of the LM factor in two compared retrievals may induce a smoothing error. I think this effect should be very small and I am not quite sure whether it is worth of mentioning in the paper. The authors can just ignore this suggestion.

19. Page 920, line 20: 'decontamination events'. I suggest to write at least 'ice decontamination events' (for the non-MIPAS specialists).

csgittr..

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 911, 2007.

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