

Interactive comment on “Validation of SCIAMACHY tropospheric NO_2 -columns with AMAXDOAS measurements” by K.-P. Heue et al.

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Anonymous Referee 1

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The authors present a comparison between SCIAMACHY tropospheric NO_2 column and collocated airborne measurements in the Mediterranean area focusing mainly on the Po-valley. Such kind of work is very important to validate satellite observations and the selected area is one of the most suitable in Europe for the high concentration of NO_2 due to natural and human activity observed there. The work is presented clearly and with appropriated scientific approach. Results show good agreement between measurements and this is encouraging for the use of satellite data in tropospheric

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monitoring and studies. However the paper would benefit from a more detailed analysis of some issues which are not discussed enough in the text. They are:

1) Satellite observations are compared with similar measurements performed by an UVS2924 Vis spectrometer installed on board the FALCON aircraft and operating in the nadir geometry as well as SCIAMACHY. Thus the observations to be compared are very similar, as stated by the same authors, either in the geometric configuration or in the retrieval method. This means that the results of the comparison would give us indications on the proper functioning of instruments (they must observe similar amounts) but nothing about the accuracy of the measured tropospheric column of NO_2 . In fact, as reported by the same authors, the sensitivity to the lowest (closer to the surface) atmospheric layers can be a critical point for such measurements and NO_2 tropospheric column can be underestimated. Is there available any comparison with independent measurements? Has the AMAXDOAS method been validated separately?

The AMAXDOAS instrument has been compared to a local ground-based measurement close to Frankfurt a. M. which was published by Wang et al. (2004). Besides we also added a comparison with ground-based data observed close to the flight track.

2a) Even if the linear regression between SCIAMACHY and AMAXDOAS collocated observations gives a good correlation (of the order of 0.9, figure 9) data are often scattered a lot with discrepancy of the order of 30% or more (neglecting the measurements performed over mountain regions). On page 7526 authors make the hypothesis that discrepancy may be due to the no-simultaneity between observations but nothing is said about the different field of view (FOV) of both instruments. Which effect the FOV has on the comparison?

The large difference in the FOV is one of the major sources for the high variability of the AMAXDOAS-SCIAMACHY correlation plot. To reduce this effect the AMAXDOAS data are now averaged across one SCIAMACHY pixel. The correlation coefficient increased from $R=0.899$ to $R=0.941$. However we only average in north south direction,

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whereas SCIAMACHY's pixel average in both north south and east west direction. It is obvious that averaging the data can only reduce this effect to a certain degree.

2b) For example the SCIAMACHY observation around 27×10^{15} molec/cm² (figure 9) corresponds to an AMAXDOAS measurements in the range 17 - 27×10^{15} molec/cm² (that is very large!). Does this observation match the flying over a city? If this is the case such points must be dealt with care in the linear regression otherwise all the considerations on the correlation coefficient (that is, any possible "overestimation of SCIAMACHY") and on the offset (that is, "for SCIAMACHY data the stratospheric NO_2 is overestimated") may have no sense!

The measurements mentioned here were taken at the edge between the Alps and the Po-valley. Here this effect is most probably caused the large difference in the FOV. The SCIAMACHY pixel partly covered the mountains but the main part was over the valley. The AMAXDOAS measurement point in the mountains resulted in the column of 17×10^{15} molec/cm² whereas the others were around 25×10^{15} molec/cm².

After we applied all the changes mentioned above the situation changed. The tropospheric vertical columns changed to 29.3×10^{15} molec/cm² for AMAXDOAS and 37×10^{15} molec/cm² for SCIAMACHY. The difference in the FOVs is the most probable reason: The SCIAMACHY pixel also includes the city of Verona (250000 inh.), whereas AMAXDOAS crossed this region east of the city.

3) On page 7521 authors fix the parameters for the calculation of the AMF. The NO_2 profile is a critical parameter and authors should motivate the choice made. A discussion also on the variation of AMF as a function of the input NO_2 profile could help the interpretation of results when the conversion from slant column to vertical column is performed.

We agree and modified our analyses accordingly. In particular we based our assumptions on independent observations. Besides we varied the NO_2 profile and the aerosol profile and studied the influence on the AMFs. The reference *Petrìoli et al. 2004 was

added especially because here an overview on MLH in this region and time of the year can be found.

Furthermore, concerning some more technical aspects: - On page 7523: the reference "(NERC, 2004)" has no match in the "References" section - I suggest also an accurate reading of the paper to correct some typing errors.

Thank you for the comments and the help provided this way.

*Petritoli, A., Bonasoni, P., Giovanelli, G., Ravegnani, F., Kostadinov, I., Bortoli, D., Weiss, A., Schaub, D., Richter, A., and Fortezza, F.: First Comparison between ground based and satellite borne measurements of tropospheric nitrogen dioxide in the Po-Valley?, JGR 109, D15307, 2004

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