

Interactive comment on “Formaldehyde and nitrogen dioxide over the remote Western Pacific Ocean: SCIAMACHY and GOME-2 validation” by E. Peters et al.

Anonymous Referee #2

Received and published: 20 August 2012

This is a paper presenting HCHO and NO₂ MAXDOAS measurements along the Trans-Brom cruise during October 2009. This is an interesting contribution to the knowledge of NO₂ and HCHO distribution over Pacific Ocean, where measurements are sparse, and gives a new estimation of the background concentrations for both gases over Pacific boundary layer. Tropospheric vertical distribution for NO₂ and HCHO have been retrieved from MAXDOAS measurements and a comparison between MAXDOAS data and satellite retrievals have been given for stratospheric and tropospheric columns of NO₂ and tropospheric column of HCHO with a good agreement. Validation of NO₂ stratospheric columns between GOME2 and SCIAMACHY has been performed with a very good agreement between 0.7 and 1.1 %. The paper is good structured. Descrip-

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tion of instrumentation and analysis settings and retrievals is generally well explained and results are showed clearly with well discussion although it is qualitative in some sections. I would recommend the publication of this paper in ACP after the consideration of the following comments and technical revision:

Minor revisions.

Please consider to include in the title that GB measurements used for validation have been performed using MAXDOAS instrumentation.

Page 15978 L12-14. Please indicate that the increase estimated for NO₂ in the stratosphere is during the day due to diurnal cycle of NO₂.

Page 15980. L 19, substitute 'low' by 'under instrumental detection limit'.

Page 15981 L 26. Please specify a little the characteristic of backtrajectories used for this study (i.e. potential temperature or altitude).

Page 15986 L9. It is said here that reference at zenith at the end of the every scan is taken as DOAS reference, but later on in the text it is said that this reference is used only for the retrieval of tropospheric columns whereas for stratospheric column of NO₂ a single reference is used during all the period of measurements and a daily reference is used for HCHO. Please clarify.

Page 15987 L4. Indicate temperature for NO₂ XS used in this retrieval.

Page 15987 L13-14. Indicate temperature for both BrO and NO₂ XS.

Page 15988 L18. I suppose the instrumental FOV has been included in these calculations. How does the uncertainty in FOV affect to profile calculations for both NO₂ and HCHO?

Page 15989 L5-6. I would appreciate more detail in the vmr used for the a priori profiles used for these calculations.

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Page 15990. Calculation of SC ref. It's not clear for me why satellite data from SCIAMACHY have been used to calculate the SCref for MAXDOAS measurement. Specially when the obtained final VCs are going to be compared with SCIAMACHY. There are methods to consider the diurnal variation of NO₂ taking into account the photochemical behaviour of NO₂ using modified LP (i.e., Lee et al., J. Quant. Spectrosc. Ra., 52, 5, 649–657, 1994 or Roscoe et al., J. Quant. Spectrosc. Ra., 68, 337–349, 2001) is there any reason for not to use them? Please clarify.

Page 15991. Discussion of data showed at figure 5. As the x-axis of figure 5 is local time, it's difficult to me follow the discussion about the difference between vertical columns if figure 4. For an amount of 1.7×10^{14} molec/cm², the difference between MAXDOAS vertical column time and the overpassing of satellite should be about two hours (and it's not, SZA 90° it's at 6AM and overapssing at 9.30AM). As the used vertical columns used is an average between 90° and 88° SZA, I find that an extra axis with SZA would be very useful in figure 5. I would appreciate if the fit for calculation of rate of diurnal production of NO₂ would appear in the figure as well.

Page 15991 L25. Discussion of differences between satellite and MAXDOAS NO₂. It would be very useful to have a table in which would appear day, latitude, MAXDOAS NO₂, SCIA NO₂, diference MAXDOAS-SCIA, GOME2 NO₂, diference MAXDOAS-GOME2. Please, consider to include it.

Page 15993 L5. It's really difficult to observe the difference between SC for different elevations. Would be possible to modify the scale or the figure in order to see the described differences?

Page 15994 L20. It's not possible to distinguish when SC is abover detection limit or not by only looking at figure 6. I don't know if the line at $y=0$ is $y=2 \times 10^{15}$ molec/cm² instead. At any case that should be explained in the figure caption.

Page 15994 L 22-23. What difference would be if the method for estimating detection limit of Platt and Stutz 2008 were used instead?

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Page 15995 L 15-17. I don't understand this sentence. MAXDOAS measurements have been performed at ship geolocation, what MAXDOAS measurements have been averaged and showed in figure 8?

Page 15995 L 25 and Page 15996 L10. Please don't mention figure 11 before figure 10 in the text. Change the figures' order in the manuscript.

Page 15997 L22. Please, mention how the detection limit for HCHO has been calculated. If it's the same way than HCHO, indicate it. In that case, if Platt and Stutz 2008 is applied instead the definition of detection limit, is there any appreciable variation observed on the results?

Page 15998 L12. Regarding the observed diurnal cycle of HCHO peaking at noon, if oxidation of CH₄ is the only mechanism to produce HCHO at a clean location, and destruction mechanism are reaction with OH and photodissociation, is this noon peaking expected by chemistry? Has this behaviour been previously observed?

Page 16011. Caption of figure 2. Please do not include information in the caption that is an explanation of results or methodology. In this caption I would keep only the first sentence.

Page 16013. Caption of figure 4. Error margin plotted as grey-shaded area is not mentioned previously in the text. Please, describe it in the text when the figure is introduced. Change "gray" by "grey".

Page 16014. Figure 5. It would be very useful to have an extra axis with SZA in this figures and the line of the linear fit (mentioned in the text) over-imposed to data.

Page 16015. Caption of figure 6. Please do not include information in the caption that is an explanation of results or methodology. I consider that last sentence should be explained in the text, except the explanation what red arrows mean.

Page 16017. Figure 8. Please indicate what grey-shaded area is.

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Page 16018. Caption of figure 9. Please do not include information in the caption that is part of the conclusions or of the discussion. Last sentence is explained in the text.

Technical corrections

Page 15978, L3. Change '-20°S' to '20°S'.

Page 15985, L17, Change 'Vis' by 'visible'.

Page 15987 L3. Change '(Richter, 1997)' by 'Richter (1997)'.

Page 15992 L16. Change '(Takashima et al, 2011)' by 'Takashima et al (2011)'.

Page 15999 L12. Change '-10°S' to '10°S'.

Page 16020. Figure 11 (This figure is mentioned before figure 10 in the text). Contour of continent and islands as well as the trajectory of the cruise would be more visible in white instead black.

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