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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Estimates of free-tropospheric NO_2 and HCHO mixing ratios derived from high-altitude mountain MAX-DOAS observations in the mid-latitudes and tropics" *by* S. F. Schreier et al.

Anonymous Referee #2

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Title: Estimates of free-tropospheric NO2 and HCHO mixing ratios derived from high-altitude mountain MAX-DOAS observations in the mid-latitudes and tropics Author(s): S.F. Schreier et al. MS No.: acp-2015-799 MS Type: Research article

MAXDOAS data from two high mountain stations at mid and tropical latitudes are analysed to obtain estimations of the background concentrations of NO2 and HCHO in the free troposphere. The analysis makes use of the novel technique MGA extended toward the UV spectral region. Radiation data are compared with synthetic ones to evaluate the accuracy of the measurements and results are discussed considering the

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aerosol loading (AOD) and the influence of the biomass burning in the area.

General comments.

Results provide new and additional information on the free troposphere minor species chemically active, a region where data are scarce. The manuscript is clearly written and figures are illustrative. I recommend the article for publication after addressing the comments below.

Specific comments

+ The applied technique is quite sensitive to the amount of aerosols present in the air. However, there is little information in the paper on how this has been treated in the data analysis. AOD data based on MODIS (in the visible?) show mean values over 0.2 on 5 out of the 8 months considered in the study. In such conditions the errors of the approach increases notably compared to a Rayleigh atmosphere. In page 31795, lines 10-12 lower limits for considering too much aerosol loading at each spectral range is established. How are these limiting paths calculated?. Is there any "visibility" device at the stations to correlate with the obtained paths? Have the MAX-DOAS data themselves used to retrieve aerosols as part of the rejection criterion? A more detailed description on filtering criterion concerning the atmospheric visibility would be needed. If data with AOD larger than 0.1 passed the filter, it would be useful also to estimate the error in the computed paths.

+ FOV of the instruments is not mentioned in the paper, neither references to previous publicactions. They are relevant for the reasons exposed below (page 31789).

+ 31784, line 26. It is more accurate to use "minimize" than "cancel out" since local effects contribute to the hOPL, as well.

+ 31789, line 15. If the average terrain height below the path at Pico Espejo is of only 150 m, and the path length is of 20-30 km, typical FOV of 1° would hit the ground. The quality of the signal should be affected by the contribution of the ground spectrum. A

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comment on how this geometry affects the measurements should be included in the text.

+ 31794, line 3-6. Measurements of larger paths than those obtained for a Rayleigh atmosphere are also possible due to the use of a room-temperature O4 cross-section. Spinei et al. (AMT, 2015) have shown that too large paths are obtained when using room temperature cross-sections (i.e. Hermans) in low effective-temperature conditions, which I assume is the case at Pico Espejo. I suggest the authors to estimate the error in the path due to the temperature dependence based on the Spinei paper.

+ 31796, line 4-7. I guess the authors make use of MODIS because AOD devices on the stations are lacking. However, since MODIS averages over an area with probably a lower mean heigh than the observing point, the correlation shown in figure 8 and conclusion of table 3 are missundertanding. I suggest explaining this subject in more detail and provide some information on MODIS (size of the footprint, mean altitude, etc). Again, interpretation of section 6.2 (relies on the correlation Xno2-AOD. If AOD is not that above the station, it must be outlined.

Techical corrections

+ 31796, line 10. Typo: remove “of”

+ 31796, line 6. “averages” ->“averaged”

+ Check the spectral range in which spectrometers are operating. Different numbers appear along the text.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 31781, 2015.