

Interactive comment on “Estimates of free-tropospheric NO₂ 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 #3

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This article reports on MAX-DOAS observations of free tropospheric nitrogen dioxide and formaldehyde volume mixing ratios measured from two high-altitude locations: Zugspitze (Germany) and Pico Espejo (Venezuela). Accurate observations of this part of the atmosphere are sparse because with ground-based (i.e. from within the boundary layer) or satellite remote sensing it is almost impossible to do accurate retrievals of this part of the atmosphere. Therefore the study is quite relevant as a first-order quantification of trace gas abundances in the free troposphere, despite the fact that the retrieved values are at best indicative for volume mixing ratios at other locations around

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the world.

The paper describes the applied methodology in a clear and concise way and the quality of English writing is high.

It would have been nice if the authors would also have reported free tropospheric trace gas partial columns above the location of the instrument. This complementary information would have been equally unique and relevant and is contained in the MAX-DOAS data set used in this work.

A drawback of the work discussed in this paper is the fact that results are almost not compared to other data sets (except for some references to papers reporting similar values for other locations). However, as measurements of tropospheric trace gas abundances with other sensors are so rare, the lack of comparison with other data sets should not be a reason to reject this study.

In my view, the paper can be published after minor changes described below.

p.31782, l.7: Please replace “close to the instrument” by “close to the instrument altitude”. Same for the sentence in the conclusions (p.31799, l.22)

p.31785, l.1: Please remove “The authors of”.

p.31791: About Fig. 2: The residual spectrum of the HCHO fitting window appears to have a considerable amount of structure in it (it does not look like random noise). Are the residual spectra similar for other cases? What could be the cause of these structures?

p.31797: First paragraph: I find the reasoning to exclude the month of June not so convincing. I would say that the NO₂ life time in July and May is not so very different from June. Did the authors explore back-trajectory calculations to support the hypothesis that air masses measured in June can be linked to different (pollution) source regions?

p.31797, l.25: Please replace “Due” by “Due to”

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p.31798, l.1-8: In my view this paragraph should be part of the previous section (as it is about NO₂). Please consider to copy it to that section, and then remove the first part of the first sentence: "Before . . . HCHO,"

p.31801, l.12-15: "This implies . . . free troposphere." This sentence is difficult to understand and appears gramatically incorrect. Please rephrase.

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