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# Comment on acp-2021-815

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Community comment on "MAX-DOAS observations of formaldehyde and nitrogen dioxide at three sites in Asia and comparison with the global chemistry transport model CHASER" by Hossain M. S. Hoque et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-815-CC1, 2021

The study by Hoque et al., 2021 presents MAX-DOAS measurements of $NO_2$ and HCHO at three different sites in south-Asia and compareS the vertical distributions with simulations from the chemical transport model CHASER. I have a few comments regarding the study.

- In the introduction (lines 88-93), the authors mention that it is the first study to evaluate the CHASER model simulated $NO_2$ and HCHO profiles using MAX-DOAS observations in three atmospheric environments. They also mention that no relevant literature in the past has described the use of MAX-DOAS datasets to evaluate global CTMs in southern and southeastern Asian regions. In this context, the study by Kumar et al. (2021) should be mentioned, which proposed a robust method to evaluate the vertical distribution of trace gases in an atmospheric chemistry model using MAX-DOAS measurements.
- In lines 145-146, the authors mention that the reference spectra were recorded at elevation angle of 70° instead of 90° to minimize variations in the signals measured at each elevation angle. I find it difficult to understand. How would a reference at 70° minimize the variation in signals and what advantage does it have?
- In lines 147-148, the authors mention that the off-axis elevation angles were limited to < 10° to reduce the systematic error in the in-oxygen collision complex ($O_4$) fitting results. This statement is not so clear and should be explained.
- The authors mention that they have used the anthropogenic emissions from HTAP_v2.2 for 2008, while the model simulations were performed for almost a decade later. I wonder why EDGAR v5AP (https://edgar.jrc.ec.europa.eu/emissions_data_and_maps) was not used, which includes the anthropogenic emissions for up to 2015.
- Sections 3.1.1 and 3.1.2 show the seasonal variability of HCHO and $NO_2$, respectively, in two different vertical layers at Pantnagar located in the Indo-Gangetic plain and discuss the impact of crop residue burning in this region. The Study by Kumar et al. (2020) have also shown more than four years long vertically resolved measurements of the same species from a regionally representative site in the Indo-Gangetic plain and highlighted the impact of crop residue burning in the pre-monsoon and post-monsoon period. It is unfortunate to have no mention of the findings of Kumar et al., 2020 in this context.
- Again, in section 3.1.3, $HCHO/NO_2$ ratios are investigated to determine the ozone production sensitivity for the site Pantnagar in the Indo-Gangetic plain. Yet, there is no mention of two very relevant studies (Kumar et al., 2020; Kumar and Sinha, 2021) in this context that discusses the ozone production sensitivity on VOC and $NO_x$ using

various indicators, including $HCHO/NO_2$. Here, I would like to point out that the threshold values used for $HCHO/NO_2$ ratios are valid for tropospheric columns and using the same for concentrations might lead to inappropriate inferences (Martin et al., 2004). This aspect should be discussed by the authors.

**References**

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