Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2022-170

Anonymous Referee #1

Referee comment on "Evaluation of correlated Pandora column NO_2 and in situ surface NO_2 measurements during GMAP campaign" by Lim-Seok Chang et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-170-RC2, 2022

The authors compare in situ measurements and column measurements of NO_2. The overall purpose of this comparison is to investigate how well surface measurements can be used for the validation of (GEMS) satellite measurements of NO_2.

The authors find that the correlation between both data sets depends on meteorological conditions. They define specific classes based on different slopes and correlation coefficients. They explain the different relationships making also use of additional measurements, e.g. vertical profiles from aircraft measurements.

Their main conclusion is that ‚caution is required when performing GEMS validation using either PC or SI observations alone, particularly under prevailing local wind meteorological conditions or transport processes.'

While I agree that caution is required if only surface observations are available, I disagree that caution is required if tropospheric column amount measurements from independent sources are available.

Overall, this is a very useful study and I recomment publication in ACP after mafor revisions.

Major points:

1) As mentioned above, I disagree with the authors that caution is required if tropospheric column amount measurements from independent sources are available.

In contrast, such independent data sets (e.g. from MAX-DOAS observations) are a very good source for satellite observations of tropospheric NO_2 columns. I suggest to remove this statement from the abstract and from other parts of the paper.

2) From Pandora, also tropospheric profiles and tropospheric VCDs are available. These quantities are much better suited for a correlation analysis than the total NO_2 columns. It is not clear to me why the authors chose the total VCDs.

I suggest that the correlation analysis should be extended (or replaced) using tropospheric VCDs and surface concentrations from pandora measurements.

3) I suggest to extend the correlation analysis by looking how the correlation between PC or SI observations depends on the time of the day. This would be a very valuable addition. We can expect that the correlation changes with time, because also the vertical mixing and the photolysis rate changes with time.

4) line 241: You write: ‚These hourly data exhibited a fair logarithmic relationship (R = 0.45),...'

(Why) do you calculate the logartithmic relationship? Please clarify

Minor comments:

Line 159: It is not clear how direct light measurements can be performed under partly cloud-covered skies. Please clarify.

Line 254: how can you expect a constant value? The stratospheric NO2 amount varies with season (and time of the day). Please clarify.

Line 361: You write: ‚All observed NO2 profiles shown in Fig. 7 appeared to have generally exponential curves...'

I think you can not conclude this because there is not measurement between the surface and 500m. Please clarify.