

## ***Interactive comment on “Full-azimuthal imaging-DOAS observations of NO<sub>2</sub> and O<sub>4</sub> during CINDI-2” by Enno Peters et al.***

### **Anonymous Referee #2**

Received and published: 10 June 2019

This manuscript introduces a newly developed imaging-DOAS instrument (IMPACT) with the ability to simultaneously measure 50 elevation angles and achieve a panoramic view of the surrounding NO<sub>2</sub> distribution within 15 minutes. This enables the retrieval of tropospheric trace gas profiles at high temporal resolution. The observations presented in this paper were made at Cabauw during the CINDI-2 intercomparison campaign and hence, observations made with IMPACT could be compared with coinciding MAX-DOAS measurements. The azimuthal distribution of NO<sub>2</sub> around the measurement site was found to be homogeneous on longer time scales but highly variable on short time scales which is certainly of relevance and interest for the validation of tropospheric NO<sub>2</sub> from satellites. The authors found that one reason for the observed NO<sub>2</sub> variability are transport events and one such event is further investigated in the manuscript. In

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addition to the NO<sub>2</sub> observations, the potential of O<sub>4</sub> measurements along multiple almucantar scans to be used to retrieve information about the aerosol phase function is investigated as well.

The research described in the manuscript is clearly presented and the manuscript is well written. The scientific content is certainly also relevant for AMT and the paper is recommended for publication in AMT.

Specific comments:

Page 2, line 10-11: Sounds a little strange and since the traffic fleet applies to both, domestic and industrial, I would recommend to delete 'in industry;'. And savanna and forest fires can certainly also be anthropogenic (intentional burn-offs), so needs some rewording.

Page 2, line 13: Add comma: 'Overall, the ..'

Page 3, line 7: 'In summary, all previously reported ...'

Page 3, line 14: '... retrieval of the entire ...'

Page 3, line 15: 'The short acquisition time ...' – although discussed later, it would be good to add already here how long (15 min).

Page 3, line 26: Better: '... be observed by investigating the temporal ...'

Page 4, line 12: Better: 'The latter part is ...'

Page 4, line 25-27: Sentence could be a bit improved, e.g.: ... either measured at a small solar zenith angle (SZA), or taken ...(sequential), as for the zenith viewing geometry the light path ... is then short'

Page 4, line 28: Add comma after (lo)

Page 6, lines 1-5: If there are 69 fibres of which are only 50 used, wouldn't the others be a source of straylight in the spectrograph? If so, how is this dealt with?

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Page 6, lines 18-19: Add commas after 'instrument' and after '(Sect. 2.4)'

Page 10, lines 8-9: replace 'realize' with either 'note' or 'acknowledge' and add 'the' before 'telescope elevation'

Page 10, line 11: Delete 'promptly'

Page 12, line 21: 'molec cm<sup>-2</sup>' needs -2 in superscript  
Caption of Figure 7: Any reason why that particular period (17-23 Sep) was picked and not e.g. the complete campaign period

Page 14, line 13: Replace 'persistence' with 'persisting', right?

Page 14, line 15: Should be 'overall'

Page 14, line 24 etc.: Would be interesting to know how many such transport events could be identified within the campaign period. Could you add that to the discussion?

Page 15, Figure 8 caption: Could you please add here the time period used (i.e. averaged over)? I assume it is the complete campaign period?

Page 17, Figure 12: Would be helpful if the blue arrow head could be bigger; in my printout, it was not really detectable.

Page 20, line 17: Add comma after 'question (1)'

Page 23, line 4: Add 'with' after 'interfering'

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-33, 2019.

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