Review of "Full-azimuthal imaging-DOAS observations of NO2 and O4 during CINDI-2"
by E. Peters et al.

This paper presents a novel imaging-DOAS instrument able to perform panoramic 360° azimuth views. The instrument is presented in details with: 1) a comparison to MAXDOAS instrument during the CINDI-2 campaign (pointing to horizontal/temporal short term NO2 variability), 2) illustration of a rapid plume transport in the rural Cabauw location, and 3) the potential of O4 measurements added value for the aerosols retrieval with the various almucantar geometries measured simultaneously.
The scientific content of the paper fits well the scope of AMT and the manuscript is well written and of interest for the community. The large NO_2 variabilities seen on short time scales in the remote location is of interest for MAXDOAS and validation studies. I recommend the publication after the suggested revisions.

General comments:

Consider moving paragraph 4.2 after 4.3, to present results in a more clear way (as in the introduction and in the conclusions). To improve readability, please add a sentence explaining that different days are selected to present different studies: first the 23/9, to present temporal variations and comparison with MAXDOAS, then 20/9 to illustrate a transport event and finally the 24/9 for exploring the aerosols potential with O4 measurements. It would be nice to also specify wind conditions for each case.
Please clarify somewhere the time needed for 1 azimuth image and how "large" it is, i.e. what is the azimuthal "FOV" (compared to the ~40° in elevation) (p. 4, L 2). My understanding is 10 azimuth degrees covered in one azimuth image, and it needs 15 minutes for the 36 steps that covers the 360°? (but P.6, L12: -175 to 175= 350°, so is it 350 or 360°?). 10 steps azimuth (as mentioned in P.6), but 11 points on figure 6, which covers 12 minutes… please clarify/add a small paragraph on the azimuth "FOV" (512 pixels for 10° azimuths in one image ?) somewhere (as a confrontation to the elevation 4x0.2°=0.8° FOV and total image of 40 to 41° in the vertical). See also detailed question for figure 6.
Please explain in more details what is done for the zenith measurements and for the dark current correction (see specific comments).
To improve readability of the figures, also consider adding "N", "E", "W" and "S" letters in addition to azimuth angles from the north in figures 8, 10, 13, 16 and 17.

Specific comments and Technical corrections

- P. 4, fig2: add the x and y label on the figure for improved readability
- what is done for the zenith measurements? After each azimuth scan, a zenith image that is correcting pixel-by-pixel the azimuth image? Or one zenith after a whole 360° hemispheric measurement? Never mentioned except very slightly in P.4, L4 P. 4, L 15: 41° vertical FOV: in P2 L70 is 40° - check the coherence!
- P. 4, L61: "the detector continuous to be illuminated" → continue to be
- Considering the increased exposure time (P.5, L5 - how much) to decrease impact of the sequential CCD read out, what is done for the dark current correction?
- P. 5, L46: cite Kreher et al. for the intercomparison period
- P. 6, L26 : remove the acknowledgements in the acknowledgements section.
- P.6, L31: the 0.2° steps of the telescope are done in elevation, right? → add 0.02° steps vertically to clarify.

- P. 6, L35 to 41: figure 3b is not very clear in representing these sentences – there are 3 yellow spots in each of the fibers instead of 4
- P. 6, L97: remove point after “Figure. 6 “
- P. 7, L 21: “while IMPACT repeats measurements of the complete elevation angle range”. Clarify in which azimuthal direction. Is figure 6 presenting, in 12 minutes, a full 360° IMPACT scan or only scans in the same “main” azimuthal direction than the MAXDOAS? Same question for P 8, L 6 “the closest IMPACT vertical scan (measured simultaneously) was selected” for figure 7. I.e., is it temporal variability in the MAXDOAS viewing direction (what is the wind speed?) or space variability around the MAXDOAS?
- Table 2/figure 7: why not including the results for 1° elevation, which is the elevation with the steepest decrease in figure 6? Because of explanations in P. 7, L2 to 14? If yes, this will also have an impact on the profiling comparison of Sect. 4.3, figure 15b… could you quantify/estimate it? Link the statistical results to those from the semi-blind intercomparison.
- P. 8, L 45: “In general, largest NO2 slant columns are found not in 0 or 1 but ~2 elevation,… which is an effect of the instrument’s FOV, i.e. surface effects are present in the 0 and (to a lesser extent) in 1 elevation angle as a result of the overlap of adjacent fibres mapped onto the CCD ”: is this taken into account in the profiling? How?
- P. 9, L 10 to 16: it would be nice to compare the horizontal variability during the campaign illustrate in figure 9 for 4° elevation (between 10 and 120%, with 35% in average), to the vertical variability in the first kilometer
- P. 9, L 22: cite references of validation studies that did this averaging in several directions. Is averaging ground-based data in time also an advisable option (i.e Pandora instruments measuring with a very high frequency)?
- Figure 11: add a little bit of description (beta is the azimuth, 75° is the mean wind direction between 10 and 11h, …)
- P. 11, L 27: “However, … ” this sentence is strange. Reformulate to something like “with MAXDOAS it is also possible to incorporate O4… as suggested by Wagner…”
- P. 11, L 33: “the aureole region“ of the sun ?!
- P. 11, L 52: “For research question (1) it is important that sky radiometers (e.g. within the AERONET network) and current state of the art MAX-DOAS instrument”. Modify the “it is important” by “a limitation of”?
- P. 11, L 59: replace to “Fig 13, both above and below the …”
- P. 11, L79: “short” and “much larger”: give an estimation/order of magnitude.
- P. 11, L 88: change to “this is not the location of largest scattering angles (occurring at ~55° azimuth only)”
- Figure 13: specify somewhere in the text or figure caption that the sun is at 25° elevation and 125° azimuth (fig 13 a))
- P. 13, L 11: remove “again” when specifying the decrease. Before, only ‘increase” as been using for describing figure 14 d).
- P. 13, L 22: remove “interestingly”. This is somehow “hoped”, no?! that the measurements of the aeronet “g=0.75” value gives the best correlations.
- Figure 15: panel a) and b) do not cover exactly the same time-period. A) stops before 9h06, while in b) profiles up to 9h11 are presented, and averaged together. Use a more distinct color than black and blue for the IMPACT mean profile and MAXDOAS profile in panel b.

- check that the day is specified in all the figures (not the case in fig 14 and 15).
- P. 14, L. 90: " These small elevations contain much information and have a large influence on the retrieved profile in lower altitudes": cf previous question on the impact of the low elevations of IMPACT being impacted by surface + impact of the different decimal digits of IMPACT elevation instead of round elevations of MAXDOAS?
  What are the Degrees of freedom for the profiles coming from the 2 instruments? Are they comparable?
- P. 16, L 16 "coinciding observations". word should be attenuated, as the measurements are up to 12 minutes apart.
- P. 16, L 35 "measurements in one direction are not enough to characterize tropospheric NO2, which is in particular crucial for MAXDOAS validation of tropospheric NO2 from satellites". This is true, but also the low sensitivity of the satellite close to the ground is a "limiting" factor.