Author's response to comments by referee #1

We would like to thank the reviewer for his / her useful comments.

General comments:

The authors present a study that combines observations from a mobile DOAS system and a stationary system that rotates through every azimuth approximately hourly. Additionally, they pull in data from in situ samplers to compare the column-converted NO2 mixing ratio to in situ observations. In my view the novelty of this experiment is the combination of observations, with little or no novelty in the presented chemistry/physics, making it by far more applicable to AMT as opposed to ACP. While this paper could be considerably shorter (by focusing on the technique and omitting unnecessary discussion of chemistry that is well understood), I recommend it for publication after some minor revisions.

Specific Comments:

page 8 line 10: "anti-clockwise" should be changed to counter-clockwise

We have now changed "anti-clockwise" into "counter-clockwise".

page 8 line 28 - page 9 line 2: there is no need to "assume" the rotation speed. You can calculate this from your observations.

We have now omitted "assuming" and rephrased the sentence accordingly.

page 20 line 22: it will be helpful to the reader if you identify the day of week corresponding to each date.

We have now added the day of week in parenthesis after each of the three dates.

page 20 line 24-26: Does "starting point" reference the starting point of Fig. 1? This says that "as we go farther from the clean area NO2 increases". Would it make more sense to reference the distance from the center of the city, which would better show the gradient from the "source" to background?

"Starting point" does not reference the starting point of Fig. 1. "Starting point" is the start point of individual car DOAS zenith-sky measurements at the full resolution of 0.05 seconds (see page 11, line 3-11).

page 21 line 19: What do you mean by "horizontal NO2 scale"? Is this the e-folding distance?

We agree that this is a somewhat qualitative statement. The idea is that over this distance, the NO2-field is more homogeneous than over longer distances, implying that this is a typical size of NO2 plumes observed in the columns. This is of course related to the e-folding distance but given the complex mix of pattern of emission sources, transport, and mixing and photochemistry of the plume, a single e-folding distance has little meaning within an urban area.

page 22 lin 16: Please clarify what these starting/ending points are (same as Fig. 1?)

Also here the starting and end points are not referenced to Fig. 1. Here, starting and end points define the distance of the A22 motorway for evaluating the NO2 variation along this section of an individual car DOAS route.

page 23 line 4: replace "left" and "right" with "east" and "west" as necessary.

We have now changed it accordingly.

page 25 line 22: I see nothing on 2-October near the 1:1 line. Please clarify.

We agree that it is not close to 1:1 line. We have now rephrased the sentence accordingly.

page 27 line 21: define "hOPL" after first use.

hOPL is defined after first use on page 20, line 1.

fig. 11: is the distance here the same as in Fig. 10?

The distance is not the same. The time series in Fig. 10 present measurements of the whole day (e.g. measurements of three circuits as shown in Fig. 1 plus an additional circle in an rural area outside of Vienna), while time series of Fig. 11 present the selected section of an individual round (A22 motorway, along the Danube River) as described in Sect. 4.2.

fig. 18: please define hOPL

We have now defined hOPL in the figure caption of Fig. 18.

Author's response to comments by referee #2

We would like to thank the reviewer for his / her useful comments.

General comments:

Is still unclear to me if the SCDref (in the author's opinion) contain tropospheric and stratospheric absorptions. The authors present that the SCDref calculation is based on ground-based tropospheric in-situ measurements. Please confirm if the stratospheric contribution to the SCDref is neglected or canceled.

SCDref contains both tropospheric and stratospheric absorptions. Stratospheric NO2 amounts are calculated from B3dCTM simulations and tropospheric residual amounts of SCDref are calculated by assuming the empirical relationship between VCDtropo and in situ NO2 mixing ratios as reported in Kramer et al. (2008).