

The present manuscript presents a complete analysis of O₄ and NO₂ vertical profiles during three months in Madrid, Spain with the aid of ground-based MAX-DOAS 2-D observations. The aerosol and NO₂ vertical profiles in multiple viewing azimuth directions are presented here as well as the horizontal NO₂ distribution around the measurement site. Finally, the 2-D MAX-DOAS NO₂ near-surface concentrations are compared with the in-situ NO₂ measurements in Madrid.

I recommend the publication of the manuscript after consideration of a major number of specific comments:

Specific comments:

1. Page 1, Line 19: Please write the spatial resolution of the mesoscale events.
2. Page 1, Line 27: In my understanding, you used one inversion algorithm (not inversion algorithms) for the aerosol and the NO₂. Please correct that and write the name of the inversion algorithm that is used (bePRO).
3. Page 1, Abstract: I would recommend that you write in a more clear way, the main findings of this study and the main contributions/innovations that you have made.
4. Page 2, Line 49: I would recommend to write that you have developed two MAX-DOAS instruments and not just MAX-DOAS instruments.
5. Introduction: It would be valuable to add a paragraph in which you cite previous MAX-DOAS studies of two-dimensional measurements (like Ortega, Schreier, Wang, Dimitropoulou etc.) as well as studies where MAX-DOAS observations are compared with in-situ measurements.
6. Section 3.2: Where do you expect to measure higher NO₂ concentrations (North, South etc.)?
7. Page 7, Line 193: In your study, one complete MAX-DOAS scan takes one hour. The advantage is that you have a very nice horizontal sampling but at the other hand, you risk to measure the same NO₂ air mass in multiple azimuthal directions (for example, during one hour, the NO₂ that you observe in the North can be moved by the wind in the North East direction). Please add a sentence in which, you make clear the advantages and disadvantages of your choice.
8. Page 11, Line 252: After the filtering of the MAX-DOAS measurements, which is the percentage of accepted scans?
9. Page 11, Line 264: The RTM is the forward model and the bePRO is the inversion algorithm. Please correct this.
10. Page 12, Line 290: It's not exactly an analogous process because for the O₄ and aerosol, non-linear calculations are performed and for trace gases as NO₂, we have linear calculations. Please verify if it's the case for bePRO and correct or not this sentence.
11. Page 13, line 310-318: You have used Standard atmosphere profiles, which are widely used in studies like the present one. But, you should include an uncertainty estimate of using a standard profile instead of a real profile (by meteorological measured data)
12. Section 4.2: You should a paragraph in which you present an average error estimate of the retrievals and add a Table with all the error sources (smoothing error etc).
13. Section 4.3: In your results, you should discuss the range of the estimated horizontal distances for the UV and Vis during your measurement period
14. Figure 6: These results are from which measurement day and scan/hour? I assume that it is not the whole period, right?
15. Figure 7: How do you explain the aerosol peak at around 50 deg. VAA and in high altitude?
16. Page 20, Line 465: Why do you use the UV distance and the Vis which is larger?

17. Figure 10: Please include a 1:1 line and put the same axis limits in both x, y axis in order to quantify rapidly the underestimation on the near-surface NO₂ concentrations by the MAX-DOAS
18. Page 21, Line 480: You write that the slope is lower than 1 (it is 0.4) which is true but you should add a sentence in which you discuss this finding. Is it in agreement with previous studies that compared MAX-DOAS and in-situ?
19. Conclusions: You should make this section larger and discuss more your results
20. Through the whole manuscript, references should be added, as I mentioned in previous comments

Technical corrections

1. Page 2, line 34: gaseous pollutant concentrations instead of gaseous pollutants concentrations
2. Page 3, line 73: path lengths instead of paths lengths
3. Page 11, Line 256: inversion algorithm method instead of inversion algorithms