

Interactive comment on “Two-dimensional monitoring of air pollution in Madrid using a MAXDOAS-2D instrument” by David Garcia-Nieto et al.

Anonymous Referee #2

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In their manuscript “Two-dimensional monitoring of air pollution in Madrid, Spain using a MAXDOAS-2D instrument”, the authors report on measurements in Madrid using a new MAX-DOAS instrument with both elevation and azimuth pointing capabilities. Examples of NO₂ profile retrievals are discussed and some results of onion peeling retrievals presented. Finally, a comparison is performed between hourly mean values from the lowest MAX-DOAS profile level and data from the air quality network, showing good correlation.

The manuscript is generally clear and well written but lacks detail in many places. It also does not provide reference to the many existing studies using similar instruments,

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performing similar retrievals, and addressing similar research questions.

My main problem with this manuscript is however the lack of novelty: In fact, I do not see anything new in this manuscript on instrument development, DOAS retrievals, profile retrievals, the onion peeling approach or the validation of the retrievals. The instrument is similar to many others operated (see Kreher et al., 2020), the DOAS retrieval is performed using the freely available software QDOAS, the profile retrieval is using the software BePro, the onion peeling follows the work by Ortega et al. and the validation is limited to a single figure showing measurements from a not further defined time period. I therefore unfortunately cannot recommend this manuscript for publication in Atmospheric Measurement Techniques.

The measurements of the 2d-MAX-DOAS instrument in Madrid certainly have the potential to provide interesting results on pollution in the city, and how it depends on emissions and meteorology. Such a study would then however be more appropriate for ACP than for AMT.

I also have some more detailed comments, which the authors could take into consideration when using the existing draft as base for another manuscript providing novel results and data.

Line 120: I am not sure that profile retrievals “try to reconstruct the photon paths” – in my view, they mainly try to find a vertical distribution that is consistent with the retrieved DSCDs

Table 1 / Table 2: I am not sure what exactly is meant by “All spectra and the Ring cross sections were allowed to shift and stretch (order 1) in wavelength”. However, in my opinion, reference spectra should not be allowed to shift and stretch as they are measured at high precision. If the background spectrum (here: the zenith-sky measurement) is well calibrated using a Fraunhofer Atlas, the only spectrum that should be allowed to shift and stretch is the horizon measurement itself.

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Line 239: Cloud clearance using AERONET data will work in the direction of the sun, but as far as I know, it does not guarantee 360° of cloud free measurements.

Figure 4 and discussion: I did not fully understand what was done here and why – surely, it does not make sense to use an atmosphere for the wrong surface height. I also fail to understand what the conclusions i) and ii) exactly imply, and how they follow from the fact that the profile retrieval is able to compensate a wrong atmospheric pressure profile by wrong extinction coefficients when reproducing O4 measurements.

Figure 9: I think it does not make sense to present two pieces of radial information from the onion peeling approach in this smoothed fashion that suggest a higher information content than there really is.

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