

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2021-270

Anonymous Referee #1

Referee comment on "The Aerosol Research Observation Station (AEROS)" by Karin Ardon-Dryer et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-270-RC1>, 2021

This manuscript describes a new aerosol monitoring station (AEROS) located in West Texas. Three mid-cost instruments (OPS 3330, Grimm-11D and DustTrak DRX) are installed, which provide PM mass concentration, particle number concentration and size distribution. Inter-comparisons and validation of the instruments in the laboratory as well as with atmospheric aerosols are presented. The manuscript is written in a clear language (apart from an issue with the units which is explained below) and the authors describe in adequate detail the monitoring site and facility.

I agree with the authors that mid-cost optical particle size spectrometers, such as the OPS 3330 and Grimm 11-D, seem to perform almost as good as high-end (and therefore more expensive) instruments with regards to particle number concentration and size distribution. I am not so convinced though about the performance of the Grimm 11-D and DustTrak DRX when it comes to PM mass concentration. As the authors correctly highlight, the algorithms used by these instruments are not disclosed. Moreover, calibration of PM monitors in the laboratory is not as standardised yet. In my opinion, mid-cost PM sensors are useful for providing high time-resolution data but there are still open questions about the accuracy of the results. Considering that PM mass concentration is the only regulated metric for aerosols (in most parts of the world), it is important that PM mass concentration is also monitored by the reference (manual) gravimetric method or, at least, by high-end instruments such as Beta Attenuation Mass (BAM) monitor or a Tapered Element Oscillating Microbalance (TEOM). In that sense, I think it is a pity that the manuscript does not provide any reference PM mass concentration data (the filter sampler unit was not operational). This could have increased the overall quality of the manuscript.

Specific comments:

- I would like to kindly ask the authors to check carefully the units (cm^{-3} vs m^{-3}) throughout the manuscript. Please make sure that number concentrations are given per

cm³ and mass concentrations per m³.

Page 5/Line 148: According to the manual of the 11-D monitor, the number concentration can reach up to 3 000 000 particles/L (= 3 000 particles/cm⁻³, not 3 000 000 particles/cm⁻³) without coincidence losses and mass concentration up to 100 µg/m³ (not 100 000 µg/cm⁻³).

Moreover, the manufacturer has recently revised the online technical specifications of the 11-D monitor to 5 300 000 particles/liter (<https://www.grimm-aerosol.com/products-en/dust-monitors/the-dust-decoder/11-d/>) (which we have also tested and confirmed in our laboratory).

In Section 3.2 (text), mass concentrations are given in µg/cm⁻³ where it should have been µg/m⁻³.

Sometimes, number concentration is expressed as #/cm⁻³ and some other times as #/cc (e.g. in Figure 4B). Please harmonise units throughout the text and figures.

Page 5, Lines 118 & 147: the unit of time is "s" (instead of "sec.").

Page 3, Line 86: Consider revising "liters per min" to "L min⁻¹" to be consistent with the rest of the manuscript.

- Figures 3, 6, 7: When referring to particle diameter (x-axis), please specify what type of diameter this is (e.g. mobility, aerodynamic, geometric, optical etc.). In this case, I guess you are referring to optical diameters.
- Page 1, Line 21: More precisely, PM_x is particulate matter suspended in air which is small enough to pass through a size-selective inlet with a 50 % efficiency cut-off at x µm aerodynamic diameter.
- Page 2/Line 54: Consider adding "... provided that they undergo a regular (e.g. yearly) service and recalibration".
- Throughout the text: The term aerosol concentration or particle concentration is vague. Please consider revising to "particles number concentration" or "particle mass concentration" as appropriate.
- Page 3/Line 87: I would be interested to know whether the filters are conditioned (in Europe, filters must be conditioned in the weighing room at 19 °C to 21 °C and 45 % RH to 50 % RH for ≥ 48 h according to the standard EN 12341).
- Page 5/Line 123: Do you mean "to convert the optical DIAMETER to aerodynamic sizes"?
- Page 14/Lines 360 & 376, Figure 7: How can the TOTAL particle number concentration be so low (122 # cm⁻³) when the number concentration of 0.25-0.3 µm particles is

10^5 \# cm^{-3} ? Do you mean "total number concentration of particles with optical diameter larger than $1 \text{ }\mu\text{m}$ "?

- Page 16/Section 3.5: Please specify how often the instruments undergo maintenance and calibration at the manufacturer or another calibration laboratory. In my experience, light-scattering instruments need to be calibrated on a yearly basis.
- Figures 3 and 6: Please clarify in the caption what the error bars designate. Is it statistical uncertainties and at which confidence interval? Similarly, in Lines 273 and 281, please specify what the measurement uncertainties represent.

Minor corrections:

Line 29: consider revising "to monitors..." to "to monitor..."

Line 46: Consider adding "are", so that it reads "sensors are gaining popularity"

Line 71: Consider adding a comma after "Texas" so that it reads "Lubbock, Texas, located...."

Line 185: consider revising "There only reference..." to "The only reference..."

Line 195: Nowadays, particles are usually made of polystyrene (without latex)

Line 199: Please provide the location of the company Powder Technology Inc.