

Interactive comment on “The Influence of Humidity on the Performance of Low-Cost Air Particle Mass Sensors and the Effect of Atmospheric Fog” by Rohan Jayaratne et al.

Anonymous Referee #2

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This paper has the possibility of being a good paper, with some considerable extra additional text and analysis. The science area being discussed is very topical and the authors seek to show a particle-bound water effect on the DustTrak instrument measurements compared to the dried TEOM data.

Some specific areas which I think could improve the manuscript:

1. Referencing

The authors only cite 15 papers, despite there being a significant body of work now in this area. For example, Kingham et al. <https://www.sciencedirect.com/science/article/pii/S1352231005008885> who Specifi-

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cally compare TEOMs with dusttrak and other instruments (And cites other measurement which have shown the differences and over reading of the instruments which do not dry the particles. I could have chosen several other papers.

The authors should do a more detailed literature review and clearly define the reasons why their new study adds to the wider knowledge

2. Quality assurance of laboratory experiment

The description of the lab results is short and not detailed enough to have confidence in the work. The chamber at 1 m³ is rather small and probably has significant wall effects from particle deposition/emission. No description of how this is checked for is reported - the citation to the previous study is not enough for a reader to have confidence in the methodology. Only one set of experimental results are shown. Ideally at least 5 repeats with similar PM loading should be shown with an uncertainty analysis/error bars etc. In addition a blank run to show there is no effect of background in the chamber.

Did the authors do any runs with laboratory derived aerosol?

3. Field study.

Despite running the experiment for a month nearly the authors only show the one day (when there was fog). In the results they talk about several different periods but it is hard to have a clear overview as no dates are mentioned. It would be better to show the full dataset along with the associated local meteorology. Discuss that larger dataset and then focus in on the fog events. Did the RH get close to 100 in the absence of fog? Did the over reading occur then?

The authors do not mention the systematic under reading by the dusttrak of the TEOM in the non fog part of the graphs shown. No summary statistics of the comparisons between the instruments over the intercomparison period shown - Which I think is essential to understand the bias and offsets. It would be good to see the statistics of different RH bands.

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4. Fog vs high RH:

Though there is some discussion about the process of fog formation and particle activation, the fog effect is mixed up with deliquescence. What the DustTrak observes is aqueous particles, and the TEOMs will have a mixture of effloresced and supersaturated aqueous particles. The growth curve either from a dry or supersaturated aqueous particle is similar. This is completely different to fog formation which is cloud particle activation which occurs when $RH > 100\%$. The author should clearly separate these two regimes and these separate processes, both in the results and discussion.

Though I am reasonably sure the observation of fog and rain with the different measurements by both instruments are correct, and are somewhat explained by the authors, there is a more scientific discussion required to make sense of the results. It would also be useful to see a clear extrapolation to more a general discussion about what type of fog it was (see <https://www.atmos-therm-phys.net/14/10517/2014/acp-14-10517-2014.pdf> for definitions) and how typical the short period of observation they have is (i.e. how would it affect annual data capture, could you write a met station interface to remove data with fog?)

Figure 2 and 7 are not needed as these are well known in the literature, and only need mentioning in the text.

Following a major re-write it is likely that further comments would arise.

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