

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2021-11

Anonymous Referee #1

Referee comment on "Assessing the sources of particles at an urban background site using both regulatory instruments and low-cost sensors – a comparative study" by Dimitrios Bousiotis et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-11-RC1>, 2021

This manuscript presents an analysis to examine the ability of a low-cost optical particle counter (OPC) to separate atmospheric aerosol sources and conditions. The authors use k-means clustering on a low-cost OPC and a regulatory-grade scanning mobility particle sizer (SMPS). Given the different particle size ranges measured by the SMPS and the OPC, their performance differs by the sources and the temporal resolution they are able to untangle. Unsurprisingly, the OPC has limited success to separate the sources of smaller particles and higher temporal variability (e.g., diurnal variation). SMPS-based source identification performed well for sub-micron size range and was consistent with existing literature. As the authors themselves mention "the study of SMPS data with k-means clustering is far superior at separating complex pollution sources within urban environments in which the variation of very small particles is crucial for identifying particle and emission sources". However, the low-cost OPC based clustering performed well for particles in the 1–10 μm range and can have applications in regions and periods where coarse-mode particles are dominant such as dust storms, marine aerosol, bioaerosols, and other natural/resuspension sources.

I think the importance and quality of this manuscript warrants its publication in Atmospheric Measurement Techniques.

(Page 6, line 149) "*...as increased concentrations of semi-volatile compounds are usually associated with anthropogenic sources, especially in the urban environment (Harkov, 1989; Schnelle-Kreis et al., 2007).*" Requires more recent references — preferably based on online measurements.

Does mixing layer height play an important role in some of the clusters? The authors can include summary mixing layer height for the existing clusters in Table S1 (Hourly MLH Reanalysis data can be obtained from ECMWF's ERA5).

It seems that new particle formation was not observed during the measurement period. Is this consistent with the region and the measurement period? Please cite accordingly.

Some relevant papers for this manuscript that can be cited:

- McGreggor et al. (1995), Synoptic Typing and its Application to the Investigation of Weather Air Pollution Relationships, Birmingham, United Kingdom, <https://link.springer.com/article/10.1007/BF00867281> (Discuss the relationship of meteorology, air pollution, and use clustering analysis)
- Hagan and Kroll (2020), Assessing the accuracy of low-cost optical particle sensors using a physics-based approach, <https://doi.org/10.5194/amt-13-6343-2020>
- Brines et al. (2015), Traffic and nucleation events as main sources of ultrafine particles in high-insolation developed world cities, <https://doi.org/10.5194/acp-15-5929-2015>. (SMPS-based k-means paper)

Minor comment: The figure captions for both the main manuscript and the supplement should be more descriptive.