

Interactive comment on “Development of a new Nano-particle sizer equipped with a 12 channel multi-port differential mobility analyzer and multi-condensation particle counters” by H. K. Lee et al.

Anonymous Referee #1

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General comments

The manuscript presents the experimental work on the development of a nano-particle sizer for measuring a particle size distribution in 1 s time resolution. As a fast measurement system for ambient aerosols has attracted attention, this paper has an originality and deals with important contents. In general, the manuscript shall be considered for the journal publication after some major and minor revisions. Specific comments after reviewing the manuscript are given in the following:

Major comments

1. As shown in fig. 1, the inlet of each port seems to be a small hole not an annular ring. Therefore, only a part of introduced particles would be detected by a CPC because particles would be deposited at the wall. So, the particle loss in the MP-DMA might be significant. If particle loss in MP-DMA is high, NPS could not measure low concentration. Then what is minimum measuring concentration of NPS? If the inlet shape of each port is the annular ring, the flow is expected to be deflected. In a typical DMA, the flow deflection is minimized by centering the flow from the annular ring. How did author solve the flow deflection problem in the MP-DMA?

2. TSI-SMPS and NPS showed very good agreement for the particle concentration distribution as shown in fig. 7. Can the NPS detect particles smaller than 17 nm by decreasing NPS voltage? Why did not the authors perform the experiment with the voltage lower than 1000 V?

3. As shown in fig. 9, while the SMPS immediately responded when an aerosol valve was closed or opened., the NPS has 15-20 s response time. Authors explained it with concentration stabilization and particle transportation. However, concentration stabilization might not be the reason because the SMPS responded immediately. Furthermore, particle transportation cannot be the reason if the length of transportation pipe of SMPS and NPS were same. It would be only 3 seconds late even considering the flying time in NPS. Why NPS response time was too late?

Specific comments

1. It seems that the difference between concentrations obtained by the M-CPC and electrometer was insignificant in fig. 3b. However, in fig. 5, the difference between the data from the M-CPC and TSI-CPC is large. Authors should explain why the two cases are different so that the reader will not be confused.

2. It should be good to indicate '50 nm monodisperse' in fig. 3b.

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3. It might be better to change fig. 6 to a table.
4. It will be better to denote the “valve open” and “valve close” fig. 9 (1) and (2) as well.
5. The minor ticks in the x-axis in fig. 9 (1) and (2) are hard to recognize.
6. Line 85: The NPS seems to be movable. Then, what is the weight of the NPS? Is it hard to move by human hands or not?
7. Line 168: Author mentioned that the maximum flying time of particles inside the NPS is approximately 3 s. Were the NPS data corrected based on the flying time?
8. Line 182: Z_p is not presented in Eq. (1), but the description of Z_p is shown in the manuscript. Please check the equation.
9. It might be difficult for the readers to understand and compare contour graphs of the NPS and SMPS in fig. 10. It might be better to include in the plot of the obtained mode diameters and concentrations as a function of time.
10. Line 283: The authors should state the positions of the sampling inlets of the NPS and SMPS. The sampling positions for the two instruments should be close to each other for the reliable data comparison. This should be also mentioned in the manuscript.
11. Line 307: In general, particle concentration of diesel emission or roadside atmospheric particles is high, and the authors mentioned in the conclusion that the NPS can be used in these applications. Furthermore, the authors mentioned that the advantage of the NPS is in measuring low concentration of particles in the introduction when compared to the FMPS. The authors need to clearly state the purpose (or applications) of the NPS.

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