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Atmospheric Measurement Techniques Discussions

Interactive comment on "Effects of Temperature, Pressure, and Carrier Gases on the Performance of an Aerosol Particle Mass Analyser" *by* Ta-Chih Hsiao et al.

Anonymous Referee #2

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This manuscript by Hsiao et al. entitled as 'Effects of Temperature, Pressure, and Carrier Gases on the Performance of an Aerosol Particle Mass Analyser' discusses the influence of carrier gas on the operation of the APM. As far as I know, most of previous work on the APM has been focusing on operations under a normal atmospheric condition. The experimental result of the present study will help interpreting experimental data of the APM (or DMA-APM system) in the future, especially when the instrument is operated under unusual conditions. My major concern about the manuscript is that the experimental part of the study focuses on the operation of the APM under different types of gases (air, CO2, and O2). No experiment seems to have been conducted to investigate the influence of temperature and pressure on the APM, even though the

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title mentions them. It is not clear to me when CO2 or O2 could be the major carrier gas of aerosol particles during atmospheric measurement. In that sense, I am not sure if the manuscript really fits well with the scope of the journal. I leave this question to the handling editor of the manuscript. My comments in this review focuses on scientific/technical components of the manuscript.

P5L11 Detailed information about the standard PSL particles is important for papers characterizing instruments. Please provide further detailed information about the PSL particles (e.g. manufacturer, model number, standard deviation of the distribution). Also, please provide more detailed information about the generation and desiccation processes of the PSL particles. P5L12 It was not clear to me how the DMA voltage has been set. Both the transfer function of the DMA and size-distribution of the PSL particles have relatively sharp distributions. Thus, it is important set the DMA voltage so that the center of the DMA transfer function matches with that of the size-distribution of the PSL particles. P5L21 The authors found 6% of differences in the size of PSL particles when they were measured under different types of gas. Although the authors mention that it is not significant, I do not think that the difference is small. I wonder if they have any explanations on it. P6L20 'The results revealed that particle mass was generally underestimated for cases where CO2 was used as a carrier gas. In particular, underestimation was 23%-25% for a 50-nm PSL sphere. By contrast, when O2 was used as the carrier gas, an overestimation of mass measurements was observed, with an error within 9%.' I wonder how the authors explain it. P6L25 '(convoluted with the known size distribution classified by DMA)' It might also be needed to consider the size-distribution of particles entering the DMA when they have a narrow distribution. I wonder if the authors could add any comments on it. P7L5 'Therefore, we suspect that the fluid field in the APM classification zone, also known as Taylor–Couette flow, is influenced by gas-specific properties such as μ and .' I am not sure if the APM only relies on the viscosity to rotate gas between the two rotating cylinders. There might be some kinds of internal structures to force the gas to rotate at the same angular velocity as the rotating cylinders. I suggest the authors to contact the manufacturer for

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it. Figure 6: Are the y-axis of the figure the APM transfer functions, or are they the number concentration of particles measured by the CPC?

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