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On the time-averaging of ultrafine particle number size spectra in vehicular plumes

X. H. Yao¹, N. T. Lau¹, M. Fang¹, and C. K. Chan²¹Institute for the Environment, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, People's Republic of China²Department of Chemical Engineering, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, People's Republic of China

Abstract. Ultrafine vehicular particle (<100 nm) number size distributions presented in the literature are mostly averages of long scan-time (~30 s or more) spectra mainly due to the non-availability of commercial instruments that can measure particle distributions in the <10 nm to 100 nm range faster than 30 s even though individual researchers have built faster (1–2.5 s) scanning instruments. With the introduction of the Engine Exhaust Particle Sizer (EEPS) in 2004, high time-resolution (1 full 32-channel spectrum per second) particle size distribution data become possible and allow atmospheric researchers to study the characteristics of ultrafine vehicular particles in rapidly and perhaps randomly varying high concentration environments such as roadside, on-road and tunnel. In this study, particle size distributions in these environments were found to vary as rapidly as one second frequently. This poses the question on the generality of using averages of long scan-time spectra for dynamic and/or mechanistic studies in rapidly and perhaps randomly varying high concentration environments. One-second EEPS data taken at roadside, on roads and in tunnels by a mobile platform are time-averaged to yield 5, 10, 30 and 120 s distributions to answer this question.

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