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Sub-micron particle number size distributions characteristics at an urban location, Kanpur, in the Indo-Gangetic Plain

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We present long-term measurements of sub-micron particle number size distributions (PNSDs) conducted at an urban location, Kanpur, in India, from September 2007 to July 2011. The mean Aitken mode (NAIT), accumulation mode (NACCU), the total particle (NTOT), and black carbon (BC) concentrations were 12.4x10^3 cm^{-3}, 18.9x10^3 cm^{-3}, 31.9x10^3 cm^{-3}, and 7.96 μg m^{-3}, respectively, falling in the observed range at urban locations worldwide, but much higher than those at urban locations in developed nations. At Kanpur, the total particle volume concentrations appears to be dominated mainly by the accumulation mode particles, except during the monsoon months due to efficient wet deposition of accumulation mode particles by precipitation. A distinct seasonal variation in the total particle number and BC concentrations was observed, with the maximum in winter and minimum during the rainy season, however, the Aitken mode particles did not show a clear seasonal fluctuation. The ratio of Aitken and accumulation mode particles, NAIT/NACCU, was varied from 0.1 to 14.2, with maximum during April to September months, suggesting the important source of new aerosol particles, via gas-to-particle conversion process, those probably growing to Aitken mode sizes. This finding suggests that dedicated long-term measurements of PNSDs (from few nanometer to a micron) are required to systematically characterize new aerosol formation over the Indian subcontinent that has been largely unstudied so far. Contrarily, the low NAIT/NACCU indicated the likely presence of aged and/or larger size particles emitted as a primary aerosol at this site. The diurnal variation of particle number was very distinct, with highest during morning and late evening hours, and lowest during the afternoon hours. This behavior could be attributed to the large primary emissions of aerosol particles and evolution of the planetary boundary layer.