

A model study of the impact of vehicle density and speed on the concentrations of submicron particles in the urban atmosphere in Hangzhou

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Abstract

Studies focused on the impact of vehicle density and driving speed on the concentrations of submicron particles in the atmosphere are rare. As the majority of submicron particles in the atmosphere come from combustion emissions, it is important to understand the contributions to this problem made by vehicle factors such as vehicle density and driving speed. In order to investigate the impact of vehicle density and speed on the concentrations of submicron particles in the atmosphere, a study was conducted in Hangzhou, a city in Southeast China. Results showed that the average ultrafine particle (UFP) concentration was 45805 particles cm^{-3} and the average concentration of particulate matter 1.0 (PM1.0) was $217\mu\text{g m}^{-3}$ during the survey period. An autoregressive integrated moving average modelling results indicated that the increase of UFP and PM1.0 concentrations in the atmosphere correlated positively ($P < 0.05$) with the increase of vehicle density and driving speed, implying that vehicle density and driving speed are significant predictors of submicron particles emission. This study provides first hand information for future studies on the submicron particle emissions in Hangzhou, a city with rapidly increasing vehicle numbers. The results will also assist in further investigation of any causal relationship between submicron particles and the health of local residents.

Key words: submicron particles; vehicle density; driving speed; air quality