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Evolution of particle size distribution near a busy road: observation of secondary particle formation

The evolution of the size distribution of fine and ultra fine particles with the distance from a busy road for several different meteorological conditions has been analysed. Experimental measurements have been taken near a motorway in the Brisbane area, Australia with two SMPS's that were set to measure from 5 nm to 170 nm and from 14 nm to 710 nm. Two distinct modes in the size distribution (11 nm and 30 nm) have been observed during several days of the experiment. The most interesting feature is that the second mode (at 30 nm) appears only at some distance from the road that depends on the component of the wind, perpendicular to the road. In the case, when this component was equal to $\sim 1.4 \text{ ms}^{-1}$, 30 nm mode was observed at the distance $\sim 40 \text{ m}$ from the center of the road, while for the wind speed of $\sim 2 \text{ ms}^{-1}$ the formation of the 30 nm mode has been observed at the distance 80 m from the center of the road. The position of the main maximum at 11 nm remains practically independent of the distance from the road while the 30 nm mode, reached a maximum, than started decreasing and shifting towards smaller particle sizes, until it merged with the main mode at $\sim 11 \text{ nm}$. The particle number concentration in the main mode significantly increased at the moment of merger with the second mode. This resulted in the overall increase of the total number concentration at the distance where the two modes merged.