1.006 Air pollution near unpaved roads: An experimental and modelling study.

Early Career Scientist

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Abstract:

Aiming to advance in the understanding of pollutant dispersion near roads, we measured, simultaneously, vehicle traffic, meteorological parameters, 24-hour average mass concentration of particulate matter (Total suspended particles-TSP, PM_{10}, and $PM_{2.5}$) at several locations downwind two unpaved roads, located on a flat region without any other source of pollutants. We also implemented a commercial software of computational fluids dynamics (ANSYS Fluent), an air quality model to simulate the dispersion of solid and gas-phase pollutants emitted from roads. Numerical results of long-term and daily averages of TSP, PM_{10} and $PM_{2.5}$ concentrations showed high correlation with experimental measurements (R^2>0.76). We found, analytically and experimentally, that the plots of 24h and long-term averages of pollutant concentrations vs distance to the road edge converge into a single curve when they are expressed in terms of non-dimensional numbers and that this curve is well described by a beta function. Profiles of vertical concentration sketch an exponential function at the road edge, an S shape downwind and a flat shape far from the road. Particle size distribution fits a Rosin Rammler function with an average diameter of ~ 7 µm. This distribution remains unaltered downwind from the road, which implies that at any location within 1.5 km from the road, PM_{10} and $PM_{2.5}$ concentrations are a constant fraction of TSP concentration. Experimental data confirmed this observation. Previous results can be used to determine the size of the area impacted by roads, identify mitigating and adaptive countermeasures, and to improve the accuracy of vehicular emission factors