

1.142 Trends in primary NO₂ emissions and investigation into vehicle cold start effects from ambient monitoring data in the UK.

Early Career Scientist

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Abstract:

Nitrogen oxides (NO and NO₂) are key air pollutants and atmospheric chemical intermediates; exceedance of air quality limits for NO₂ is a significant policy challenge in many urban environments globally. Here, we investigate trends in measured ambient NO₂ and NO_x mixing ratios from urban (road traffic dominated) monitoring sites in the UK over the period 2009-2016. We apply an oxidant analysis approach to the ambient data to determine trends in primary NO₂ emissions, and introduce a methodology to examine evidence for enhanced vehicle “cold start” primary NO₂ emissions. Analysis of the trends indicates an overall reduction of 18 % (from 0.17 to 0.14) in the monthly mean primary NO₂ emission fraction in the UK from 2009 to 2016, with a significant median decrease of -0.32 per year. However, during cold weather (temperatures of 5 °C or below) overall NO₂ primary emissions are elevated from 6.2 (±0.4) % to 10.2 (±0.1) %, and from 5.6 (±0.4) % to 9.8 (±0.1) % for morning and evening rush hours respectively. For individual locations, cold weather primary emissions can be factors of 1.6 - 3.8 higher. Trends in ambient NO_x and NO₂ and in the primary NO₂ emission in general indicate that there is an improvement in urban air quality over the last decade. However, the cold weather results may indicate that the combination of recent vehicle driving history and ambient weather conditions, in conjunction with technological constraints on the operating temperature range of emission control systems in some vehicles, have a substantial impact upon NO₂/NO_x emissions and hence upon UK urban air quality.