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Monitoring on-road air quality and measuring vehicle emissions with remote sensing in an urban area

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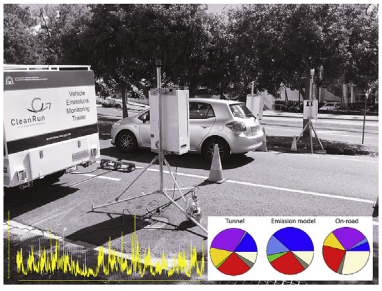
GRAPHICAL ABSTRACT



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ABSTRACT

Simultaneous day-time measurement (8 a.m.–5 p.m.) of on-road air quality and emissions (remote sensing) on an urban road with traffic volumes varying between approximately 400-800 vehicles per hour and an average speed of about 40 km/h has been used to compare multiple measurement techniques and assess on-road air quality. It was found that observed daytime concentration levels of CO, NO_x, NO_2, O_3, PM_{10} and $PM_{2.5}$ are below current WHO health based guideline values, varying from a few percent (CO) to above 60% (O_3 and $PM_{2.5}$) of the guideline values. NO_2 to NO_x ratios were about a factor of two higher than measured in a previous tunnel study, which indicates that about half of measured NO_2 concentrations are due to urban background levels. Statistical analysis suggest that on-road NO_2 and ozone concentrations are largely driven by atmospheric chemistry processes, and not significantly affected by variation in local traffic volume and fleet mix. A significant positive weighted correlation (r = 0.71–0.74) between remote sensing and air concentration monitoring is observed for CO in calm conditions. Speciated VOC measurements on the road show large discrepancies with current COPERT (Australia) vehicle emission factors, confirming the results from an earlier tunnel study. The weight of evidence suggests that the current (EU based) VOC speciation in COPERT Australia is likely not appropriate for the Australian on-road fleet.

1. Introduction

Motor vehicles are a major source of air pollution and greenhouse gas (GHG) emissions in urban areas around the world. Several studies have linked proximity to busy roads with adverse health effects, including asthma and other respiratory symptoms, birth and development effects, premature mortality, cardiovascular effects and cancer (e.g. Baldauf et al., 2008; Karner et al., 2010; Hood et al., 2018; Wang et al.,

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