

1.060 Nitrogen oxides and specified hydrocarbons - twenty years of ambient observations in air masses dominated by traffic emissions in Germany.

Early Career Scientist

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Abstract:

During the past 20 years the number of violations of ozone alarm threshold values decreased to nearly zero in Germany. This air quality improvement was achieved through the reduction of traffic related emissions in urban areas. We analyse ambient observations of nitrogen oxide and hydrocarbon (VOC) concentrations. Diesel vehicles can be identified as the dominating source of nitrogen oxide emissions. Detailed hydrocarbon composition measurements identify temporarily reduced catalyst efficiency of petrol cars as the major source of VOC emissions in urban areas.

Taking the reactivity of the individual hydrocarbons with the OH radical into account, the total VOC reactivity ($R_{\text{VOC}} = \sum(k_{\text{OH}+\text{VOC}_i} \cdot [\text{VOC}_i])$) can be calculated from the measured VOC concentrations. Together with the reactivity of nitrogen oxide with the OH radical (R_{NO_2}) this parameter can be used to describe the local ozone production instead of using the full details of the hydrocarbon mixture.

Our observations show a decrease in the $R_{\text{VOC}}/R_{\text{NO}_2}$ ratio by a factor 7.5 during the period from 1994 to 2014. The analysis revealed that the reduction of the local ozone production rate was mainly caused by large VOC reduction combined with small NO_x reduction at the same time.

In terms of air quality, future effects of new technologies for nitrogen oxide reductions for diesel cars will be discussed as well as a discrepancy between the observed VOC composition and the emission inventories: While the traffic related VOC emissions have

been significantly reduced in line with emission inventories, the inventory reports approximately constant VOC emissions from solvent use, being the dominating source of VOC in Germany. This is in contrast to our observations in cities where solvent use seems to be a minor VOC source. The contributions of the different sources will be discussed, based on ongoing measurements ranging from urban to remote regions.