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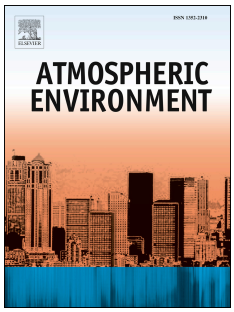

The traffic emission-dispersion model for a Central-European city agrees with measured black carbon apportioned to traffic

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The traffic emission-dispersion model for a Central-European city agrees with measured black carbon apportioned to traffic

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Abstract. The bottom-up traffic emission model EMISENS is used to calculate hourly black carbon (BC) and nitrogen oxides (NO_x) emission rates on an average workday in Maribor (Slovenia), using emission factors that were previously determined with the on-road chasing measurements in Slovenia. From modeled NO_x emission rates and in-situ NO_x measurements we empirically determined the hourly dispersion of traffic emissions and applied it to model BC concentrations using BC emission rates. We compared the modeled BC concentrations with in-situ BC concentration measurements over three periods in winters 2011-2012 and 2012-2013, a total of 67 workdays. Measured BC concentrations were first apportioned to traffic using the top-down Aethalometer model. We found that the bottom-up modeled BC concentrations overestimated the top-down apportioned values by only 19%, 32% and 6% in each of the three investigated time periods, respectively. We did not find any influence of meteorology on the performance of the model. This is the first time that BC source apportionment results were used to evaluate traffic emissions calculated using the bottom-up modeling approach. We demonstrate that the two independent approaches yield similar results. We use thus validated emission inventory for evaluating different emission reduction scenarios. We show that excluding 10% of vehicles that are highest BC or NO_x emitters would reduce the total BC or NO_x emissions from traffic in Maribor by 39% and 33% respectively.

Keywords: traffic emissions, black carbon, EMISENS model, on-road emission factors, Aethalometer source apportionment model

1. Introduction

Traffic emission models have been used to backup discussions related to improvements in air quality and to define mitigation policies in cities. They are especially useful when designing air quality plans and quantifying the effects of hypothetical interventions on the fleet collective emission rates. Numerous models were developed. An overall review of the methodologies that are available and used in Europe to compile local and regional air quality plans is proposed by Thunis et al., 2016. Choosing the right model depends on the required spatial and temporal detail of the investigated subject, and on the available resources in terms of time, finance and available data. While some models may oversimplify the traffic situation, more complex models require more detailed input data, which may be more susceptible to errors in estimations, measurement or to