Black carbon and particle number emission factors of different vehicle types measured in real driving conditions

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For estimating emissions from on road mobile sources models multiply the activity of the source to its emission factor. The activity of a vehicle fleet is monitored by traffic counters which can report the number of different types of vehicles passing one site and sometimes also their speed. To determine emission factors for a vehicle fleet is more difficult due to the large number of vehicles with different engines and different exhaust treatment systems. Not only the versatility of engines and exhaust treatments, the amount of pollutants vehicles emit depends also on the vehicles maintenance, quality of fuel, traffic fluency, driving regime, topography, and weather. Usually emission factors for individual vehicles are measured with dynamometers. These tests are good for studying the influence of fuel type, additives, acceleration, engine type, temperature, dilution... but are expensive, time consuming and measure emissions of only few vehicles supposedly representative for the whole vehicle fleet. Studies have shown that few individual vehicles can contribute significantly to the fleet emissions, much more than the average vehicle in the fleet, and measurements of large number of vehicles are desired (eg. Kirchstetter, 1999 and Wang, 2011).

We measured emission factors of individual vehicles in real driving conditions by chasing them on European highways and regional roads similar as Wang (2011). We did not measure only heavy duty vehicles and busses but also light duty vehicles and cars, for which no similar studies have been performed so far. We measured concentrations of black carbon (Aethalometer AE33), particle number concentration (FMPS) and CO2 (Carbocap 343). We developed a methodology for calculating time evolution of the emission factors, with which we can evaluate individual vehicles EF while accelerating and while constant driving as shown on figure 1. We measured approximately 250 different vehicles.

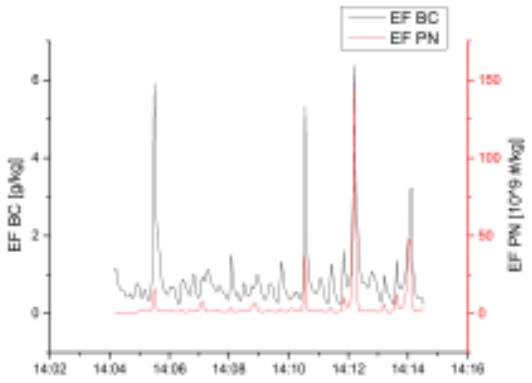

Figure 1 Time evolving emission factors for black carbon (EF BC) and particle number (EF PN).

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