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BLACK CARBON CAR EMISSION FACTORS

APPLICATION NOTE

MOTIVATION

One of the main sources of air pollution is traffic. To estimate the traffic contribution to air pollution the emissions are calculated from the vehicle fleet composition and vehicle emission factors (EF). Since the emission factors depend on vehicle type (cars, heavy and light duty), engine maintenance, driving environment (city, highway, regional roads) and weather, the emmision factors must be measured for in-use vehicles in actual traffic situations.

Two methods can be used to determine the so-called “real world” emission factors. The first method is the stationary method where EFs are calculated from the instantaneous rise of pollutants as a vehicle passes the measuring station. The second is the chasing method where vehicle emissions are measured by driving a mobile station behind the measured vehicle on the road.

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METHODOLOGY

- To have a proper representation of the whole vehicle fleet emissions, a large number of random in-use vehicles must be measured.
- Emission factors are determined as 0.86 * BC/CO_2.
- Aethalometer, Vaisala CO_2 sensor and Dekati particle counter ELPI+ running at 1s timebase were used.
- Stationary and chasing methods yield similar EFs and are thus complementary.
- Stationary method needs more measurements of a single vehicle to obtain the representative EF distribution or a measurement of a large number of vehicles to obtain a representative distribution for the fleet, but isn't affected by the background.
- With the chasing method one can get the EF distribution in a single chase, but the data is more difficult to collect and analyze due to possible disturbances from other vehicles on the road, or sources close to the road, which may disturb the background.

CHASING METHOD

- Vehicle equiped with PEMS was used to validate the method.
- A 10 s running window was used to obtain time resolved EF during 5 min chasing runs.

STATIONARY METHOD

- Only peaks where the pollutant increase was higher than 3 standard deviations of the background concentrations were used.
- BC time derivative (k) was used to determine the start and end of the plume.
- Plumes lasted 10 – 20 s.
- Out of 150 vehicle passes, 70 EFs could be determined.

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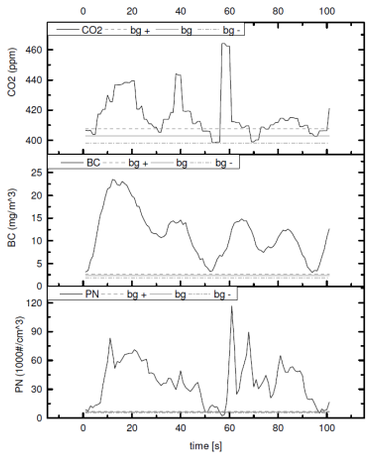

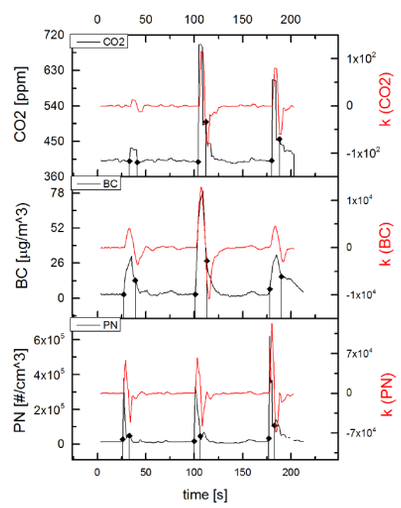

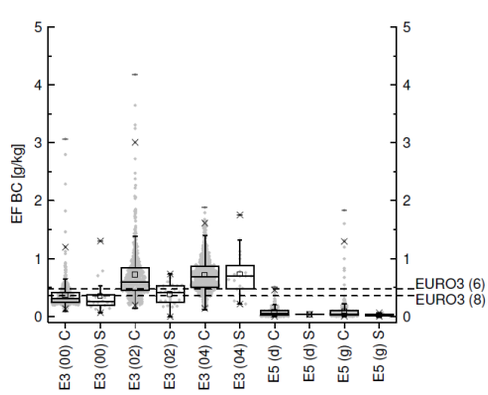

Related articles

- I. Jezek et. al., „Determination of car on-road black carbon and particle number emission factors and comparison between mobile and stationary measurements ", Atmos. Meas. Tech. Discuss., 7, 5423–5455, (2014).
- M. G. Perone et. al., „Particle size, chemical composition, seasons of the year and urban, rural or remote site origins as determinants of biological effects of particulate matter on pulmonary cells.", Environ. Pollut., 176, 215–27, (2014).
- V. Franco et. al., „Road vehicle emission factors development: a review ", Atmos. Environ., 70, 84–97, (2013).

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Keeping an Eye on the Air