Abstract

Mobile monitoring can supplement regulatory measurements, particularly in low-income countries where stationary monitoring is sparse. Here, we report results from a ~ year-long mobile monitoring campaign of on-road concentrations of black carbon (BC), ultrafine particles (UFP), and carbon dioxide (CO_2) in Bengaluru, India. The study route included 150 unique kms (average: ~22 repeat measurements per monitored road segment). After cleaning the data for known instrument artifacts and sensitivities, we generated 30 m high-resolution stable 'data only' spatial maps of BC, UFP, and CO_2 for the study route. For the urban residential areas, the mean BC levels for residential roads, arterials, and highways were ~ 10, 22, and 56 μgm^{-3}, respectively. A similar pattern (highways being characterized by highest pollution levels) was also observed for UFP and CO_2. Using the data from repeat measurements, we carried out a Monte Carlo subsampling analysis to understand the minimum number of repeat measures to generate stable maps of pollution in the city. Leveraging the simultaneous nature of the measurements, we also mapped the quasi-emission factors (QEF) of the pollutants under investigation. The current study is the first multi-season mobile monitoring exercise conducted in a low or middle -income country (LMIC) urban setting that oversampled the study route and investigated the optimum number of repeat rides required to achieve representative pollution spatial patterns characterized with high precision and low bias. Finally, the results are discussed in the context of technical aspects of the campaign, limitations, and their policy relevance for our study location and for other locations. Given the day-to-day variability in the pollution levels, the presence of dynamic and unorganized sources, and active government pollution mitigation policies, multi-year mobile measurement campaigns would help test the long-term representativeness of the current results.