Geophysical Research Abstracts
Vol. 18, EGU2016-12706, 2016
EGU General Assembly 2016

Impacts of traffic composition and street-canyon geometry on on-road air quality in a high-rise building area

Kyung-Hwan Kwak (1), Kyung Hwan Kim (1), Seung-Bok Lee (1), Sung Ho Woo (1), Gwi-Nam Bae (1), Young Sunwoo (2), and Jong-Jin Baik (3)

(1) Korea Institute of Science and Technology, Seoul, Republic of Korea (studizen@gmail.com), (2) Konkuk University, Seoul, Republic of Korea, (3) Seoul National University, Seoul, Republic of Korea

Mobile measurements using a mobile laboratory and numerical simulations using a computational fluid dynamics (CFD) model were conducted over different time periods of multiple days in a high-rise building area, Seoul, Republic of Korea. Mobile measurement can provide actual on-road emission levels of air pollutants from vehicles as well as validation dataset of a CFD model. On the other hand, CFD modeling is required for the process analysis of mobile measurement data and the quantitative estimation of determining factors in complex phenomena. The target area is characterized as a busy street canyon elongated along a major road with hourly traffic volumes of approximately 4000 vehicles during working hours on weekdays. Nitrogen oxides (NO_x), black carbon (BC), particle-bound polycyclic aromatic hydrocarbons (pPAH), and particle number (PN) concentrations were measured during 39 round trips of mobile laboratory. The associations of the measured NO_x, BC, pPAH, and PN concentrations with the traffic volumes of individual compositions are analyzed by calculating the correlation coefficients (R2) based on linear regressions. It is found that SUV, truck, van, and bus are heavy emitters responsible for the on-road air pollution in the street canyon. Among the measured pollutants, the largest R2 is shown for pPAH. The measured NO_x, BC, pPAH, and PN concentrations are unevenly distributed in the street canyon. The measured concentrations around an intersection are higher than those in between intersections, particularly for NO_x and pPAH. The CFD modeling for different dispersion scenarios reveals that the intersection has counterbalancing roles in determining the on-road concentrations. The emission process acts to increase the on-road concentrations due to accelerating and idling vehicles, whereas the dispersion process acts to decrease the on-road concentrations due to lateral ventilations along the crossing street. It is needed to control the number of heavy emitters and the building geometries around an intersection for better air quality in a high-rise building area.