Geophysical Research Abstracts
Vol. 20, EGU2018-4124, 2018
EGU General Assembly 2018


# Multivariate evaluation of emissions- and meteorology-related effects on the long-term air pollution trends

Jihoon Seo (1,2), Jin Young Kim (1), and Daeok Youn (3)

(1) Green City Technology Institute, Korea Institute of Science and Technology, Seoul, Korea, Republic Of (jseo@kist.re.kr), (2) School of Earth and Environmental Sciences, Seoul National University, Seoul, Korea, Republic Of , (3) Department of Earth Science Education, Chungbuk National University, Cheongju, Korea, Republic Of

Temporal variability of air pollution at a given place is intrinsically affected by two primary factors such as emissions and meteorology. The changes in local emissions of primary pollutants and secondary precursors are undoubtedly a major contributor to the air pollution variability. However, meteorological conditions often play the more important roles in air quality with accumulation/ventilation of pollutants and precursors, atmospheric productions of secondary pollutants, and regional transport of polluted/clean air masses. Therefore, meteorological effects on the air pollution trend must be considered before assessing effectiveness of past regulations and establishment of new environmental policies for improving local air quality. We here tried to isolate each effect of local emissions and meteorological conditions on the long-term air pollution trends in Seoul, a densely populated megacity in Korea. For the past decades, Seoul has experienced a gradual decrease of particulate matter (PM) and an increase of $O_3$ concentrations. A simple low-pass filter (Kolmogorov-Zurbenko filter) and multiple linear regression model with meteorological factors were applied to $PM_{10}$, $SO_2$, $NO_2$, CO, and $O_3$ data measured in Seoul for the period of 1999–2016. As a result, long-term trend of $PM_{10}$ was –1.75 $\mu$g m$^{-3}$ yr$^{-1}$, and the separate trends affected by each change in emissions and meteorology were –0.81 and –0.94 $\mu$g m$^{-3}$ yr$^{-1}$, respectively. In terms of the effect of local emission changes, a major decline of $PM_{10}$ concentration occurred between 2008 and 2009. CO, $SO_2$, and $NO_2$ revealed similar temporal variability during the period probably due to 2008 global economic recession together with the enhanced regulation policy, which has been implemented since the mid-2000s. In terms of the meteorological effect, increasing trends of wind speed in Seoul clearly induced the decreasing trends of $PM_{10}$, $NO_2$, and CO. Therefore, the recent achievement of ambient $PM_{10}$ reduction would not be successful without such long-term changes in meteorology. Interestingly, the long-term trends of daily maximum 8 h $O_3$ (+0.88 ppb yr$^{-1}$) related to both emissions and meteorology were increasing (+0.41 and +0.47 ppb yr$^{-1}$, respectively). More rapid reduction of $NO_x$ emissions in the VOC-limited regime and clear sky due to less PM in recent years might affect the increasing trends of $O_3$.