Abstract

[Project Information]

Project Title :	Improvement of Prediction Accuracy of VOCs and Related Pollutants by Identifying Background Concentrations and Advancement of Health Risk Assessment
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[Abstract]

Atmospheric concentrations of chemicals in urban areas are influenced by emissions from anthropogenic activities within the urban area and by background (BG) concentrations, such as the advection of pollutants emitted outside the area and persistent substances. Therefore, BG concentrations are essential for accurately assessing regional pollution in urban areas.
The study aimed to estimate accurate BG concentrations in the Kanto urban area, develop methods and conditions for monitoring BG concentrations, and improve the accuracy of model simulations using BG concentrations.

In Subtheme 1, atmospheric observations were conducted at nine Kanto BG sites to determine concentrations inflowing from outside the Kanto region and at six Japan BG sites to determine concentrations that are constantly present in the Northern Hemisphere or advected from outside the country. A maximum of 150 substances were studied per site, including volatile organic compounds (VOCs), ethylene oxide, and heavy metals. By comparing the observed data between the Kanto BG sites and the Kanto urban area, we found that some substances, such as long-lived hydrocarbons, had higher BG concentrations than expected. In addition, we identified substances whose BG concentrations fluctuated seasonally and locations affected by wind direction from urban areas and abroad. Based on these findings, we proposed the frequency and locations necessary for monitoring BG concentrations. We also investigated the conditions for using passive samplers—devices that collect air samples without a power supply—at low concentration levels in BG areas and developed sampling rates for 51 substances, including ethylene oxide.

In Subtheme 2, the data from the BG site observations in Subtheme 1 were used to improve the reproducibility of VOC concentrations, including hazardous air pollutants, through air quality simulation. The simulation was refined by incorporating new emissions reported in the Pollutant Release and Transfer Register (PRTR) and by using BG concentrations to correct the boundary conditions and emissions within the calculation area. As a result, the calculated concentration values, which were significantly underestimated prior to the improvements, aligned with the observed values after the modifications, thereby enhancing concentration reproducibility. Although the improved simulation did not significantly impact the calculated ozone concentrations, it enabled more accurate calculation of the concentrations of each VOC component, including hazardous air pollutants, and clarified the impact of their sources.

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