Abstract

[Project Information]

Project Title : Development of Measurement System for Individual Components of Ambient Nitrogen Oxides by Thermal Dissociation Method and Clarification of Their Behaviors by Year-round Continuous Observation at Multiple Locations in Kanto Region

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[Abstract]

In recent decades, Nitrogen Oxide (NOx) and Non-Methane Hydrocarbon (NMHC), which are precursors of photochemical oxidants (Ox), have been decreasing gradually in Japan; however, environmental standards of Ox have not yet been achieved. Particularly in the Kanto region, the Ox concentration tends to be high inland areas, suggesting that air masses from the Tokyo Bay coastal area emit high concentrations of air pollutants, which react photochemically during transportation. Nitrogen dioxide plays an important role in photochemical reactions by forming Ox via photodissociation, while forming peroxy nitrate (PNs), alkyl nitrate (ANs), and HNO_3 as NOx reservoirs. PNs, ANs, and HNO_3 form NO_2 via thermal dissociation, suggesting that they may form NO_2 in inland areas and contribute to the formation of Ox. In this study, PNs, ANs, and HNO_3 concentrations were measured at several sites in cooperation with a regional environmental laboratory in the Kanto region. The thermal dissociation method was used for the measurements, while the CAPS and chemiluminescence methods with an optical converter were used to detect NO_2. The instruments were calibrated using the permeation tube method. Observations were conducted at the Tokyo Metropolitan Research Institute for Environmental Protection (TMRIEP), Center for Environmental Science in Saitama (CESS), and Gunma Prefectural Institute of Public Health and Environmental Sciences (GPIPHES) for the periods 2022/06/29–2022/11/10 and 2023/08/09–

2024/01/17. There were clear daily variations in NO_2, PNs, and ANs in GPIPHES, and HNO_3 in TMRIEP and GPIPHES. Although the concentration of compounds at GPIPHES tended to be lower than that at the other two sites, the ratio of PNs, ANs, and HNO_3 in the total nitrogen oxides concentration was highest at the three sites, suggesting that the farther the air mass was transported, the more oxidants were produced by the NO_2 supply through thermal dissociation from PNs, ANs, and HNO_3.