Abstract

[Project Information]

Project Title : Projection of Ground Level Ozone in Japan in 2050 Carbon-neutral Environment and Proposal of Co-benefit Strategy of Low Ozone and Decarbonization

Project Number : JPMEERF20235M01

Project Period (FY) : 2023-2024

Principal Investigator : Nagashima Tatsuya

(PI ORCID) :

Principal Institution : National Institute for Environmental Studies
16-2 Onogawa, Tsukuba City, Ibaraki, JAPAN
Tel: +81-29-850-2898
E-mail: nagashima.tatsuya@nies.go.jp

Cooperated by : Center for Environmental Science in Saitama; Asia Center for Air Pollution Research; Research Institute for Applied Mechanics, Kyushu University

Keywords : Surface Ozone, 2050 Carbon Neutral, Future Emission Scenarios, Air Quality Simulation, Climate Change

[Abstract]

In this study, we created a baseline emission scenario and a decarbonization emission scenario for the 2030s and 2050s, which have different approaches to decarbonization and air pollution measures, and two scenarios with different levels of measures within each scenario (four future emission scenarios in total: FIX, BAU, 20D, and 15D). We set a model domain that allows for the analysis of transboundary pollution, including both the whole of Asia and the detailed Japanese region, and then used a pseudo-global warming method to create spatially detailed future climate scenarios for Asia and Japan. We input these future scenarios and future climate scenarios into a regional air quality model to conduct experiments to predict changes in domestic surface ozone (O_3) concentrations in the 2030s and 2050s. In the baseline emission scenario, surface O_3 pollution in Japan continues to worsen toward the 2050s, but in the 15D scenario, which is the future scenario that corresponds to the conditions for achieving carbon neutrality in 2050 in Japan, we quantitatively showed at the prefectural level that domestic O_3 pollution will improve significantly at the same time as decarbonization is achieved, and that it is possible that O_3 pollution will fall below the US National Air Quality Standards of 70 ppb nationwide in Japan in the 2050s. A sensitivity experiment was conducted based on the 15D scenario to estimate the contribution of domestic emission reductions to the improvement of O_3 pollution under the scenario. The national average was about 37%, but the contribution exceeded 50% in urban areas on the Pacific coast side of Japan and exceeded 70% in northern Kanto area. The exceedance rate of the current environmental quality standard, the US environmental quality standard value, and the WHO AQG level were selected as the domestic O_3

concentration achievement targets, and the achievement status of each target in 2050 under the 15D scenario was confirmed. Furthermore, the effect of additional reductions in domestic emissions was also explored. It was quantitatively shown that domestic measures remain important for improving domestic O_3 pollution in a decarbonized society, and that international efforts are also essential.

This study was supported by the Environment Research and Technology Development Fund of the ERCA (JPMEERF20235M01) funded by the Ministry of the Environment.