

B-8.1 Analysis of Regional Characteristics and Source of Seasonal Variation of Tropospheric Ozone Distribution

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Abstract Variation of surface ozone concentration in East Asia is characterized by long-range transport of air mass, which can be broadly categorized into "clean continental," "regionally polluted continental" and "marine." Surface ozone concentration in the "clean continental" and "regionally polluted continental" air mass shows seasonal maximum in spring and summer, respectively. These features are analogous to those in Europe, while concentration range in Northeast Asia is about 10 ppbv higher than in Europe. About 20 ppbv of ozone is photochemically formed in the regionally polluted air mass before reaching to Japan. Surface ozone in continental Southeast Asia is characterized by "wet" and "dry" season. In wet season ozone concentration is very low due to marine air mass from Indian Ocean, while in dry season ozone level can be very high due to regional scale biomass burning.

Key Words: Tropospheric ozone, Surface ozone, East Asia, Regionally polluted continental air mass, Biomass burning

1. Introduction

Short-lived greenhouse gases such as ozone are expected to exert peculiar effect on global warming/climate change since their distributions are not uniform globally and are characterized by continental-scale inhomogeneity. Particularly in East Asia it is of great importance to elucidate the regional characteristics of spatial and temporal variation of tropospheric ozone and to clarify quantitative impact of anthropogenic activity. This study is the first attempt toward the elucidation of quantitative evaluation of regional human activity on surface ozone in East Asia.

2. Objectives

The purpose of this study is to evaluate quantitatively the effect of regional anthropogenic activity in East Asia through the observation of distribution and seasonal change of surface ozone in a regional scale.

3. methodology

Instruments for surface ozone and CO measurements are set-up at several remote sites in Japan and in foreign country in East Asia to obtain year-round continuous monitoring data. Observed concentrations of ozone and CO are characterized by air mass category based on trajectory analysis and their seasonal change are elucidated. Their characteristics are compared with European data.

4. Results and discussion

It has been revealed that air masses in East Asia can be broadly classified into two categories, "continental" and "marine." The continental air mass can further be classified into "Eurasian background" and "Northeast Asian regionally polluted." The marine air mass can further be classified into "Pacific oceanic," "South China Sea" and "Indian Oceanic."

In order to elucidate quantitative information on photochemical activity from observational data, surface ozone data at Oki, Japan, has been categorized by backward trajectory analysis. The N/NE corresponds to Eurasian background air mass, and the WNW/W corresponds to regionally polluted one. Ozone concentration in the WNW/W air mass is much higher than in N/NE and has broad plateau from spring to fall in contrast to a distinct spring peak in the latter air mass. Much higher ozone concentration and the broad summer plateau in the WNW/W trajectory is thought to be characteristic to regionally polluted air mass, while the spring peak of ozone is known to be characteristic to clean air mass in the mid- and high-latitude in the northern hemisphere. The difference in ozone concentration between the WNW/W and N/NE can be interpreted as the build-up of ozone when the continental background air parcel passes over polluted area of Asian Continent before reaching Oki. About 20 ppbv of ozone has been built up in summer at the inflow point to Japan.

The spring peak in the Eurasian background air mass agrees well with those in Mondy (Siberia) and Mace Head (Ireland) while summer plateau in the Northeastern regional polluted air mass agrees well with those observed in the continental. Further, ozone concentrations in both the Eurasian background and the Northeast Asian regionally polluted air mass is nearly 10 ppbv higher than those in the corresponding air masses in Europe.

Surface ozone in Thailand is characterized by "wet" and "dry" season. In wet season ozone concentration is very low (ca. 10 ppbv) due to marine air mass from Indian Ocean, while in dry season ozone level is higher than 80 ppbv in March due to regional scale biomass burning.

5. Publications

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