



The influence of consecutive sea and land breeze days on the accumulation of photochemical oxidants and nitrogen oxide

Ko Nakajima and Hideo Takahashi

Tokyo Metropolitan University, Japan (nakajima-ko@ed.tmu.ac.jp)

Efforts have been made to improve the air pollution environment, in Japan, since the first photochemical smog was reported in 1970. While nitrogen oxide and non-methane hydrocarbon levels, both of which are precursors of photochemical oxidants (Ox), are tending to decrease, Ox levels are tending to increase. Local wind, such as sea and land breeze circulation, plays important roles in the production and accumulation of Ox. It has been suggested that continuous sea and land breeze circulation serves to accumulate pollutants. However, pollutant concentrations do not necessarily increase compared with the previous day even if similar weather conditions persist, such as sea and land breeze circulation. As such, the factors related to changes in the pollutant concentrations are not well understood. The purpose of this study is to analyze the accumulation and distribution of air pollutants for days in which sea and land breeze days was consecutive for two days.

We chose to study sea breeze days in which a southerly wind develops in the southern Kanto plain, north of Tokyo Bay, during July and August for the years 1990 [U+F02D] 2012. We used principal component analysis and cluster analysis to classify the variations in pollutant concentrations. We classified sea breeze days into four groups, i.e. Group 1: days when the pollutant concentration decreased around Tokyo Bay and increased inland, Group 2: days when the concentration increased across almost the entire study region, Group 3: days when the concentration decreased inland and in southern Tokyo Bay, and Group 4: days when the concentration increased, particularly around Tokyo Bay. In Group 2, in which the pollutant concentration increased as compared with the previous day, the wind direction had clearly changed from southerly to northerly during the night of the first day and a land breeze penetrated toward the coastal area. In the other groups, wind velocity also became weaker but there was no change from sea-breeze to land-breeze. In Group 1, in which the pollutant concentration decreased around Tokyo Bay, there was a southerly wind after 24 hours Japanese Standard Time (JST) in the coastal area. This suggests that the change from sea-breeze to land-breeze influences the accumulation of pollutants.