

2.077 Direct evaluation of photochemical ozone production regime.

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Abstract:

In order to develop correct ozone control strategies, it is necessary to diagnose ozone production regime (i.e. NO_x -limited or VOC-limited) accurately. We developed direct evaluation system of the ozone production regime by applying a direct measurement system of oxidant ($\text{Ox} = \text{O}_3 + \text{NO}_2$) production rate ($P\text{-}L(\text{Ox})$) recently developed. The $P\text{-}L(\text{Ox})$ measurement system has “reaction” and “reference” chambers. The reaction and reference chambers are made of quartz and Pyrex, respectively. An outer wall of the reference chamber is coated with a UV-protection film. Both the chambers were exposed directly to artificial sunlight. Ambient air is introduced into both the chambers. Photochemical reactions proceed to generate Ox in the reaction chamber while Ox is not generated in the reference chamber. The difference of Ox concentrations (DOx) in air from the two chambers is the Ox produced photochemically in the reaction chamber. The $P\text{-}L(\text{Ox})$ is obtained by dividing DOx by a mean residence time of air in the reaction chamber. Ox concentrations were obtained as follows. O_3 in Ox is converted into NO_2 by the reaction of O_3 with large excess of NO, and then the NO_2 concentration is measured by a cavity attenuated phase shift spectroscopy technique. In addition, an automatic additional system of NO or propane was set before the reaction and reference chambers and NO or propane was added to ambient air perturbationally at regular intervals. The ozone production regime was diagnosed by investigating increase and decrease of $P\text{-}L(\text{Ox})$ from the addition of NO or propane. We performed an intensive observation of $P\text{-}L(\text{Ox})$, OH reactivity, and various trace species at National Institute for Environmental Studies in Tsukuba, Japan, in August 2017. The observation results are discussed in this presentation.