



Abstract Details

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Title: OH and HO2 radical measurements by a highly sensitive LIF instrument at a remote island and at an urban site

Abstract: OH and HO2 radicals play crucial roles in the troposphere, providing loss terms for most anthropogenic/natural gaseous species, participating in the key reaction steps, and thereby determining the transformation of the pollutants. We should know how the radicals are produced, converted to each other, and then lost in the troposphere quantitatively in order to accurately predict the oxidative capacity and the behaviors of the trace components such as methane and ozone in the future. In this perspective, it is highly required to measure both radicals accurately, although their concentrations are quite low, together with the controlling parameters such as O3/H2O/CO/hydrocarbons/NOx concentrations, photolysis frequencies (J values), and temperature to fully uncover the radical budget. We have almost completed the development of an instrument based on the laser-induced fluorescence (LIF) technique for measuring OH and HO2 radical concentrations down to $2 \times 10^{-5} \text{ cm}^{-3}$ with 1-min integration. This ultra-low detection limit was achieved by utilizing a diode-pumped YAG laser with a high repetition rate (8kHz) to excite a dye laser and by choosing a photodetector with negligible after-pulse problem. The performance of the instrument under field conditions was tested in Rishiri Island, a remote island in Japan in September 2003, and also in Tokyo in January/February 2004. At both sites, clear diurnal variations of OH concentrations were discernible, attesting the good performance of the instrument. Basic behaviors of the observed OH and HO2 concentrations, such as the dependence on NOx concentrations, were as expected from our current understanding of the tropospheric chemistry. Critical tests of the tropospheric chemistry mechanism were performed by comparing the observed OH/HO2 radical concentrations with those predicted by using a box model. They did not necessarily agree, suggesting the lack of our knowledge of the radical budget. (session OA5)

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