

Recent trends of NO₂, VOC, and tropospheric ozone concentrations observed around Chiba, Japan in 2013-2018

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Tropospheric ozone (O₃) is not only a major photochemical oxidant but also the third important greenhouse gas. In recent years its importance is widely recognized as a short-lived climate pollutant (SLCP). As nitrogen dioxide (NO₂) and volatile organic compounds (VOC) are both important precursors of O₃, they play a central role in photochemical chemistry in the atmosphere. In addition, they have negative direct effects on human health. However, recent trends of O₃, NO₂, and VOC have not been fully understood yet even in Japan.

Using the multi-axis differential optical absorption spectroscopy (MAX-DOAS), we conducted continuous observations of NO₂, formaldehyde (HCHO; as a substitute for VOC) and O₃ concentrations for altitudes of 0-1 km at the SKYNET Chiba site (35.63°N, 140.10°E, 21 m asl) for 6 years from 2013 to 2018. Analysis of the data showed that NO₂ and HCHO concentrations decreased by about 30%, but a systematic decrease in O₃ concentration was not observed. Similar trends were seen in tropospheric NO₂ column data obtained by the Ozone Monitoring Instrument (OMI) onboard the Aura satellite of the National Aeronautics and Space Administration (NASA), and concentration data of NO₂, non-methane hydrocarbon (NMHC; as a substitute for VOC), and photochemical oxidant (Ox; as a substitute for O₃) observed by the atmospheric environmental regional observation system (AEROS) called Soramamekun. These results are consistent with previous reports. In this presentation, the observed trends and their causes will also be discussed by utilizing our unique MAX-DOAS system that was directed to 4 different azimuth directions (north, east, west, and south), while traffic is heavy at the north, a residential area is located at the east, there is a sea at the west, and a factory area is located at the south around the SKYNET Chiba site.

Keywords: Nitrogen dioxide, Volatile organic compounds, Tropospheric ozone