

Validation observation for the derivation of lower tropospheric ozone by remote sensing

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The lower tropospheric ozone is a major photochemical oxidant affecting human health and vegetation. In recent years, the long-range transport of the tropospheric ozone from the Asian Continent affects air quality in Japan and other wide areas. Remote sensing from a satellite is effective to observe such extensive/transboundary air pollution. However, it has been quite difficult to measure the lower tropospheric ozone from the satellite.

We have proposed that it can be evaluated with simultaneous measurement of solar backscattering spectra in the ultraviolet(UV) and visible(Vis) regions. Because the atmospheric Rayleigh scattering cross-section is much larger in UV than that in Vis, lower tropospheric light path length of the solar scattered radiation observed from space is significantly different in these two wavelength regions. This difference in the light path changes ozone column amount along it in the lower troposphere, and enables us to evaluate the lower tropospheric ozone amount.

We carried out aircraft experiments to validate this method over Tsukuba on 10th and 13rd September 2012. UV and Vis backscatter spectra were measured with two Maya2000pro (Ocean Optics) spectrometers at two altitudes 2500 ft (760 m) and 25000 ft (7600 m). Simultaneously, ozone profile was measured with ozone monitors on-board the aircraft, with ozonesonde launched near Tsukuba, and the tropospheric ozone lidar. Because aerosol scattering may significantly affect the evaluation of the lower tropospheric ozone amount, in situ aerosol observation with the CRDS, PSAP, and PASS instruments and the lidar observation were carried out in the Meteorological Research Institute. From the aircraft, we observed solar scattered radiation from zenith, nadir and 20 degree oblique directions in ultraviolet(300 ~ 380nm wavelength) and visible(400 ~ 700nm wavelength) spectral range. Because the surface reflected light greatly contribute to the scattered light from nadir, especially in the visible spectral range, for accurately estimation of the ozone amount, it is particularly important to understand the surface reflection spectrum. In this experiment, ground reflection spectra at different surface conditions such as rice paddy, forest, urban areas and so on were measured at a low altitude of 2500ft (760m). Similar aircraft observation was also carried out in January, 2013. Results of these observations will be presented at this session.

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