Estimation and trend analysis of the tropospheric baseline ozone and carbon monoxide concentrations at Mt. Happo

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A large increase in tropospheric O_3 concentrations was observed during spring for the period from 1998 to 2006 at Mt. Happo Observatory (36.7°N, 137.8°E, 1840 m asl), which is one of the Acid Deposition Monitoring Network in East Asia (EANET) stations (Tanimoto, 2009). The increase in the springtime O_3 reproduced by a regional chemistry-transport model incorporating the updated anthropogenic emissions inventory in East Asia can only explain about half of the observed O_3 increase (Tanimoto et al., 2009). Observational datasets at mountain sites have been utilized for estimation of baseline levels of greenhouse gases and aerosols because remote mountainous sites are regarded as having little direct influence from local or regional sources/sinks (e.g., Parrish et al., 2012). However, observations at ground-based stations can often be influenced by local sources. Therefore, the data selection is often an essential part of the analysis for estimation of regional representative baseline levels.
In this study, we estimated baseline and polluted concentrations of O_3 (1998–2014) and CO (1996–2014 and 2013–2014) at Mt. Happo by using the statistical method “REBS (Robust Extraction of Baseline Signal)” (Ruckstul et al., 2012), which is based on the robust local regression. Then, we analyzed these long-term trends. CO concentration (2013–2014) is significantly lower than CO concentration (1996–2004), and the degree is larger in summer and autumn than in spring. Recent baseline CO concentrations are decreasing in all season except for spring. Spring baseline concentration is slightly increasing. Polluted CO concentrations are decreasing in all season, and the degrees are larger than those of baseline concentration. On the other hand, O_3 concentrations show decreasing trends with maximum in the mid-2000s in all season. The rate of decrease is characterized by a spring maximum and summer minimum. Both baseline and polluted O_3 concentrations show decreasing trends in all season and both rates of decrease are the same degree. Hence it is considered that the decrease of springtime CO concentration at Mt. Happo is mainly caused by the decrease of polluted CO concentration, and that the decrease of O_3 concentration is caused by the decreases of baseline and polluted O_3 concentrations.

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