Long-term measurements of the column-averaged mixing ratios of tropospheric substances related to the air pollution using ground-based FTIRs at Rikubetsu, Japan

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Air pollutants originating from carbon compounds such as reactive volatile organic compounds (VOCs) cause a serious degrading of the air quality near their sources. In addition, these are transported to remote areas with chemical composition changes, and affect air quality in urban areas and their surrounding areas, and therefore, are one of major issues in preserving the air quality. Especially, HCHO and HCOOH originating from forest fires and biogenic VOCs are distributed near their sources since their chemical lifetime is within a few days, and therefore, their distributions and time variations are one of important keys in associating the sources with the impact to the global environment. In order to understand the characteristics of long-term variation of the air quality and its influence on the global environment, the temporal variation of tropospheric substances related to the air pollution are measured with ground-based Fourier Transform InfraRed (FTIR) instrument (Bruker IFS120M and IFS120/5HR) installed at Rikubetsu observatory in Hokkaido, Japan. The cooperative measurements of solar absorption spectra using the FTIRs are conducted by the Institute for Space-Earth Environmental Research (ISEE) of Nagoya University and the National Institute for Environmental Studies (NIES) since 1995. The spectrum is obtained in a 3-15 μm band with a resolution of 0.0035 cm^{-1}. The vertical distribution of trace gases in troposphere and stratosphere is retrieved from the measured spectrum by using the SFIT4 (version 0.944) software. Using SFIT4, we have retrieved the total column amounts and tropospheric column-averaged mixing ratio of O_3, CH_4, C_2H_6, N2O, CO, HCN, HCHO, HCOOH, C_2H_2, CH_3OH, and find their seasonal and long-term variations from 1995 to 2018. The observed tropospheric column-averaged mixing ratios of O_3, C_2H_6 and CO show the maximum in March and April, although that of HCHO peaks in July and that of HCN is in May and August, respectively. These differences among the substances may reflect the source and sink processes. Especially, HCHO having a short lifetime may reflect oxidation of biogenic VOCs in summer as well as forest fires.
In the presentation, we will report the detailed features of temporal variations of these substances in troposphere and will discuss its influence on the global environment.

Keywords: Air pollutants, Column-averaged mixing ratio, Infrared spectroscopy, Seasonal variation, Long-term trend

