

A long-term monitoring of trace gases in troposphere and stratosphere retrieved from high-resolution FTIR measurements at Rikubetsu in Hokkaido, Japan

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The Institute for Space-Earth Environmental Research (ISEE) of Nagoya University had carried out measurements of solar absorption spectra using a ground-based Fourier Transform InfraRed Spectroscopy (FTIR) instrument (Bruker IFS120M) at Rikubetsu observatory (43.46°N, 143.77°E, 380 m a.s.l.) in Hokkaido since 1995. In 2014, the National Institute for Environmental Studies (NIES) installed another high-resolution FTIR instrument (Bruker IFS 120/5HR), and started the cooperative measurements with ISEE. The spectrum is obtained in mid-infrared 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 with uniform retrieval parameters recommended by the Infrared Working Group of the Network for the Detection of Atmospheric Composition Change (NDACC/IRWG). This is for the purpose of obtaining the homogeneous retrievals at the NDACC measurement sites. We use an initial profile of pressure and temperature taken from the NCEP Reanalysis dataset and those of the molecular species except for water vapor taken from the results of the WACCM V6 40-yrs run. The vertical profile of water vapor is retrieved from the spectrum before the retrievals of the other species. Using SFIT4, we have retrieved the total column amounts and vertical profiles of O₃, HCl, HF, HNO₃, ClONO₂, CH₄, C₂H₆, N₂O, CO, HCN, CCl₄, and find the various temporal variations and the long-term trends from 1995 to 2016. Although the observed partial column of stratospheric O₃ does not show any trend with significance, that in the troposphere seems to decrease in 2000s. In addition, after 2000, we find negative trends in the time series of HCl and ClONO₂ total columns, being consistent with the global results. In the presentation, we report the features of temporal variations of the species in stratosphere and troposphere as well as the details of the retrieval.

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