Ground-based FTIR Observations of HCFC-22, HCFC-142b and HFC-23

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We carried out atmospheric solar absorption measurements with ground-based Fourier-Transform InfraRed spectrometer (FTIR) (Bruker IFS120M) under clear-sky conditions at the Antarctic Syowa station (69.0°S, 39.6°E) in 2007, 2011 and 2016. FTIR observation is able to contribute to monitor the trace gases related to ozone destruction and global warming because many absorption spectra of tropospheric and stratospheric trace gases can be taken by FTIR in mid-infrared region (2-15μm). Recently the Network for Detection of Atmospheric Composition Change (NDACC) has made an effort to monitor greenhouse gases with ground-based FTIR instruments around the world, and abundances of chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), which are powerful greenhouse gases, were successfully retrieved in previous studies (Zander et al., 2005; Zhou et al., 2016, Mahieu et al., 2016). Also there is the previous study that profiles of hydrofluorocarbons (HFCs) were retrieved from the spectra taken by satellite-borne FTIR (ACE-FTS) (Harrison et al., 2012).
In this study, we tried to retrieve the profiles of CHF_2Cl (HCFC-22), CH_3CClF_2 (HCFC-142b) and CHF_3 (HFC-23) from the atmospheric absorption spectra taken by ground-based FTIR at Syowa station for the period from 2007 to 2016. All profile retrievals for the target gases have been performed with the SFIT4 inversion program which is based on the optimal estimation method of Rodgers (Rodgers, 2000). For the line parameters of the target species, the Pseudo-Line-Lists (PLL) provided by G. C. Toon (NASA/JPL) are used (http://mark4sun.jpl.nasa.gov/pseudo.html). As a result, the analyzed total column trend for HCFC-142b between 2007 and 2011 is ~6%/year, while since 2011 the abundance started to decline. The trends for HCFC-22 and HFC-23 for the period from 2007 to 2016 are ~4%/year and ~5%/year, respectively. We will also analyze the abundances of the target gases above Rikubetsu station in Japan (43.46°N, 143.77°E). In this presentation, the comparison of our measurements with data of the in-situ surface observations and flask sampling operated by NOAA/ESRL will be shown.

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