



Long-term observations of CFC-11, CFC-12, HCFC-22, HCFC-142b, and HFC-23 from ground-based FTIR at Rikubetsu and Tsukuba in Japan, and Syowa Station, Antarctica since 1995

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We analyzed long-term variation of CFC-11, CFC-12, HCFC-22, HCFC-142b, and HFC-23 from a ground-based Fourier-Transform infrared spectrometer (FTIR) installed at Rikubetsu, Japan (43.5N, 143.8E), Tsukuba, Japan (36.1N, 140.1E), and Syowa Station, Antarctica (69.0S, 39.6E). FTIR observations at Rikubetsu started from 1995, at Tsukuba from 2014, while FTIR observations at Syowa Station were done only in 2007, 2011, and 2016. Due to the regulation by the Montreal Protocol on Substances that Deplete the Ozone Layer which was adopted in 1987, production and consumption of chlorofluorocarbons (CFCs) are regulated by 2010. The production and consumption of hydrochlorofluorocarbons (HCFCs), which are the initial substitutes of CFCs, will also regulated by 2020 in developed countries, and by 2030 in developing countries. Nowadays, the production and consumption of hydrofluorocarbons (HFCs), which are the further substitutes of HCFCs, are dramatically increased in developed countries. High-resolution ground-based FTIR is a powerful tool to monitor several atmospheric minor constituents remotely, with a capability of measuring vertical distribution of gases using a line-shape information. We analyzed FTIR spectra recorded at three sites using a SFIT4 spectral fitting code. The spectral information of analyzed gases were taken from a pseudo-line list developed by Dr. Geoffrey Toon. The decline of CFC-11 was seen from the beginning of the measurement (1995), while CFC-12 peaked around 2002, then started to decline afterwards. Continuous increase of HCFC-22 was observed throughout the period (1995-2018), while increase of HCFC-142b reached its plateau recently (2018). The increase of HFC-23, which is a strong greenhouse gas with a 100-year global warming potential of 14,800, is continuing until recently. This is the first result to monitor atmospheric amounts of HFC-23 by FTIR from ground.