

Trend and seasonal variation in the atmospheric CO observed at the mid-latitudes in Japan using ground-based FTIR spectrometers

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Infrared solar spectra have been recorded at Rikubetsu since May of 1995 and Moshiri since April 1996. From these spectra, total column amounts and mixing ratios of the atmospheric CO were retrieved using 2111 and 4231 cm⁻¹ micro-windows. Seasonal variations in the total column and mixing ratios of the atmospheric CO were observed at the mid-latitudes in Japan. Trend in CO content was estimated.

An IFS 120M Fourier transform infrared (FTIR) spectrometer was installed at Rikubetsu in May 1995 and another FTIR spectrometer of IFS 120HR was installed at Moshiri in April 1996. Ground-based infrared solar spectra were recorded at the two sites using the FTIR spectrometers. From these spectra, the tropospheric mixing ratios of carbon monoxide (CO) were retrieved at the 2111cm⁻¹ micro-window and the stratospheric CO mixing ratios were retrieved at the 4231cm⁻¹ micro-window. Total column amounts of atmospheric CO were derived from the retrieved vertical profiles. Since observations at Rikubetsu and Moshiri were very similar, in order to increase the number of observational data for the statistic analysis and extend the coverage of observational period, data obtained at the two sites were combined to present the results of the atmospheric CO over the mid-latitudes in Japan.

Significant seasonal variations in both tropospheric and stratospheric CO mixing ratios were observed. The maximum of averaged CO mixing ratio below 13 km occurred in March-April with a value of 165.9 \pm 18.1 part per billion by volume (ppbv) and the minimum value was about 123.3 \pm 19.8 ppbv in September-October. By comparison, the maximum value of averaged CO mixing ratio between 13-28 km was about 46.0 \pm 9.2 pptv occurring in July-August and the minimum was about 21.6 \pm 4.4 pptv in January-February. Seasonal cycle in the total column amounts of atmospheric CO was observed as well. The maximum and minimum values were about (2.97 \pm 0.31) \times 10¹⁸ molecule/cm² in March-April and about (2.31 \pm 0.55) \times 10¹⁸ molecules/cm² in September-October, respectively.

Based on a 3.5 years ground-based FTIR observations at the mid-latitudes in Japan from mid-1995 to the end of 1998, trend in the tropospheric CO mixing ratios was estimated to be about (2.3 \pm 0.6)%/year and that in total CO column was about (3.2 \pm 0.7)%/yr. Sudden increases of the tropospheric CO in summers of 1996 and 1998 were observed at Moshiri and Rikubetsu simultaneously, possibly due to the transport of polluted air.