Experimental Studies of Carbon Monoxide Based on Measurements in the Antarctic (Novolazarevskaya Station)

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The measurement results of Carbon Monoxide (CO) obtained in the atmospheric optical depth with the use of solar radiation absorption spectroscopy. The observations were made in 2003 – 2012 at the Novolazarevskaya Station (the Antarctic, 70°46’S, 11°50’E, 120 m above the sea level). The measurement complex consists of a system following the Sun and a diffraction spectrometer. The spectral resolution is 0.2 cm^{-1}. The measurements were made with the account for direct solar radiation at the Sun’s altitudes over 150. The gas content was determined from the transmission function within the ranges including CO absorption band rotation lines of about 4.6 micrometers. The relationship of the CO transmission function and its content is calculated with the use of the spectrum fine structure parameters, the data on vertical profiles of pressure, temperature, humidity and CO mixing ratios.

The contents of CO are given in atm.-cm (the gas thickness is in cm reduced to normal conditions, 1 atm.-cm = 2.69 x 10^{19} mole/cm^2). The instrumentation random error in determining CO content obtained from the repetition frequency of measurement results during a day makes no more than ±4%. The measurement results are given in Fig. 1(1). They present average daily CO contents. The gaps in the data are connected with the absence of measurements during a polar night. For a correct analysis of the temporal trend, a method of CO atmospheric content reconstruction was developed. It is based on the application of moving average values in short time periods and a spectral analysis for reconstruction of data for a polar night. The reconstructed data are given in Fig. 1(2).

A statistical analysis of the data obtained and a comparison with the CO measurement data obtained at the Syowa Station are presented.

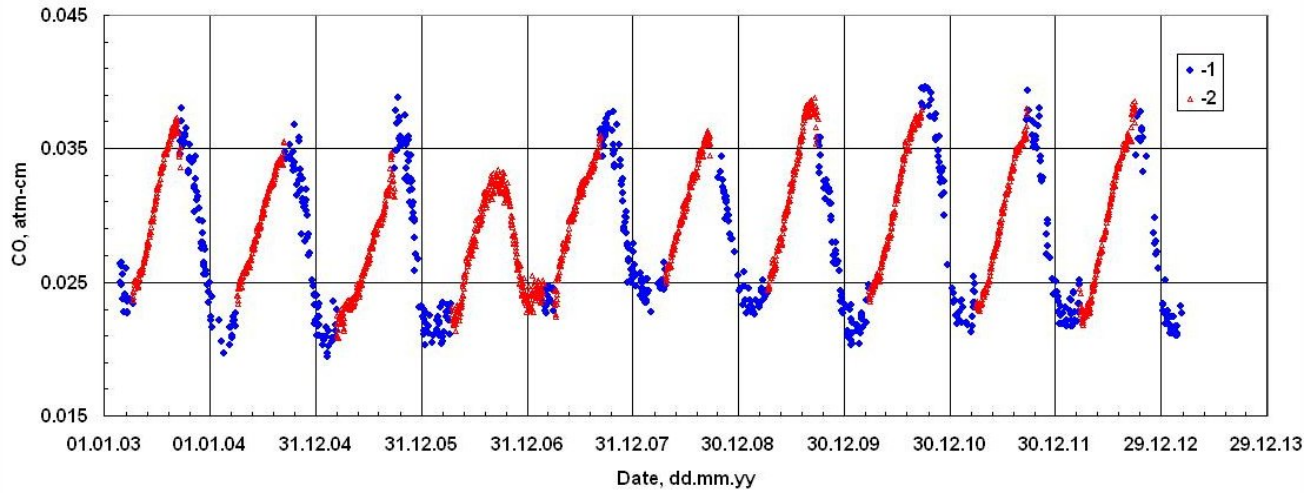

Figure 1. The contents of CO in the atmosphere. (1) measurement data, (2) reconstructed data.