

Results of Carbon Dioxide Measurements in the Atmospheric Boundary Layer in Obninsk, Russia

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From 1998 through 2007 CO₂ has been measured in the atmospheric boundary layer in Obninsk, Russia (55.11°N, 36.57°E, 183 m above sea level). The CO₂ mixing ratio is measured in air samples collected 4 m above the ground, and in samples taken at 25, 100, 200 and 300 m from the high meteorological mast. The absorption spectroscopy method consists of a Fourier-spectrometer, an optical multipass cell, and a sample handling system [Baranov *et al.*, 1999]. The accuracy of the method was evaluated by comparing the results of analyses made in Obninsk and at NOAA ESRL of the same air samples collected several times during the year.

As is seen from the data presented in Fig. 1, the CO₂ time series is characterized by large short term variability caused by natural and anthropogenic sources and sinks. A simple averaging of measurement results to obtain mean daily, monthly and annual values does not allow one to reliably determine the contribution of anthropogenic sources to the temporal variability of CO₂ mixing ratio in the atmospheric boundary layer. The statistical method of smoothing selected data does not give optimal results either [Thoning K.W. *et al.*, 1989], because the number of measurements is sparse and there are gaps in the data series. Therefore, a preliminary analysis of measurement results was made to determine the minimum and maximum monthly values. This method is illustrated by Fig. 2, where the measurements of CO₂ mixing ratio in the air near the ground are given for every month of 2007. The maximum and minimum monthly values of CO₂ mixing ratio found in this way are presented in Fig. 3.

Minimum CO₂ mixing ratios are mainly determined by natural sources and sinks and may be used as indices of "regional background". Maximum CO₂ mixing ratios are determined by both natural and anthropogenic sources. The difference between them can characterize the anthropogenic contribution to the CO₂ content in the atmosphere. As is seen from the data in Fig. 3, the fraction of anthropogenic CO₂ has been decreasing during the last several years.

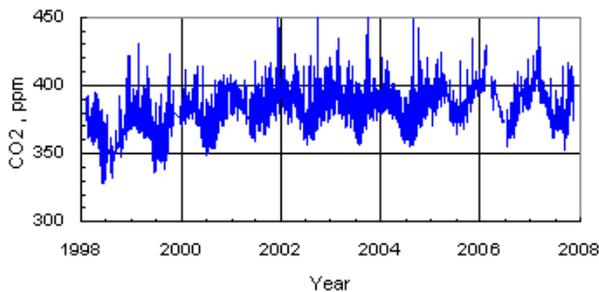


Figure 1. Variations of CO₂ mixing ratio in the air near the ground.

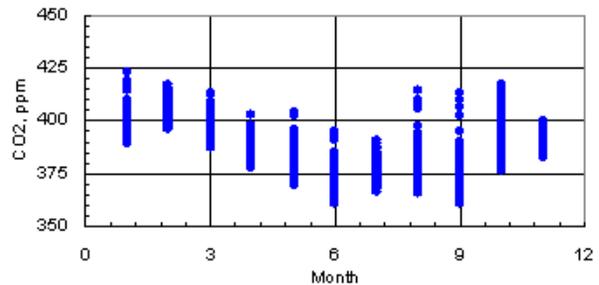


Figure 2. The range of CO₂ measurements during each month of 2007.

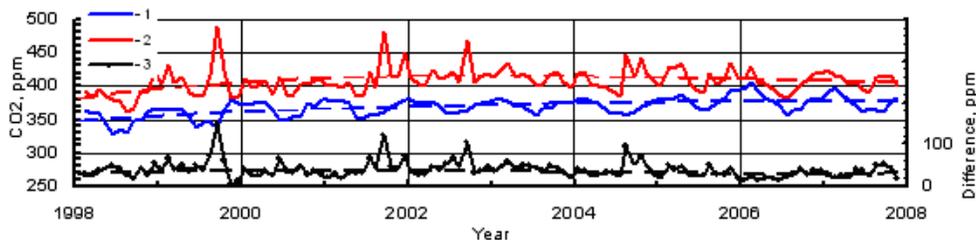


Figure 3. Variations of monthly minimum (1), maximum (2) CO₂ mixing ratios and the difference between them (3).