Automated Sampling System for the Stable Isotopic Ratio Determination of Atmospheric CO_2 at a Remote Site in Canada

D. Ernst, L. Huang, S. Racki, and D. Worthy

Meteorological Service of Canada, Environment Canada, 4905 Dufferin Street, Toronto, Ontario, Canada M3H 5T4; 416-739-4112; E-mail: Darrell.Ernst@ec.gc.ca

An automated system was first designed and constructed in 1998 for filling 2-L flasks with ambient air, at regular intervals (every 2 hours) around the clock. The auto-sampler was used during eight intensive field campaigns held over the period from fall 1998 to summer 2000, collecting air samples from the 20-m level of a 40-m tower situated at Fraserdale (Ontario, Canada) for measurements of CO_2, N_2O, CH_4, CO, and SF_6 concentrations, and the stable isotopes ($\delta^{13}C$ and $\delta^{18}O$) in CO_2. This prototype was controlled by an IBM-compatible computer using QuikBasic software running under MSDOS.

In 2002, we were interested in monitoring the trend in stable isotopic signatures ($\delta^{13}C$ and $\delta^{18}O$) of CO_2 in the diurnal cycle at Fraserdale, a continental site, to understand the relationship of the regional terrestrial ecosystem to the global carbon cycle on a longer time scale and were planning to collect a pair of diurnal samples (one maximum and one minimum concentration sample, as revealed by measurements) on a weekly basis. In order to operate more reliably during the unattended mode and also permit remote control, the system was upgraded (Figure 1). The logic control was upgraded to a commercially available datalogger (Campbell Scientfic CR23X/Loggernet software) with remote linkup by two-way satellite connection. This upgrade has proved to be 100% reliable over the past 6 months (September 2002-March 2003). The control program allows us to set sampling dates and times flexibly and to track the key sampling functions during the active sampling period. Other features of the system include automatic sample flow shut-off, cryogenic air drying, capability to sample up to eight 2-L flasks per week (based on a once weekly operator visit), and numerous monitoring devices to ensure quality control in the sampling procedure.

Some preliminary data from air samples collected via the automated system are presented.

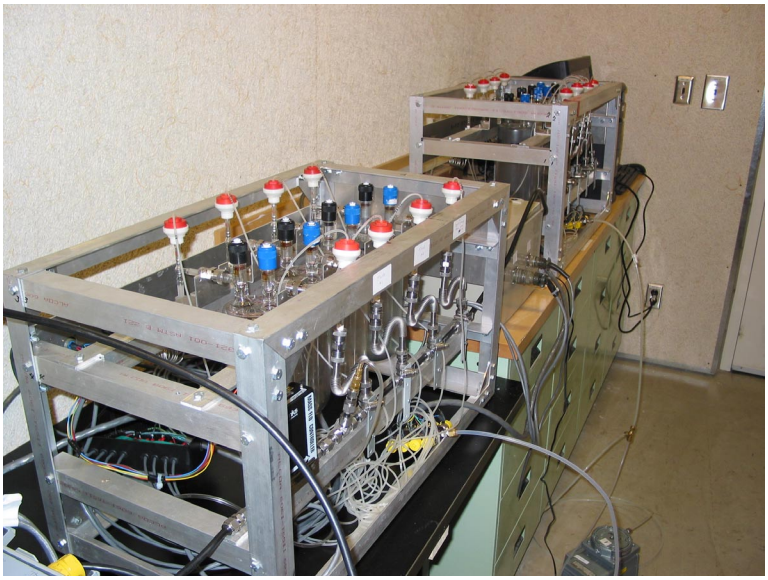

Figure 1. Automated sampling system for determining the stable isotopic ratio of atmospheric CO_2.