LBA-ECO TG-07 Soil CO2 Flux by Automated Chamber, Para, Brazil: 2001-2003

Summary:

Measurements of the soil-atmosphere flux of CO2 were made at the km 67 flux tower site in the Tapajos National Forest, Santarem, Para, Brazil. Eight chambers were set up to measure trace gas exchange between the soil and atmosphere about 5 times a day (during daylight and night) at this undisturbed forest site from April 2001 to April 2003. CO2 soil efflux data are reported in one ASCII comma separated file.

The automated chamber system consisted of 8 automatically opening and closing aluminum chambers with an infrared gas analyzer. The chambers were installed in a 0.5 ha area close to the flux tower on patches of ground without apparent photosynthetic vegetation. Each chamber was sequentially closed, sampled, and re-opened 5 times per day (closed 7% of the day). The maximum daily average flux was 4.3 and the minimum was 1.3 μmol CO2 m-2 s-1.

Data Citation:

Cite this data set as follows:

Varner, R.K. and M.M. Keller. 2009. LBA-ECO TG-07 Soil CO2 Flux by Automated Chamber, Para, Brazil: 2001-2003. Data set. Available on-line [http://daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. doi:10.3334/ORNLDAAC/927

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The LBA Data and Publication Policy [http://daac.ornl.gov/LBA/lba_data_policy.html] is in effect for a period of five (5) years from the date of archiving and should be followed by data users who have obtained LBA data sets from the ORNL DAAC. Users who download LBA data in the five years after data have been archived must contact the investigators who collected the data, per provisions 6 and 7 in the Policy.

This data set was archived in April of 2009. Users who download the data between April 2009 and March 2014 must comply with the LBA Data and Publication Policy.

Data users should use the Investigator contact information in this document to communicate with the data provider. Alternatively, the LBA Web Site [http://lba.inpa.gov.br/lba/] in Brazil will have current contact information.

Data users should use the Data Set Citation and other applicable references provided in this document to acknowledge use of the data.

Table of Contents:

1. Data Set Overview:

Project: LBA (Large-Scale Biosphere-Atmosphere Experiment in the Amazon)

Activity: LBA-ECO

LBA Science Component: Trace Gas and Aerosol Fluxes

Team ID: TG-07 (Keller / Oliveira)

The investigators were Keller, Michael M.; Oliveira Jr., Raimundo Cosme de; Crill, Patrick Michael; Silva, Hudson Pereira and Varner, Ruth K. You may contact Varner, Ruth (ruth.varner@unh.edu).

LBA Data Set Inventory ID: TG07_Autochamber_Soil_CO2_Flux_Km67

Measurements of the soil-atmosphere flux of CO2 were made at the km 67 flux tower site in the Tapajos National Forest, Santarem, Para, Brazil. Eight chambers were set up to measure trace gas exchange between the soil and atmosphere about 5 times a day (during daylight and night) at this undisturbed forest site from April 2001 to April 2003. CO2 soil efflux data are reported in one ASCII comma separated file.

The automated chamber system consisted of 8 automatically opening and closing aluminum chambers with an infrared gas analyzer. The chambers were installed in a 0.5 ha area close to the flux tower on patches of ground without apparent photosynthetic vegetation. Each chamber was sequentially closed, sampled, and re-opened 5 times per day (closed 7% of the day). The maximum daily average flux was 4.3 and the minimum was 1.3 µmol CO2 m-2 s-1.

Related_Data_Set:

TG 07 Trace Gase Fluxes, Undisturbed and Logged Sites, Para, Brazil: 2000-2002

2. Data Characteristics:

Autochamber CO2 soil efflux data are reported in one ASCII comma separated file.

File: Automated_CO2_Flux_Km67.csv

Column	Label	Description
Year	YYYY	Year of data collection
Temp	degrees Celsius	Chamber temperature, missing values are -9999
JulianFraction	Fractional day of the year	Such that noon (local time) on January 1 would be represented as 1.500
Chamber	1 through 8	Chambers 1 through 8
CO2 Flux	umoles m-2 s-1	By convention, positive flux values indicate movement of CO2 out of the soil.
There are no missing flux values. Flux values failing quality checks were not reported. Please contact Ruth Varner at UNH at ruth.varner@unh.edu or (603)862-0853 with questions regarding the data.		

Example Data Records:

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Header records omitted
...

Year,Temp,JulianFraction,Chamber,CO2Flux
2001,24.7,78.56,1,6
2001,25.5,78.58,2,6.35
2001,24.6,78.61,3,3.19
2001,23.2,78.63,4,1.02
2001,23.1,78.65,5,3.28
...
2003,24.5,124.95,7,2.16
2003,-9999,124.97,8,4.35
2003,24.5,125.05,1,2.78
2003,24.2,125.09,3,3.12
2003,24,125.12,4,2.46
```

Site boundaries: (All latitude and longitude given in degrees degrees)

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Geodetic Datum
Para Western (Santarem) - km 67 Primary Forest Tower Site (Para Western (Santarem))	-54.95900	-54.95900	-2.85700	-2.85700	World Geodetic System, 1984 (WGS-84)

Time period:

- The data set covers the period 2001/03/19 to 2003/05/05.
- Temporal Resolution: 5 times per day

Platform/Sensor/Parameters measured include:

- FIELD INVESTIGATION / GAS EXCHANGE SYSTEM / SOIL RESPIRATION
- FIELD INVESTIGATION / THERMOCOUPLE / AIR TEMPERATURE
- FIELD INVESTIGATION / IRGA (INFRARED GAS ANALYZER) / CARBON DIOXIDE

3. Data Application and Derivation:

Soil CO2 efflux is the sum of litter decomposition, soil organic matter decomposition and root respiration. It can account for up to 30% of ecosystem respiration in tropical forests. This data set is a valuable tool to determine the diurnal, seasonal and interannual controls on CO2 efflux from the soil surface in the Tapajos National Forest.

4. Quality Assessment:

Fluxes were calculated using Autoflux, a Visual Basic program developed by M. Palace of UNH. This program allowed manual fitting of CO2 vs time regression curves for individual fluxes. Fluxes were not calculated for periods with obvious sampling problems (e.g. abnormally high or low initial CO2 mixing ratios, extremely non-linear fluxes, etc.) Fluxes deemed good visually were fitted with a linear least squares regression to the linear part of the curve for each individual chamber closure. Efflux of CO2 from the soil was calculated as the slope of the linear fit (ppmv/min) converted to molar volume divided by the collar area and multiplied by the system volume (chamber volume and tubing volume). The short closure times for the fluxes allow for

the least amount of buildup of CO2 in the chamber headspace while still allowing for a flux calculation based on 10 to 20 concentration measurements.

5. Data Acquisition Materials and Methods:

Aluminum chambers are used to measure the efflux of CO2 from the soil to the atmosphere. Eight chambers were set up to measure trace gas exchange between the soil and atmosphere about 5 times a day (high frequency chambers). Each chamber is sampled for 22.5 min although the CO2 flux is measured within the first 4 minutes.

Chambers are pushed closed over an area of 1,866 cm2 by a pneumatic cylinder onto an anchor/frame that is set about 2 cm into the soil and extends an average of 4 cm above the soil surface. Closed chambers are sealed to the frame by fitting into a water-filled trough that is replenished as necessary. They enclose an average volume of 38,100 cm3. Headspace air is pulled through an infrared gas analyzer (LI-6262, LiCor Inc., Lincoln, Nebraska, USA) in absolute mode at a flow rate of 300 ml m-1 (MKS Instruments, Andover, MA). Air was circulated through the chambers at 1,000 ml min-1. Chambers were intentionally leaky to ensure no pressure gradient when the chambers were closed. All tubing and connectors are selected to minimize water vapor and CO2 absorption and permeability.

The data are recorded and the system managed with a CR10X datalogger (Campbell Scientific, Logan UT). The chamber temperature, IRGA sample cell pressure, and raw CO2 are sampled every 3 seconds and averaged every 12 seconds. The solenoids used for chamber selection, chamber closure and calibration are controlled with four 16-channel control modules. The set point for the mass flow controller is provided by a 4 channel analog output module. The signals from the thermocouples in each chamber are multiplexed. The data are transferred to a laptop computer weekly. Autoflux, a Visual Basic program by M. Palace of UNH, allows fitting of regression curves for each flux by manually selecting the linear portion of the sampling period. A linear least squares fit was applied to the linear part of the curve for each individual chamber closure. Efflux of CO2 from the soil was calculated as the slope of the linear fit (ppmv/min) converted to molar volume divided by the collar area and multiplied by the system volume (chamber volume and tubing volume). The short closure times for the fluxes allow for the least amount of buildup of CO2 in the chamber headspace while still allowing for a flux calculation based on 10 to 20 concentration measurements.

6. Data Access:

This data is available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

Data Archive Center:

Contact for Data Center Access Information:

E-mail: uso@daac.ornl.gov
Telephone: +1 (865) 241-3952

7. References:

Saleska, S.R., S.D. Miller, D.M. Matross, M.L. Goulden, S.C. Wofsy, H.R. da Rocha, P.B. de Camargo, P. Crill, B.C. Daube, H.C. de Freitas, L. Hutyra, M. Keller, V. Kirchhoff, M. Menton, J.W. Munger, E. Hammond Pyle, A.H. Rice, and H. Silva. (2003) Carbon in Amazon Forests: Unexpected Seasonal Fluxes and Disturbance-Induced Losses. Science, 302:1554-1557. DOI:10.1126/science.1091165

Silver, W.L., J. Neff, M. McGroddy, E. Veldkamp, M. Keller, and R. Cosme (2000). Effects of soil texture on belowground carbon and nutrient storage in a lowland Amazonian forest ecosystem. Ecosystems 3(2):193-209.
