

Revision date: December 14, 2009

# **LBA-ECO ND-02 Soil Trace Gas Fluxes in Eastern Amazonia, Para, Brazil: 1999-2003**

## **Summary:**

This data set reports the results of a study to quantify the effects of moisture and substrate availability on soil trace gas fluxes in a regrowth forest in Eastern Amazonia, Apeu, Para, Brazil, from 1999-2003. The efflux of carbon dioxide (CO<sub>2</sub>), nitric oxide (NO), nitrous oxide (N<sub>2</sub>O), and methane (CH<sub>4</sub>) from soil was measured as a response to (1) increased soil moisture availability during the dry season by irrigation and (2) decreased substrate availability by continuous removal of aboveground litter and compared to (3) untreated control plots. Soil gas fluxes are reported in one comma-separated data file.

## **Data Citation:**

**Cite this data set as follows:**

Davidson, E.A., C.J.R. de Carvalho, and R.O. Figueiredo. 2009. LBA-ECO ND-02 Soil Trace Gas Fluxes in Eastern Amazonia, Para, Brazil: 1999-2003. 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/953](https://doi.org/10.3334/ORNLDAAC/953)

## **Implementation of the LBA Data and Publication Policy by Data Users:**

The LBA Data and Publication Policy [[http://daac.ornl.gov/LBA/lba\\_data\\_policy.html](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 Users who download LBA data in the five years after data have been archived must contact the investigators who collected the data, per provisions 6 and 7 in the Policy.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 December of 2009. Users who download the data between December 2009 and November 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.

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## 1. Data Set Overview:

**Project:** LBA-ECO

**Activity:** Biogeochemical Cycles in Degraded Lands

**LBA Science Component:** Trace Gas and Aerosol Fluxes

**Team ID:** ND-02 (Davidson / Stone / Markewitz / Carvalho / Sa / Vieira / Moutinho / Figueiredo)

The investigators were Davidson, Eric A.; Stone, Thomas A.; Figueiredo, Ricardo de Oliveira; Moutinho, Paulo Roberto de Souza; Reis de Carvalho, Claudio Jose; Sa, Tatiana Deane De Abreu; Vieira, Ima Celia G.; Almeida, Arlete Silva de; Coelho, Roberta de Fatima R.; Cunha, Ewerton da Silva; de Figueiredo, Tenilson Monteiro; Freire, Georgia Silva; Guerrero, Jose Benito; Guild, Liane S.; Hayashi, Sanae Nogueira; Ishida, Francoise Yoko; Kinglerlee, Wendy; Leal, Eliane Constantinov; Lobato Junior, Ivan da Costa; Lopes, Leticia Campos; Rodrigues Pantoja, Karina de Fatima; Salimon, Cleber Ibrahim; Santos, Elisana Batista; Santos, Maria Tereza Primo dos; Santos Junior, Mario Rosa; Schuler, Marysol A. E.; Serrao, Bruno de Oliveira; Silva, Patricio de Sousa; Silva, Wanderley Rocha da; Solorzano Cardenas, Luis Anibal and Tancredi, Nicola Saverio Holanda . You may contact Davidson, Eric (edavidson@whrc.org)

**LBA Data Set Inventory ID:** ND02\_Soil\_Gas\_Flux\_Apeu

This data set is part of the larger Manflora study, led by Dr. Daniel Zarin and Dr. Francisco Assis. This project poses the question: How important are nutrient and moisture limitations during the successional development of forest ecosystems?

The data reported here includes the measurements of efflux from the soil of carbon dioxide, nitrous oxide, methane, and nitric oxide in replicated plots that were irrigated, had litter removed, or were untreated controls.

## 2. Data Characteristics:

The efflux of carbon dioxide (CO<sub>2</sub>), nitric oxide (NO), nitrous oxide (N<sub>2</sub>O), and methane (CH<sub>4</sub>) from soil was measured as a response to increased soil moisture availability during the dry season by irrigation and decreased substrate availability by continuous removal of aboveground litter and compared to untreated control plots. Soil gas fluxes are reported in one comma-separated data file.

### Data File Description: ND02\_Soil\_Gas\_Flux\_Apeu.csv

Column Number	Heading	Description
1	Site	Study Site: Apeu
2	Date	Sample date (YYYY/MM/DD)
3	Year	Sample year (YYYY)
4	Month	Sample month (MM)
5	DayofYear	Day of Year
6	Treatment_Status	Treatment: pre-treatment, post-treatment
7	Treatment	Treatment class: Control, Irrigation, Litt.Exc. [Litt.Exc. = litter exclusion, removal of existing litter and exclusion of new litter]
8	CO2_Mean	Carbon dioxide, mean
9	CO2_Std_Err	Carbon dioxide, standard error
10	CO2_Reps	Carbon dioxide, number of repetitions
11	CO2_Units	Carbon dioxide, measurement units
12	NO_Mean	Nitric oxide, mean
13	NO_Std_Err	Nitric oxide, standard error
14	NO_Reps	Nitric oxide, number of repetitions
15	NO_Units	Nitric oxide, measurement units
16	N2O_Mean	Nitrous oxide, mean
17	N2O_Std_Err	Nitrous oxide, standard error
18	N2O_Reps	Nitrous oxide, number of repetitions
19	N2O_Units	Nitrous oxide, measurement units
20	CH4_Mean	Methane, mean
21	CH4_Std_Err	Methane, standard error
22	CH4_Reps	Methane, number of repetitions
23	CH4_Units	Methane, measurement units

**Example data record:**

```

Site,Date,Year,Month,DayofYear,Treatment_Status,Treatment,CO2_Mean,CO2_Std_Err,CO2_Reps,CO2_Units,
NO_Mean,No_Std_Err,NO_Reps,NO_Units,N2O_Mean,N2O_Std_Err,N2O_Reps,N2O_Units,
CH4_Mean,CH4_std_err,CH4_Reps,CH4_Units
Apeu,1999/08/12,1999,8,224,pre-treatment,Irrigation,0.189,0.01,8,g C/m2/h ,
0.442,0.17,8,ng N/cm2/h ,-0.104,0.29,8,ng N/cm2/h ,
-0.945,0.18,8,mg CH4/m2/d
Apeu,1999/08/12,1999,8,224,pre-treatment,Litt.Exc.,0.195,0.03,8,g C/m2/h ,
0.142,0.09,8,ng N/cm2/h ,0.610,0.12,8,ng N/cm2/h ,
-0.903,0.60,8,mg CH4/m2/d
...
Apeu,2003/04/24,2003,4,114,post-treatment,Litt.Exc.,0.580,0.13,8,g C/m2/h ,
0.320,0.16,8,ng N/cm2/h ,0.690,0.41,7,ng N/cm2/h ,
-0.100,0.06,8,mg CH4/m2/d
Apeu,2003/04/24,2003,4,114,post-treatment,Control,0.420,0.07,8,g C/m2/h ,
1.650,0.86,8,ng N/cm2/h ,1.050,0.11,8,ng N/cm2/h ,
0.330,0.16,8,mg CH4/m2/d

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Geodetic Datum
Para Eastern (Belem) - Apeu (Para Eastern (Belem))	-47.95	-47.95	-1.31667	-1.31667	World Geodetic System, 1984 (WGS-84)

**Time period:**

- The data set covers the period 1999/08/19 to 2003/04/19.
- Temporal Resolution: Quarterly

**Platform/Sensor/Parameters measured include:**

- FIELD INVESTIGATION / IRGA (INFRARED GAS ANALYZER) / CARBON DIOXIDE
- FIELD INVESTIGATION / GC-ECD (GAS CHROMATOGRAPH/ELECTRON CAPTURE DETECTOR) / NITROUS OXIDE
- LABORATORY / CHEMILUMINESCENCE / NITRIC OXIDE
- LABORATORY / GC-FID (GAS CHROMATOGRAPH/FLAME IONIZATION DETECTOR) / METHANE

### **3. Data Application and Derivation:**

These results demonstrate significant soil moisture and substrate constraints on soil trace gas emissions, particularly for CO<sub>2</sub>, and suggest that climate and land-use changes that alter moisture and substrate availability are therefore likely to have an impact on atmosphere chemistry.

### **4. Quality Assessment:**

Measurement quality control procedures are described in Vasconcelos et al.(2004).

### **5. Data Acquisition Materials and Methods:**

Plots were established in 1999, when the regrowth forest was 12 years old. Each of the 12 plots was 20 x 20 m with a centrally nested 10 x 10 m measurement subplot. Litter was removed in four of the 20 m x 20 m plots. Another four plots were irrigated during the dry season, and the remaining plots were left as an experimental control. To avoid edge effects, all measurements were taken within the center 10 meter x 10 meter of each treatment. These 100 meter square areas were further divided into 2.5 m x 2.5 m subplots, each of which was dedicated to a particular use. Fluxes of N<sub>2</sub>O, NO, CO<sub>2</sub>, and CH<sub>4</sub> were measured about bi-monthly or quarterly within two of these mini-plots. Treatments began in 2000, after more than one full year of baseline data had been gathered. Two chambers were located in each of two of the subplots of each plot, for a total of eight replicated per treatment type.

Fluxes of nitric oxide (NO) and carbon dioxide (CO<sub>2</sub>) were measured in the field using dynamic chambers connected to a Scintrex LMA-3 chemiluminescent analyzer and a LICOR 6252 IRGA. Fluxes of N<sub>2</sub>O and CH<sub>4</sub> were measured by filling syringes with gas from static chamber headspace at 10-minute intervals, and analyzing the samples in a laboratory using gas chromatography. See Vasconcelos et al. (2004) for complete details.

### **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](mailto:uso@daac.ornl.gov)

Telephone: +1 (865) 241-3952

## 7. References:

Vasconcelos, S.S., D.J. Zarin, M. Capanu, R. Littell, E.A. Davidson, F.Y. Ishida, E.B. Santos, M.M. Araujo, D.V. Aragao, L.G.T. Rangel-Vasconcelos, F.D. Oliveira, W.H. McDowell, and C.J.R. de Carvalho. 2004. Moisture and substrate availability constrain soil trace gas fluxes in an eastern Amazonian regrowth forest. *Global Biogeochemical Cycles* 18(2). *Global Biogeochemical Cycles* 18, GB2009, doi:10.1029/2003GB002210

### Related Publications

- Vasconcelos, S.S., D.J. Zarin, M. Capanu, R. Littell, E.A. Davidson, F.Y. Ishida, E.B. Santos, M.M. Araujo, D.V. Aragao, L.G.T. Rangel-Vasconcelos, F.D. Oliveira, W.H. McDowell, and C.J.R. de Carvalho. 2004. Moisture and substrate availability constrain soil trace gas fluxes in an eastern Amazonian regrowth forest. *Global Biogeochemical Cycles* 18(2). *Global Biogeochemical Cycles* 18, GB2009, doi:10.1029/2003GB002210

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