LBA-ECO CD-32 LBA Model Intercomparison Project (LBA-MIP) Meteorological Forcing Data

Summary:

This data set provides gap-filled meteorological observations from nine Brazilian flux towers for periods between 1999 and 2006. The measurements include: air temperature, specific humidity, module of wind speed, downward long wave and shortwave radiation at the surface, surface pressure, precipitation, and carbon dioxide (CO2). These atmospheric data are provided at 1-hour time-steps. These data were used as the standardized forcing data input for the LBA Model Intercomparison Project (LBA-MIP).

The Amazonian sites and nine towers include:

- Reserva Cuieiras near Manaus (K34 forest tower)
- Tapajos National forest, near Santarem (K67 and K83 forest towers, and K77 pasture/agriculture tower)
- Caxiuana National forest (CAX forest tower), near Belem
- Reserva Jaru (RJA forest tower)
- Fazenda Nossa Senhora (FNS pasture tower), near Ji-Parana
- Tocantins-Javaes site (BAN seasonally flooded ecotone tower)
- Reserva Pe-de-Gigante in Sao Paulo state (PDG savanna tower)

Refer to the companion file CD32_MIPDrivers_Sites.pdf for the list of investigators and data reference information for each site.

The LBA-MIP goal was to gain comparative understanding of ecosystem models that simulate energy, water, and CO2 fluxes over the LBA area. The task was to subject all the models to the same forcing and experimental protocol, and to compare the outputs. The protocol is provided as a companion file,lba_mip_protocol4.0_20100309.pdf.

The source meteorological observations for the forcing data, from the nine Brazilian flux towers, were recently published at the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) as LBA-ECO CD-32 Flux Tower Network Data Compilation, Brazilian Amazon: 1999-2006 (Saleska, et al., 2013). See related data sets. These source data were gap-filled according to the LBA-MIP standard protocol. Note that the CAX forest tower was not included in the MIP. See the companion file driver_data.pdf for additional gap-filling information.

There are 34 data products with this data set and they are provided in both text (.txt) and ALMA-compliant NetCDF (.nc) formats. The files have been compressed into nine *.zip files according to site.

Data User Guidance

- **Newer Flux Tower Data**
  - More recent flux tower data for these Brazilian sites as identifed in Table 1 may be found at the FLUXNET web site, http://fluxnet.ornl.gov.
- **Important Data File Usage Note**
  - In several of the data files, the flags (GF) that indicate whether a meteorolgical value is an original or a gap-filled number do not have consistent values. The majority of the GF fields have correct values, either 0 for an orginal value or 1 for a gap-filled value. A few GF fields have values of "NaN" and inspection reveals that the correct GF value could be either 0 or 1. The meterological values are unaffected by the GF flag inconsistency.
  - Note that we expect to received data files with corrected GF values in the near future and will notify users who have downloaded the curent version of the data.

Data Citation:

Cite this data set as follows:

de Goncalves, L.G.G., N. Restrepo-Coupe, H.R. da Rocha, S.R. Saleska, and R. Stockli. 2013. LBA-ECO CD-32 LBA Model Intercomparison Project (LBA-MIP) Meteorological Forcing Data. Data set. Available on-line [http://daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA http://dx.doi.org/10.3334/ORNLDAAC/1177

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] 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 August 2013. Users who download the data between August 2013 and July 2018 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.

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: Carbon Dynamics

Team ID: CD-32 (Saleska / da Rocha / Artaxo / Nobre / Shimabukuro)

The investigators were Saleska, Scott R.; Rocha, Humberto Ribeiro da; Artaxo, Paulo Eduardo; Huete, Alfredo R.; Nobre, Antonio Donato; Parker, Geoffrey; Ratana, Piyachat; Restrepo-Coupe, Natalia; Shimabukuro, Monica Takako; Shimabukuro, Yosio Edemir and Tannus, Rafael Nora . You may contact Saleska, Scott R. (saleska@email.arizona.edu).

LBA Data Set Inventory ID: CD32_LBA_MIP_Drivers

This data set provides gap-filled meteorological observations from nine Brazilian flux towers for periods between 1999 and 2006. The measurements include: air temperature, specific humidity, module of wind speed, downward long wave and shortwave radiation at the surface, surface pressure, precipitation, and carbon dioxide (CO2). These atmospheric data are provided at 1 hour time-step. These data were used as the standardized forcing data input for the LBA Model Intercomparison Project (LBA-MIP).

- **Related Data Sets** (data from the flux tower sites for similar time periods)

  - LBA-ECO CD-32 Brazil Flux Network Integrated Data: 1999-2006 (flux tower data for similar time periods)
  - LBA-ECO CD-10 CO2 & H2O Eddy Flux Data at km 67 Tower Site, Tapajos National Forest (data for the period 2002/01/01 to 2006/01/18)
  - LBA-ECO CD-10 H2O Profiles at km 67 Tower Site, Tapajos National Forest (data for the period 2002/01/01 to 2006/01/18)
  - LBA-ECO CD-10 CO2 Profiles at km 67 Tower Site, Tapajos National Forest (data for the period 2002/01/01 to 2006/01/18)
  - LBA-ECO CD-10 Temperature Profiles at km 67 Tower Site, Tapajos National Forest (data for the period 2002/01/01 to 2006/01/18)
  - LBA-ECO CD-03 Flux-Meteorological Data, km 77 Pasture Site, Para, Brazil: 2000-2005 (data for the period 2000/09/01 to 2006/01/01)
  - LBA-ECO CD-04 CO2 Profiles, km 83 Tower Site, Tapajos National Forest (data for the period 2000/07/01 to 2004/03/12)

- LBA-ECO CD-04 Meteorological and Flux Data, km 83 Tower Site, Tapajos National Forest (data for the period 2000/06/29 to 2004/03/11)
- LBA-ECO CD-02 Carbon and Oxygen Isotopes in Atmospheric CO2 in the Amazon: 1999-2004 (data for the period 1999/03/01 to 2004/03/31)
- LBA-ECO CD-04 CO2 and Heat Flux, km 83 Gap Tower Site, Tapajos National Forest (data for the period 2002/06/03 to 2004/01/30)
- LBA-ECO CD-04 Meteorological and Flux Data, km 83 Tower Site, Tapajos National Forest (data for the period period 2000/06/29 to 2004/03/11)
- LBA-ECO TG-07 Soil Trace Gas Fluxes km 67 Seca-Floresta Site, Tapajos National Forest (data for the period 2000/01/12 to 2004/04/28)
- LBA-ECO CD-04 Soil Respiration, km 83 Tower Site, Tapajos National Forest, Brazil (data for the period 2001/12/19 to 2002/03/01)

2. Data Characteristics:

File naming conventions:

There are 34 data files with this data set in text (.txt) and NetCDF formats. The files have been compressed into nine *.zip files according to site.

The nine *.zip files are named as **Site.zip:**

Example file names: **Manaus_KM34.zip** and **Reserva_Jaru.zip.**

The .txt and .nc files are named according to Site and Year.

Example file names:

Bananal_Island_2004uaz.100217LWnet.leap.csv

Bananal_Island_2004.uaz.100217LWnet.leap.nc

Data file contents:

The NetCDF (.nc) format files are ALMA-compliant and largely self-documenting.

The ASCII (.csv) format files have content organized as follows:

Column	Column Heading	Units/format	Description	Range
1	Year	YYYY	Year of measurement (YYYY)	1999-2006
2	DoY	DD	Day of year (DD)	0-366
3	Hour	HH	Hour (HH)	0-23
4	Minute	MM	Minute (MM)	0-0

5	Tair	K	Near surface air temperature (degrees K)	
6	GF		Gap filled: 0=original, 1=filled (See NaN note)	
7	Qair	kg/kg	Near surface specific humidity (kg/kg)	0.000-0.030
8	GF		Gap filled: 0=original, 1=filled (See NaN note)	
9	Wind	m2/s	Near surface module of the wind (m2/s)	0-9
10	GF		Gap filled: 0=original, 1=filled (See NaN note)	
11	Rainf	kg/m2/s	Rainfall rate (kg/m2/s)	0-0.02
12	GF		Gap filled: 0=original, 1=filled (See NaN note)	
13	PSurf	Pa	Surface pressure (Pa)	93000-100000
14	GF		Gap filled: 0=original, 1=filled (See NaN note)	
15	SWdown	W/m2	Surface incident shortwave radiation (W/m2)	0-1500
16	GF		Gap filled: 0=original, 1=filled (See NaN note)	
17	LWdown	W/m2	Surface incident longwave radiation (W/m2)	270-540
18	GF		Gap filled: 0=original, 1=filled (See NaN note)	
19	CO2air	ppmv	Near surface CO2 concentration (ppmv). CO2 set at constant 375--not measured	375-375
20	GF		Gap filled: 0=original, 1=filled (See NaN note)	

Missing values represented as -999.00. Years have 365 or 366 days, depending on if the year is or is not a leap year.

NaN note: In several of the data files, the flags (GF) that indicate whether a meteorolgical value is an original or a gap-filled number do not have consistent values. The majority of the GF fields have correct values, either 0 for an orginal value or 1 for a gap-filled value. A few GF fields have values of "NaN" and inspection reveals that the correct GF value could be either 0 or 1. The meterological values are unaffected by the GF flag inconsistency.

Example file: Reserva_Jaru_2000uaz.100217LWnet.leap.csv

```
Year,DoY,Hour,Minute,Tair,GF,Qair,GF,Wind,GF,Rainf,GF,PSurf,GF,SWdown,GF,LWdown,GF,CO2air,GF
2000,1,0,0,298.82,0,0.01596846,1,2.78049685,0,0.000150426,NaN,100538.3333,NaN,0,0,415.055,0,375,NaN
2000,1,1,0,297.8607782,0,0.016135424,1,1.994083389,0,0.000413556,NaN,100643.3333,NaN,0,0,442.59,0,375,NaN
...
2000,196,4,0,290.24,0,0.008681715,0,4.16,0,0,0,101745,0,0,0,354.735,0,375,1
2000,196,5,0,289.39,0,0.00844715,0,4.18,0,0,0,101725,0,0,0,351.17,0,375,1
...
2000,366,22,0,300.8085515,0,0.018639643,1,0.74,0,0,1,100492.4609,1,33.15678571,1,445.5732047,1,375,1
2000,366,23,0,300.1969176,0,0.018303222,1,0.28,0,0,1,100577.4609,1,0.010535714,1,428.7657042,1,375,1
```

Site boundaries:(All latitude and longitude given in decimal 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)
Para Western (Santarem) - km 77 Pasture Tower Site (Para Western (Santarem))	-54.88850	-54.88850	-3.02020	-3.02020	World Geodetic System, 1984 (WGS-84)
Para Western (Santarem) - km 83 Logged Forest Tower Site (Para Western (Santarem))	-54.97070	-54.97070	-3.01700	-3.01700	World Geodetic System, 1984 (WGS-84)
Amazonas (Manaus) - ZF2 km 34 (Amazonas (Manaus))	-60.20910	-60.00000	-2.50000	-2.60900	World Geodetic System, 1984 (WGS-84)
Para Eastern (Belem) - FLONA Caxiuana (Para Eastern (Belem))	-51.45360	-51.45360	-1.74830	-1.74830	World Geodetic System, 1984 (WGS-84)
Rondonia - Fazenda Nossa Senhora (Rondonia)	-62.35720	-62.35720	-10.76180	-10.76180	World Geodetic System, 1984 (WGS-84)
Rondonia - Jaru Biological Reserve Tower B (Rondonia)	-61.93310	-61.93310	-10.07800	-10.07800	World Geodetic System, 1984 (WGS-84)
Tocantins - Ilha do Bananal (Tocantins)	-50.1591111	-50.1591111	-9.824416667	-9.824416667	World Geodetic System, 1984 (WGS-84)
Sao Pablo - Reserva	-47.6498889	-47.6498889	-21.61947222	-21.61947222	World

Pe-de-Gigante (Sao Pablo)					Geodetic System, 1984 (WGS-84)

Time period:

- The data set covers the period 1999/01/01 to 2006/12/31.
- Temporal Resolution: Hourly

Platform/Sensor/Parameters measured include:

- TOWER / SHORTWAVE RADIATION / ANALYSIS
- TOWER / LONGWAVE RADIATION / PYRRADIOMETERS
- TOWER / TEMPERATURE SENSOR / AIR TEMPERATURE
- TOWER / ANEMOMETER / WIND PROFILES

3. Data Application and Derivation:

Typical Application of Data:

Forcing drivers and boundary conditions for ecosystem models that simulate terrestrial energy, water and CO2 fluxes based on continuous observations of these quantities over the LBA area.

Derivation Techniques:

For information on the derivation techniques and algorithms, refer to the companion file: driver_data.pdf

For site-specific data references refer to the companion file: CD32_MIPDrivers_Sites.pdf.

4. Quality Assessment:

Data Usage Guidance:
Please refer to The Large Scale Biosphere-Atmosphere Experiment in Amazonia, Model Intercomparison Project (LBA-MIP) protocol companion file: lba_mip_protocol4.0_20100309.pdf.

5. Data Acquisition Materials and Methods:

The source meteorological observations for the forcing data, from the nine Brazilian flux towers, were recently published as Saleska, et al. (2013).

Site descriptions:

Table 1. Nine towers and corresponding study areas (information for these sites may also be found at the FLUXNET web site**,** http://fluxnet.ornl.gov/**):**

Site code	Description	Fluxnet Site Name/Site Code	Altitude (m)	Measurement Height (m)	Temporal Coverage
BAN	Tocantins State, Bananal seasonally flooded forest, mixture of cerrado, cerrado and campo (natural grassland)	Ecotone Bananal Island/ BR-Ban	120.000	40.000	2004-2006
K34	Manaus, km 34 tropical forest site	Manaus-ZF2 K34/ BR-Ma2	130.000	50.000	2002-2005
K67	Santarem, km 67 tropical forest site	Santarem-Km67-Primary Forest/ BR-Sa1 **	130.000	63.000	2002-2004
K77	Santarem, km 77 pasture-agriculture site	Santarem-Km77-Pasture/ BR-Sa2	130.000	18.000	2001-2005
K83	Santarem, km 83 selectively logged tropical forest	Santarem-Km83-Logged Forest/ BR-Sa3 ***	130.000	64.000	2001-2003
RJA	Rondonia State, Reserva Jaru, tropical dry forest	Rond.- Rebio Jaru Ji Parana-Tower B/ BR-Ji3	191.000	60.000	2000-2002
FNS	Rondonia State, Fazenda Nossa Senhora, pasture	Rond.- Faz. Nossa Senhora-Ji Parana-pasture/ BR-Ji1	306.000	8.5000	1999-2001
CAX	Para State, Caxiuana tropical forest	Caxiuana Forest-Almeirim/ BR-Cax	130.000	51.5000	1999-2003
PDG	Sao Paulo State, Reserva Pe-de-Gigante (PDG) cerrado	Sao Paulo Cerrado/ BR-Sp1	690.000	21.000	2001-2003

** Site information and data are also available from AmeriFlux (http://ameriflux.ornl.gov/). In AmeriFlux, site name = LBA Tapajos KM67 Mature Forest/BR-Sa1.

***** Site information and data are also available from AmeriFlux (http://ameriflux.ornl.gov/). In AmeriFlux, site name = LBA Tapajos KM83 Logged Forest/BR-Sa3.

Processing Flux Tower Data:

Yearly gap-filled meteorological driver data were created from flux tower data sets at hourly time-steps.

Please refer to the companion file driver_data.pdf for additional information.

Data at the tower reference height were used and only filled by lower profile measurements where available and needed.

Outliers which deviated from the median-filtered time-series were removed. Gaps up to two-months long were filled by applying a seven day running mean diurnal cycle forwards and backwards through the yearly time-series. Years with more than 2 months of consecutive missing data were not used.

Observations were flagged to indicate if a value is an original value or a filled value. See "Data User Guidance" in Summary.

6. Data Access:

These data are 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:

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