LBA-HMET PC-06 ECMWF Modeled Precipitation and Surface Flux, Rondonia, Brazil: 1999

Summary:

This data set provides the mean diurnal cycle of precipitation, near-surface thermodynamics, and surface fluxes generated from short-term forecasts from the European Centre for Medium-Range Weather Forecasts (ECMWF) model.

The model outputs were 12- to 36-hour short-range forecasts, run at a triangular truncation of T319 and a vertical resolution of 60 levels, from each daily 1200 (UTC) analysis. The version of the forecast model used to prepare this data product was the operational ECMWF model in fall 2000, which included the tiled land-surface scheme (TESSEL) (Van den Hurk et al., 2000) and recent revisions to the convection, radiation, and cloud schemes described by Gregory et al., (2000).

The ECMWF model was run for two Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA) campaigns conducted in Rondonia, Brazil, during January and February of 1999: the Wet Season Atmospheric Mesoscale Campaign (WETAMC) and the Tropical Rainfall Measuring Mission (TRMM). See Silva Dias et al.,(2002) for additional information regarding the WETAMAC and TRMM campaigns.

There are two comma-delimited data files with this data set: the ECMWF model output data and a file containing the mean hourly precipitation observations used to check the model output for biases.

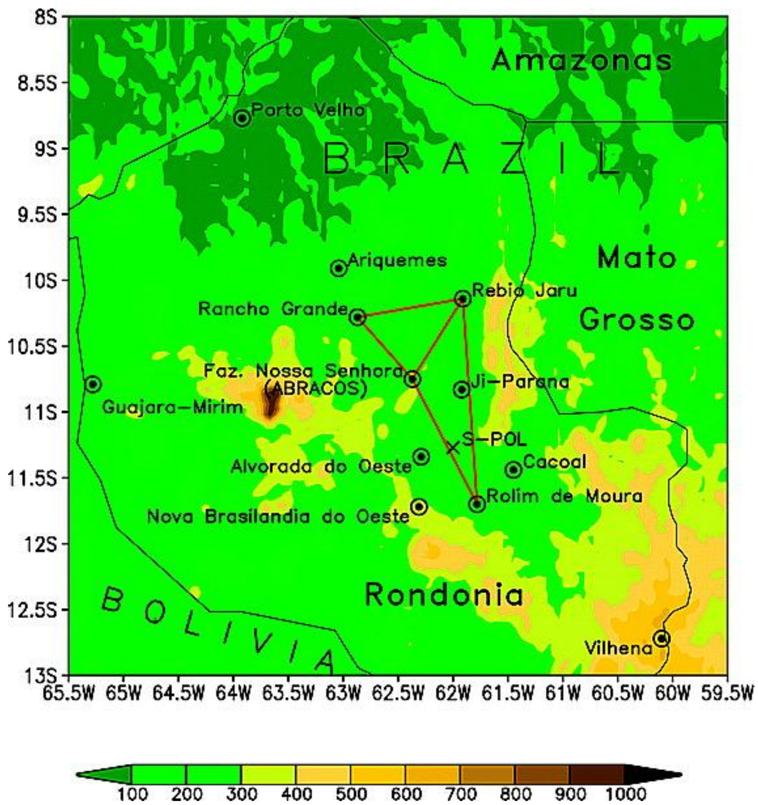

Figure 1. WETAMC/LBA and TRMM/LBA sites (Silva Dias et al., 2002). Scale is elevation in meters AMSL.

Data Citation:

Cite this data set as follows:

Betts, A.K. and C. Jakob. 2013. LBA-HMET PC-06 ECMWF Modeled Precipitation and Surface Flux, Rondonia, Brazil: 1999. 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/1141

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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 Users who download LBA data in the five years after data have been archived must contact the investigators who collected the data, per provisions 6 and 7 in the Policy.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 January of 2013. Users who download the data between January 2013 and December 2017 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 website [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: Physical Climate

Team ID: PC-06 (Betts / Maria Silva Dias / Pedro Silva Dias)

The investigators were Betts, Alan K. and Jakob, Christian. You may contact Betts, Alan K. (akbetts@aol.com)

LBA Data Set Inventory ID: PC06_ECMWF_LBA

This data set provides the mean diurnal cycle of precipitation, near-surface thermodynamics, and surface fluxes generated from short-term forecasts from the European Centre for Medium-Range Weather Forecasts (ECMWF) model.

The model outputs were 12- to 36-hour short-range forecasts, run at a triangular truncation of T319 and a vertical resolution of 60 levels, from each daily 1200 (UTC) analysis. The version of the forecast model used to prepare this data product was the operational ECMWF model in fall 2000, which includes the tiled land-surface scheme (TESSEL) (Van den Hurk et al., 2000) and recent revisions to the convection, radiation, and cloud schemes described by Gregory et al., (2000).

The ECMWF model was run for two Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA) campaigns conducted in Rondonia, Brazil, during January and February of 1999: the Wet Season Atmospheric Mesoscale Campaign (WETAMC) and the Tropical Rainfall Measuring Mission (TRMM). See Sillva Dias et al.,(2002) for additional information regarding the WETAMC and TRMM campaigns.

2. Data Characteristics:

There are two comma-delimited data files with this data set.

File #1: **ECMWF_SFC_TESSEL.csv--** ECMWF model output data, run at T319 L60 with land-surface scheme TESSEL: (ECMWF TM #295: Van den Hurk et al., 2000). This was the operational model in fall, 2000.

Time period of data: 1999, Day 20-60

Location: Model grid point in Rondonia: at 10.85 deg S, 61.87 deg W (the grid point closest to Rondonia Abracos pasture site).

Data frequency: 20 minutes.

Data source: Extracted from 12-36 short term forecasts from ECMWF model.

Column	Heading	Units/format	Description
1	jdaydec	decimal time	Julian day as decimal time
2	fdate	YYYMMDD	Initialization date (YYYYMMDD)
3	itime	12	Initialization time:12
4	Date	YYYYMMDD	Date of forecast (YYYYMMDD)
5	UTC	decimal hours	Time of forecast (end-time for fluxes)
6	UTC2	decimal hours	Relabel for 2400 UTC: to identify 36h-forecast data
7	Hour		0.5 + integer(utc2 - 0.16666); used for hourly means
8	DOY	DD	Day of year
9	DOY2	DD	Conditional value. If UTC2 < 24 then DOY2=DOY. Else if UTC2 is equal to or greater than 24 then DOY2=DOY – 1. DOY2 is paired with 2400 UTC time
10	Month	1, 2, or 3	Month: January (1) to March (3)
11	Year	YYYY	Year (YYYY) - all records are 1999

12	k	0 or 2	Label for 2400 UTC record in UTC2
13	T_soil_1	K	Soil temperature in layer 1 (7 cm deep) reported in degrees Kelvin
14	Rad_sw_net	W/m2	Net shortwave radiation reported in Watt per square meter (W/m2)
15	Rad_lw_net	W/m2	Net longwave radiation reported in watts per meter squared (W/m2)
16	LH	W/m2	Latent heat flux over water reported in watts per meter squared (W/m2)
17	LHsnow	W/m2	Latent heat flux over ice/snow reported in watts per meter squared (W/m2); all values =0
18	SH	W/m2	Sensible heat flux reported in watts per meter squared (W/m2)
19	Rnet	W/m2	Net incoming radiation calculated as the sum of shortwave and longwave radiation and reported in watts per meter squared (W/m2)
20	G	W/m2	Heat flux at the ground surface calculated as the sum of net incoming radiation, latent heat flux over water, and latent heat flux over snow and reported in watts per meter squared (W/m2)
21	G1	W/m2	Heat flux between soil layer 1 (7 cm deep) and soil and lower soil layers 2/3/4 reported in watts per meter squared (W/m2)
22	SW1	m3/m3	Soil moisture in layer 1 (7 cm depth) reported in cubic meters of water per cubic meters of soil (m3/m3)
23	LSrain	mm/s	Large-scale rain reported in millimeters per second (mm/s)
24	CSrain	mm/s	Convective rain reported in millimeters per second (mm/s)
25	LSsnow	mm/s	Large-scale snow reported in millimeters per second (mm/s)
26	CSsnow	mm/s	Convective snow reported in millimeters per second (mm/s)
27	Precip_total	mm/hr	Total precipitation calculated as 3600 * (CSrain + LSrain) and reported in millimeters (mm/hr)
28	p0	hPa	Model surface pressure reported in hectopascals (hPa) (T-319 topography)
29	T2	K	Air temperature measured at 2 meters above the soil and reported in degrees Kelvin (K)
30	q2	g/kg	Specific humidity measured at 2 meters above the soil and reported in grams per kilogram (g/kg)
31	u10	m/s	Wind u-component at 10 meters above the ground reported in meters per second (m/s)
32	v10	m/s	Wind v-component at 10 meters above the ground reported in meters per second (m/s)
33	wv	m/s	Wind speed = (u10 * u10 + v10 * v10) ^ 0.5 (m/s)
34	Tskin	K	Skin temperature in degrees Kelvin (K) which is equal to SST over sea
35	albedo	fraction	Albedo reported as the proportion of visible light reflected
36	SWdown	W/m2	Downward surface solar radiation reported in watts per meter squared (W/m2)
37	LWdown	W/m2	Downward surface longwave radiation reported in watts per meter squared (W/m2)
Note: Very small (less than 1.E-10 for precipitation and less than 1.E-1 for radiation) and small negative numbers in solar radiation and precipitation are due to GRIB packing and unpacking mechanisms and do not represent model problems			

Example data records: ECMWF_SFC_TESSEL.csv

```
jdaydec,idate,itime,date,utc,utc2,hour,DOY,DOY2,month,year,k,ST1,SWnet,LWnet,LH,
LHsnow,SH,Rnet,G,G1,SW1,LSrain,CSrain,LSsnow,CSsnow,precip_total,p0,T2,q2,u10,v10
,wv,Tskin,albedo,SWdown,LWdown

20,19990119,0,19990120,0,0,0.5,20,20,1, 1999,0,297.84,-0.00097656,
-36.472,0.17383,0,3.8324,-36.47297656,-32.46674656
-6.5701,23.402,3.09E-06,-2.91E-11,0,0,0.011136855,984.29,297.33,17.674,
1.7108,0.05716,1.711754628,295.63,0.13669,0.00097656,397.01
...
40.75,19990208,12,19990209,18,18,17.5,40,40,2,1999,
0,300.83,591.09,-45.601,-425.39,0,-86.049,545.489,34.05,
27.09,23.293,3.89E-05,2.33E-10,1.26E-29,-5.17E-26,0.139896838,984.25,301.14,18.443
-1.0825,0.016714,1.082629026,302.44,0.13683,684.87,429.16
...
61,19990228,0,19990302,0,24,23.5,61,60,2,
1999,2,297.33,0,-31.9,0.063477,0,15.785,-31.9,-16.051523,
5.8091,24.779,0,0,7.03E-27,0,0,980.99,296.65,17.644,
,-0.41154,-1.3327,1.394795491,295.88,0.13673,0,401.83
```

File #2: **Mean_Precip_ECMWF.csv--** the mean hourly precipitation data used to check the model output for biases.

Column	Heading	Units/format	Description
1	Year	YYYY	Sampling date: year
2	Month	MM	Sampling date: month
3	Day	DD	Sampling date: day
4	DOY		Sampling date reported in day of the year
5	UTC_hour		Midpoint for the sampling period reported in UTC time
6	Decimal_day		Sampling period reported in decimal day calculated as DOY + (UTC_hour/24)
7	Mean_precip	mm/hr	Mean hourly precipitation by network reported in millimeters (mm/hr)
8	Num_gauges		Number of gauges included in the calculation of the average precipitation
9	Network		Network identification: networks (e.g. 1,2,3, or 4) were designated by Dr Betts. See Figure 2.

Example data records: Mean_precip_ECMWF.csv

```
Year, Month, Day, DOY, UTC_hour, Decimal_day, Mean_precip, Num_gauges, Network
1999, ,1 1, 1, 0.5, 1.02083, 0, 12, 1
1999, ,1 1, 1, 1.5, 1.0625, 0, 12, 1
1999, ,1 1, 1, 2.5, 1.10417, 0, 12, 1
...
1999, 3, 4, 63, 2.5, 63.10417, 0, 13, 2
1999, 3, 4, 63, 3.5, 63.14583, 0, 13, 2
1999, 3, 4, 63, 4.5, 63.1875, 0, 13, 2
...
1999 3 31 90 21.5 90.89583 0 5 4
1999 3 31 90 22.5 90.9375 0 5 4
1999 3 31 90 23.5 90.97917 0 5 4
```

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Geodetic Datum
Rondonia, Brazil - Ouro Preto do Oeste (1999 LBA field campaigns)	-62.37222	-62.37222	-10.75	-10.75	World Geodetic System, 1984 (WGS-84)
Rondonia, Brazil - (Model grid point closest to pasture site of the 1999 LBA field campaigns)	-61.87	-61.87	-10.85	-10.85	World Geodetic System, 1984 (WGS-84)

Time period

- The data set covers the period 1999/01/20 to 1999/02/28.
- Temporal Resolution: 20-minute

Platform/Sensor/Parameters reported include:

- COMPUTER MODEL / ANALYSIS / PRECIPITATION AMOUNT
- COMPUTER MODEL / ANALYSIS / HEAT FLUX
- TOWER / RAIN GAUGE / PRECIPITATION AMOUNT
- COMPUTER MODEL / ANALYSIS / AIR TEMPERATURE
- FIELD INVESTIGATION / EDDY CORRELATION APPARATUS / HEAT FLUX

3. Data Application and Derivation:

We conducted an exploration of the impact of changing different components in the ECMWF convection schemes, their mass and energy budget closures, and the sequence in which the schemes are called by the model, as a first step toward developing a more robust representation of tropical convection over land (Betts and Jakob, 2002a).

4. Quality Assessment:

The following taken from Betts and Jakob, 2002:

The model did not simulate well the morning growth of the non-precipitating convective boundary layer (CBL).

The mean daily precipitation during the wet season compared well with observed rainfall, but there were errors in the diurnal cycle of precipitation over Rondonia.

On most days, maximum early afternoon temperature and cloud base height were lower in the model than observed.

Maximum equivalent potential temperature was close to that observed.

The model surface evaporative fraction was higher than observed and rose to near unity in the late afternoon.

5. Data Acquisition Materials and Methods:

Site description: LBA research campaigns

The ECMWF model was run for two LBA campaigns conducted in Rondonia, Brazil during January and February of 1999: WETAMC and TRMM. The study site was the Abracos pasture site (located near Ouro Preto d'Oeste, Rondonia, Brazil (10.75 S, 62.37 W; about 30 km northwest of Ji-Parana)).

The pasture site was part of a large deforested area (250 km2) dominated by a short grass (Brachiaria brizantha) with isolated palm and hardwood trees scattered throughout the landscape.

Data collection and instrumentation

Note: The data used as input to the model are not included with this data set.

The model used as inputs, hourly averaged data from WETAMC and precipitation estimates from four rain gauge networks from TRMM.

A micromet tower, eddy correlation instrumentation, and a gas analyzer reported the surface meteorology and energy balance components. A tethered balloon system and a rawinsonde reported profiles up through the CBL and atmosphere, while the structure of the convection nearby was mapped by two Doppler radars (Rutledge et al., 2000; Rickenbach et al., 2002; Cifelli et al., 2002).

The estimates of precipitation came from averaging the four rain gauge networks, which were established to help calibrate the TRMM radars (Rickenbach et al., 2002). These four networks were in a northwest to southeast line with the nearest group 25 km east of the pasture site. The mean hourly precipitation data were used to check the model output for biases.

Figure 2. Rain gauge networks are indicated by red numbers 1, 2, 3, and 4. Deforestation in the background is light green. Dark green is forest. Center of the range circles (at every 20 km) is at the S-Pol position in Fazenda Jamaica. Yellow circles are the Dual Doppler regions. TOGA radar position is indicated by T. S-Pol position is indicated by S. (Silva Dias et al., 2002).

Model output

The model outputs used for comparison were 12- to 36-hour short-range forecasts, run at a triangular truncation of T319 and a vertical resolution of 60 levels, from each daily 1200 (UTC) analysis. The forecast model was the operational ECMWF model in fall 2000, which included the TESSEL (Van den Hurk et al., 2000) and recent revisions to the convection, radiation, and cloud schemes described by Gregory et al., (2000). Model data were extracted every time step at the model grid point in Rondonia (10.85 S, 61.87 W) closest to the field measurement site (10.75 S, 62.37 W).

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

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