LBA-ECO LC-02 Hot Pixel Fire Indicator Data for Tri-national MAP Region: 2003-2006

Revision date: October 18, 2011

Summary:

This data set provides hot pixel data, as an indicator of fires, that were detected by various satellites in the tri-national MAP region (Madre de Dios-Peru, Acre-Brazil, and Pando-Bolivia) in 2003, 2004, 2005, and 2006. Data from the following satellites/sensors were compiled: NOAA-12, NOAA-14, NOAA-15, and NOAA-16, which transports the AVHRR sensor; GOES-8 and GOES- 12, which transports the GOES Imager; and AQUA and TERRA, both which transport the MODIS sensor. These data were made available by the Centro de Previsão do Tempo e Estudos Climáticos (CPTEC) of the Instituto Nacional de Pesquisas Espaciais (INPE) via the internet (http://sigma.cptec.inpe.br/queimadas/). This data set contains 12 comma-delimited ASCII data files.

Hot pixel data from satellites can be used as an indicator of fires and for the understanding of fire frequency in remote areas. The publication by Vasconcelos and Brown, 2007, which has been included as a companion file, describes the application of these data in the MAP region.

In addition to the the hot pixel data, each observation has a derived vegetation type, susceptibility to fire, recent and past precipitation amounts, and a calculated fire risk value. These data are described in the Fire Risk Factor companion file, by Alberto W. Setzer and Raffi A. Sismanoglu, Version 5, February 2006.

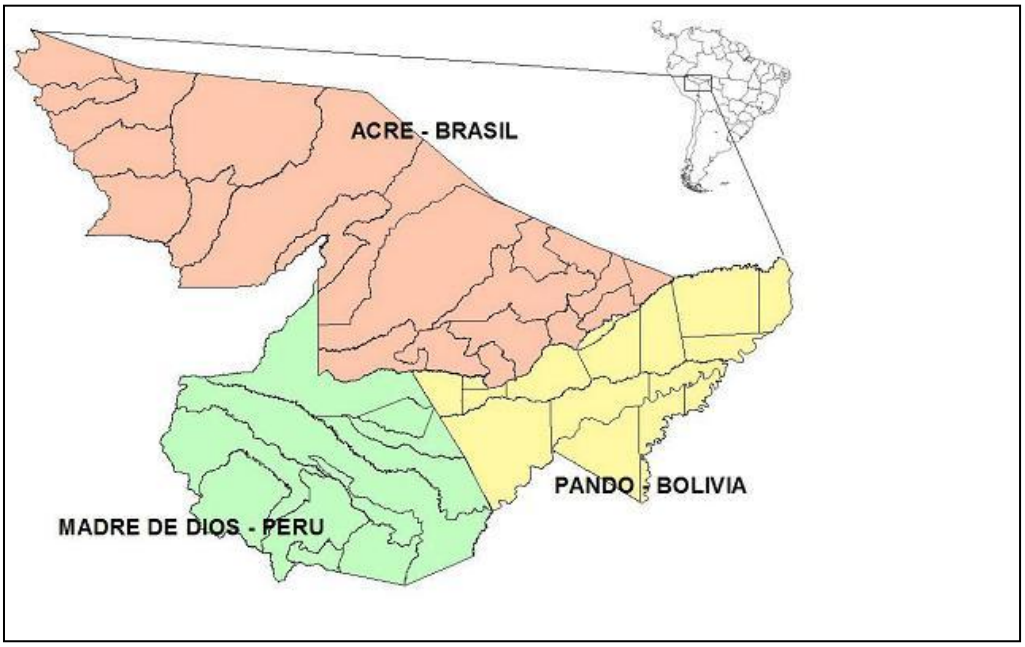

Figure 1: Region of Madre de Dios-Peru, Acre-Brazil, and Pando-Bolivia, called MAP region.

Data Citation:

Cite this data set as follows:

Vasconcelos, S., and I.F. Brown. 2011. LBA-ECO LC-02 Hot Pixel Fire Indicator Data for Tri-national MAP Region: 2003-2006. Data set. Available on-line [http://daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. http://dx.doi.org/10.3334/ORNLDAAC/1044

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 October of 2011. Users who download the data between October 2011 and September 2016 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: Land Use and Land Cover

Team ID: LC-02 (Brown / Silveira / Esteves)

The investigators were Dobson, Myron Craig; Soares, Joao Vianei; Barros, Oton Osorio; Kellndorfer, Josef; Kobayashi, Tatsuharu; Lucas, Richard M.; Pan, Liang; Pierce, Leland E.; Santos, Joao Roberto dos; Ulaby, Fawwaz T.; Valeriano, Dalton De Morisson and Xie, Hua. You may contact Vasconcelos, Sumaia (sumaiasv@yahoo.com.br) and Brown, Foster (fbrown@whrc.org).

LBA Data Set Inventory ID: LC02_MAP_Fire_Indicators

The data for this data set are presented in 12 comma-delimited ASCII files: 4 files for each year included in the study (one file for each study area: Bolivia, Brazil, Peru). Each file gives the date, time and location for each detected hot pixel as well as the satellite image used. In addition, conditions including type of vegetation, days without rain, and fire risk factor are included for each pixel.

2. Data Characteristics:

The data for this data set are presented in 12 comma-delimited ASCII files: 4 files for each year included in the study (one file for each study area: Bolivia, Brazil, Peru). Each file gives the date, time and location for each detected hot pixel as well as the satellite image used. In addition, conditions including type of vegetation and days without rain are included for each pixel. Study locations are indicated on a map provided as: Regional_map.jpg

File names:

Bolivia	Brazil	Peru
LC02_Bolivia_Hot_Pixels_2003.csv	LC02_Brazil_Hot_Pixels_2003.csv	LC02_Peru_Hot_Pixels_2003.csv
LC02_Bolivia_Hot_Pixels_2004.csv	LC02_Brazil_Hot_Pixels_2004.csv	LC02_Peru_Hot_Pixels_2004.csv
LC02_Bolivia_Hot_Pixels_2005.csv	LC02_Brazil_Hot_Pixels_2005.csv	LC02_Peru_Hot_Pixels_2005.csv
LC02_Bolivia_Hot_Pixels_2006.csv	LC02_Brazil_Hot_Pixels_2006.csv	LC02_Peru_Hot_Pixels_2006.csv

All data files follow the structure and organization shown below for the file:
LC02_Bolivia_Hot_Pixels_2003.csv

Column	Heading	Units/format	Description
1	Pixel_ID		Unique id number for the pixel
2	Latitude	degrees	Latitude in decimal format where negative values represent S, positive values N
3	Longitude	degrees	Latitude in decimal format where negative values represent E, positive values W
4	Image_Date	YYYYMMDD	Image date
5	Image_Year	YYYY	Year for image
6	Image_Month	MM	Month for image
7	Image_Day	DD	Day of month for image
8	Image_Time	HHMMSS	Time image was taken reported on 24 hour clock GMT time. Local time is GMT-5

9	Satellite		Satellite platform
10	Municipality		Municipality for each pixel location
11	State		State for each pixel location
12	Country		Country for each pixel location: Brazil, Bolivia or Peru
13	Veg_Class		Vegetation type. Classes include: Open wet forest, Closed wet forest, Seasonal Deciduous, Seasonal Semi-deciduous, Agriculture, Not forested, Not identified, Water and Transition zone
14	Risk_Class		Susceptibility of area to fire. Classes include: High; Medium; Low; Water; and Not_calculated
15	Precipitation	mm	Measured precipitation between 7 am (GMT) on this date and 7 am (GMT) on the following day from local weather stations
16	Days_Dry		Number of days without rain in the 120 days previous to sampling date estimated by interpolation from weather stations in the region
17	Risk_Factor		Calculated fire risk factor. See accompanying documentation for the calculations used
Missing data are represented by -9999			

For description of columns Veg_Class through Risk_Factor, see Fire Risk Factor companion file, by Alberto W. Setzer and Raffi A. Sismanoglu, Version 5, February 2006.

Example data records for the file: LC02_Bolivia_Hot_Pixels_2003.csv:

```
Pixel_ID,Latitude,Longitude,Image_Date,Image_Year,Image_Month,Image_Day,Image_Time,
Satellite,Municipality,State,Country,Veg_Class,Risk_Class,Precipitation,Days_Dry,Risk_Factor
1,-18.85,-57.82833,20030101,2003,1,1, 22210,
TERRA, Puerto Suarez,Santa Cruz,Bolivia,Transition zone,High,2.9,15,0.9
2,-18.85,-57.81833,20030101,2003,1,1,22210,
TERRA, Puerto Suarez,Santa Cruz,Bolivia,Transition zone,High,2.9,15,0.9
3,-18.84167,-57.84,20030101,2003,1,1,22210
...
```

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Geodetic Datum
Region MAP (Madre de Dios/Peru, Acre/Brazil and Pando/Bolivia) (Amazonia Ocidental)	-81.28333	- 57.7933	- 0.6667	- 22.3833	World Geodetic System, 1984 (WGS-84)

Time period:

- The data set covers the period 2003/01/01 to 2006/12/31
- Temporal Resolution: Daily

Platform/Sensor/Parameters measured include:

- GOES-12 (AQUA/TERRA) / MODIS (MODERATE-RESOLUTION IMAGING SPECTRORADIOMETER) / LAND COVER
- NOAA-12 / AVHRR (ADVANCED VERY HIGH RESOLUTION RADIOMETER) /LAND COVER

3. Data Application and Derivation:

In areas such as Acre, where there is a large number of small rural producers in elongated properties of 150 m to 500 m in width, many simultaneous slash and burn fires of 1 to 5 ha can be clustered in one pixel of 1 km by 1 km (NOAA-12, AQUA, TERRA) or 4 km by 4 km (GOES-12), resulting in an underestimation of the number of burn events. On the other hand, in areas with large ranches, a single fire event can extend over dozens to hundreds of hectares and burn for days, being detected by many satellites simultaneously. Such large-area burns have been relatively infrequent in the MAP region.

In addition to fire size relative to pixel area, detection of fires by satellites can be influenced by factors including: cloud and smoke cover, differences in temporal coverage by different satellites, the off-nadir satellite observation which can reduce detection, different algorithms used in fire detection etc. The number of fires in Acre have been shown to be 5 to 10 times greater than the number detected in hot pixels of satellite images from a number of different satellites (Selhorst and Brown 2004, Pantoja et al. 2005)

4. Quality Assessment:

Fire events vary in size. In areas such as Acre, where there is a large number of small rural producers in elongated properties of 150 m to 500 m in width, many simultaneous slash and burn fires of 1 to 5 ha can be clustered in one pixel of 1 km by 1 km (NOAA-12, AQUA, TERRA) or 4 km by 4 km (GOES-12), resulting in an underestimate of the number of burn events. On the other hand, in areas with large ranches, a single fire event can extend over dozens to hundreds of hectares and burn for days, being detected by many satellites simultaneously. Such large-area burns have been relatively infrequent in the MAP region.

5. Data Acquisition Materials and Methods:

Data from the following satellites/sensors were compiled: NOAA-12, NOAA-14, NOAA-15, and NOAA-16, which transports the AVHRR sensor; GOES-8 and GOES- 12, which transports the GOES Imager; and AQUA and TERRA, both which transport the MODIS sensor. These data were made available by the Centro de Previsão do Tempo e Estudos Climáticos (CPTEC) of the Instituto Nacional de Pesquisas Espaciais (INPE) via the internet (http://sigma.cptec.inpe.br/queimadas/).

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Excerpt from Setzer and Raffi:

Data Sources

The data on maximum temperature and minimum relative humidity at 1800 hours (UTC) at the surface are taken from the NCEP analysis done at CPTEC by the global scale model Global T213 at 62-km resolution. There is also the option of “kriging” data from meteorological stations for the entire area.

Values for precipitation were obtained at a 4-km resolution from estimates of precipitation generated by DSA from satellite images from GOES-10 and MSG-2. We chose to use the estimates from satellite images since the density of climate stations is limited in various regions and this is the most important variable in the risk factor calculation.

The map of vegetation types was adapted from the most recent mosaic Vegetation Index image of South America generated by DSA with AQUA MODIS images. 5 principle classes of vegetation were used: Closed wet forest, Open wet forest, Contato+ Campinarana, Seasonal Deciduous + Semi-deciduous and Not-forested.

Predictions for RF for up to 3 days are generated from the products of regional ETA models at 20-km resolution and from the global scale model T213 at 62-km resolution. In addition the BRAMS models at two resolutions and ETA at 40-km resolution were also used in this research. Weekly forecasts for up to one month with a resolution of 40-km were also generated from the ETA model products.

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:

Pantoja, N.V. et al. 2005. Observacoes de queimadas no leste do Acre: subsidios para validacao de focos de calor derivados de dados de satelites. In: Simposio Brasileiro de Sensoriamento Remoto 12: 3215-3222.

Goiana Anais, Selhorst, D. and I.F. Brown. 2004. Queimadas na Amazonia Sul-Ocidental, Estado do Acre-Brasil: Comparacao entre produtos de satelite (GOES-8 e NOAA-12) e observacoes de campo. In: Simposio Brasileiro de Sensoriamento Remoto 11: 3215-3222.

Seltzer, Alberto, and Raffi Sismanoglu. Fire Risk Factor- Summary of the Calculation Method. DSA/CPTEC/INPE, Version 5, Feb 2006.

Vasconcelos, S.S., I.F. Brown. 2007. The use of hot pixels as an indicator of fires in the MAP region: tendencies in recent years in Acre, Brazil. In: Simposio Brasileiro de Sensoriamento Remoto, 13. (SBSR), 21-26 abr. 2007, Florianopolis. Anais. Sao Jose dos Campos: INPE, 2005. Artigos, p. 4549-4556. CD-ROM. (http://marte.dpi.inpe.br/col/dpi.inpe.br/sbsr@80/2006/11.01.20.14/doc/4549-4556.pdf).

Related Publications

- Vasconcelos, S.S.; N. V. Pantoja; D. Selhorst; I.F. BROWN. 2005. Evolucao de focos de calor nos anos de 2003 e 2004 na regiao de Madre de Dios/Peru - Acre/Brasil - Pando/Bolivia (MAP): uma aplicacao regional do banco de dados INPE/IBAMA. In: Simposio Brasileiro de Sensoriamento Remoto, 12. (SBSR), 16-21 abr. 2005, Goiania. Anais. Sao Jose dos Campos: INPE, 2005. Artigos, p. 3411-3417. CD-ROM.
- I. F. Brown; S. S. Vasconcelos. As queimadas de 2005 e seu impacto nas florestas do Acre. Jornal Página 20, p. 20, 11/01/2006.
- I. F. Brown; E. M. N. P. Moulard; J. Nakamura; W. Schroeder; M. R. Maldonado; S. S. Vasconcelos; D. Selhorst. Relatorio preliminar do mapeamento de areas de risco para incendios no leste do Estado do Acre: Primeira aproximacao. 18 ago 06. Rio Branco: Ministerio Publico Federal do Acre, 2006.