LBA-ECO LC-39 MODIS Active Fire and Frequency Data for South America: 2000-2007

Get Data

Revision Date: September 4, 2013

Summary:

This data set provides active fire locations and estimates of annual fire frequencies for South America from 2000-2007. Data from the Moderate Resolution Imaging Spectroradiometer (MODIS) sensors aboard the Terra (2000–2007) and Aqua (2003– 2007) satellite platforms were analyzed to determine spatial and temporal patterns in satellite fire detections.

The analysis considered a high-confidence subset of all MODIS fire detections to reduce the influence of false fire detections over small forest clearings in Amazonia (Schroeder et al., 2008). The number of unique days on which the active fire detections were recorded within a 1-km radius was estimated from the subset of active fire detections and the ArcGIS neighborhood variety algorithm.

There are 14 data files with this data set: 7 GeoTIFF (.tif) files of fire frequency at MODIS 250-m resolution, where each grid cell value represents the number of days in that year on which active fires were detected, and 7 shape files of active fire locations for the years 2001-2007.

Data Citation:

Cite this data set as follows:

Morton, D.C., R.S. DeFries, J.T. Randerson, L. Giglio, W. Schroeder, and G.R. van der Werf. 2013. LBA-ECO LC-39 MODIS Active Fire and Frequency Data for South America: 2000-2007. 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/1186

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 Users who download LBA data in the five years after data have been archived must contact the investigators who collected the data, per provisions 6 and 7 in the Policy.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 September 2013. Users who download the data between September 2013 and August 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: Land Use and Land Cover

Team ID: LC-39 (DeFries / Shimabukuro)

The investigators were DeFries-Bajpai, Ruth; Anderson, Liana and Morton, Douglas. You may contact Morton, Douglas (douglas.morton@gmail.com)

LBA Data Set Inventory ID: LC39_MODIS_Fire_SA

This data set provides active fire locations and estimates of annual fire frequencies for South America from 2000-2007. Data from the Moderate Resolution Imaging Spectroradiometer (MODIS) sensors aboard the Terra (2000–2007) and Aqua (2003– 2007) satellite platforms were analyzed to determine spatial and temporal patterns in satellite fire detections.

The analysis considered a high-confidence subset of all MODIS fire detections to reduce the influence of false fire detections over small forest clearings in Amazonia (Schroeder et al., 2008). The number of unique days on which the active fire detections were recorded within a 1-km radius was estimated from the subset of active fire detections and the ArcGIS neighborhood variety algorithm.

Related Data Set:

LBA-ECO LC-39 Modeled Carbon Flux from Deforestation, Mato Grosso, Brazil: 2000-2006. Estimates of the frequency and duration of repeated fires for deforestation were used as inputs to the Deforestation Carbon Fluxes (DECAF) biogeochemical model

2. Data Characteristics:

There are 14 data files with this data set:

- Seven GeoTIFF (.tif) files for annual fire frequency in South America from Terra (MOD14) and Aqua (MYD14) MODIS sensors for the years 2000 and 2007.
- Seven ESRI ArcGIS shapefiles which provide the location of active fires in South America derived from Terra (MOD14) and Aqua (MYD14) MODIS sensors for the years 2001 to 2007. The data are from MODIS Collection 4 Active Fire Detections from Terra (MOD14) and Aqua (MYD14) MODIS sensors. Each shapefile is formed by seven files (extensions: .dbf, .prj,. sbn, .sbx, .shp, .xml, and .shx).

Annual Fire Frequency GeoTIFF (.tif) files

There are seven compressed (.zip) files which expand to seven GeoTIFF (.tif) files. These files represent annual fire frequency in South America for the years 2001 - 2007. The files are at MODIS 250-m resolution, where each grid cell value represents the number of days in that year on which active fires were detected.

File naming convention:

The .zip and .tif files are named **saYYYY_terra_neighborhood_variety.tif** or **saYYYY_taq_neighborhood_variety.tif**

where

sa = South America, YYYY = refers to the year range noted as the last two digits of **two year pairs** represented in the image; terra = Terra MODIS sensor-- labeled as either "terra" or "taq" for years with combined data from Terra & Aqua MODIS sensors; and neighborhood_variety indicates the ArcGIS neighborhood variety algorithm that was used.

The year ranges are denoted as follows: 2000-2001, in the data file name, noted as 0001; 2001-2002, noted as 0102; 2002-2003, noted as 0203; 2003-2004, noted as 0304; 2004-2005 noted as 0405; 2005-2006 noted as 0506; and 2006-2007, noted as 0607.

Example file names:

sa0001_terra_neighborhood_variety.tif -- data for the years 2000-2001 from the Terra sensor, and

sa0506_taq_neighborhood_variety.tif -- data for the years 2005-2006 which has combined data from Terra and Aqua MODIS sensors.

Images characteristics:

Resolution: 250 meters

Projection: Geographic Datum: 1984 World Geodetic System

Spheroid: WGS_1984

Semimajor Axis: 6378137.0

Semiminor Axis: 6356752.314245179

Active Fire Location Shapefiles

File naming convention:

sa_YYYY_YYYY_terra_subset.ext

where

sa = South America, YYYY_YYYY= fire year range, terra = Terra MODIS sensor, labeled as either "terra" or "taq" for years with combined data from Terra & Aqua MODIS sensors.

Example file names:

sa_2000_2001_terra_subset.shp, and

sa_2002_2003_taq_subset.shp

There are separate calendar periods for Northern Hemisphere (July 2000-June 2001) and Southern Hemisphere (January 2001-December 2001) South America.

ESRI ArcGIS shapefiles have the following information in the attribute table:

SHAPE = feature geometry

TIME = UTC time (HHMM)

DATE = UTC date (YYYYMMDD)

LAT = Latitude, in decimal degrees (WGS84), LON = Longitude, in decimal degrees (WGS84)

T21 = MODIS Channel 21 brightness temperature (kelvins)

T31 = MODIS Channel 31 brightness temperature (kelvins)

BMT21 = Brightness mean temperature, MODIS Channel 21 (kelvins)

BMT31 = Brightness mean temperature, MODIS Channel 31 (kelvins)

FRP = Fire Radiative Power (MW)

R2 = MODIS Channel 2 Reflectance (Percent, scaled as 0-100. Value of -1 indicates nighttime fire detections)

CONF = Confidence (0-100).

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Geodetic Datum
South America	-81.286	-53.308	11.74525	-34.86	WGS-84

Time period:

- The data set covers the period: 2000/03/01 to 2007/12/3
- Temporal Resolution: Daily and annual

Platform/Sensor/Parameters measured include:

- TERRA (MORNING EQUATORIAL CROSSING TIME SATELLITE) / MODIS (MODERATE-RESOLUTION IMAGING SPECTRORADIOMETER) / FIRE OCCURRENCE
- AQUA (AFTERNOON EQUATORIAL CROSSING TIME SATELLITE) / MODIS (MODERATE-RESOLUTION IMAGING SPECTRORADIOMETER) / DEFORESTATION

3. Data Application and Derivation:

Multiyear analyses of fire frequency provide insight into fire use for land management during the deforestation process and subsequent agricultural activity in Amazonia. Frequent fire detections are diagnostic of deforestation activity (Morton et al., 2008), and both the frequency and duration of fire activity provide important clues to the time-varying carbon emissions from deforestation in Amazonia (DeFries et al., 2008, van der Werf et al., 2009). Finally, the location and timing of deforestation fire activity, as estimated based on frequent fire detections in the same dry season, provide additional insight into the climatic constraints on fire-driven deforestation in the region (Le Page et al., 2010).

4. Quality Assessment:

Validation of the MODIS active fire detection algorithm has been conducted over a range of land cover and fire types (e.g., Schroeder et al., 2005, 2008).

5. Data Acquisition Materials and Methods:

Data Acquisition

Data products were from the MODIS sensors aboard the Terra (2002-2007) and Aqua (2003-2007) satellite platforms.

The date and center location of each MODIS active fire detection, satellite (Terra or Aqua), time of overpass, 4 micron brightness temperature (band 20/21), and confidence score were extracted from the Collection 4 MODIS Thermal Anomalies/Fire 5-min swath (Level 2) product at 1-km spatial resolution (MOD14/MYD14).

Data for January 1–November 1, 2007, were provided by the Fire Information for Resource Management System (FIRMS) at the University of Maryland, College Park (http:// maps.geog.umd.edu), based on the Collection 5 processing code.

Data Analysis

MODIS data were analyzed to determine spatial and temporal patterns in satellite fire detections.

-- Active Fire Location Detection

The analysis considered a high-confidence subset of all MODIS fire detections to reduce the influence of false fire detections over small forest clearings in Amazonia (Schroeder et al., 2008). For daytime fires, only those 1-km fire pixels having a brightness temperature of 4330 K in the 4-mm channel were considered. The subset of high-confidence fires included all nighttime fire detections, regardless of brightness temperature.

-- Active Fire Detection Frequency

The frequency of fire detections was calculated using a neighborhood search algorithm. Specifically, the variety of days on which fires were detected was determined for each cell of the standard MODIS 250-m grid using a search radius of 1 km to interpret the center locations of all high-confidence fire detections for each year. This gridded product of fire days was then used to select those fire detections contributing to high-frequency fire activity, and to characterize fire frequency for recent deforestation events.

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:

DeFries, R.S., D.C. Morton, G.R. van der Werf GR, L. Giglio, G.J. Collatz, J.T. Randerson, R.A. Houghton, P.S. Kasibhatla. 2008. Fire-related carbon emissions from multiple land use transitions in southern Amazonia. Geophysical Research Letters 35, doi:10.1029/2008GL035689.

Le Page, Y., G.R. van der Werf, D.C. Morton, J.M.C. Pereira JMC. 2010. Modeling fire-driven deforestation potential in Amazonia under current and projected climate conditions. Journal of Geophysical Research-Biogeosciences, doi:10.1029/2009JG001190.

Morton, D.C., R.S. DeFries, J.T. Randerson, L. Giglio, W. Schroeder, G.R. van der Werf. 2008. Agricultural intensification increases deforestation fire activity in Amazonia. Global Change Biology 14: 2262-2275.

Schroeder, W., J. Morisette, I. Csiszar , L. Giglio, D.C. Morton, C.O. Justice. 2005. Characterizing vegetation fire dynamics in Brazil through multisatellite data: Common trends and practical issues. Earth Interactions 9, Paper 09-013.

Schroeder, W., E. Prins, L. Giglio, I. Csiszar, C. Schmidt, J. Morrisette, D.C. Morton. 2008. Validation of GOES and MODIS active fire detection productions using ASTER and ETM+. Remote Sensing of Environment 112, 2711-2726.

van der Werf, G.R., D.C. Morton, R.S. DeFries, L. Gilgio, J.T. Randerson, G.J. Collatz, P.S. Kasibhatla. 2009. Estimates of deforestation-induced carbon fluxes in the southern Amazon based on satellite data and biogeochemical modeling. Biogeosciences 6: 239-245.

Related Publications

- Morton, D.C., R.S. DeFries, Y.E. Shimabukuro, L.O. Anderson, E.Arai, F. del Bon Espirito-Santo, R. Frietas and J. Morisette. 2006. Cropland expansion changes deforestation dynamics in the southern Brazilian Amazon. PNAS 103: 14637-14641.
- Morton, D.C., Y.E. Shimabukuro, B.F.T. Rudorff, A. Lima, R. Freitas, R.S. DeFries. 2007. Challenges for conservation at the agricultural frontier: deforestation, fire, and land use dynamics in Mato Grosso. Agua & Ambiente 2(1): 5-20.
- Morton D.C., R.S. DeFries, J.T. Randerson, L. Giglio, W. Schroeder, G.R. van der Werf. 2008. Agricultural intensification increases deforestation fire activity in Amazonia. Global Change Biology 14: 2262-2275.
- DeFries R.S., D.C. Morton, G.R. van der Werf GR, L. Giglio, G.J. Collatz, J.T. Randerson, R.A. Houghton, P.S. Kasibhatla. 2008. Fire-related carbon emissions from multiple land use transitions in southern Amazonia. Geophysical Research Letters 35, doi:10.1029/2008GL035689.
- van der Werf, G.R., D.C. Morton, R.S. DeFries, L. Gilgio, J.T. Randerson, G.J. Collatz, P.S. Kasibhatla. 2009. Estimates of deforestation-induced carbon fluxes in the southern Amazon based on satellite data and biogeochemical modeling. Biogeosciences 6: 239-245.
- Le Page Y., G.R. van der Werf, D.C. Morton, J.M.C. Pereira JMC. 2010. Modeling fire-driven deforestation potential in Amazonia under current and projected climate conditions. Journal of Geophysical Research-Biogeosciences, doi:10.1029/2009JG001190.