LBA-ECO CD-34 Landsat Fractional Land Cover Analysis, Manaus, Brazil: 2004-2005

Summary:

This data set provides the results of fractional land cover analysis for nonphotosynthetic vegetation (NPV) from two Landsat images of Manaus, Brazil, for October 14, 2004, and for July 29, 2005. Both images are from Landsat 5, path 231, row 62. The Manauas area experienced a squall line with intense downbursts from January 16-18, 2005, that resulted in widespread blowdown and tree mortality. The pre- and post- disturbance Landsat images were obtained and processed using spectral mixture analysis (SMA) in order to investigate forest disturbance and tree mortatility resulting from the downburst. SMA was based on scene-derived end-members of green vegetation (GV, photosynthetically active vegetation), NPV (wood, dead vegetation, and surface litter), soil, and shade obtained using a pixel purity index (PPI) algorithm (Negron-Juarez et al., 2010). Changes in NPV due to disturbance were calculated by subtracting the 2004 NPV image from the 2005 NPV image. This NPV difference image is provided.

There are three image files (.tif) with this data set: The two Landsat images that were georectified and converted to reflectance values and the NPV difference image.

DATA QUALITY STATEMENT: The Data Center has determined that there are questions about the quality of the data reported in this data set. The data set has missing or incomplete data, metadata, or other documentation that diminishes the usability of the products.

KNOWN PROBLEMS: Four additional images were needed to make this data set complete but are unavailable. Specifically, the two images resulting from SMA as applied to the Landsat images collected on the 14th of October, 2004 and the 29th of July, 2005 to determine per-pixel fractional abundance of GV, NPV (wood, dead vegetation, and surface litter), soil, and shade and the 2004 NPV and 2005 NPV images that were used to derive the “NPV changes” image (which we do provide) (Negron-Juarez, et al., 2010).

Data Citation:

Cite this data set as follows:

Negron-Juarez, Robinson I, J.Q. Chambers, G. Guimaraes, H.C. Zeng, C.F.M. Raupp, D.M. Marra, G.H.P.M. Ribeiro, S.S. Saatchi, B.W. Nelson, and N. Higuchi. 2013. LBA-ECO CD-34 Landsat Fractional Land Cover Analysis, Manaus, Brazil: 2004-2005. 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/1176

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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-34 (Chambers / Higuchi / J. dos Santos / Camargo)

The investigators were Chambers, Jeffrey Q.; Higuchi, Niro; Trumbore, Susan E. and Negron-Juarez, Robinson I. You may contact Negron-Juarez, Robinson I. (rjuarez@tulane.edu).

LBA Data Set Inventory ID: CD34_Amazon_Landsat

This data set provides the results of fractional land cover analysis for nonphotosynthetic vegetation (NPV) from two Landsat images of Manaus, Brazil, for October 14, 2004, and for July 29, 2005. Both images are from Landsat 5, path 231, row 62. The Manauas area experienced a squall line with intense downbursts from January 16-18, 2005, that resulted in

widespread blowdown and tree mortality. The pre- and post-disturbance Landsat images were obtained and processed using spectral mixture analysis (SMA) in order to investigate forest disturbance and tree mortatility resulting from the downburst. SMA was based on scene-derived end-members of green vegetation (GV, photosynthetically active vegetation), NPV (wood, dead vegetation, and surface litter), soil, and shade obtained using a pixel purity index (PPI) algorithm (Negron-Juarez et al., 2010). Changes in NPV due to disturbance were calculated by subtracting the 2004 NPV image from the 2005 NPV image. This NPV difference image is provided.

2. Data Characteristics:

There are three GeoTIFF data files with this data set.

Image files 1 and 2 below are named with the date, sensor, path/row, and by processing method performed (Carlotto haze correction (CRL) and calibration):

File 1. **20041014_L5p231r062_CRLRSZCAL.tif:** Image from October 14, 2004, Landsat 5 (L5), path 231, row 62 (p231r062). CRL was applied and resized with aspect to the original image (RSZ) to have a consistent size of all images, and calibrated (CAL) using invariant targets to get reflectance values.

File 2. **20050729_L5p231r062_CRLRSZCAL.tif**: Image from July 29, 2005, Landsat 5 (L5), path 231, row 62 (p231r062). CRL was applied and resized with aspect to the original image (RSZ) to have a consistent size of all images, and calibrated (CAL) using invariant targets to get reflectance values.

Both images have 6 bands from Landsat:

Band	Wavelength (micrometers)
1	0.45-0.52
2	0.52-0.60
3	0.63-0.69
4	0.76-0.90
5	1.55-1.75
7	2.08-2.35

Landsat band 6, the thermal band with wavelength 10.40-12.50, was not used since it has a different pixel size with respect to the other Landsat bands.

Each band was labeled with their respective calibration equation. These files are in UTM, Zone 20 South, in the WGS-84 datum. They have a 30-meter pixel size with the upper left corner of the upper left pixel (1,1) at coordinate: 666825.000, 9778885.000.

Image metadata for the files above are listed as follows:

Metadata for file 1: 20041014_L5p231r062_CRLRSZCAL.tif

ENVI description = {Create Layer File Result [Wed May 06 12:47:52 2009]}
samples = 7032
lines = 6656
bands = 6
header offset = 0
file type = ENVI Standard
data type = 4
interleave = bsq
sensor type = Unknown
byte order = 0
map info = {UTM, 1.000, 1.000, 666825.000, 9778875.000, 3.0000000000e+001, 3.0000000000e+001, 20, South, WGS-84, units=Meters}
wavelength units = Unknown
band names = {
b1*16.31411377-821.3806818,
b2*34.65796959-443.1142717,
b3*26.82790961-204.1494793,
b4*32.05057696+41.82232691,
b5*18.74715201+375.3391976,
b7*25.42619496+443.4382217}

Metadata for file 2: 20050729_L5p231r062_CRLRSZCAL.tif

ENVI description = {Create Layer File Result [Wed May 06 12:47:52 2009]}
samples = 7032
lines = 6656
bands = 6
header offset = 0
file type = ENVI Standard
data type = 4
interleave = bsq
sensor type = Unknown
byte order = 0
map info = {UTM, 1.000, 1.000, 666825.000, 9778875.000, 3.0000000000e+001, 3.0000000000e+001, 20, South, WGS-84, units=Meters}
wavelength units = Unknown
band names = {
b1*17.05993998-595.69985,
b2*34.98846268-161.6102948,
b3*27.23028674+55.0692951,
b4*34.79025755+402.7022774,

b5*21.69408247+560.9756933,
b7*33.00068666+507.3183794}

Spectral mixture analysis was applied to both images.

File 3. **sma_dNPV_2005-2004.tif:** contains the difference of NPV on July 29, 2005 and NPV on October 24, 2004.

The source *.hdr file is as follows:

sma_dNPV_2005-2004.hdr

ENVI description = {Band Math Result, Expression = [b1-b2] B1:Unmix (20050729_L5p231r062_CRLRSZCAL) B2:Unmix (20041014_L5p231r062_CRLRSZCAL) [Tue Dec 20 15:26:56 2011]}
samples = 7032
lines = 6656
bands = 1
header offset = 0
file type = ENVI Standard
data type = 4
interleave = bsq
sensor type = Unknown
byte order = 0
map info = {UTM, 1.000, 1.000, 666825.000, 9778875.000, 3.0000000000e+001, 3.0000000000e+001, 20, South, WGS-84, units=Meters}
wavelength units = Unknown
band names = {
Band Math (b1-b2)}

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Geodetic Datum
Amazonas (Manaus) - BIONTE (Amazonas (Manaus))	-60.17	-60.17	-2.63	-2.63	World Geodetic System, 1984 (WGS-84)

Time period:

- The data set covers the period 2004/10/14 to 2005/07/29 (one image for each date).
- Temporal Resolution:

Platform/Sensor/Parameters measured include:

- LANDSAT-5 (LAND REMOTE-SENSING SATELLITE-5) / ANALYSIS / BIOMASS
- LANDSAT-7 (LAND REMOTE-SENSING SATELLITE-7) / ANALYSIS / DEFORESTATION

3. Data Application and Derivation:

These data can be used to quantitative tree mortality associated with convective storms and areas of significant differences in photosynthetically active vegetation (PV), non-photosynthetically active vegetation (NPV).

4. Quality Assessment:

A visual quality control attending both the shape and direction of blowdown patches was performed to validate the results. Many snapped trees with significant biomass loss survived by resprouting and were not included. Smaller treefall clusters (gaps with less than five fallen trees) and single wind-thrown trees were not amenable to detection with 900 m2 Landsat data.

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KNOWN PROBLEMS: Four additional images were needed to make this data set complete but are unavailable. Specifically, the two images resulting from SMA as applied to the Landsat images collected on the 14th of October, 2004 and the 29th of July, 2005 to determine per-pixel fractional abundance of GV, NPV (wood, dead vegetation, and surface litter), soil, and shade and the 2004 NPV and 2005 NPV images that were used to derive the "NPV changes" image (which we do provide) (Negron-Juarez, et al., 2010).

5. Data Acquisition Materials and Methods:

Site:

Squall lines in Amazonia form along the northeastern coast of South America as sea breeze-induced instability lines and propagate inside the continent and can reach the central and even the extreme western parts of Amazonia. On January 16-18, 2005, a squall line was observed propagating from southwest to northeast Brazil. This squall line was triggered by convection induced by the convergence associated with a cold front that reached southeast Brazil on January 16th and by a cold surge from the Northern Hemisphere. Downburst velocities were determined to be between 26 and 41 ms^{-1}. Squall lines propagating toward the northeast Amazon are observed, on average, around twice per year (Robinson et al., 2010). The single squall line across amazonia in January 2005 caused widespread forest tree mortality and could have contributed to the elevated mortality observed that year. This study was concerned with vegetation and tree mortality in the Manaus, Brazil, area which resulted from the squall line January 16-18, 2005.

Image Acquisition and Processing:

Landsat images were acquired from Brazil's National Institute for Space Research (INPE) covering Manaus, Brazil (scene P231 R062, 3.4 × 104 Km2), collected on 14 October 2004 (Landsat 5, L5, previous to disturbance), and 29 July 2005 (Landsat 5, for disturbance evaluation). These images were available in encoded radiance values and converted to reflectance values (Robinson et al., 2010). All images were georeferenced (400 control points per image) with respect to the NASA Geocover data (https://zulu.ssc. nasa.gov/mrsid/). The CRL technique (Carlotto, 1999), which accounts for correction due to haze and smoke contamination, was applied over the images as needed.

L5 images were radiometrically calibrated band by band using invariant targets. Landsat bands used were 1,2,3,4,5 and 7. SMA (Adams et al., 1995) based on scene-derived end-members of GV, NPV, soil, and shade were obtained using a PPI algorithm. After SMA, land-use areas were distinguishable from natural forest since the first have exposed soil while the second are covered by damaged vegetation (Souza et al., 2005).

Changes in NPV provide a quantitative measure of changes in forest structure from tree mortality (increase in tree mortality) and were calculated by subtracting the 2004 NPV image from the 2005 NPV image.

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:

Adams, J. B., et al. (1995), Classification of multispectral images based on fractions of endmembers: Application to land-cover change in the Brazilian Amazon, Remote Sens. Environ., 52, 137–154, doi:10.1016/0034-4257(94)00098-8.

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forest tree mortality from a single cross-basin squall line event. Geophysical Research Letters 37, L16701, doi:10.1029/2010GL043733.

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