LBA-ECO CD-34 Hyperion 30-m Surface Reflectance, Amazon Basin: 2002-2005

Summary:

This data set contains 20 multispectral surface reflectance images collected by the EO-1 satellite Hyperion sensor at 30-m resolution and covering the entire Amazon Basin for 2002 - 2005. All images were converted to GeoTiff format for distribution. The respective ENVI *.hdr files are included as companion files and contain image projection and band information.

The selected multispectral images were processed using ENVI software as described in Chambers et al. (2009). Bands with uncalibrated wavelengths and those with low spectral response were removed leaving a spectral subset of generally 196 bands (some images have fewer). A cloud mask was developed using 2-d scatter plots of variable reflectance bands to highlight clouds as regions of interest (ROIs), allowing clouds and cloud edges to be masked. A de-streaking algorithm was then applied to the image to reduce variance in balance between the vertical columns. Apparent surface reflectance was calculated for this balanced image using the atmospheric correction algorithm ACORN in 1.5pb mode (AIG-LLC, Boulder, CO). The images (18 of the 20) were georeferenced using the corresponding Advanced Land Imager (ALI) satellite images.

Data Citation:

Cite this data set as follows:

Chambers, J.Q. 2012. LBA-ECO CD-34 Hyperion 30-m Surface Reflectance, Amazon Basin: 2002-2005. Data set. Available on-line [http://daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. doi:10.3334/ORNLDAAC/1064

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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 Users who download LBA data in the five years after data have been archived must contact the investigators who collected the data, per provisions 6 and 7 in the Policy.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 February of 2012. Users who download the data between February 2012 and January 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: Carbon Dynamics

Team ID: CD-34 (Chambers / Higuchi / J. dos Santos / Camargo)

The investigators were Chambers, Jeffrey Q.; Higuchi, Niro and Trumbore, Susan E. You may contact Chambers, Jeffrey Q. (chambers@tulane.edu).

LBA Data Set Inventory ID: CD34_Amazon_Hyperion

The multispectral images were processed using ENVI software. Bands with uncalibrated wavelengths and those with low spectral response were removed leaving a spectral subset of generally 196 bands (some images have fewer). A cloud mask was developed using 2-d scatter plots of variable reflectance bands to highlight clouds as regions of interest (ROIs), allowing clouds and cloud edges to be masked. A de-streaking algorithm was then applied to the image to reduce variance in balance between the vertical columns. Apparent surface reflectance was calculated for this balanced image using the atmospheric correction algorithm ACORN in 1.5pb mode (AIG-LLC, Boulder, CO). The images (18 of the 20) were georeferenced using the corresponding Advanced Land Imager (ALI) satellite images.

2. Data Characteristics:

GeoTiff format files (n=20) created from the ENVI files are provided with this data set. The respective ENVI *.hdr files are included as companion files and contain image projection, band, and wavelength information.

Image file characteristics:

- Resolution: 30 meters
- Projection: Universal Transverse Mercator (UTM). The UTM "zone" for an image is specified in the respective *.hdr file.
- Datum: World Geodetic System, 1984 (WGS-84)
- Georeferenced to the corresponding ALI image.

File naming convention:

The files names are coded as follows using the first file in the following table as an example:

EO1H0020682004132110PZ_196b_a15_m_d_geo where:

EO1 = Satellite
H = Sensor (Hyperion)
002 = Target WRS Path
068 = Target WRS Row
2004 = Year of acquisition
132 = Julian day of acquisition
1 = Hyperion sensor ON
1 = ALI sensor ON
0 = AC sensor OFF
P = Pointing mode (P = Pointed within path/row, K= Pointed outside path/row)
Z = Scene Length
196b - 196 band subset (or fewer)
a15 - ACORN algorithm used for atmospheric correction,
m - clouds masked
d - imaged destreaked as described above,
geo - georeferenced to the corresponding ALI image

Note that two of the images were not georeferenced, but are still provided.

File names and spatial extents of images:

File Name	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
EO1H0020682004132110PZ_196b_a15_m_d_geo.tif	- 68.257542	-67.972561	-11.051242	-11.973314
EO1H0020692003225110PZ_196b_a15_m_d_geo.tif	-68.926628	-68.671408	-12.601581	-13.460917
EO1H0020692005314110KZ_196b_a15_m_d.tif*	N/A	N/A	N/A	N/A
EO1H0030572003344110PZ_196b_a15_m_d_geo.tif	-67.142036	-66.895069	-4.328169	-3.467286
EO1H0030652004187110PZ_196b_a15_m_d_geo.tif	-69.795042	-69.531319	-7.005456	-7.927933
EO1H0040632003255110PZ_196b_a15_m_d_geo.tif	-70.113358	-69.866433	-3.829900	-4.690889
EO1H0040692002204110PZ_196b_a15_m_d_geo.tif	-72.467664	-72.197350	-12.25545	-13.120194
EO1H0040692003143110PY_196b_a15_m_d_geo.tif	-72.231006	-71.985547	-12.883500	-13.741042
EO1H0060622003333110PZ_196b_a15_m_d_geo.tif	-73.308553	-73.058083	-3.267433	-4.130317
EO1H0070632003292110PZ_196b_a15_m_d_geo.tif	-74.899100	-74.650161	-4.115294	-4.976250
EO1H0070652003244110PZ_196b_a15_m_d_geo.tif	-75.395547	-75.142827	-6.712642	-7.575733
EO1H2250612002248110PZ_196b_a15_m_d_geo.tif**	-51.557444	-51.306389	-1.292706	-2.155997
EO1H2290662002180110PZ_196b_a15_m_d_geo.tif	-58.400758	-58.150153	-7.899706	-8.761883
EO1H2310622002226110PY_196b_a15_m_d_geo.tif	-60.337036	-60.083442	-2.258869	-3.121786
EO1H2310622005218110PE_196b_a15_m_d_geo.tif	-60.348000	-60.078258	-2.153147	-3.108258
EO1H2310622005266110PB_196b_a15_m_d_geo.tif	-60.383442	-60.122175	-2.121353	-3.056678
EO1H2316022002315110KV_194b_a15_m_d.tif*	N/A	N/A	N/A	N/A

EO1H2330602003051110PZ_196b_a15_m_d_geo.tif	-63.045069	-62.807542	-0.528367	-1.333706
EO1H2330622004070110PZ_184b_a15_m_d_geo.tif	-63.738478	-63.487306	-2.223603	-3.086792
EO1H2330632002320110PY_196b_a15_m_d_geo.tif**	-63.996275	-63.631253	-3.870914	-5.279197

* Image not georeferenced

** Companion file example provided.

Companion file examples:

Each of the 20 image files has a companion *.hdr file. The contents of the *.hdr files varies. All (except for 2) specify the map info. Wavelengths are in units of nanometers. All *.hdr files specify the wavelength for each band and the full width at half maximum (fwhm). Band names and the bad bands list (bbl) list may or may not be provided.

EO1H2250612002248110PZ_196b_a15_m_d_geo.hdr (band names not included)

```
ENVI
description = {
File Imported into ENVI.}
samples = 931
lines = 3181
bands = 196
header offset = 0
file type = ENVI Standard
data type = 2
interleave = bsq
sensor type = Unknown
byte order = 0
map info = {UTM, 1.500, 1.500, 438000.000, 9857100.000, 3.0000000000e+01,
3.0000000000e+01, 22, South, WGS-84, units=Meters}
wavelength units = Nanometers
wavelength = {
426.820007, 436.989990, 447.170013, 457.339996, 467.519989, 477.690002,
487.869995, 498.040009, 508.220001, 518.390015, 528.570007, 538.739990,
... }
fwhm = {
11.387100, 11.387100, 11.387100, 11.387100, 11.387100, 11.387100, 11.378400,
11.353800, 11.313300, 11.258000, 11.190700, 11.111900, 11.024500, 10.932100,
... }
bbl = {
0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
... }
```

EO1H2330632002320110PY_196b_a15_m_d_geo.hdr

```
ENVI
description = {
Mosaic Result [Wed Jan 31 17:20:00 2007]}
samples = 1351
lines = 5191
```

```
bands = 196
header offset = 0
file type = ENVI Standard
data type = 2
interleave = bsq
sensor type = Unknown
byte order = 0
map info = {UTM, 1.500, 1.500, 389400.000, 9572100.000, 3.0000000000e+01,
3.0000000000e+01, 20, South, WGS-84, units=Meters}
wavelength units = Nanometers
band names = {
Mosaic (Band 1), Mosaic (Band 2), Mosaic (Band 3), Mosaic (Band 4),
Mosaic (Band 5), Mosaic (Band 6), Mosaic (Band 7), Mosaic (Band 8),
Mosaic (Band 9), Mosaic (Band 10), Mosaic (Band 11), Mosaic (Band 12),
...}
wavelength = {
426.820007, 436.989990, 447.170013, 457.339996, 467.519989, 477.690002,
487.869995, 498.040009, 508.220001, 518.390015, 528.570007, 538.739990,
548.919983, 559.090027, 569.270020, 579.450012, 589.619995, 599.799988,
...}
fwhm = {
11.387100, 11.387100, 11.387100, 11.387100, 11.387100, 11.387100, 11.378400,
11.353800, 11.313300, 11.258000, 11.190700, 11.111900, 11.024500, 10.932100,
10.836800, 10.740700, 10.648200, 10.560700, 10.482300, 10.414700, 10.359500,
...}
bbl = {
0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
...}
```

Site boundaries:

(Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Geodetic Datum
Amazon basin (Entire Amazon basin)	-75.395547	-51.306389	-0.528367	-13.741042	World Geodetic System, 1984 (WGS-84)

Time period:

- The data set covers the period 2002/06/29 to 2005/10/01

Platform/Sensor/Parameters measured include:

- EO-1 (EARTH OBSERVING-1) / HYPERION (HYPERSPECTRAL IMAGER) / REFLECTANCE

3. Data Application and Derivation:

Hyperion satellite images were collected from across the Amazon basin and processed using ENVI software. The large number of spectral bands on the Hyperion imager allow for the classification and imaging of more complex land ecosystems than is possible with Landsat technology.

The multispectral images were processed using ENVI software. Bands with uncalibrated wavelengths and those with low spectral response were removed leaving a spectral subset of generally 196 bands (some images have fewer). A cloud mask was developed using 2-d scatter plots of variable reflectance bands to highlight clouds as ROIs, allowing clouds and cloud edges to be masked. A de-streaking algorithm was then applied to the image to reduce variance in balance between the vertical columns. Apparent surface reflectance was calculated for this balanced image using the atmospheric correction algorithm ACORN in 1.5pb mode (AIG-LLC, Boulder, CO). The images (18 of the 20) were georeferenced using the corresponding Advanced Land Imager (ALI) satellite images.

4. Quality Assessment:

Assessment of the quality of each image after completion of the processing steps as described in the next section (eg., for cloud cover). Fair images (eg., high percent cloud cover) are still adequate for use in imaging and classification of complex land surfaces.

EO1H002069**2**003225110PZ excellent
EO1H004069**2**003143110PY good
EO1H007063**2**003292110PZ good
EO1H004063**2**003255110PZ excellent
EO1H006062**2**003333110PZ good
EO1H003057**2**003344110PZ excellent
EO1H002068**2**004132110PZ excellent
EO1H225061**2**002248110PZ fair
EO1H007065**2**003244110PZ excellent
EO1H233060**2**003051110PZ excellent
EO1H229066**2**002180110PZ excellent
EO1H233062**2**004070110PZ fair
EO1H231062**2**003174110KT excellent
EO1H003065**2**004187110PZ good
EO1H233063**2**002320110PY good
EO1H004069**2**002204110PZ very good
EO1H231062**2**005218110PE excellent
EO1H231062**2**002226110PY good
EO1H231602**2**002315110KV excellent
EO1H231062**2**005266110PB excellent
EO1H002069**2**005314110KZ very good

5. Data Acquisition Materials and Methods:

Hyperion satellite images were collected from across the Amazon basin and processed using ENVI software as follows: Bands with uncalibrated wavelengths and those with low spectral response were removed leaving a spectral subset of generally 196 bands (some images have fewer). A cloud mask was developed using 2-d scatter plots of variable reflectance bands to highlight clouds as ROIs, allowing clouds and cloud edges to be masked. A de-streaking algorithm was then applied to the image to reduce variance in balance between the vertical columns which are common in push-broom sensor systems such as Hyperion. Apparent surface reflectance was calculated for this balanced image using the atmospheric correction algorithm ACORN in 1.5pb mode (AIG-LLC, Boulder, CO). This mode is designed specifically for push-broom sensors, such as Hyperion. Finally, images were georeferenced using the corresponding ALI satellite images. Each image comes with a header (.hdr file) containing additional image metadata.

ORNL DAAC Processing:

The data received from the investigators were in ENVI format. Each image came with a header file (*.hdr) containing additional image metadata. GeoTiffs were created from the ENVI files and are provided with this data set.

6. Data Access:

This data is available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) or the EOS Data Gateway.

Data Archive Center:

Contact for Data Center Access Information:

E-mail: uso@daac.ornl.gov
Telephone: +1 (865) 241-3952

7. References:

AIG-LLC, Boulder, CO. ACORN has transitioned to ImSpec, Boulder, CO. (http://www.imspec.com)

Chambers, Jeffrey Q., Amanda L. Robertson, Vilany M. C. Carneiro, Adriano J. N. Lima, Marie-Louise Smith, Lucie C. Plourde and Niro Higuchi. (2009) Hyperspectral remote detection of niche partitioning among canopy trees driven by blowdown gap disturbances in the Central Amazon. Oecologia. Volume 160, Number 1, 107-117, DOI:10.1007/s00442-008-1274-9