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## LBA-ECO LC-07 Validation Overflight for Amazon Mosaics, Video, 1999

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Revision date: February 16, 2015

### Summary:

This data set presents georeferenced digital video files from Validation Overflight for Amazon Mosaics (VOAM) aerial video surveys as part of the Large-Scale Biosphere-Atmosphere Experiment in the Amazon. The VOAM flights were carried out in the wet-season (June) 1999 in the Brazilian Amazon to provide ground verification for mapping of wetland cover with the Global Rain Forest Mapping (GRFM) Project JERS-1 (Japanese Earth Remote Sensing Satellite) mosaics of the Amazon basin. Digital camcorder systems were installed in a Bandeirante survey plane operated by Brazil's National Institute for Space Research. The VOAM99 surveys circumscribed the Brazilian Amazon, documenting ground conditions at resolutions on the order of 1-m (wide-angle format) and 10-cm (zoom format) for wetlands, forests, savannas, and human-impacted areas. Other applications of the VOAM videography include acquisition of ground control points for image geolocation, creation of a high-resolution geocoded mosaic of a forest study area, forest biomass estimation, and rapid assessment of fire damage.

Geocoded digital videography provides a cost-effective means of compiling a high-resolution validation data set for land cover mapping in remote, cloud-covered regions.

There are 3,488 georeferenced video clips (\*.mov), two compressed shapefiles (\*.zip), and two compressed Keyhole Markup Language Google Earth files (\*.kmz) with this data set.

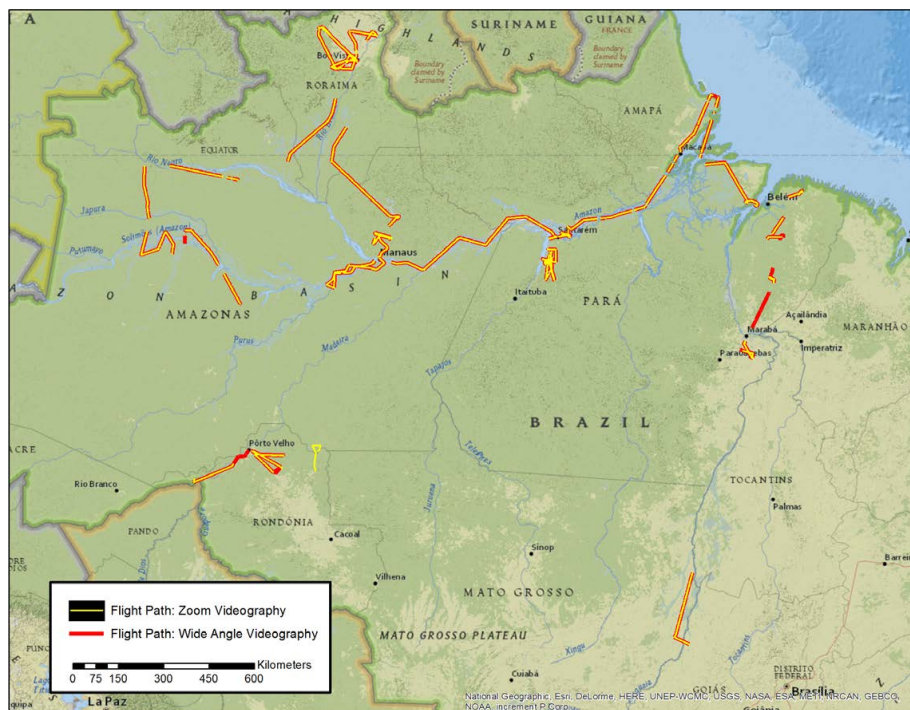


Figure 1. Overview of flight paths from the June 1999 VOAM aerial video surveys.

## Data Citation:

### Cite this data set as follows:

Hess L.L., J.M. Melack, E.M.L.M. Novo, C.C.F. Barbosa, and M. Gastil-Buhl. 2015. LBA-ECO LC-07 Validation Overflight for Amazon Mosaics, Video, 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/1272>

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The LBA Data and Publication Policy [[http://daac.ornl.gov/LBA/lba\\_data\\_policy.html](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 2015. Users who download the data between February 2015 and January 2020 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.

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**Project:** LBA (Large-Scale Biosphere-Atmosphere Experiment in the Amazon)

**Activity:** LBA-ECO

**LBA Science Component:** Land Use and Land Cover

**Team ID:** LC-07 (Melack / Novo / Forsberg)

The investigators were Melack, John M.; Novo, Evelyn Marcia Leao de Moraes; Hess, Laura; Mertes, Leal, (deceased); Slaymaker, Dana Munro; Gastil-Buhl, Mary; Valeriano, Dalton De Morisson; Krug, Thelma; Hayward, C; Holt, J.; Steffen, C. and Holmes, C. You may contact Gastil-Buhl, Mary

(mary@icess.ucsb.edu) and Affonso, Adriana (affonso@ltd.inpe.br).

### LBA Data Set Inventory ID: LC07\_Airborne\_Videography

This data set presents georeferenced digital video files from Validation Overflight for Amazon Mosaics (VOAM) aerial video surveys as part of the Large-Scale Biosphere-Atmosphere Experiment in the Amazon. The VOAM flights were carried out in the wet-season (June) 1999 in the Brazilian Amazon to provide ground verification for mapping of wetland cover with the Global Rain Forest Mapping (GRFM) Project JERS-1 (Japanese Earth Remote Sensing Satellite) mosaics of the Amazon basin. Digital camcorder systems were installed in a Bandeirante survey plane operated by Brazil's National Institute for Space Research. The VOAM99 surveys circumscribed the Brazilian Amazon, documenting ground conditions at resolutions on the order of 1-m (wide-angle format) and 10-cm (zoom format) for wetlands, forests, savannas, and human-impacted areas. Other applications of the VOAM videography include acquisition of ground control points for image geolocation, creation of a high-resolution geocoded mosaic of a forest study area, forest biomass estimation, and rapid assessment of fire damage. Geocoded digital videography provides a cost-effective means of compiling a high resolution validation data set for land cover mapping in remote, cloud-covered regions.

More information may be found at the Instituto Nacional de Pesquisas Espaciais (INPE) website: <http://www.obt.inpe.br/videografia/>. The data set and methodology are also described in Hess et al. (2002).

### Related Data Sets:

- LBA-ECO LC-07 Validation Overflight for Amazon Mosaics, Raster, 1999
- [LBA-ECO LC-07 Monthly Mean Flooded Wetlands Habitat, Central Amazon Basin: 1979-1996](#)
- [LBA-ECO LC-07 JERS-1 SAR Wetlands Masks and Land Cover, Amazon Basin: 1995-1996](#)

## 2. Data Characteristics:

The data consist of 3,488 georeferenced video clips (\*.mov), two compressed shapefiles (\*.zip), and two compressed Keyhole Markup Language Google Earth files (\*.kml). The companion file **LC07\_videos\_georef\_metadata\_v3.csv** provides the longitude, latitude, and height of the aircraft when starting and stopping the videography. An additional 215 video clips include temporal information but lack georeference information and are provided as companion files.

### Video Files:

The video clips are approximately one minute in length and use standard names specifying the date, starting time, ending time, and format. Dates and times are given in UTC.

File Naming convention:

Date[yyyymmdd]\_StartTime[h:mm:ss]\_EndTime[h:mm:ss]\_Format[wide-w or zoom-z].mov

Example File names:

19990603\_170300\_170400\_w.mov  
 19990603\_170300\_170400\_z.mov  
 19990603\_170400\_170500\_w.mov  
 19990603\_170400\_170500\_z.mov

### Shapefiles:

Two compressed shapefiles are provided to represent the flight paths of all wide-angle and zoom georeferenced video clips: **Wide\_Angle\_Flight\_Paths.zip** and **Zoom\_Flight\_Paths.zip**.

**Wide\_Angle\_Flight\_Paths.zip:** When unzipped, this shapefile contains six files (\*.shx, \*.dbf, \*.prj, \*.sbn, \*.sbx, and \*.shp).

### Shapefile Parameters:

Geometry Type: Line  
 Geographic Coordinate System: GCS\_WGS\_1984  
 Datum: D\_WGS\_1984  
 Prime Meridian: Greenwich  
 Angular Unit: Degree  
 Extent:  
 North: 3.8222  
 South: -14.5219  
 West: -67.1088  
 East: -47.4492

### Attributes:

FID: Internal feature number; sequential unique whole numbers that are automatically generated  
 Shape: Feature geometry  
 START\_LON: Starting longitude of the flight path  
 START\_LAT: Starting latitude of the flight path  
 STOP\_LON: Ending longitude of the flight path  
 STOP\_LAT: Ending latitude of the flight path  
 FILE\_NAME: Name of the video file taken from the aircraft during the flight  
 DATE: Date of the flight

START\_TIME: Start time of the flight (UTC)  
 STOP\_TIME: Ending time of the flight (UTC)  
 STRT\_ALT\_M: Starting altitude of the aircraft (meters)  
 STOP\_ALT\_M: Ending altitude of the aircraft (meters)

**Zoom\_Flight\_Paths.zip** contains the analogous information and attributes for zoom footage.

**KMZ files:**

The data set also includes two compressed KMZ files for visualization in Google Earth: **Wide\_Angle\_Flight\_Paths.kmz** and **Zoom\_Flight\_Paths.kmz**. These files describe the flight paths of all wide-angle and zoom georeferenced video clips and contain the same information as the shapefiles.

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude	Datum
Amazon Basin, Brazil	-68	-44	4	-14.5042	WGS-84

**Spatial Resolution:** Resolution of the VOAM99 video data is approximately 0.75-m per pixel for wide-angle footage and 7.5-cm per pixel for zoom.

**Time period:** The data set covers the period 1999/06/03 to 1999/06/21.

**Temporal Resolution:** Multiple flights per day.

**Platform/Sensor/Parameters measured include:**

- AIRCRAFT / VIDEO CAMERA / SAVANNAS
- AIRCRAFT / VIDEO CAMERA / FORESTS
- AIRCRAFT / VIDEO CAMERA / WETLANDS

### 3. Data Application and Derivation:

The VOAM99 dataset was used to validate other LBA-ECO LC-07 data products, including: Monthly Mean Flooded Wetlands Habitat and JERS-1 SAR Wetlands Masks and Land Cover (listed under Related Datasets). This data was also used by other LBA-ECO projects, including LC-20 and LC-32. The VOAM99 data can be used to generate ground control points of known geographic location in remote, unmapped, regions. In addition, it also serves as a high resolution historical baseline for studies of land cover change in the Amazon basin in the early 21st century (see Roberts et al 2002).

### 4. Quality Assessment:

Geolocation accuracy and altitude measurement accuracy are discussed in Hess et al. (2002) sections 4.3 and 4.4. The absolute geolocation accuracy of VOAM99 data is affected by errors from several sources, including: aircraft GPS location, and frame center location. For the real-time, differentially corrected GPS signal received once per second during the VOAM99 survey, expected probabilities of horizontal error are 67-73% that location error will be less than 0.5-m, 95-97% that it will be less than 1.0-m, and 99% that it will be less than 1.5-m.

### 5. Data Acquisition Materials and Methods:

The VOAM99 survey was conducted in June over the Legal Brazilian Amazon by INPE and University of California, Santa Barbara. The flight lines were designed to provide coverage of intensive study sites for the LBA-ECO projects including: human-impacted areas (secondary forests, selectively logged forests, and pastures) and major floodplains of whitewater rivers including the central Solimões, Amazon, lower Purus, and lower Japurá and blackwater rivers including the lower Negro (including Anavilhanas archipelago), lower Jaú, the Balbina Reservoir, interfluvial blackwater wetlands in the Jaú basin, and the Tefé, and Mamirauá blocked-valley lakes.

Aerial surveys were conducted in Brazil's National Institute for Space Research (INPE) Bandeirante aerial survey plane, which had a camera mount custom-built in which both cameras were vertically-oriented and operated in tandem (Fig. 2).



Figure 2. Digital video acquisition system for the VOAM99 survey.

The 1999 survey was conducted using a video acquisition system developed by the departments of Natural Resource Conservation and Computer Science of the University of Massachusetts (UMass) Amherst. The system included two vertically oriented digital camcorders (one in wide-angle mode and one in zoom mode), a laser range finder (904 nm wavelength) which measured aircraft height above ground or canopy, an Attitude and Heading Reference System (AHRS) which measured aircraft tip and tilt, a system GPS which received a real-time, differentially corrected GPS signal from the Omnistar commercial GPS satellite network and a Horita GPS3 Timecode Generator which converted the GPS signal to SMPTE format and encoded on the audio tracks of the digital videotapes.

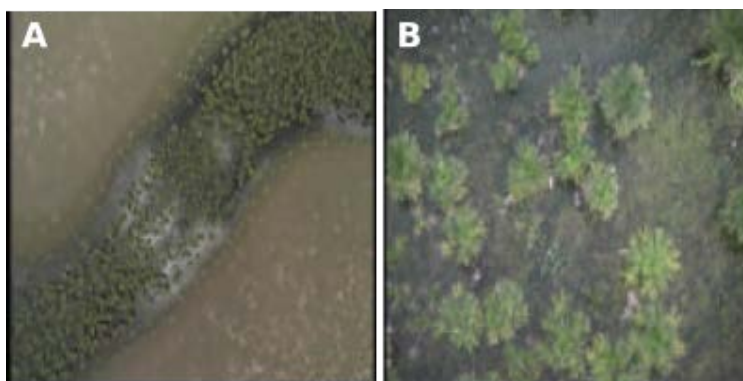


Figure 3. Example stills from VOAM99 videography. A: Single wide-angle frame, 80-cm resolution. B: Single zoom frame, 8-cm resolution.

Flying height for the VOAM99 survey ranged from 100 to 900 m, with a median of 350 m. For segments where laser data was required, flying height was selected to maximize swath width while remaining within the range of the laser instrument and below the cloud ceiling. At the median flying height, swath width was about 550 m (wide-angle) and 55 m (zoom), with pixel dimensions of about 0.75 m (wide) and 7.5 cm (zoom). Resolution of the VOAM99 video data was in general equivalent to pixel dimension, with the exception of occasional loss of focus over smooth water surfaces. On the high-resolution zoom footage, features such as individual branches, leaves, and grass stems are distinguishable.

For a detailed description of Materials and Methods used see Hess et al. (2002) or [http://www.obt.inpe.br/videografia/the\\_1999\\_voam.htm](http://www.obt.inpe.br/videografia/the_1999_voam.htm)

## 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](mailto:uso@daac.ornl.gov)

Telephone: +1 (865) 241-3952

## 7. References:

Hess, L.L., E.M.L.M. Novo, D.M. Slaymaker, J. Holt, C. Steffen, D.M. Valeriano, L.A.K. Mertes, T. Krug, J.M. Melack, M. Gastil, C. Holmes, and C. Hayward. 2002. Geocoded digital videography for validation of land cover mapping in the Amazon basin. *International Journal of Remote Sensing* 23:1527-1555. DOI: 10.1080/01431160110092687

Roberts, D.A., I. Numata, K. Holmes, G. Batista, T. Krug, A. Monteiro, B. Powell, and O.A. Chadwick. 2002. Large area mapping of land-cover change in Rondonia using multitemporal spectral mixture analysis and decision tree classifiers. *Journal of Geophysical Research* 107:8073. DOI:10.1029/2001JD000374

### Related publications:

Alsdorf, D.E., J.M. Melack, T. Dunne, L.A.K. Mertes, L.L. Hess, and L.C. Smith. 2000. Interferometric radar measurements of water level changes on the Amazon floodplain. *Nature*, 404:174-177. Available online at: [http://www.obt.inpe.br/videografia/publications\\_arquivos/Alsdorf\\_et\\_al\\_2000.pdf](http://www.obt.inpe.br/videografia/publications_arquivos/Alsdorf_et_al_2000.pdf)

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