CMS: LiDAR-derived Canopy Height, Elevation for Sites in Kalimantan, Indonesia, 2014

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Data Set Version: 1

Summary

This dataset provides canopy height and elevation data products derived from airborne LiDAR data collected over 90 sites on the island of Borneo in late 2014. The sites cover approximately 100,000 hectares of forested land in Kalimantan, Indonesia. The data were produced as part of an effort to improve a national forest monitoring system for Indonesia that uses a combination of remote sensing and ground-based forest carbon inventory approaches.

This dataset contains 258 data files in GeoTIFF (*.tif) file format and one compressed shapefile (*.zip) providing the file footprints. The source LiDAR data files are provided in a related dataset.

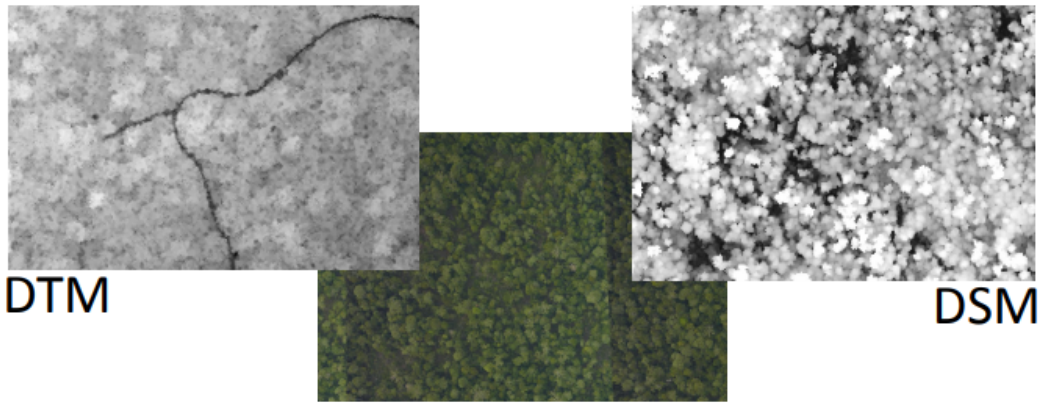

Figure 1. Digital terrain model (DTM) and digital surface model (DSM) generated for the Mawas region of Central Kalimantan, Indonesia on the island of Borneo (from Hagen 2015).

Citation

Melendy, L., S. Hagen, F.B. Sullivan, T. Pearson, S.M. Walker, P. Ellis, Kustiyo, K.A. Sambodo, O. Roswintiarti, M. Hanson, A.W. Klassen, M.W. Palace, B.H. Braswell, G.M. Delgado, S.S. Saatchi, and A. Ferraz. 2017. CMS: LiDAR-derived Canopy Height, Elevation for Sites in Kalimantan, Indonesia, 2014. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1540

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1. Data Set Overview

This dataset provides canopy height and elevation data products derived from airborne LiDAR data collected over 90 sites on the island of Borneo in late 2014. The sites cover approximately 100,000 hectares of forested land in Kalimantan, Indonesia. The data were produced as part of an effort to establish a national forest monitoring system for Indonesia that uses a combination of remote sensing and ground-based forest carbon inventory approaches.

Project: Carbon Monitoring System (CMS)

The NASA Carbon Monitoring System is designed to make significant contributions in characterizing, quantifying, understanding, and predicting the evolution of global carbon sources and sinks through improved monitoring of carbon stocks and fluxes. The System will use the full range of NASA satellite observations and modeling/analysis capabilities to establish the accuracy, quantitative uncertainties, and utility of products for supporting national and international policy, regulatory, and management activities. CMS will maintain a global emphasis while providing finer scale regional information, utilizing space-based and surface-based data and will rapidly initiate generation and distribution of products both for user evaluation and to inform near-term policy development and planning.

Related Data Set:

Melendy, L., S. Hagen, F.B. Sullivan, T. Pearson, S.M. Walker, P. Ellis, Kustiyo, K.A. Sambodo, O. Roswintiarti, M. Hanson, A.W. Klassen, M.W. Palace, B.H. Braswell, G.M. Delgado, S.S. Saatchi, and A. Ferraz. 2017. CMS: LiDAR Data for Forested Sites on Borneo Island, Kalimantan, Indonesia, 2014. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1518

Related Publication:

Melendy, L., S.C. Hagen, F.B. Sullivan, T.R.H. Pearson, S.M. Walker, P. Ellis, Kustiyo, Ari Katmoko Sambodo, O. Roswintiarti, M. Hanson, A.W. Klassen, M. Palace, R. Braswell, G. Delgado, S. Saatchi, and A. Feraz. 2017. Automated method for measuring the extent of selective logging damage with airborne LiDAR data. *Remote Sensing of Environment.* In Review.

Acknowledgements:

This study was funded by NASA Carbon Monitoring System (Grant number: NNX13AP88G) under the title of “Operational multi-sensor design for national scale forest carbon monitoring to support REDD+ MRV systems” (Project Lead: Stephen Hagen).

2. Data Characteristics

Spatial Coverage: Sites in Kalimantan province, Indonesia

Spatial Resolution: 1-meter

Temporal Coverage: 20141018 - 20141130

Temporal Resolution: Each study site was surveyed once

Study Area (These coordinates encompass the approximate locations of the study sites and may not match the extents of the data files. All latitude and longitude given in decimal degrees.)

Site	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Kalimantan, Indonesia	109.81	118.00	3.21	-2.76

Data File Information

There are 258 files in GeoTIFF (*.tif) format included in this dataset. A digital surface model (DSM), digital terrain model (DTM), and canopy height model (CHM) are provided for each of the 90 surveyed areas. Spatial reference properties for the data files are listed below. Data files are named as follows:

Polygon_<siteid>_utm_<zone>_<metric>.tif

siteid = three-digit site identifier (corresponds to siteID attribute in *indonesia_lidar_footprints.shp*)

zone = UTM Zone

metric = Type of elevation data provided in the file (CHM, DTM, DSM)

Spatial Reference Properties

Geographic Coordinate System: GCS_DGN95
Angular Unit: Degree (0.0174532925199433)
Prime Meridian: Greenwich (0.0)
Datum: D_Datum_Geodesi_Nasional_1995
Spheroid: WGS_1984
Semimajor Axis: 6378137.0
Semiminor Axis: 6356752.314245179
Inverse Flattening: 298.257223563

UTM Zones 49N, 49S, 50N, 50S

Spatial Data Properties

Spatial Representation Type: Raster
Pixel Depth: 32 bit
Pixel Type: float
Compression Type: LZW
Number of Bands: 1
Raster Format: TIFF
No Data Value: -9999
Scale Factor: 1

The survey footprints are provided as a compressed shapefile (in *indonesia_lidar_footprints.zip*) and identified by the “siteID” attribute. Shapefile attribute names and descriptions are given in Table 1.

The shapefile is also provided as a companion file in kmz (*.kmz) format for viewing in Google Earth.

Table 1. Shapefile (*indonesia_lidar_footprints.shp*) attribute names, units, and descriptions.

Attribute Name	Units	Descriptions
siteID		three-digit site identifier
sid_int		siteID converted to integer format
Specs	ppm^2	LiDAR data were collected according to five different sets of specifications, primary focused on point density: 1) 4.03 points per square meter (ppm^2) excluding overlap; 2) 5.75 ppm^2; 3) 6.02 ppm^2; 4) 10.05 ppm^2; 5) no specification
area_ha	hectare	Approximate site area
LiDAR_Line	YYMMDD	Survey date; YY = 2014

3. Application and Derivation

The data were produced as part of an effort to establish a national forest monitoring system for Indonesia. Future goals of the project include mapping forest carbon stocks across Kalimantan and estimating forest carbon flux associated with logging.

4. Quality Assessment

Uncertainty associated with this data has not been analyzed.

5. Data Acquisition, Materials, and Methods

This dataset was produced as part of an effort to establish a national forest monitoring system for Indonesia that uses a combination of remote sensing and ground-based forest carbon inventory approaches. The effort was led by Applied GeoSolutions (http://www.appliedgeosolutions.com/) and funded through NASA's Carbon Monitoring System project with support from Winrock (https://www.winrock.org/), NASA's Jet Propulsion Laboratory, the University of New Hampshire, Wageningen University, and the University of Virginia.

Data Acquisition

Airborne LiDAR observations were collected over 104,000 hectares of forest across Kalimantan, Indonesia on the island of Borneo between 18 October and 30 November 2014 by Jakarta-based company Surtech (http://www.surtech-group.com/). The data were collected at point densities ranging between 4- and 10-ppm.

Product Derivation

The digital surface models (DSM), digital terrain models (DTM), and canopy height models (CHM) were generated from the raw LiDAR observations using the multi-stage processing routine depicted in Figure 2. The workflow uses the “pdal_ground” and “points2grid“ functions available through the open source Point Data Abstraction Library (PDAL; https://www.pdal.io).

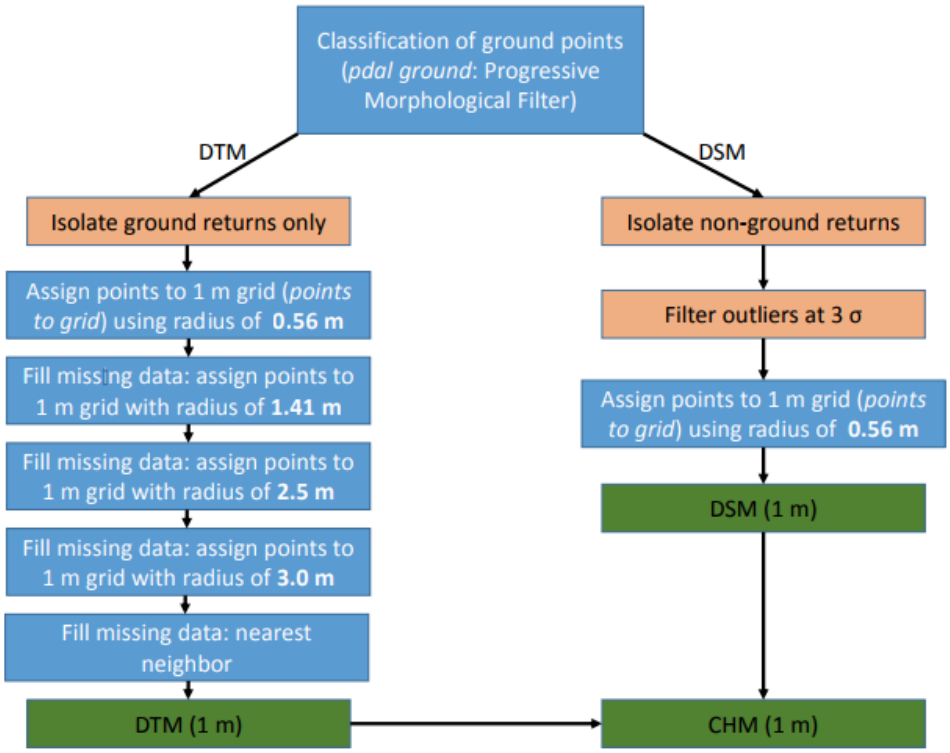

Figure 2. Workflow for generating DTM, DSM, and CHM from LiDAR point cloud data (from Hagen 2015).

6. References

Hagen, S., F.B. Sullivan, S. Saatchi, T. Pearson, M. Palace, B.H. Braswell, S. Brown, W.A. Salas, M. Hanson. 2015. Forest Monitoring in Indonesia: Using an extensive LiDAR data set to map forest carbon stock and logging impacts. Poster for the American Geophysical Union 2015 conference. Poster is include as a companion file: Hagen_2015_AGU_poster.pdf

Melendy, L., S.C. Hagen, F.B. Sullivan, T.R.H. Pearson, S.M. Walker, P. Ellis, Kustiyo, Ari Katmoko Sambodo, O. Roswintiarti, M. Hanson, A.W. Klassen, M. Palace, R. Braswell, G. Delgado, S. Saatchi, and A. Feraz. 2017. Automated method for measuring the extent of selective logging damage with airborne LiDAR data. *Remote Sensing of Environment.* In Review.