


ORNL DAAC
DISTRIBUTED ACTIVE ARCHIVE CENTER
FOR BIOGEOCHEMICAL DYNAMICS



Feedback
About Us
Get Data
Submit Data
Data Management
Tools
Sign in

DAAC Home

AirMOSS: L2 Hourly Precipitation at AirMOSS Sites, 2011-2015

Get Data

Documentation Revision Date: 2016-09-12

Data Set Version: V1

Summary

This data set provides level 2 (L2) calibrated hourly precipitation (cm/hr) from rain gauges at seven North American sites as part of the Airborne Microwave Observatory of Subcanopy and Subsurface (AirMOSS) project. Three gauges were installed at each site. Initial sampling began at three sites in September 2011 and additional sites were added during 2012 and 2013. All sampling concluded in December 2015. The AirMOSS project used an airborne radar instrument to estimate root-zone soil moisture at 10 study sites across North America. These precipitation data were collected in conjunction with in-ground soil moisture data in order to calibrate and validate the AirMOSS data.

There are 29 files in NetCDF v4 (*.nc4) format with this data set.

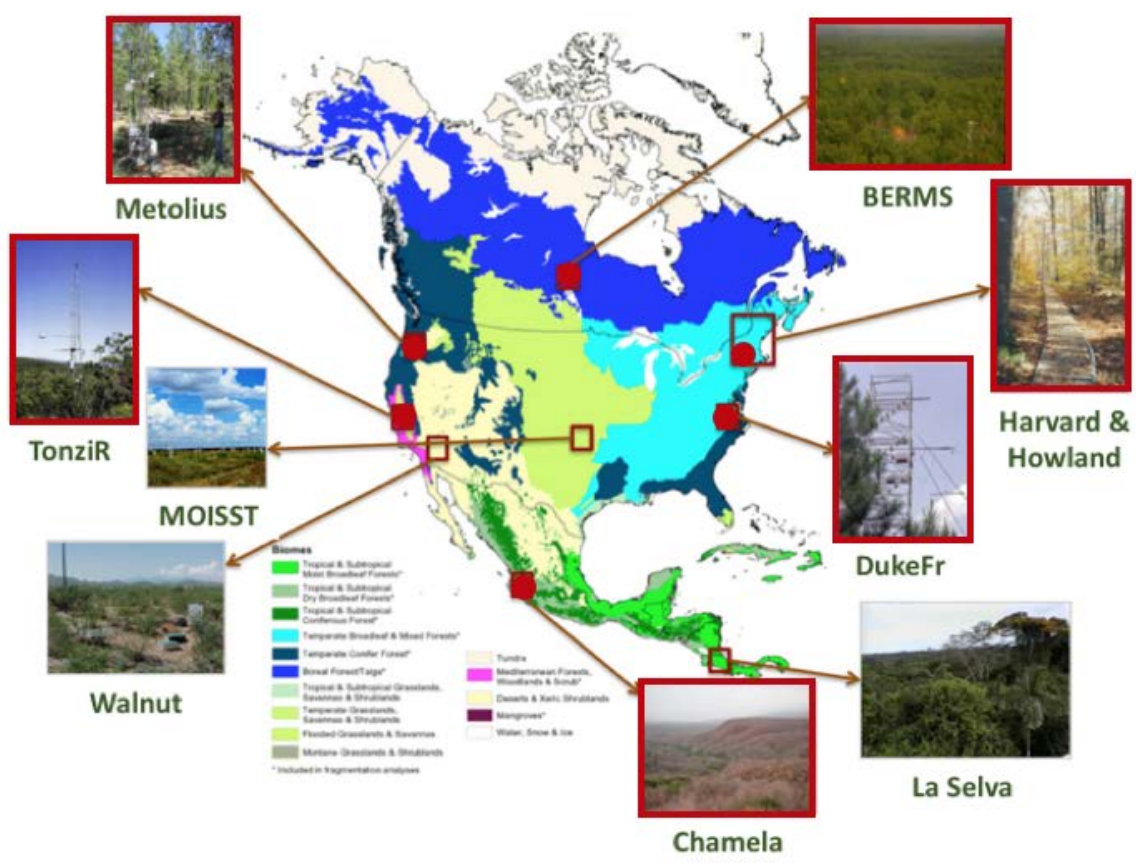


Figure 1: Precipitation measurements were taken at six of the ten AirMOSS sampling sites, highlighted here in red.

Citation

Cuenca, R., Y. Hagimoto, and AirMOSS Science Team. 2016. AirMOSS: L2 Hourly Precipitation at AirMOSS Sites, 2011-2015. ORNL DAAC, Oak Ridge, Tennessee, USA. <http://dx.doi.org/10.3334/ORNLDAAC/1417>

Table of Contents

1. [Data Set Overview](#)
2. [Data Characteristics](#)
3. [Application and Derivation](#)
4. [Quality Assessment](#)
5. [Data Acquisition, Materials, and Methods](#)
6. [Data Access](#)
7. [References](#)

1. Data Set Overview

This data set provides level 2 (L2) calibrated hourly precipitation (cm/hr) from rain gauges at seven North American sites as part of the Airborne Microwave Observatory of Subcanopy and Subsurface (AirMOSS) project. Three gauges were installed at each site. Initial sampling began at three sites in September 2011 and additional sites were added during 2012 and 2013. All sampling concluded in December 2015. The AirMOSS project used an airborne radar instrument to estimate root-zone soil moisture at 10 study sites across North America. These precipitation data were collected in conjunction with in-ground soil moisture data in order to calibrate and validate the AirMOSS data.

Project: Airborne Microwave Observatory of Subcanopy and Subsurface (AirMOSS)

The goal of NASA's Airborne Microwave Observatory of Subcanopy and Subsurface (AirMOSS) investigation is to provide high-resolution observations of root-zone soil moisture over regions representative of the major North American climatic habitats (biomes), quantify the impact of variations in soil moisture on the estimation of regional carbon fluxes, and extrapolate the reduced-uncertainty estimates of regional carbon fluxes to the continental scale of North America.

- The AirMOSS campaign used an airborne ultra-high frequency synthetic aperture radar flown on a Gulfstream-III aircraft to derive estimates of soil moisture down to approximately 1.2 meters.
- Extensive ground, tower, and aircraft in-situ measurements were collected to validate root-zone soil measurements and carbon flux model estimates.

The AirMOSS soil measurements can be used to better understand carbon fluxes and their associated uncertainties on a continental scale. Additionally, AirMOSS data provide a direct means for validating root-zone soil measurement algorithms from the Soil Moisture Active & Passive (SMAP) mission and assessing the impact of fine-scale heterogeneities in its coarse-resolution products.

Related Data:

[AirMOSS: L2 Hourly In-Ground Soil Moisture at AirMOSS Sites, 2011-2015](#)

A full list of AirMOSS data products is available at: <https://airmoss.ornl.gov/dataproducts.html>.

2. Data Characteristics

Spatial Coverage: Seven sites across the USA, Canada, and Mexico

Spatial Resolution: Point locations

Temporal Coverage: 20110901 to 20151231

Temporal Resolution: Hourly

Study Area (coordinates in decimal degrees)

Site	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Selected AirMOSS sites	-121.5583	-72.1712	53.9169	19.5086

Data File Information

There are 29 files in NetCDF v4 (*.nc4) format with this data set.

File-naming convention

L2PRECIP_calibrated_SITE_yyyymmdd_vv.nc4

where:

L2PRECIP_calibrated = data product name

SITE = six character site name (see Table 1)

yyymmdd = start date of data file

vv = data version number

Example file names: L2PRECIP_calibrated_BERMSP_20120101_03.nc4

L2PRECIP_calibrated_HARVRD_20150101_03.nc4

Table 1. AirMOSS sites where in-ground soil moisture (IGSM) and precipitation were recorded.

Site name	Site description	Start date	End date	Rain gauge	Latitude	Longitude
BERMSA	BERMS (Boreal Ecosystem Research and Monitoring Sites), Old Aspen site, Saskatchewan, Canada.	20130714	20151231	1	53.6289	-106.1979
				2	53.6287	-106.1983
				3	53.6284	-106.1985
BERMSP	BERMS (Boreal Ecosystem Research and Monitoring Sites), Old Jack Pine site, Saskatchewan, Canada.	20120622	20151231	1	53.9167	-104.6922
				2	53.9167	-104.6916
				3	53.9169	-104.6911
CHAMEL	Chamela Biological Station, Jalisco, Mexico.	20130303	20150930	1	19.5095	-105.0402
				2	19.5089	-105.0407
				3	19.5086	-105.0410
DUKEFR	Duke Forest site, North Carolina, USA.	20110907	20150923	1	35.9733	-79.1001
				2	35.9733	-79.0994
				3	35.9732	-79.1008
HARVRD	Harvard Forest site, Massachusetts, USA.	20110905	20151231	1	42.5378	-72.1714
				2	42.5381	-72.1712
				3	42.5385	-72.1718

METOLI	Metolius site, Oregon, USA.	20110923	20151231	1	44.4523	-121.5517
				2	44.4521	-121.5575
				3	44.4519	-121.5583
TONZIR	Tonzi Ranch site, California, USA.	20120109	20151231	1	38.43119	-120.9667
				2	38.4309	-120.9659
				3	38.4301	-120.9661

Table 2. Data fields in the precipitation data files (e.g. *L2PRECIP_calibrated_BERMSP_20120101_03.nc4*). Note that precipitation data at the Tonzi Ranch site was recorded in an open field, not under the forest canopy as at the other sites.

Data Field	Units	Description
SP01	cm/hr	Hourly precipitation rate under forest canopy for Profile 1
SP02	cm/hr	Hourly precipitation rate under forest canopy for Profile 2
SP03	cm/hr	Hourly precipitation rate under forest canopy for Profile 3
time	hours since 2011-01-01 00:00:00 UTC	Date and time of the data collection

3. Application and Derivation

The Level 2 precipitation data were collected in conjunction with in-ground soil moisture data in order to calibrate and validate other, higher-level, AirMOSS data products including the Level 2/3 Root Zone Soil Moisture estimates for each AirMOSS flight (Cuenca et al., 2015).

4. Quality Assessment

These data are provided with no QA information. The in-situ data were subjected to calibration procedures described in detail in Cuenca et al. (2015).

5. Data Acquisition, Materials, and Methods

The goal of the Airborne Microwave Observatory of Subcanopy and Subsurface (AirMOSS) investigation is to provide high-resolution observations of root-zone soil moisture over regions representative of the major North American climatic habitats (biomes), quantify the impact of variations in soil moisture on the estimation of regional carbon fluxes, and extrapolate the reduced-uncertainty estimates of regional carbon fluxes to the continental scale of North America. See Chapin et al. (2012) for more details.

AirMOSS Flights

These Level 2 in-situ precipitation data are one set of products generated by the AirMOSS campaign.

For AirMOSS, NASA's Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR) was flown on a Gulfstream-III aircraft, making frequent flights over ten sites (given in Table 3) in 9 different biomes of North America over the course of four years. Precipitation was not measured at all sites.

Table 3. AirMOSS sites

Site name	North latitude	South latitude	East longitude	West longitude	Fluxnet Site ID	Description
BermsP	54.125	53.501	-103.626	-107.125	CA-Ojp & CA-Oas	BERMS (Boreal Ecosystem Research and Monitoring Sites), Saskatchewan, Canada. Landcover: Mixed boreal forest. Elevation: 518m.
Chamel	20.326	19.316	-104.22	-105.29	MX-Cha	Chamela Biological Station, Jalisco, Mexico. Landcover: Seasonally dry tropical forest. Elevation: 58m.
DukeFr	36.368	35.437	-78.694	-79.849	US-Dk1,US-Dk2, US-Dk3	Duke Forest site, North Carolina, USA. Landcover: Mature oak-hickory dominated hardwood forest. Elevation: 169m.
Harvrd	43.376	42.293	-71.839	-72.389	US-Ha1 & US-Ha2	Harvard Forest site, Massachusetts, USA. Landcover: Temperate deciduous forest. Elevation: 353m.
Howlnd	45.778	44.669	-68.336	-69.086	US-Ho1, US-Ho2, US-Ho3	Howland Forest site, Maine, USA. Landcover: boreal - northern hardwood transitional forest. Elevation 72m.
LaSelv	10.878	9.92	-83.519	-84.57	CR-Lse	La Selva Biological Station, Costa Rica. Landcover: tropical rain forest. Elevation 93m.
Metoli	45.242	43.38	-120.363	-123.283	US-Me1 to US-Me6	Metolius site, Oregon, USA. Landcover: evergreen needleleaf forest. Elevation 1237m.
Oklaho or Moisst	36.880	35.775	-96.824	-98.996	US-ARM	The Marena, Oklahoma In Situ Sensor Testbed (MOISST) is located in Oklahoma, USA. Landcover: temperate grasslands, crops. Elevation: 312m.
TonziR	38.625	37.501	-120.001	-121.25	US-Ton	Tonzi Ranch site, California, USA. Landcover: oak savanna and grazed grassland. Elevation 170m.
Walnut	32.125	31.501	-109.376	-111.5	US-Wkg & US-Whs	Walnut Gulch site, Arizona, USA. Landcover: warm season C4 grassland with a few shrubs. Elevation 1524m.

Beginning in September 2012, the AirMOSS instrument flew 215 flight campaigns. A summary of flight campaigns by year and site is found in Table 4. Typically, the aircraft made repeat visits to sites in the same region in a single week and then proceeded to another region. Most sites had at least three campaigns per year. The Harvard and Howland forest sites were flown together in a single day. In 2012, Chamela, La Selva, and Tonzi were not surveyed.

Table 4. Summary of AirMOSS flight campaigns.

Year	Site									
	BermsP	Chamel	DukeFr	Harvrd	Howlnd	LaSelv	Metoli	Oklaho	TonziR	Walnut
2012	3	0	3	3	3	0	4	3	0	3
2013	6	3	9	9	9	6	7	8	5	6
2014	7	3	10	9	9	3	9	9	6	5

2015	9	2	5	5	5	3	9	6	5	6
Total	25	8	27	26	26	12	29	26	16	20

A complete list of AirMOSS flights can be found at: <https://airmoss.ornl.gov/flights.html>.

AirMOSS Level 2 Precipitation Data

The objective of the in situ precipitation and soil profile instrumentation was specifically to monitor soil water content over a depth representative of that which will have an impact on the P-band radar signal. Each of the seven AirMOSS sites sampled (Table 1) had three monitored soil profiles with rain gauges installed approximately 40 to 50 m apart along a “representative” (in terms of soil texture and vegetation) transect within the footprint of the flux tower. Tipping bucket precipitation gauges were used to collect rainfall intensity and depth data. The Texas Electronics TE525 gauge was used primarily because it is durable, able to be deployed in remote areas, and can be connected to different recording devices. The main disadvantages of tipping bucket gauges are that there is loss of rainfall data during periods of high rainfall intensity (significant underestimation), strong winds, and during light drizzle (loss of rain water through evaporation). A calibration process was performed to estimate the uncertainty of data collected from the TE525 and to minimize these effects, particularly underestimation of precipitation during high intensity events. Calibration methods and additional details are available in Cuenca et al. (2015).

6. Data Access

These data are available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

[AirMOSS: L2 Hourly Precipitation at AirMOSS Sites, 2011-2015](https://airmoss.ornl.gov/flights.html)

Contact for Data Center Access Information:

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

7. References

Chapin, E., A. Chau, J. Chen, B. Heavey, S. Hensley, Y. Lou, R. Machuzak, and M. Moghaddam. 2012. AirMOSS: An Airborne P-band SAR to measure root-zone soil moisture, *2012 IEEE Radar Conference*, Atlanta, GA, 2012, pp. 0693-0698. <http://dx.doi.org/10.1109/RADAR.2012.6212227>

Cuenca, R.H., Y. Hagimoto, T.M. Ring, and J.P. Beamer. 2015. Interpretation of in situ observations in support of P-band radar retrievals. *Geoscience and Remote Sensing Symposium (IGARSS)*, 2015 IEEE International. 5083-5086. <http://dx.doi.org/10.1109/IGARSS.2015.7326976>



[Privacy Policy](#) | [Feedback](#) | [FAQs](#) | [Site Map](#)



<input type="checkbox"/> Home	About Us	Get Data	Data Management	Tools	Help	<input type="checkbox"/> Contact Us
	Who We Are	Complete Data Set List	Plan	Data Search	FAQs	
	Partners	Search for Data	Manage	Site Search	Tutorials	
	User Working Group	Field Campaigns	Archive	Search by DOI		
	Biogeochemical Dynamics	Validation	DAAC Curation	WebGIS		
	Data Citation Policy	Regional/Global	Submit Data	SDAT		
	News	Model Archive		MODIS Land Subsets		
	Workshops			THREDDS		