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# NACP Regional: Original Observation Data and Biosphere and Inverse Model Outputs

## Get Data

Revision Date: September 27, 2013

### Summary:

This data set contains the originally-submitted observation measurement data, terrestrial biosphere model output data, and inverse model simulations that various investigator teams contributed to the North American Carbon Program (NACP) Regional Synthesis activities.

The data set provides nine (9) data packages of remote sensing and ground observation measurements (OM) (MODIS gross primary productivity (GPP), MODIS net primary production (NPP), MODIS fraction of photosynthetically active radiation (fPar), MODIS leaf area index (LAI), MODIS enhanced vegetation index (EVI), MODIS normalize difference vegetation index (NDVI), Forest Inventory and Analysis (FIA) forest biomass, National Agricultural Statistics Service (NASS) crop NPP, and Flux Anomaly). The data set also provides data packages of simulation results from 19 terrestrial biosphere models (TBM) and eight (8) inverse models (IM). The data packages are respectively OM, TBM, and IM data files listed in Tables 4-6.

Each OM, TBM, and IM data package contains all of the original data (and documentation, if any) that the NACP Modeling and Synthesis Thematic Data Center (MAST-DC) acquired or received. These originally-submitted data were processed by the MAST-DC to produce the three standardized gridded data sets of carbon flux for inter-comparison purposes (see Related Data Products below). These original data and documentation are provided to allow users of the standardized gridded data products to be able to trace back to the data origins when needed.

The Data Center (ORNL DAAC) transformed some of the originally-submitted data files to file formats that are more suitable for long-term archiving. For example, \*.xlsx files were saved as \*.csv, ERDAS Imagine files were converted to GeoTIFFs, and MATLAB files were converted to GeoTIFF and NetCDF formats as appropriate. Files received in NetCDF, GeoTIFF, and HDF formats were not transformed.

Detailed descriptions of observation measurement data and terrestrial biosphere and inverse models used in this study can be found in a separate companion document: [NACP Regional Synthesis - Description of Observations and Models](#).

MAST-DC was a component of the NACP ([www.nacarbon.org](http://www.nacarbon.org)) designed to support NACP by providing data products and data management services needed for modeling and synthesis activities. The overall objective of MAST-DC was to provide data management support to NACP investigators and agencies performing modeling and synthesis activities.

### Data and Documentation Access:

**Get Data:** [http://daac.ornl.gov/cgi-bin/dsviewer.pl?ds\\_id=1193](http://daac.ornl.gov/cgi-bin/dsviewer.pl?ds_id=1193)

#### Related Data Products:

NACP Regional: Gridded 1-deg Observation Data and Biosphere and Inverse Model Outputs [<http://dx.doi.org/10.3334/ORNLDAAC/1157>]

NACP Regional: Supplemental Observation Data and Biosphere and Inverse Model Outputs [<http://dx.doi.org/10.3334/ORNLDAAC/1158>]

NACP Regional: National Greenhouse Gas Inventories and Aggregated Gridded Model Data [<http://dx.doi.org/10.3334/ORNLDAAC/1179>]

## Data Citation:

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## 1. Data Set Overview:

**Project:** North American Carbon Program (NACP)

The NACP (Denning et al., 2005; Wofsy and Harriss, 2002) is a multidisciplinary research program to obtain scientific understanding of North America's carbon sources and sinks and of changes in carbon stocks needed to meet societal concerns and to provide tools for decision makers. Successful execution of the NACP has required an unprecedented level of coordination among observational, experimental, and modeling efforts regarding terrestrial, oceanic, atmospheric, and human components. The program has relied upon a rich and diverse array of existing observational networks, monitoring sites, and experimental field studies in North America and its adjacent oceans. It is supported by a number of different federal agencies through a variety of intramural and extramural funding mechanisms and award instruments.

MAST-DC organized several synthesis activities to evaluate and inter-compare biosphere model outputs and observation data at local to continental scales for the time period of 2000 through 2005. The synthesis activities have included three component studies, each conducted on different spatial scales and producing numerous data products: (1) site-level analyses that examined process-based model estimates and observations at over 30 AmeriFlux and Fluxnet-Canada tower sites across North America; (2) a regional, mid-continent intensive study centered in the agricultural regions of the United States and focused on comparing inventory-based estimates of net carbon exchange with those from atmospheric inversions; and (3) a regional and continental synthesis evaluating model estimates against each other and available inventory-based estimates across North America. A number of other NACP syntheses are underway, including ones focusing on non-CO<sub>2</sub> greenhouse gases, the impact of disturbance on carbon exchange, and coastal carbon dynamics. The Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) is the archive for the NACP synthesis data products.

This data set contains part of the third NACP synthesis product described above: regional analyses. It provides the original regional observation measurements and terrestrial biosphere and inverse model outputs retrieved by MAST-DC from various sources and modeling teams contributing to NACP. The originally-submitted data were processed by MAST-DC to produce three "analyzed" regional data sets: (1) NACP Regional: Gridded 1-deg Observation Data and Biosphere and Inverse Model Outputs (2) NACP Regional: Supplemental Gridded Observations, Biosphere and Inverse Model Outputs; and (3) NACP Regional: National Greenhouse Gas Inventories and Aggregated Gridded Model Data (see Related Data Products above).

This data set provides three categories of original data: (1) remote sensing and ground observation measurements (OM) data; (2) output data from 19 terrestrial biosphere models (TBM); and (3) output data from eight inverse models (IM) (Table 2). Data format, spatial and temporal resolution, and spatial and temporal extents varied among the original data files. These data (and documentation where available) are provided to allow users of the standardized data sets to be able to trace back to the data origins when needed. Detailed descriptions of observation data, TBM, and inverse models can be found in a separate document: [NACP Regional Synthesis - Description of Observations and Models](#).

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Table 2. List of Observation Measurements and Models

**OBSERVATION MEASUREMENTS**

Observation Data	Short Name
MODIS MOD17A2 Gross Primary Production (GPP)	MODIS GPP

MODIS MOD17A3 Net Primary Production (NPP)	MODIS NPP
Conterminous U.S. Forest Biomass	FIA Forest Biomass
Conterminous U.S. Crop Net Primary Production (NPP)	NASS Crop NPP
MODIS MOD15A2GFS Fraction of Photosynthetically Active Radiation (fPAR)	MODIS fPAR
MODIS MOD15A2GFS Leaf Area Index (LAI)	MODIS LAI
MODIS MOD09A1G_EVI Enhanced Vegetation Index (EVI)	MODIS EVI
MODIS MOD09A1G_NDVI Normalized Difference Vegetation Index (NDVI)	MODIS NDVI
Terrestrial Ecosystem Productivity and Respiration Anomalies	Flux Anomaly
<b>TERRESTRIAL BIOSPHERE MODELS</b>	
<b>Prognostic Models</b>	<b>Short Name</b>
Biome-BGC (BioGeochemical Cycles)	Biome-BGC
Canadian Integrated Biosphere Simulator	Can-IBIS
Community Land Model with CASA	CLM-CASA
Community Land Model with Carbon&Nitrogen	CLM-CN
Dynamic Land Ecosystem Model	DLEM
Integrated Science Assessment Model	ISAM
Lund-Potsdam-Jena managed Land model	LPJmL
MC1 Dynamic Vegetation Model	MC1
Organizing Carbon and Hydrology in Dynamic Ecosystems model	ORCHIDEE
Simple Biosphere model version 3.1	SiB3.1
Terrestrial Ecosystem Model version 6	TEM6
Vegetation Global Atmosphere and Soil model	VEGAS
<b>Diagnostic Models</b>	<b>Short Name</b>
Boreal Ecosystems Productivity Simulator	BEPS
Carnegie-Ames-Stanford-Approach model (Transcom version)	CASA-Transcom
Carnegie-Ames-Stanford-Approach model (Global Fire Emissions Database v 2 version)	CASA-GFEDv2
NASA-Carnegie-Ames-Stanford-Approach model	NASA-CASA
Eddy-Covariance Light Use Efficiency model	EC-LUE
Eddy-Covariance model with MODIS	EC-MOD
MOD17-plus	MOD17+
<b>INVERSE MODELS</b>	
<b>Inversion Models</b>	<b>Short Name</b>
CarbonTracker	CarbonTracker
University of Toronto Nested Global model	UToronto
Michigan Geostatistical model	Michigan Geostatistical
Laboratoire des Sciences du Climat et de l'Environnement (LSCE) no.1 (Peylin-LSCE) model	LSCE-no1 (Peylin)
Laboratoire des Sciences du Climat et de l'Environnement (LSCE) no.2 (Chevallier-LSCE) model	LSCE-no2 (Chevallier)
JENA CO <sub>2</sub> Inverse model	Jena (Rodenbeck)
CSU no. 1 (MLEF-PCTM) model	CSU-no1 (MLEF-PCTM)
CSU no. 2	CSU no. 2

Table 3. Data Package Summary

Data Set	Sub Category
Original Observation Measurements Data and Biosphere and Inverse Model Outputs	Observation Measurements (OM)
	Terrestrial Biosphere Model (TBM) Outputs
	Inverse Model (IM) Outputs

## 2. Data Description:

This data set contains OM data, TBM output data, and IM output data. The data format, spatial and temporal resolution, and spatial and temporal extents varied among the original data that MAST-DC acquired. The Data Center performed some file format transformations. Archived data file formats include .tif, .hdf, .csv, and .nc. Spatial and temporal resolutions and extents are unchanged.

### 2.1. Spatial Coverage

**Site:** North America

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
North America	-170	-50	84	10

### 2.2. Spatial Resolution

Varies. See Tables 4-6.

### 2.3. Temporal Coverage

Varies (Range: 1990-2008). See Tables 4-6.

### 2.4. Temporal Resolution

One time, 8-day, monthly, or annual. See Tables 4-6.

### 2.5. Data File Information

Table 4. Observation Measurements (OM) Data Files

COMPRESSED FILE NAME	DESCRIPTIONS
OM_FIA_Biomass_Original.zip	Forest biomass data (short Tons C/acre) at 250 m resolution for the conterminous United States, 2000, in .tif format
OM_Flux-Anomaly_Original.zip	Global monthly flux anomalies (g C/m <sup>2</sup> /mo) at 1 degree resolution, 1990-2008, in .tif format. Data were calculated using upscaled water deficit ~ carbon balance relationships and represent net ecosystem productivity, gross ecosystem productivity, and ecosystem respiration.
OM_MODIS_EVI_Original.zip	MODIS MOD09A1 8-day 500 m surface reflectance EVI product, gap-filled and smoothed to derive MOD09A1G_EVI for North America, 2000-2005, in HDF format
OM_MODIS_FPAR_Original.zip	MODIS MOD15A2 8-day 1 km (926 m) fPAR product (dimensionless ratio m <sup>2</sup> /m <sup>2</sup> ), gap-filled and smoothed to derive MOD15A2GFS for North America, 2000-2005, in HDF format
OM_MODIS_GPP_Original.zip	MODIS MOD17A2 Collection 5.1, 8-day 1 km GPP (kg C/m <sup>2</sup> /mo) for North America, 2000-

	2006, in HDF format
OM_MODIS_LAI_Original.zip	MODIS MOD15A2 8-day 1 km (926 m) LAI product (dimensionless ratio $m^2/m^2$ ), gap-filled and smoothed to derive MOD15A2GFS for North America, 2000-2005, in HDF format
OM_MODIS_NDVI_Original.zip	MODIS MOD09A1 8-day 500 m surface reflectance NDVI product, gap-filled and smoothed to derive MOD09A1G_NDVI for North America, 2000-2005, in HDF format
OM_MODIS_NPP_Original.zip	MODIS MOD17A3 Collection 5.1, annual NPP ( $kg\ C/m^2/yr$ ) at 0.05 degree resolution for North America, 2000-2006, in HDF format
OM_NASS_CropNPP_Original.zip	Annual crop net primary production by county FIPS code ( $Mg\ C/county/year$ ) at 1 km resolution for the conterminous United States, 1996-2008, in comma-separated (.csv) format

Table 5. Terrestrial Biosphere Model (TBM) Output Data Files

FILE NAME		DESCRIPTION
TBM_BEPS_Original.zip		Monthly GPP, NPP, and NEP ( $g\ C/m^2/mo$ ) at 1 degree resolution for North America, 2000-2004, in .tif format from the Boreal Ecosystems Productivity Simulator (BEPS) model
TBM_Biome-BGC_Original.zip		Daily GPP, NPP, NEP, auto_resp, and hetero_resp ( $kg/m^2/yr$ ) and wmas ( $kg/m^2$ ) at 1 km resolution for Oregon, 2000-2002, in netCDF data from the Biome-BGC (BioGeochemical Cycles) model
TBM_CASA-GFEDv2_Original.zip		Monthly NEE, GPP, and R ( $Ra+Rh$ ) ( $g\ C/m^2/mo$ ) and NEEF ( $kg\ C/m^2/mo$ ) at 1 degree resolution for North America, 2000-2005, in netCDF format from the Carnegie-Ames-Stanford-Approach (CASA) model (Global Fire Emissions Database v 2 version)
TBM_CASA-Transcom_Original.zip		Monthly NEE data ( $g\ C/m^2/mo$ ) at 1 degree resolution for North America, 2002-2003, in .tif format from the Carnegie-Ames-Stanford-Approach (CASA) (TransCom version). There is also 1 netCDF file
TBM_CLM-CASA_Original files not zipped due to file size. There are 8 TBM_CLM-CASA_Original_***.nc files.	i01.54	Global monthly GPP, NPP, NEE, NEP, and HR ( $g\ C/m^2/s$ ), TLAI and landfrac (N/A), LEAFC, LITTERC, SOILC, WOODC, CWDC, and FROOTC ( $g\ C/m^2$ ), and VegC ( $g\ C/m^2$ ) derived from LEAFC+WOODC+FROOTC) at $2.5 \times 1.89474$ degree resolution, 1990-2004, in netCDF format from the Community Land Model with CASA
	i01.54_q15	
	i01.55	
	i01.55_q15	
TBM_CLM-CN_Original files not zipped due to file size. There are 4 TBM_CLM-CN_Original_***.nc files.	i01.56	Global monthly GPP, NPP, NEE, NEP, and HR ( $g\ C/m^2/s$ ), TLAI and landfrac (N/A), TOTVEGC, LEAFC, LITTERC, SOILC, WOODC, CWDC, and FROOTC ( $g\ C/m^2$ ) at $2.5 \times 1.89474$ degree resolution, 1990-2004, in netCDF format from the Community Land Model with Carbon&Nitrogen
	i01.57_q15	
TBM_Can-IBIS_Original.zip		Monthly GPP, NPP, NEP, Ra, and Rh ( $kgC/m^2/mo$ ) and annual CBiomass, CSoil ( $g\ C/m^2/yr$ ) at 0.5 degree resolution for United States and Canada, 2000-2005, in netCDF format from the Canadian Integrated Biosphere Simulator model

TBM_DLEM_Original.zip		Monthly GPP, NEE, NPP, Ra, and Rh (g C/m <sup>2</sup> /mo) and TotLivBiom, TotSoilCarb (g C/m <sup>2</sup> ) at 32 km resolution for North America, 2000-2005, in netCDF format from the Dynamic Land Ecosystem Model (DLEM)
TBM_EC-LUE_Original.zip		Monthly GPP (g C/m <sup>2</sup> /mo) at 1 degree resolution for North America, 2004-2005, in netCDF format from the Eddy-Covariance Light Use Efficiency (EC-LUE) model
TBM_EC-MOD_Original.zip		Monthly GPP (GPPn+GPPc) and NEE (NEEn+NEEc) (g C/m <sup>2</sup> /mo) at 1 degree resolution for North America, 2001-2006, in netCDF format from the Eddy-Covariance model with MODIS (EC-MOD v2.0)
TBM_ISAM_Original.zip		Monthly NEE, NPP, and Rh (kg C/m <sup>2</sup> /mo) at 1 degree resolution for North America, 2000-2007, in netCDF format from the Integrated Science Assessment Model (ISAM)
TBM_LPJmL_Original.zip		Monthly NEE, GPP, NPP, RH, and RA (kg C/m <sup>2</sup> /mo), annual FIRE (kg C/m <sup>2</sup> /yr), and annual VEGC, SOILC, LITC (kg C/m <sup>2</sup> ) at 0.5 degree resolution for North America, 1990-2006, in netCDF format from the Lund-Potsdam-Jena managed Land (LPJmL) model
TBM_MC1_Original.zip		Monthly NPP, NEE, NBP, and RespH (kg C/m <sup>2</sup> /mo), TotLivBiom and TSLC (kg C/m <sup>2</sup> ), and BioCons (kg C/m <sup>2</sup> /mo) at 0.5 degree resolution for the conterminous United States, 2000-2007, in netCDF format from the MC1 Dynamic Vegetation Model
TBM_MOD17-plus_Original.zip		Monthly GPP and Reco (R=Ra+Rh) (g C/m <sup>2</sup> /mo) at 1 degree resolution for North America, 2000-2005, in netCDF format from the MOD17-plus model
TBM_NASA-CASA_Original.zip		Monthly NPP and NEP (g C/m <sup>2</sup> /mo) at 8 km resolution for the conterminous United States, 2001-2004, in .tif format from the NASA-Carnegie-Ames-Stanford-Approach (NASA-CASA) model
TBM_ORCHIDEE_Original.zip	v1.0	Monthly GPP, NPP, and CO2FLUX (NEE) (g C/m <sup>2</sup> /da), LAI (N/A), and GROWTH_RESP, HET_RESP (g C/m <sup>2</sup> /da) at 0.3512 degree (T511) resolution for North America, 2001-2007, in netCDF format from the ORCHIDEE mode, version 1.0
	v2.1	Monthly GPP, NPP, and CO2FLUX (NEE) (g C/m <sup>2</sup> /da), LAI (N/A), HET_RESP (g C/m <sup>2</sup> /da), and TOTAL_M, TOTAL_SOIL_CARB (g C/m <sup>2</sup> ) at 0.5 degree resolution for North America, 1991-2008, in netCDF format from the ORCHIDEE mode, version 2.0
TBM_SiB3_Original.zip		Monthly NEE (g C/m <sup>2</sup> /mo) at 1 degree resolution for North America, 2000-2005, in netCDF format from the Simple Biosphere model (SiB) version 3.1, 2 fortran model codes (*.f90), and one .pdf
TBM_TEM6_Original.zip		Monthly GPP, NCE, NECB, NPP, and RH (kg C/m <sup>2</sup> /mo) and SOILC, VEGC (kg C/m <sup>2</sup> ) at 0.5 degree resolution for North America (>45°N), 2000-2006, in netCDF format from the Terrestrial Ecosystem Model

	(TEM) version 6
TBM_VEGAS_Original.zip	Monthly GPP, NEE (fire emissions included), NPP, Ra, Rh, NEP (derived from NPP-Rh), and cfire (kg/m <sup>2</sup> /yr), cleaf, csoil, cb, and cvege (kg/m <sup>2</sup> ), evap (W/m <sup>2</sup> ), and LAI (N/A) at 1 degree resolution for North America, 2000-2007, in netCDF format from the Vegetation Global Atmosphere and Soil (VEGAS)

Table 6. Inverse Model (IM) Output Data Files

FILE NAME	DESCRIPTION
IM_CSU-no1_Original.zip	Global monthly NEE and FF (moles/m <sup>2</sup> /sec) at 1 degree resolution, 2003-2004, in netCDF format from the CSU no. 1 (MLEF-PCTM) model
IM_CSU-no2_Original.zip	Monthly GPP, NEE and RESP (kg C/m <sup>2</sup> /mo) at 1 degree resolution for North America, 2004, in netCDF format from the CSU no. 2 model
IM_CarbonTracker_Original.zip	Global monthly NEE (micromol/m <sup>2</sup> /sec) at 1 degree resolution, 2000-2007, in netCDF format from CarbonTracker
IM_JENA_Original.zip	Global monthly NEE (micromol/m <sup>2</sup> /sec) at 1 degree resolution, 2001-2007, in netCDF format from the JENA CO <sub>2</sub> Inverse model
IM_LSCE-no1_Original.zip	Global monthly NEE (micromol/m <sup>2</sup> /sec) at 1 degree resolution, 2000-2004, in netCDF format from the LSCE No.1 (Peylin-LSCE) model
IM_LSCE-no2_Original.zip	Global monthly NEE (micromol/m <sup>2</sup> /sec) at 1 degree resolution, 2000-2006, in netCDF format from the Laboratoire des Sciences du Climat et de l'Environnement (LSCE) no.2 (Chevallier-LSCE) model
IM_Michigan-Geostatistical_Original.zip	Global monthly NEE (mol/m <sup>2</sup> /sec) at 1 degree resolution, 1997-2001, in (.txt) format from the Michigan Geostatistical model
IM_UToronto_Original.zip	Global monthly NEE (g C/m <sup>2</sup> /mo) at 1 degree resolution, 2000-2003, in netCDF format from the University of Toronto Nested Global model

2.6. Observation Data and Model Output Variables

Table 7. Observation and Model Output Variables --general measurement types and variable short names

Short Name	Units	Long Name	Temporal Resolution	OM and Model Short Names
<b>Gross Primary Productivity (GPP)</b>				
GPP	vary	gross primary production	vary	MODIS GPP, BEPS, Can-IBIS, CASA-GFEDv2, CLM-CASA, CLM-CN, DLEM, EC-LUE, EC-MOD, LPJmL, MOD17-plus, ORCHIDEE (v1.0), TEM6, VEGAS, OSU-BGC
<b>Net Primary Productivity (NPP)</b>				
NPP	vary	net primary production	vary	MODIS NPP, BEPS, Can-IBIS, ISAM, LPJmL, MC1, NASA-CASA, ORCHIDEE (v1.0), TEM6, VEGAS, DLEM, OSU-BGC
FNPP	g/m2/s	net primary	monthly	CLM-CASA, CLM-CN

		production		
NPPCrop	kg C m-2 month-1	net primary production crop	monthly	ORCHIDEE (v2.1)
CropNPP	MgC y-1	crop NPP	annual	NASS CropNPP
<b>Net Ecosystem Exchange (NEE)</b>				
NEE	vary	net ecosystem exchange	vary	BEPS, Can-IBIS, CASA-GFEDv2, CLM-CASA, CLM-CN, EC-MOD, ISAM, LPJmL, MC1, MOD17-plus, NASA-CASA, SiB3, TEM6, VEGAS, CASA-Transcom, DLEM, CarbonTracker, UToronto, LSCE-no1, LSCE-no2, JENA, CSU-no1, CSU-no2, Michigan-Geostatistical
CO2FLUX	kg C m-2 month-1	co2 flux	monthly	ORCHIDEE (v1.0)
ANEE	kg C m-2 year-1	annual net ecosystem exchange	yearly	LPJmL
NEEF	vary	net ecosystem exchange with fire emissions	vary	MC1, CASA-GFEDv2
ANEEF	kg C m-2 year-1	annual net ecosystem exchange with fire emissions	yearly	LPJmL
<b>Net Ecosystem Production</b>				
NEP	vary	net ecosystem production	vary	BEPS, Can-IBIS, CLM-CASA, CLM-CM, NASA-CASA, VEGAS, OSU-BGC
<b>Total Respiration</b>				
R	kg C m-2 month-1	respiration	monthly	CASA-GFEDv2
Reco	kg C m-2 month-1	ecosystem respiration	monthly	MOD17-plus
<b>Autotrophic Respiration</b>				
Ra	vary	autotrophic respiration	vary	Can-IBIS, VEGAS, DLEM
RA	kg C m-2 month-1	autotrophic respiration	monthly	LPJmL
auto_resp		autotrophic respiration		OSU-BGC
<b>Heterotrophic Respiration</b>				
Rh	vary	heterotrophic respiration	vary	BEPS, Can-IBIS, ISAM, NASA-CASA, VEGAS, DLEM
HR	kg C m-2 month-1	heterotrophic respiration	monthly	CLM-CASA, CLM-CN
RH	kg C m-2 month-1	heterotrophic respiration	monthly	LPJmL, TEM6
RespH	kg C m-2 month-1	heterotrophic respiration	monthly	MC1
HetResp	kg C m-2 month-1	heterotrophic respiration	monthly	ORCHIDEE (v1.0)
hetero_resp		heterotrophic respiration		OSU-BGC
<b>Fire Emissions</b>				

Cfire	kg C m-2 month-1	fire emissions	monthly	CASA-GFEDv2
cfire	kg C m-2 month-1	fire emissions	monthly	VEGAS
FIRE	kg C m-2 year-1	fire emissions	yearly	LPJmL
BioCons	kg C m-2 month-1	biomass consumed	monthly	MC1
FireEmissions	kg C m-2 month-1	fire emissions	monthly	TEM6
<b>Total Living Biomass</b>				
TotLivBiom	kg C m-2	monthly mean total carbon content of the living biomass including heartwood	monthly	DLEM
TotLivBiom	kg C m-2	total living biomass	monthly	MC1
CBiomass	kg C m-2	biomass	yearly	Can-IBIS
cb	kg C m-2	total biomass carbon	monthly	VEGAS
Biomass	kg C m-2	forest biomass	one time	FIA Forest Biomass
<b>Total Soil Carbon: Total soil and litter carbon content vertically integrated over the entire soil column</b>				
TotSoilCarb	kg C m-2	monthly mean total soil carbon density	monthly	DLEM
CSoil	kg C m-2	soil carbon	yearly	Can-IBIS
SOILC	kg C m-2	total soil organic matter C	monthly	CLM-CASA, CLM-CN
SOILC	kg C m-2	total soil carbon	monthly	TEM6
SOILC	kg C m-2	soil carbon	yearly	LPJmL
TSLC	kg C m-2	total soil carbon	monthly	MC1
csoil	kg C m-2	soil carbon	monthly	VEGAS
<b>Leaf Area Index</b>				
LAI	(-)	leaf area index	monthly	ORCHIDEE (v1.0), VEGAS
TLAI	(-)	total projected leaf area index	monthly	CLM-CASA, CLM-CN
<b>Evapotranspiration (ET)</b>				
evap	W m-2	evapotranspiration		VEGAS
<b>Coarse Woody Debris Carbon</b>				
CWDC	kg C m-2	coarse woody debris C	monthly	CLM-CASA, CLM-CN
<b>Wood Carbon</b>				
WOODC	kg C m-2	wood C	monthly	CLM-CASA, CLM-CN
wmas	kg m-2	wood mass	annual	OSU-BGC
<b>Fine Root Carbon</b>				
FROOTC	kg C m-2	fine root C	monthly	CLM-CASA, CLM-CN
<b>Land Fraction</b>				
landfrac	(-)	land fraction	monthly	CLM-CASA, CLM-CN
<b>Leaf Carbon</b>				
LEAFC	kg C m-2	leaf C	monthly	CLM-CASA, CLM-CN
cleaf	kg C m-2	leaf carbon	monthly	VEGAS
<b>Litter Carbon</b>				
LITTERC	kg C m-2	litter C	monthly	CLM-CASA, CLM-CN

LITC	kg C m-2	litter carbon	yearly	LPJmL
<b>Vegetation Carbon</b>				
VegC	kg C m-2	vegetation C	monthly	CLM-CASA
cvege	kg C m-2	total vegetation carbon	monthly	VEGAS
VEGC	kg C m-2	live vegetation carbon	yearly	LPJmL
VEGC	kg C m-2	total vegetation above and below ground	monthly	TEM6
TOTVEGC	kg C m-2	total vegetation carbon	monthly	CLM-CN
<b>Net Biome Production</b>				
NBP	kg C m-2 month-1	net biome production	monthly	MC1
<b>Growth Respiration</b>				
GROWTH_RESP	kg C m-2 month-1	growth respiration	monthly	ORCHIDEE (v1.0)
<b>Net Carbon Exchange</b>				
NCE	kg C m-2 month-1	net exchange of C from the land to the atmosphere	monthly	TEM6
<b>Net Ecosystem Carbon Balance</b>				
NECB	kg C m-2 month-1	net ecosystem C balance from the land to the atmosphere	monthly	TEM6
<b>Soil Depth</b>				
ZSOI	m	soil depth	static	CLM-CASA, CLM-CN
<b>Soil Thickness</b>				
DZSOI	m	soil thickness	static	CLM-CASA, CLM-CN
<b>Saturated Soil Water Content (porosity)</b>				
WATSAT	mm3/mm3	saturated soil water content (porosity)	static	CLM-CASA, CLM-CN
<b>Saturated Soil Matric Potential</b>				
SUCSAT	mm	saturated soil matric potential	static	CLM-CASA, CLM-CN
<b>Slope of Soil Water Retention Curve</b>				
BSW	unitless	slope of soil water retention curve	static	CLM-CASA, CLM-CN
<b>Saturated Hydraulic Conductivity</b>				
HKSAT	unitless	saturated hydraulic conductivity	static	CLM-CASA, CLM-CN
<b>Above-ground Net Primary Production</b>				
AGNPP	gC/m2/s	above-ground net primary production		CLM-CASA, CLM-CN
<b>Moisture Dependence</b>				
BGMOIST	unitless	moisture dependence		CLM-CASA, CLM-CN
<b>Below-ground Net Primary Production</b>				
BGNPP	gC/m2/s	below-ground net primary production		CLM-CASA, CLM-CN
<b>Temperature Dependence</b>				
BGTEMP	unitless	temperature dependence		CLM-CASA, CLM-CN

Biogenic CO Flux				
BIOPENCO	uG/M2/H	biogenic CO flux		CLM-CASA, CLM-CN
Transpiration Beta Factor				
BTRAN	unitless	transpiration beta factor		CLM-CASA, CLM-CN
Amt. of Carbon Lost by Pool				
CLOSS	g/m2/s	Amt. of Carbon lost by pool		CLM-CASA, CLM-CN
Total Carbon Flux				
CFLUX	g/m2/s	total Carbon flux		CLM-CASA, CLM-CN
Amt. of Carbon Transferred Out of Pool Types				
CTRANS	g/m2/s	Amt. of Carbon transferred out of pool types		CLM-CASA, CLM-CN
Coarse Woody Debris Heterotrophic Respiration				
CWDC_HR	gC/m2/s	coarse woody debris heterotrophic respiration		CLM-CASA, CLM-CN
Coarse Woody Debris C Loss				
CWDC_LOSS	gC/m2/s	coarse woody debris C loss		CLM-CASA, CLM-CN
Accumulated Degree Days				
DEGDAY	deg C	Accumulated degree days		CLM-CASA, CLM-CN
Derivative of Hydraulic Conductivity				
DHKDW	mm/s	derivative of hydraulic conductivity		CLM-CASA, CLM-CN
Turbulent Deposition Velocity 1				
DPVLTRB1	m/s	turbulent deposition velocity 1	monthly	CLM-CASA, CLM-CN
Turbulent Deposition Velocity 2				
DPVLTRB2	m/s	turbulent deposition velocity 2	monthly	CLM-CASA, CLM-CN
Turbulent Deposition Velocity3				
DPVLTRB3	m/s	turbulent deposition velocity 3	monthly	CLM-CASA, CLM-CN
Turbulent Deposition Velocity4				
DPVLTRB4	m/s	turbulent deposition velocity 4	monthly	CLM-CASA, CLM-CN
Derivative of Soil Matric Potential				
DSMPDW	mm	derivative of soil matric potential		CLM-CASA, CLM-CN
Total Surface Dust Emission				
DSTFLXT	kg/m2/s	total surface dust emission		CLM-CASA, CLM-CN
RTM Land Change in Storage: LIQ				
DVOLRDT_LND	mm/s	RTM land change in storage: LIQ		CLM-CASA, CLM-CN
RTM Land Change in Storage: ICE				
DVOLRDT_LND_ICE	mm/s	RTM land change		CLM-CASA, CLM-CN

		in storage: ICE		
<b>RTM Ocean Change in Storage: LIQ</b>				
DVOLRDT_OCN	mm/s	RTM ocean change in storage: LIQ		CLM-CASA, CLM-CN
<b>RTM Ocean Change in Storage: ICE</b>				
DVOLRDT_OCN_ICE	mm/s	RTM ocean change in storage: ICE		CLM-CASA, CLM-CN
<b>Change in Soil Water Content</b>				
DWAT	mm <sup>3</sup> /mm <sup>3</sup>	change in soil water content		CLM-CASA, CLM-CN
<b>Exposed One-sided Leaf Area Index</b>				
ELAI	m <sup>2</sup> /m <sup>2</sup>	exposed one-sided leaf area index		CLM-CASA, CLM-CN
<b>Total Water Conservation Error</b>				
ERRH2O	mm	total water conservation error		CLM-CASA, CLM-CN
<b>Surface Energy Conservation Error</b>				
ERRSEB	watt/m <sup>2</sup>	surface energy conservation error		CLM-CASA, CLM-CN
<b>Soil /lake Energy Conservation Error</b>				
ERRSOI	watt/m <sup>2</sup>	soil/lake energy conservation error		CLM-CASA, CLM-CN
<b>Solar Radiation Conservation Error*****</b>				
	watt/m <sup>2</sup>	solar radiation conservation error		CLM-CASA, CLM-CN
<b>Exposed One-sided Stem Area Index</b>				
ESAI	m <sup>2</sup> /m <sup>2</sup>	exposed one-sided stem area index		CLM-CASA, CLM-CN
<b>Excess Carbon</b>				
EXCESSC	g/m <sup>2</sup> /timestep	excess carbon		CLM-CASA, CLM-CN
<b>Canopy Evaporation</b>				
FCEV	watt/m <sup>2</sup>	canopy evaporation		CLM-CASA, CLM-CN
<b>Fractional Area with With Water Table at Surface</b>				
FCOV	unitless	fractional area with water table at surface		CLM-CASA, CLM-CN
<b>Canopy Transpiration</b>				
FCTR	watt/m <sup>2</sup>	canopy transpiration		CLM-CASA, CLM-CN
<b>Ground Evaporation</b>				
FGEV	watt/m <sup>2</sup>	ground evaporation		CLM-CASA, CLM-CN
<b>Heat Flux into Soil</b>				
FGR	watt/m <sup>2</sup>	heat flux into soil		CLM-CASA, CLM-CN
<b>Heat Flux between Soil Layers 1 and 2</b>				
FGR12	watt/m <sup>2</sup>	heat flux between soil layers 1 and 2		CLM-CASA, CLM-CN
<b>Net Infrared (Longwave) Radiation</b>				
FIRA	watt/m <sup>2</sup>	net infrared (longwave) radiation		CLM-CASA, CLM-CN

Emitted Infrared (Longwave) Radiation				
FIRE	watt/m <sup>2</sup>	emitted infrared (longwave) radiation		CLM-CASA, CLM-CN
Atmospheric Longwave Radiation				
FLDS	watt/m <sup>2</sup>	atmospheric longwave radiation		CLM-CASA, CLM-CN
Heat Flux for Rain to Snow Conversion				
FLUXFM2A	W/m <sup>2</sup>	heat flux for rain to snow conversion		CLM-CASA, CLM-CN
Heat Flux From Rain to Snow Conversion				
FLUXFMLND	W/m <sup>2</sup>	heat flux from rain to snow conversion		CLM-CASA, CLM-CN
Photosynthesis				
FPSN	umol/m <sup>2</sup> s	photosynthesis		CLM-CASA, CLM-CN
Fine Root C				
FROOTC	gC/m <sup>2</sup>	fine root C		CLM-CASA, CLM-CN
Fine Root C Allocation				
FROOTC_ALLOC	gC/m <sup>2</sup> /s	fine root C allocation		CLM-CASA, CLM-CN
Fine Root C Loss				
FROOTC_LOSS	gC/m <sup>2</sup> /s	fine root C loss		CLM-CASA, CLM-CN
Fine Root Litter C				
FROOT_LITTERC	gC/m <sup>2</sup>	fine root litter C		CLM-CASA, CLM-CN
Fine Root Litter Heterotrophic Respiration				
FROOT_LITTERC_HR	gC/m <sup>2</sup> /s	fine root litter heterotrophic respiration		CLM-CASA, CLM-CN
Fine Root Litter C Loss				
FROOT_LITTERC_LOSS	gC/m <sup>2</sup> /s	fine root litter C loss		CLM-CASA, CLM-CN
Absorbed Solar Radiation				
FSA	watt/m <sup>2</sup>	absorbed solar radiation		CLM-CASA, CLM-CN
Atmospheric Incident Solar Radiation				
FSDS	watt/m <sup>2</sup>	atmospheric incident solar radiation		CLM-CASA, CLM-CN
Direct Nir Incident Solar Radiation				
FSDSND	watt/m <sup>2</sup>	direct nir incident solar radiation		CLM-CASA, CLM-CN
Direct Nir Incident Solar Radiation at Local Noon				
FSDSNDLN	watt/m <sup>2</sup>	direct nir incident solar radiation at local noon		CLM-CASA, CLM-CN
Diffuse Nir Incident Solar Radiation				
FSDSNI	watt/m <sup>2</sup>	diffuse nir incident solar radiation		CLM-CASA, CLM-CN
Direct Vis Incident Solar Radiation				
FSDSVD	watt/m <sup>2</sup>	direct vis incident solar radiation		CLM-CASA, CLM-CN
Direct Vis Incident Solar Radiation at Local Noon				
FSDSVDLN	watt/m <sup>2</sup>	direct vis incident solar radiation at		CLM-CASA, CLM-CN

		local noon		
<b>Diffuse Vis Incident Solar Radiation</b>				
FSDSVI	watt/m^2	diffuse vis incident solar radiation		CLM-CASA, CLM-CN
<b>Sensible Heat</b>				
FSH	watt/m^2	sensible heat		CLM-CASA, CLM-CN
<b>Sensible Heat from Ground</b>				
FSH_G	watt/m^2	sensible heat from ground		CLM-CASA, CLM-CN
<b>Sensible Heat from Veg</b>				
FSH_V	watt/m^2	sensible heat from veg		CLM-CASA, CLM-CN
<b>Snow Melt Heat Flux</b>				
FSM	watt/m^2	snow melt heat flux		CLM-CASA, CLM-CN
<b>Fraction of Ground Covered by Snow</b>				
FSNO	unitless	fraction of ground covered by snow		CLM-CASA, CLM-CN
<b>Reflected Solar Radiation</b>				
FSR	watt/m^2	reflected solar radiation		CLM-CASA, CLM-CN
<b>Direct Nir Reflected Solar Radiation</b>				
FSRND	watt/m^2	direct nir reflected solar radiation		CLM-CASA, CLM-CN
<b>Direct Nir Reflected Solar Radiation at Local Noon</b>				
FSRNDLN	watt/m^2	direct nir reflected solar radiation at local noon		CLM-CASA, CLM-CN
<b>Diffuse Nir Reflected Solar Radiation</b>				
FSRNI	watt/m^2	diffuse nir reflected solar radiation		CLM-CASA, CLM-CN
<b>Direct Vis Reflected Solar Radiation</b>				
FSRVD	watt/m^2	direct vis reflected solar radiation		CLM-CASA, CLM-CN
<b>Direct Vis Reflected Solar Radiation at Local Noon</b>				
FSRVDLN	watt/m^2	direct vis reflected solar radiation at local noon		CLM-CASA, CLM-CN
<b>Diffuse Vis Reflected Solar Radiation</b>				
FSRVI	watt/m^2	diffuse vis reflected solar radiation		CLM-CASA, CLM-CN
<b>Intercepted Water</b>				
H2OCAN	mm	intercepted water		CLM-CASA, CLM-CN
<b>Snow Depth (Liquid Water)</b>				
H2OSNO	mm	snow depth (liquid water)		CLM-CASA, CLM-CN
<b>Volumetric Soil Water</b>				
H2OSOI	mm3/mm3	volumetric soil water		CLM-CASA, CLM-CN
<b>Soil Heat Content</b>				
HCSOI	MJ	soil heat content		CLM-CASA, CLM-CN
<b>Soil Plus Snow Heat Content</b>				
HCSOISNO	MJ	soil plus snow heat content		CLM-CASA, CLM-CN

Hydraulic Conductivity				
HK	mm/s	hydraulic conductivity		CLM-CASA, CLM-CN
Urban Canyon Height to Width Ratio				
HWR	none	urban canyon height to width ratio		CLM-CASA, CLM-CN
Index for Start of Growing Season				
ISEABEG	unitless	index for start of growing season		CLM-CASA, CLM-CN
Isoprene Flux				
ISOPRENE	uG/M2/H	isoprene flux		CLM-CASA, CLM-CN
Shaded Projected Leaf Area Index				
LAISHA	none	shaded projected leaf area index		CLM-CASA, CLM-CN
Sunlit Projected Leaf Area Index				
LAI SUN	none	sunlit projected leaf area index		CLM-CASA, CLM-CN
Leaf C Allocation				
LEAFC_ALLOC	gC/m2/s	leaf C allocation		CLM-CASA, CLM-CN
Leaf C Loss				
LEAFC_LOSS	gC/m2/s	leaf C loss		CLM-CASA, CLM-CN
Leaf Litter C				
LEAF_LITTERC	gC/m2	leaf litter C		CLM-CASA, CLM-CN
Leaf Litter Heterotrophic Respiration				
LEAF_LITTERC_HR	gC/m2/s	leaf litter heterotrophic respiration		CLM-CASA, CLM-CN
Leaf Litter C Loss				
LEAF_LITTERC_LOSS	gC/m2/s	leaf litter C loss		CLM-CASA, CLM-CN
Growing Season Index				
LGROW	none	growing season index (0 or 1)		CLM-CASA, CLM-CN
Litter Heterotrophic Respiration				
LITTERC_HR	gC/m2/s	litter heterotrophic respiration		CLM-CASA, CLM-CN
Litter C Loss				
LITTERC_LOSS	gC/m2/s	litter C loss		CLM-CASA, CLM-CN
Live Fraction for Leaf, Wood, Froot				
LIVEFR	g/m2	live fraction for leaf, wood, froot		CLM-CASA, CLM-CN
Monoterpene Flux				
MONOTERP	uG/M2/H	monoterpene flux		CLM-CASA, CLM-CN
Nstep at Start of Growing Season				
NSTEPBEG	none	nstep at start of growing season		CLM-CASA, CLM-CN
Other Reactive VOC Flux				
ORVOC	uG/M2/H	other reactive VOC flux		CLM-CASA, CLM-CN
Other VOC Flux				
OVOC	uG/M2/H	other VOC flux		CLM-CASA, CLM-CN
Atmospheric Pressure				
PBOT	Pa	atmospheric pressure		CLM-CASA, CLM-CN

Atmospheric Partial Pressure of CO2				
PCO2	Pa	atmospheric partial pressure of CO2		CLM-CASA, CLM-CN
Potential Evapotranspiration				
PET	mm h2o/s	Potential Evapotranspiration		CLM-CASA, CLM-CN
Prognostic Leaf Area Index				
PLAI	m2/m2	Prognostic Leaf Area Index		CLM-CASA, CLM-CN
2-m Specific Humidity				
Q2M	kg/kg	2-m specific humidity		CLM-CASA, CLM-CN
Rural 2-m Specific Humidity				
Q2M_R	kg/kg	Rural 2-m specific humidity		CLM-CASA, CLM-CN
Urban 2-m Specific Humidity				
Q2M_U	kg/kg	Urban 2-m specific humidity		CLM-CASA, CLM-CN
Atmospheric Specific Humidity				
QBOT	kg/kg	atmospheric specific humidity		CLM-CASA, CLM-CN
RTM River Flow: LIQ				
QCHANR	m3/s	RTM river flow: LIQ		CLM-CASA, CLM-CN
RTM River Flow: ICE				
QCHANR_ICE	m3/s	RTM river flow: ICE		CLM-CASA, CLM-CN
Aquifer Recharge Rate				
QCHARGE	mm/s	aquifer recharge rate		CLM-CASA, CLM-CN
RTM River Discharge Into Ocean: LIQ				
QCHOCNR	m3/s	RTM river discharge into ocean: LIQ		CLM-CASA, CLM-CN
RTM River Discharge Into Ocean: ICE				
QCHOCNR_ICE	m3/s	RTM river discharge into ocean: ICE		CLM-CASA, CLM-CN
Sub-surface Drainage				
QDRAI	mm/s	sub-surface drainage		CLM-CASA, CLM-CN
Throughfall				
QDRIP	mm/s	throughfall		CLM-CASA, CLM-CN
Diffusion Flux into Soil Layer				
QFLX_IN_SOIL	mm/s	diffusion flux into soil layer		CLM-CASA, CLM-CN
Diffusion Flux out of Soil Layer				
QFLX_OUT_SOIL	mm/s	diffusion flux out of soil layer		CLM-CASA, CLM-CN
Soil Saturation Excess				
QFLX_RSUB_SAT	mm/s	soil saturation excess		CLM-CASA, CLM-CN
Transpiration Flux out of Soil Layer				
QFLX_TRAN_SOIL	mm/s	transpiration flux out of soil layer		CLM-CASA, CLM-CN
Infiltration				

QINFL	mm/s	infiltration		CLM-CASA, CLM-CN
<b>Interception</b>				
QINTR	mm/s	interception		CLM-CASA, CLM-CN
<b>Snow Melt</b>				
QMELT	mm/s	snow melt		CLM-CASA, CLM-CN
<b>Surface Runoff</b>				
QOVER	mm/s	surface runoff		CLM-CASA, CLM-CN
<b>Surface Runoff at Glaciers, Wetlands, Lakes</b>				
QRGWL	mm/s	surface runoff at glaciers, wetlands, lakes		CLM-CASA, CLM-CN
<b>Total Runoff</b>				
QRUNOFF	mm/s	total runoff		CLM-CASA, CLM-CN
<b>Rural Total Runoff</b>				
QRUNOFF_R	mm/s	Rural total runoff		CLM-CASA, CLM-CN
<b>Urban Total Runoff</b>				
QRUNOFF_U	mm/s	Urban total runoff		CLM-CASA, CLM-CN
<b>Excess Snowfall Due to Snow Capping</b>				
QSNWCPIECE	mm H2O/s	excess snowfall due to snow capping		CLM-CASA, CLM-CN
<b>Ground Evaporation</b>				
QSOIL	mm/s	ground evaporation		CLM-CASA, CLM-CN
<b>Canopy Evaporation</b>				
QVEGE	mm/s	canopy evaporation		CLM-CASA, CLM-CN
<b>Canopy Transpiration</b>				
QVEGT	mm/s	canopy transpiration		CLM-CASA, CLM-CN
<b>Atmospheric Rain</b>				
RAIN	mm/s	atmospheric rain		CLM-CASA, CLM-CN
<b>Atmospheric Rain Forcing</b>				
RAINATM	mm/s	atmospheric rain forcing		CLM-CASA, CLM-CN
<b>Land Rain on ATM Grid</b>				
RAINFM2A	mm/s	land rain on atm grid		CLM-CASA, CLM-CN
<b>Amt. of Carbon Lost to ATM by Pool</b>				
RESP_C	g/m2/s	Amt. of Carbon lost to atm by pool		CLM-CASA, CLM-CN
<b>2-m Relative Humidity</b>				
RH2M	%	2-m relative humidity		CLM-CASA, CLM-CN
<b>Shaded Leaf Stomatal Resistance</b>				
RSSHA	s/m	shaded leaf stomatal resistance		CLM-CASA, CLM-CN
<b>Sunlit Leaf Stomatal Resistance</b>				
RSSUN	s/m	sunlit leaf stomatal resistance		CLM-CASA, CLM-CN
<b>Solar Rad Absorbed by Ground</b>				
SABG	watt/m^2	solar rad absorbed by ground		CLM-CASA, CLM-CN
<b>Solar Rad Absorbed by Veg</b>				

SABV	watt/m <sup>2</sup>	solar rad absorbed by veg		CLM-CASA, CLM-CN
<b>Soil Moisture for Top 30 cm</b>				
SMOIST	mm3/mm3	Soil moisture for top 30 cm		CLM-CASA, CLM-CN
<b>Soil Matric Potential</b>				
SMP	mm	soil matric potential		CLM-CASA, CLM-CN
<b>Atmospheric Snow</b>				
SNOW	mm/s	atmospheric snow		CLM-CASA, CLM-CN
<b>Snow Age</b>				
SNOWAGE	unitless	snow age		CLM-CASA, CLM-CN
<b>Atmospheric Snow Forcing</b>				
SNOWATM	mm/s	atmospheric snow forcing		CLM-CASA, CLM-CN
<b>Snow Height</b>				
SNOWDP	m	snow height		CLM-CASA, CLM-CN
<b>Land Snow on ATM Ggrid</b>				
SNOWFM2A	mm/s	land snow on atm grid		CLM-CASA, CLM-CN
<b>Snow Ice</b>				
SNOWICE	kg/m <sup>2</sup>	snow ice		CLM-CASA, CLM-CN
<b>Snow Liquid Wter</b>				
SNOWLIQ	kg/m <sup>2</sup>	snow liquid water		CLM-CASA, CLM-CN
<b>Soil Heterotrophic Respiration</b>				
SOILC_HR	gC/m <sup>2</sup> /s	soil heterotrophic respiration		CLM-CASA, CLM-CN
<b>Soil C Loss</b>				
SOILC_LOSS	gC/m <sup>2</sup> /s	soil C loss		CLM-CASA, CLM-CN
<b>Soil Ice</b>				
SOILICE	kg/m <sup>2</sup>	soil ice		CLM-CASA, CLM-CN
<b>Soil Liquid Water</b>				
SOILLIQ	kg/m <sup>2</sup>	soil liquid water		CLM-CASA, CLM-CN
<b>Soil Water Potential in each Soil Layer</b>				
SOILPSI	MPa	soil water potential in each soil layer		CLM-CASA, CLM-CN
<b>Soil Temperature For Top 30 cm</b>				
SOILT	deg C	Soil temperature for top 30 cm		CLM-CASA, CLM-CN
<b>Cold + Drought Stress Function for Leaf Loss</b>				
STRESSCD		cold + drought stress function for leaf loss		CLM-CASA, CLM-CN
<b>Temperature Stress Function for Leaf Loss</b>				
STRESST		temperature stress function for leaf loss		CLM-CASA, CLM-CN
<b>Water Stress Function for Leaf Loss</b>				
STRESSW		water stress function for leaf loss		CLM-CASA, CLM-CN
<b>Factor Limiting Ground Evap</b>				
SoilAlpha	unitless	factor limiting ground evap		CLM-CASA, CLM-CN

Urban Factor limiting Ground Evap				
SoilAlpha_U	unitless	urban factor limiting ground evap		CLM-CASA, CLM-CN
Zonal Surface Stress				
TAUX	kg/m/s^2	zonal surface stress		CLM-CASA, CLM-CN
Meridional Surface Stress				
TAUY	kg/m/s^2	meridional surface stress		CLM-CASA, CLM-CN
Atmospheric Air Temperature				
TBOT	K	atmospheric air temperature		CLM-CASA, CLM-CN
Daily Averaged Temperature				
TDAYAVG	deg C	Daily Averaged Temperature		CLM-CASA, CLM-CN
Ground Temperature				
TG	K	ground temperature		CLM-CASA, CLM-CN
Rural Ground Temperature				
TG_R	K	Rural ground temperature		CLM-CASA, CLM-CN
Urban Ground Temperature				
TG_U	K	Urban ground temperature		CLM-CASA, CLM-CN
Atmospheric Air Potential Temperature				
THBOT	K	atmospheric air potential temperature		CLM-CASA, CLM-CN
Lake Temperature				
TLAKE	K	lake temperature		CLM-CASA, CLM-CN
Total Carbon for Pool				
TPOOL_C	g/m2	Total Carbon for pool		CLM-CASA, CLM-CN
Daily Minimum of Average 2-m Temperature				
TREFMNAV	K	daily minimum of average 2-m temperature		CLM-CASA, CLM-CN
Rural Daily Minimum of Average 2-m Temperature				
TREFMNAV_R	K	Rural daily minimum of average 2-m temperature		CLM-CASA, CLM-CN
Urban Daily Minimum of Average 2-m Temperature				
TREFMNAV_U	K	Urban daily minimum of average 2-m temperature		CLM-CASA, CLM-CN
Daily Maximum of Average 2-m Temperature				
TREFMXAV	K	daily maximum of average 2-m temperature		CLM-CASA, CLM-CN
Rural Daily Maximum of Average 2-m Temperature				
TREFMXAV_R	K	Rural daily maximum of average 2-m temperature		CLM-CASA, CLM-CN

Urban Daily Maximum of Average 2-m Temperature				
TREFMXAV_U	K	Urban daily maximum of average 2-m temperature		CLM-CASA, CLM-CN
2-m Air Temperature				
TSA	K	2-m air temperature		CLM-CASA, CLM-CN
Total Projected Stem Area Index				
TSAI	none	total projected stem area index		CLM-CASA, CLM-CN
Urban 2-m Air Temperature				
TSA_U	K	Urban 2-m air temperature		CLM-CASA, CLM-CN
Snow Temperature				
TSNOW	K	snow temperature		CLM-CASA, CLM-CN
Soil Temperature				
TSOI	K	soil temperature		CLM-CASA, CLM-CN
Vegetation Temperature				
TV	K	vegetation temperature		CLM-CASA, CLM-CN
Total VOC Flux Into Atmosphere				
VOCFLXT	uG/M2/H	total VOC flux into atmosphere		CLM-CASA, CLM-CN
Water in the Unconfined Aquifer				
WA	mm	water in the unconfined aquifer		CLM-CASA, CLM-CN
Watdry for Entire Column				
WATDRY	mm3/mm3	watdry for entire column		CLM-CASA, CLM-CN
Watopt for Entire Column				
WATOPT	mm3/mm3	watopt for entire column		CLM-CASA, CLM-CN
Atmospheric Wind Velocity Magnitude				
WIND	m/s	atmospheric wind velocity magnitude		CLM-CASA, CLM-CN
Water Lmitation Used in BGMoist (atmp factor)				
WLIM	none	Water limitation used in bgmoist (atmp factor)		CLM-CASA, CLM-CN
Wood C Allocation				
WOODC_ALLOC	gC/m2/s	wood C allocation		CLM-CASA, CLM-CN
Wood C Loss				
WOODC_LOSS	gC/m2/s	wood C loss		CLM-CASA, CLM-CN
Total Water Storage				
WT	mm	total water storage (unsaturated soil water + groundwater)		CLM-CASA, CLM-CN
Total Excess Carbon				
XSCPOOL	g/m2	total excess Carbon		CLM-CASA, CLM-CN
Atmospheric Reference Height				
ZBOT	m	atmospheric reference height		CLM-CASA, CLM-CN
Reference Height Forc_hgt+z0+d for each PFT				

ZBOT_PFT	m	reference height forc_hgt+z0+d for each pft		CLM-CASA, CLM-CN
<b>Water Table Depth</b>				
ZWT	m	water table depth		CLM-CASA, CLM-CN

## 2.7. Companion Files

Table 8. Companion Files

FILE NAME	DESCRIPTION
Regional-Description_of_Observations_and_Models.pdf	Overview of observation measurement data and terrestrial biosphere and inverse models, including descriptions, sources, contacts, and a comprehensive reference list
NACP_Model_Characteristics.pdf	Overview of process descriptions in participating TBMs and boundary conditions and driver data used in participating TBMs with a comprehensive reference list
NACP_Model_Metadata_Survey_Results.pdf	Metadata for TBMs Intercomparison: Site Model Data Comparison and Regional Model Data Comparison: Survey Results
OM_FIA_Biomass_Original_blackard_etal_2008RSE.pdf	
OM_FIA_Biomass_Original_conus_forest_biomass_Metadata.htm	
OM_Flux-Anoma-ly_Original_Schwalm.Anomaly.Metadata.doc	
TBM_BEPS_Original_readme.doc	
TBM_CASA-Transcom_Original_read_me.txt	
TBM_Can-IBIS_Original_README.txt	
TBM_DLEM_Original_OVERVIEW.doc	
TBM_EC-LUE_Original.doc	
TBM_NASA-CASA_Original_readme.txt	
TBM_NASA-CASA_Original_readme_nasacasa_updated.txt	
TBM_NASA-CASA_Original_usmask3.readme.txt	
TBM_TEM6_Original_TEM_NACP_Documentation.doc	

## 3. Data Application and Derivation:

This data product contributes to a multidisciplinary research program to obtain scientific understanding of North America's carbon sources and sinks and of changes in carbon stocks needed to meet societal concerns and to provide tools for decision makers. It is part of a NACP regional and continental synthesis to evaluate and inter-compare models and observation measurements across North America. This work provides a valuable assessment of the current status of terrestrial carbon modeling in North America by bringing together model estimates that incorporate a wide range of modeling choices and input data. This work also serves as a starting point for analyses that compare these model results to different observational data products.

## 4. Quality Assessment:

This data set provides the original observation measurements and model simulation output results that MAST-DC acquired or received from contributing investigators. No further data processing was done by MAST-DC to values in this data set. The data represent "off-the-shelf" observations and model simulations (i.e., existing data and model results currently available from analyses that have been completed by ongoing NACP projects and other recently published studies).

The range in estimates of regional land-atmosphere carbon fluxes from the participating models appears to be driven by a combination of factors. The models differ from each other because they are based on different simplifying assumptions and use different approaches (forward vs. inverse) and modeling strategies (detailed process, statistical, or observation based). They also differ structurally in how they represent the processes controlling carbon exchange between the land and atmosphere (e.g., representation of photosynthesis), in their input or environmental driver data (e.g., land cover, climate variables) and the temporal variability of those data, in their initial conditions, and in the parameter values used within their varying process descriptions. The gridded observation data also differ with regards to biome type, acquisition methods, spatial coverage and resolution, and temporal coverage and resolution. These varying approaches result in a large degree of variability in estimates of regional land-atmosphere carbon fluxes.

The variability in carbon flux estimates highlights the need for further analysis through the use of model runs following a common simulation protocol, in

order to isolate the influences of model formulation, structure, and assumptions on flux estimates. A more formal model-data comparison is required to more definitively quantify the impact of model formulation and supporting and driver data on the accuracy of the simulation model outputs. Such efforts are underway by NACP, requiring substantial technical support for model participation, development of consistent and optimal environmental driver data sets, a unified intercomparison protocol, as well as coordination of the intercomparison effort across research groups. These NACP projects include (1) working to understand how model formulation and model choices impact overall model performance through the use of detailed simulation protocol and controlled input environmental driver data (e.g., Schwalm et al., 2010) and (2) the Multi-Scale Synthesis and Terrestrial Model Intercomparison Project (MsTMIP), which directly builds on the NACP regional synthesis products presented here.

## 5. Data Acquisition Materials and Methods:

Several types of observation measurements were assembled to be compared against simulation model output. These include MODIS-GPP/NPP, MODIS-fPAR/LAI, MODIS-EVI/NDVI, crop carbon yield, forest biomass, and carbon flux anomalies at AmeriFlux and Fluxnet-Canada locations. The methods for acquiring these measurements are summarized in a separate document: [NACP Regional Synthesis - Description of Observations and Models](#) and relevant references therein.

Twenty-eight simulation models participated in the regional synthesis. These models included ecosystem (bottom-up) models for forward analyses, and similar models used for inversion analyses. These are complementary approaches to analyzing the synthesis questions. The forward or bottom-up models provided analysis results at the temporal and spatial resolution of simulation runs more-or-less "in hand." These ranged from hourly to annual time steps, summarized to a monthly scale, and 1-km to county to 1-degree spatial resolution. The inverse analysis models provided model results at the spatial resolution of the North America TRANSCOM region (1 degree resolution), and monthly temporal resolution. The participating models are described in a separate document: [NACP Regional Synthesis - Description of Observations and Models](#) and relevant references therein.

### Data Center Processing

The Data Center (ORNL DAAC) transformed some of the originally-submitted data files to file formats that are more suitable for long-term archiving. For example, \*.xlsx files were saved as \*.csv, ERDAS Imagine files were converted to GeoTIFFs, and MATLAB files were converted to GeoTIFF and NetCDF formats as appropriate. Files received in NetCDF, GeoTIFF, and HDF formats were not transformed.

The OM, TBM, and IM original data that MAST-DC acquired also vary in spatial and temporal resolution, and spatial and temporal extent. The Data Center performed some file format transformations but the spatial and temporal resolutions and extents are unchanged.

## 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:

Denning, A.S., et al. 2005. Science implementation strategy for the North American Carbon Program: A Report of the NACP Implementation Strategy Group of the U.S. Carbon Cycle Interagency Working Group. U.S. Carbon Cycle Science Program, Washington, DC. 68 pp.

Huntzinger, D.N., W.M. Post, Y. Wei, A.M. Michalak, T.O. West, A.R. Jacobson, I.T. Baker, J.M. Chen, K.J. Davis, D.J. Hayes, F.M. Hoffman, A.K. Jain, S. Liu, A.D. McGuire, R.P. Neilson, C. Potter, B. Poulter, D. Price, B.M. Raczka, H.Q. Tian, P. Thornton, E. Tomelleri, N. Viovy, J. Xiao, W. Yuan, N. Zeng, M. Zhao, and R. Cook. 2012. North American Carbon Program (NACP) regional interim synthesis: Terrestrial biospheric model intercomparison. *Ecological Modelling* 232(10): 144-157. [doi:10.1016/j.ecolmodel.2012.02.004](https://doi.org/10.1016/j.ecolmodel.2012.02.004)

Schwalm, C. R., et al. 2010. A model-data intercomparison of CO<sub>2</sub> exchange across North America: Results from the North American Carbon Program site synthesis. *J. Geophys. Res.* 115: G00H05. [doi:10.1029/2009JG001229](https://doi.org/10.1029/2009JG001229)

Wofsy, S.C., and R.C. Harriss. 2002. The North American Carbon Program (NACP). Report of the NACP Committee of the U.S. Interagency Carbon Cycle Science Program. U.S. Global Change Research Program, Washington, DC. 56 pp.

### Additional Sources of Information:

Please see the Reference section in the [NACP Regional Synthesis - Description of Observations and Models](#) document for publications related to the observation measurements, TBMs, and IMs used in this study.

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