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NACP Regional: Supplemental Gridded Observations, Biosphere and Inverse Model Outputs

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Revision Date: May 2, 2013

Summary:

This data set contains standardized gridded observation data, terrestrial biospheric model output, and inverse model simulations that were compiled but not used in the North American Carbon Program (NACP) Regional Synthesis activities, thus the supplemental designation. The data set provides six (6) observation data packages (9 variables - MODIS LAI, MODIS FPAR, MODIS NDVI, MODIS EVI, FIA forest biomass, forest area, GPP Anomaly, NEE Anomaly, Reco Anomaly; 8 data files), output results from three terrestrial biosphere models (TBM) (14 variables; 214 files), and simulations from one inverse model (IM) (one variable; 1 file).

To produce this data set, the NACP Modeling and Synthesis Thematic Data Center (MAST-DC) original data files were resampled to 1-degree spatial resolution for North American region (except for FIA Forest Biomass which was resampled to 0.5-degree resolution), interpolated into monthly or yearly temporal resolution, and reformatted into Climate and Forecast (CF) convention compatible netCDF format.

This data set is related to the original data submissions and two additional regional processed data sets (i.e., gridded 1-deg observation data and biosphere and inverse model outputs; and national greenhouse gas (GHG) inventories and model outputs aggregated by GHG inventory zones (see Related Data Products below). Detailed descriptions of observation data, TBMs, and IMs can be found in [Regional-Description_of_Observations_and_Models.pdf](#).

MAST-DC was a component of the NACP (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=1158

Companion Documentation for this Data Set:

- Regional Synthesis Documentation: [Regional-Description_of_Observations_and_Models.pdf](#).

Model Characteristics Overview and References: [NACP_Model_Characteristics.pdf](#)

Related Data Products:

- NACP Regional: Gridded 1-deg Observation Data and Biosphere and Inverse Model Outputs [http://daac.ornl.gov/cgi-bin/dsviewer.pl?ds_id=1157]
- NACP Regional: National Greenhouse Gas Inventories and Aggregated Gridded Model Data
- NACP Regional: Original Observation Data and Biosphere and Inverse Model Outputs

Data Citation:

Cite this data set as follows:

Wei, Y., W.M. Post, R.B. Cook, P.E. Thornton, A.R. Jacobson, D.N. Huntzinger, F.M. Hoffman, G.G. Moisen, A.E. Schuh, C.R. Schwalm, and N. Viovy. 2013. NACP Regional: Supplemental Gridded Observations, Biosphere and Inverse Model Outputs. Data set. Available on-line [<http://daac.ornl.gov>] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. <http://dx.doi.org/10.3334/ORNLDAAC/1158>

Table of Contents:

- [1 Data Set Overview](#)
- [2 Data Description](#)
- [3 Applications and Derivation](#)
- [4 Quality Assessment](#)
- [5 Acquisition Materials and Methods](#)
- [6 Data Access](#)
- [7 References](#)

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.

Recently, NACP and 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 were conducted, including ones focusing on non-CO₂ 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 supplemental gridded observation measurements and TBM and IM output data that were processed by MAST-DC but not used in the NACP Regional Interim Synthesis activities. The data set includes six (6) OM data granules (MODIS LAI, MODIS FPAR, MODIS NDVI, MODIS EVI, FIA Forest Biomass/Area, and Flux Anomaly), three (3) TBM data granules, and one IM data granule (Table 1). To produce this data set, the originally-submitted data were resampled to 1-degree spatial resolution for North American region (except for FIA Forest Biomass which was resampled to 0.5-degree resolution), interpolated into monthly or yearly temporal resolution, and reformatted into Climate and Forecast (CF) convention compatible netCDF format (Table 2).

This data set is related to two other processed regional data sets (i.e., gridded 1-degree observation data and biosphere and inverse model outputs used in the NACP Regional Synthesis activities; and national greenhouse gas (GHG) inventories and model outputs aggregated by GHG inventory zones) and the originally-submitted observation data and model outputs (see Related Data Products above). Detailed descriptions of observation data and models can be found in a separate document: [Regional-Description_of_Observations_and_Models.pdf](#).

Table 1. Contributors

Last Name	First Name	Organization	Email	Role
Wei	Yaxing	ORNL	weiy@ornl.gov	MAST-DC
Post	Wilfred M.	University of Tennessee	wmp@ornl.gov	MAST-DC
Cook	Robert B.	ORNL	cookrb@ornl.gov	MAST-DC
Thornton	Peter E.	ORNL	thorntonpe@ornl.gov	MAST-DC,

				CLM-CN
Jacobson	Andy	NOAA	andy.jacobson@noaa.gov	Synthesis Lead, CarbonTracker
Huntzinger	Deborah N.	Northern Arizona University	deborah.huntzinger@nau.edu	Synthesis Lead
Hoffman	Forrest	ORNL	forrest@climatemodeling.org	CLM-CASA
Moisen	Gretchen G.	USDA Forest Service	gmoisen@fs.fed.us	U.S. Forest Biomass
Schuh	Andrew	Colorado State University	aschuh@atmos.colostate.edu	CSU no.2
Schwalm	Christopher	Northern Arizona University	Christopher.Schwalm@nau.edu	Flux Anomaly
Viovy	Nicolas	LSCE	viovy@lsce.ipsl.fr	ORCHIDEE

Table 2. List of Observation Data and Models in the Supplemental Gridded Analysis

OBSERVATION MEASUREMENTS	
Observation Data	Short Name
MODIS MOD15A2GFS Leaf Area Index (LAI)	LAI (MODIS for NACP, gap-filled, smoothed)
MODIS MOD15A2GFS Fraction of Photosynthetically Active Radiation (fPAR)	fPAR (MODIS for NACP, gap-filled, smoothed)
MODIS MOD09A1G_NDVI Normalized Difference Vegetation Index (NDVI)	NDVI (MODIS for NACP, gap-filled, smoothed)
MODIS MOD09A1G_EVI Enhanced Vegetation Index (EVI)	EVI (MODIS for NACP, gap-filled, smoothed)
Conterminous U.S. Forest Biomass	FIA Forest Biomass
Terrestrial Ecosystem Productivity and Respiration Anomalies	Flux Anomaly
TERRESTRIAL BIOSPHERE MODELS	
Prognostic Models	Short Name
Community Land Model with CASA (i01.54, i01.54_q15, i01.55)	CLM-CASA (i01.54, i01.54_q15, i01.55)
Community Land Model with Carbon&Nitrogen (i01.56)	CLM-CN (i01.56)
Organizing Carbon and Hydrology in Dynamic Ecosystems model (v2.1)	ORCHIDEE (v2.1)
INVERSE MODELS	
Inversion Models	Short Name
CSU no. 2 (MLEF-PCTM) model	CSU-no2

Table 3. Data Packages Summary

Data Set	Sub Category	Variables	Files	File Formats
Supplemental Gridded Data	Observations (OM)	9 (LAI, fPAR, NDVI, EVI, Forest Biomass, Forest Area, GPP Anomaly, NEE Anomaly, Reco Anomaly)	8	netCDF
	Forward Terrestrial Biosphere Model (TBM)	14	214	netCDF

	Outputs			
	Inverse Model (IM) Outputs	1 (NEE)	1	netCDF

2. Data Description:

This data set contains a total of 223 data files (8 OM data files, 214 TBM output data files, and 1 IM output data file). The data have been resampled by MAST-DC to a standard 1-degree spatial resolution for North American region (except for FIA Forest Biomass which was resampled to 0.5-degree resolution for the conterminous United States), interpolated into monthly or yearly temporal resolution, converted to a standard measurement unit (generally, kg C/m²/month or year), and reformatted into CF convention compatible netCDF format.

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

1 degree x 1 degree (except FIA Forest Biomass which is half degree resolution)

2.3. Spatial Coordinate Reference System

Sphere-based Geographic Lat/Lon

In CF-compatible netCDF files, it's defined as:

char crs;

crs:grid_mapping_name = "latitude_longitude";

crs:semi_major_axis = 6370997.0f;

crs:inverse_flattening = 0.0f;

2.4. Temporal Coverage

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

2.5. Temporal Resolution

Monthly or one time

2.6. Time Variable:

Units: "days since 1990-01-01 UTC"

Calendar: "noleap"

2.7. Data File Information

All of the data files are CF convention 1.0 compatible netCDF v3 formatted. Spatial resolution for all files is 1 degree x 1 degree (except FIA Forest Biomass which is half degree resolution). Spatial extent for all files is North America (except for FIA Forest Biomass which covers the conterminous United States only). Temporal resolution is monthly (except FIA Forest Biomass which is one time). Temporal extent varies as noted in Tables 3-5. Missing values are designated by the value -9999.0.

Table 4. Observation Measurements (OM) Data Files

FILE NAMES		TEMPORAL EXTENT	UNITS	VARIABLE
COMPRESSED FILE NAMES *	UNCOMPRESSED DATA FILE NAMES			
OM_MODIS_LAI_Supplemental.zip	OM_MODIS_LAI_1d.nc	2000-2005	dimensionless ratio (m ² /m ²)	Leaf area index (MODIS LAI)
OM_MODIS_fPAR_Supplemental.zip	OM_MODIS_fPAR_1d.nc	2000-2005		Fraction of photosynthetically active radiation (MODIS fPAR)
OM_MODIS_NDVI_Supplemental.zip	OM_MODIS_NDVI_1d.nc	2000-2005	index range: 0-1	Normalized difference vegetation index (MODIS NDVI)
				Enhanced vegetation index (MODIS

OM_MODIS_EVI_Supplemental.zip	OM_MODIS_EVI_1d.nc	2000-2005		EVI)
OM_FIA_Biomass_Supplemental.zip	OM_FIA_Biomass_hd.nc	~2000	kg C/m ² of forest	Forest biomass (half degree resolution)
			m ²	Forest area (half degree resolution)
OM_Flux-Anomaly_Supplemental.zip	FLUX_GPP_Anomaly_onedeg_v1.0.nc	1990-2008	kg C/m ² /mo	Gross primary production anomaly (GPP Anomaly)
	FLUX_NEE_Anomaly_onedeg_v1.0.nc			Net ecosystem exchange anomaly (NEE Anomaly)
	FLUX_Reco_Anomaly_onedeg_v1.0.nc			Ecosystem respiration anomaly (Reco Anomaly)

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

FILE NAMES		TEMPORAL EXTENT	UNITS	VARIABLE
COMPRESSED FILE NAMES *	UNCOMPRESSED DATA FILE NAMES			
TBM_CLM-CASA_Supplemental.zip	TBM_CLM-CASA_CWDC_1d_i01.54casa.nc	1990-2004	kg C/m ²	Coarse woody debris carbon (CWDC)
	TBM_CLM-CASA_CWDC_1d_i01.54casa_q15.nc			
	TBM_CLM-CASA_CWDC_1d_i01.55casa.nc			
	TBM_CLM-CASA_FROOTC_1d_i01.54casa.nc	1990-2004	kg C/m ²	Fine root carbon (FROOTC)
	TBM_CLM-CASA_FROOTC_1d_i01.54casa_q15.nc			
	TBM_CLM-CASA_FROOTC_1d_i01.55casa.nc			
	TBM_CLM-CASA_GPP_1d_i01.54casa.nc	1990-2004	kg C/m ² /mo	GPP
	TBM_CLM-CASA_GPP_1d_i01.54casa_q15.nc			
	TBM_CLM-CASA_GPP_1d_i01.55casa.nc			
	TBM_CLM-CASA_HR_1d_i01.54casa.nc	1990-2004	kg C/m ² /mo	Heterotrophic respiration (HR)
	TBM_CLM-CASA_HR_1d_i01.54casa_q15.nc			
	TBM_CLM-CASA_HR_1d_i01.55casa.nc			
	TBM_CLM-CASA_landfrac_1d_i01.54casa.nc	1990-2004	Range: 0-1	Land fraction
	TBM_CLM-CASA_landfrac_1d_i01.54casa_q15.nc			
	TBM_CLM-CASA_landfrac_1d_i01.55casa.nc			
	TBM_CLM-CASA_LEAFC_1d_i01.54casa.nc	1990-2004	kg C/m ²	Leaf carbon (LEAFC)
	TBM_CLM-CASA_LEAFC_1d_i01.54casa_q15.nc			
	TBM_CLM-CASA_LEAFC_1d_i01.55casa.nc			
	TBM_CLM-CASA_LITTERC_1d_i01.54casa.nc	1990-2004	kg C/m ²	Litter carbon
	TBM_CLM-CASA_LITTERC_1d_i01.54casa_q15.nc			
	TBM_CLM-CASA_LITTERC_1d_i01.55casa.nc			
	TBM_CLM-CASA_NEE_1d_i01.54casa.nc	1990-2004	kg C/m ² /mo	NEE
	TBM_CLM-CASA_NEE_1d_i01.54casa_q15.nc			
	TBM_CLM-CASA_NEE_1d_i01.55casa.nc			
	TBM_CLM-CASA_NEP_1d_i01.54casa.nc	1990-2004	kg C/m ² /mo	NEP
	TBM_CLM-CASA_NEP_1d_i01.54casa_q15.nc			
	TBM_CLM-CASA_NEP_1d_i01.55casa.nc			
	TBM_CLM-CASA_NPP_1d_i01.54casa.nc	1990-2004	kg C/m ² /mo	NPP
	TBM_CLM-CASA_NPP_1d_i01.54casa_q15.nc			
	TBM_CLM-CASA_NPP_1d_i01.55casa.nc			
TBM_CLM-CASA_SOILC_1d_i01.54casa.nc	1990-2004	kg C/m ²	Total soil organic matter carbon	
TBM_CLM-CASA_SOILC_1d_i01.54casa_q15.nc				
TBM_CLM-CASA_SOILC_1d_i01.55casa.nc				
TBM_CLM-CASA_TLAI_1d_i01.54casa.nc	1990-2004	dimensionless ratio	Total projected leaf area	
TBM_CLM-CASA_TLAI_1d_i01.54casa_q15.nc				

	TBM_CLM-CASA_TLAI_1d_i01.55casa.nc		(m ² /m ²)	index
	TBM_CLM-CASA_VegC_1d_i01.54casa.nc	1990-2004	kg C/m ²	Vegetation carbon (derived from LEAFC+WOODC+FROOTC)
	TBM_CLM-CASA_VegC_1d_i01.54casa_q15.nc			
	TBM_CLM-CASA_VegC_1d_i01.55casa.nc			
	TBM_CLM-CASA_WOODC_1d_i01.54casa.nc	1990-2004	kg C/m ²	Wood carbon (WOODC)
	TBM_CLM-CASA_WOODC_1d_i01.54casa_q15.nc			
	TBM_CLM-CASA_WOODC_1d_i01.55casa.nc			
TBM_CLM-CN_Supplemental.zip	TBM_CLM-CN_CWDC_1d_i01.56cn.nc	1990-2004	kg C/m ²	Coarse woody debris carbon (CWDC)
	TBM_CLM-CN_FROOTC_1d_i01.56cn.nc			Fine root carbon (FROOTC)
	TBM_CLM-CN_GPP_1d_i01.56cn.nc	1990-2004	kg C/m ² /mo	GPP
	TBM_CLM-CN_HR_1d_i01.56cn.nc			Heterotrophic respiration (HR)
	TBM_CLM-CN_landfrac_1d_i01.56cn.nc	1990-2004	Range: 0-1	Land fraction
	TBM_CLM-CN_LEAFC_1d_i01.56cn.nc	1990-2004	kg C/m ²	Leaf carbon (LEAFC)
	TBM_CLM-CN_LITTERC_1d_i01.56cn.nc			Litter carbon
	TBM_CLM-CN_NEE_1d_i01.56cn.nc	1990-2004	kg C/m ² /mo	NEE
	TBM_CLM-CN_NEP_1d_i01.56cn.nc			NEP
	TBM_CLM-CN_NPP_1d_i01.56cn.nc			NPP
	TBM_CLM-CN_SOILC_1d_i01.56cn.nc	1990-2004	kg C/m ²	Total soil organic matter carbon
	TBM_CLM-CN_TLAI_1d_i01.56cn.nc	1990-2004	dimensionless ratio (m ² /m ²)	Total projected leaf area index
	TBM_CLM-CN_TOTVEGC_1d_i01.56cn.nc	1990-2004	kg C/m ²	Total vegetation carbon (derived from LEAFC+WOODC+FROOTC)
	TBM_CLM-CN_WOODC_1d_i01.56cn.nc			Wood carbon (WOODC)
TBM_ORCHIDEE_Supplemental.zip	TBM_ORCHIDEE_GPP_1d_v2.1.nc	1991-2008	kg C/m ² /mo	GPP
	TBM_ORCHIDEE_NEE_1d_v2.1.nc			NEE
	TBM_ORCHIDEE_NEP_1d_v2.1.nc			NEP
	TBM_ORCHIDEE_NPP_1d_v2.1.nc			NPP
	TBM_ORCHIDEE_NPPCrop_1d_v2.1.nc			Net primary production crop (NPPCrop)
	TBM_ORCHIDEE_Rh_1d_v2.1.nc			Heterotrophic respiration (Rh)

Notes: GPP = Gross Primary Production. NEE = Net Ecosystem Exchange. NEP = Net Ecosystem Production. NPP = Net Primary Production.

Table 6. Inverse Model (IM) Output Data Files

FILE NAMES		TEMPORAL EXTENT	UNITS	VARIABLE
COMPRESSED FILE NAMES *	UNCOMPRESSED DATA FILE NAMES			
IM_CSU-no2_Supplemental.zip	IM_CSU-no2_NEE_1d.nc	2004	kg C/m ² /month	NEE

Notes: NEE = Net Ecosystem Exchange.

2.8. Observation Data and Model Output Variables

Table 7. List of Observation Data and Model Output Variables

Short Name	Units	Long Name	Temporal Resolution	Observation/Models
Gross Primary Productivity (GPP)				

GPP	kg C m-2 month-1	gross primary production	monthly	CLM-CASA, CLM-CN, ORCHIDEE (v2.1)
GPP Anomaly	kg C m-2 month-1	gross primary production anomaly	monthly	Flux anomaly
Net Primary Productivity (NPP)				
NPP	kg C m-2 month-1	net primary production	monthly	CLM-CASA, CLM-CN, ORCHIDEE (v2.1)
NPPCrop	kg C m-2 month-1	net primary production crop	monthly	ORCHIDEE (v2.1)
Net Ecosystem Exchange (NEE)				
NEE	kg C m-2 month-1	net ecosystem exchange	monthly	CLM-CASA, CLM-CN, ORCHIDEE (v2.1), CSU-no2
NEE Anomaly	kg C m-2 month-1	net ecosystem exchange anomaly	monthly	Flux Anomaly
Net Ecosystem Production				
NEP	kg C m-2 month-1	net ecosystem production	monthly	CLM-CASA, CLM-CM
Biomass				
FIA Forest Biomass	kg C m-2 month-1	conterminous U.S. forest biomass	one time	FIA Forest Biomass
Total Respiration				
Reco Anomaly	kg C m-2 month-1	ecosystem respiration anomaly	monthly	Flux Anomaly
Heterotrophic Respiration				
Rh	kg C m-2 month-1	heterotrophic respiration	monthly	ORCHIDEE (v2.1)
HR	kg C m-2 month-1	heterotrophic respiration	monthly	CLM-CASA, CLM-CN
Total Soil Carbon: Total soil and litter carbon content vertically integrated over the entire soil column				
SOILC	kg C m-2	total soil organic matter C	monthly	CLM-CASA, CLM-CN
Leaf Area Index				
LAI	(-)	leaf area index	monthly	DLEM
TLAI	(-)	total projected leaf area index	monthly	CLM-CASA, CLM-CN
Coarse Woody Debris Carbon				
CWDC	kg C m-2	coarse woody debris C	monthly	CLM-CASA, CLM-CN
Wood Carbon				
WOODC	kg C m-2	wood C	monthly	CLM-CASA, CLM-CN
Fine Root Carbon				
FROOTC	kg C m-2	fine root C	monthly	CLM-CASA, CLM-CN
Land Fraction				
landfrac	(-)	land fraction	monthly	CLM-CASA, CLM-CN
Forest Land Area				
Forest area	m-2	conterminous U.S. forest area	one time	FIA Forest Biomass
Leaf Carbon				
LEAFC	kg C m-2	leaf C	monthly	CLM-CASA, CLM-CN
Litter Carbon				
LITTERC	kg C m-2	litter C	monthly	CLM-CASA, CLM-CN
Vegetation Carbon				
VegC	kg C m-2	vegetation C	monthly	CLM-CASA
TOTVEGC	kg C m-2	total vegetation carbon	monthly	CLM-CN
Enhanced Vegetation Index				
		enhanced vegetation		

EVI		index	monthly	MODIS EVI
Fraction of Photosynthetically Active Radiation				
fPAR		fraction of photosynthetically active radiation	monthly	MODIS fPAR
Normalized Difference Vegetation Index				
NDVI		normalized difference vegetation index	monthly	MODIS NDVI

2.9. Companion File Information

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

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. The data were generated by MAST-DC as part of a NACP regional and continental synthesis to evaluate and inter-compare models and observation measurements across North America. Although this work was not used in the NACP regional synthesis activities, the results can be used to compare the model outputs to different observational data products.

4. Quality Assessment:

This data set provides supplemental observation measurements and model simulation outputs that were compiled but not used in the NACP Regional Synthesis activities. The supplemental observation measurements and model simulation outputs were not used in the regional synthesis for one or more of the following reasons: (1) certain variables were not considered in the regional synthesis; (2) multiple versions of model outputs were provided; (3) the spatial extent of model output did not match the NACP regional synthesis study area, or (4) the spatial resolution did not match other standardized gridded data.

5. Data Acquisition Materials and Methods:

Original model simulation results and observation measurement data were resampled by MAST-DC to a standard 1-degree spatial resolution for North American region (except for FIA Forest Biomass which was resampled to 0.5-degree resolution), interpolated into monthly or yearly temporal resolution, converted to a standard measurement unit (generally, kg C/m²/month or year), and reformatted into CF convention compatible netCDF format.

Information about the specific data processing steps taken by MAST-DC are available by contacting the Data Center as indicated below.

6. Data Access:

This data set is available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

Data Archive:

Web Site: <http://daac.ornl.gov>

Contact for Data Center Access Information:

E-mail: 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.

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 [Regional-Description_of_Observations_and_Models.pdf](#) document for publications related to the observation measurements, TBMs, and IMs used in this study.



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 - Field Campaigns
 - Validation
 - Regional/Global
 - Model Archive
- Data**
 - Complete Data Set List
 - Search for Data
 - Field Campaigns
 - Validation
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