NACP MsTMIP Summary of Model Structure and Characteristics

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Revision Date: July 8, 2014

Summary:

This data set provides a summary of the model structure and characteristics of participating models in the North American Carbon Program (NACP) Multi-scale synthesis and Terrestrial Model Intercomparison Project (MsTMIP), a formal model intercomparison and evaluation effort focused on improving the diagnosis and attribution of carbon exchange at regional and global scales. Model structure refers to the types of processes considered (e.g. nutrient cycling, disturbance, lateral transport of carbon), and the specific ways these processes are represented in the models.

These data are the result of a comprehensive survey of investigators responsible for each MsTMIP participating model. For a given characteristic (i.e., process/attribute), a model was assigned a binary value (0 or 1) indicating whether it included a particular characteristic; a value of one (1) was given if it considered or included that process, or a zero (0) if it did not.

MsTMIP builds upon current and past synthesis activities, and has a unique framework designed to isolate, interpret, and inform understanding of how model structural differences impact estimates of carbon uptake and release.

There is one data file with this data set in .csv format.

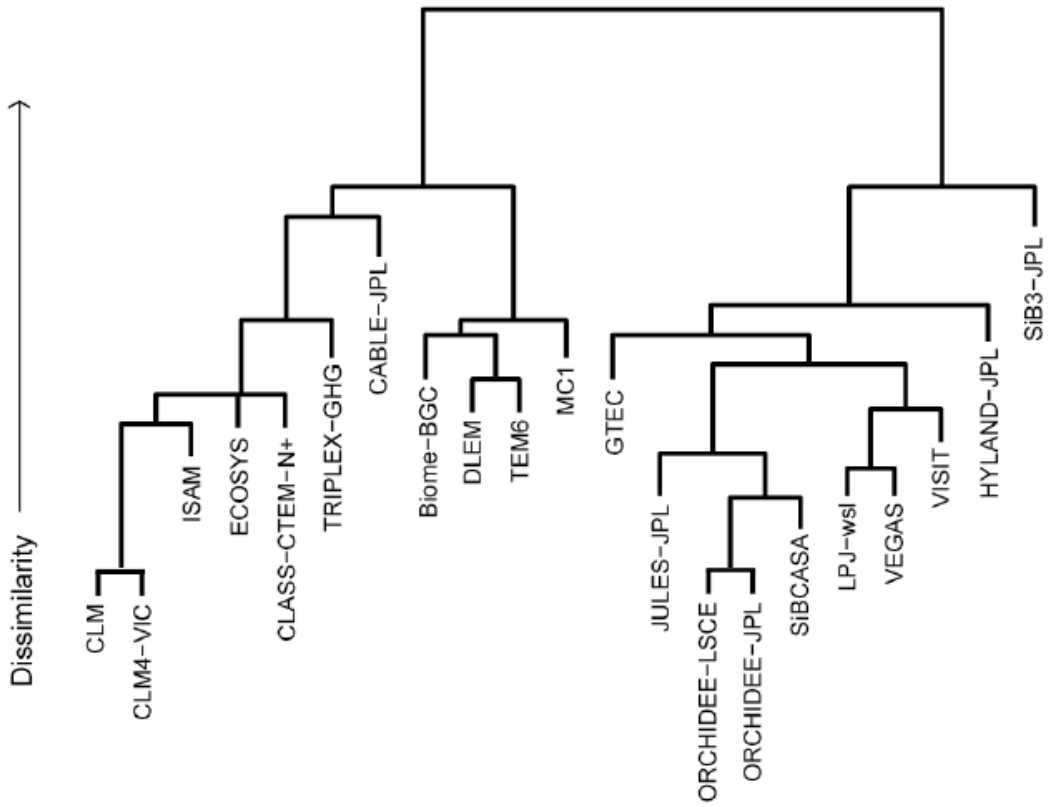

Figure 1. Dendrogram showing overall model structural differences determined by Hamming distance for the models participating in MsTMIP. Models close together in the tree share similar structural model characteristics. (Figure 2 in Huntzinger et al. 2013)

Data and Documentation Access:

Get Data: http://daac.ornl.gov/cgi-bin/dsviewer.pl?ds_id=1228

Related Data Products:

MsTMIP Model Driver Data http://daac.ornl.gov/cgi-bin/dsviewer.pl?ds_id=1220

Data Citation:

Cite this data set as follows:

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1. Data Set Overview:

Project: North American Carbon Program

The North American Carbon Program (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 project 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.

The NACP Multi-scale synthesis and Terrestrial Model Intercomparison Project (MsTMIP) is a formal model intercomparison and evaluation effort focused on improving the diagnosis and attribution of carbon exchange at regional and global scales (Huntzinger et al. 2012). The MsTMIP experimental design includes simulations run at two spatial resolutions (0.5 and 0.25-degree) and for two spatial domains (globally and regionally over North America) in order to assess model performance at scales relevant to carbon management and climate change predictions. MsTMIP builds upon current and past synthesis activities, and has a unique framework designed to isolate, interpret, and inform understanding of how model structural differences impact estimates of carbon uptake and release.

This data set provides a summary of the model structure and characteristics of MsTMIP participating models. Model structure refers to the types of processes considered (e.g. nutrient cycling, disturbance, lateral transport of carbon), and the specific ways these processes are represented in the models.

These data are the result of a comprehensive survey of investigators responsible for each MsTMIP participating model. For a given characteristic (i.e., process/attribute), a model was assigned a binary value (0 or 1) indicating whether it included a particular characteristic; a value of one (1) was given if it considered or included that process, or a zero (0) if it did not.

These data enable the assessment and quantification of structural uncertainty in terrestrial biosphere models (TBMs). An initial intercomparison of model structural differences was performed by Huntzinger et al. (2013), which highlight similarities and differences in how models account for carbon cycle, vegetation, energy, and nitrogen cycle dynamics.

Table 1. Structural information is provided for the following participating models.

MODEL NAME	AFFILIATION (CONTACT)
Biome-BGC	Organization Ames Research Center, National Aeronautics and Space Administration (Weile Wang)
CABLE-JPL	Jet Propulsion Laboratory, National Aeronautics and Space Administration (Joshua Fisher)
CABLE	School of Natural Resources and the Environment, University of Arizona (Francesc Montane)
CLASS-CTEM-N+	School of Geography and Earth Sciences, McMaster University, CA (Altaf Arain)
CLM	Environmental Sciences Division, Oak Ridge National Laboratory (Jiafu Mao, Xiaoying Shi)
CLM4-VIC	Fundamental & Computational Sciences, Pacific Northwest National Laboratory (Maoyi Huang)
DLEM	International Center for Climate and Global Change Research and School of Forestry and Wildlife Sciences, Auburn University (Hanqin Tian, Chaoqun Lu)
ECOSYS	Department of Renewable Resources, University of Alberta, CA (Robert Grant, Zelalem Mekonnen)
GTEC	Environmental Sciences Division, Oak Ridge National Laboratory (Dan Riccuito)
HYLAND-JPL	Jet Propulsion Laboratory, National Aeronautics and Space Administration (Joshua Fisher)
ISAM	Department of Atmospheric Sciences, University of Illinois, Urbana Champaign (Atul Jain)
JULES-JPL	Jet Propulsion Laboratory, National Aeronautics and Space Administration (Joshua Fisher)
LPJ-wsl	Department of Ecology, Montana State University (Ben Poulter)
MC1	Conservation Biology Institute (Dominique Bachelet)
ORCHIDEE-JPL	Jet Propulsion Laboratory, National Aeronautics and Space Administration (Joshua Fisher)
ORCHIDEE-LSCE	Laboratoire des Sciences du Climat et de l'Environnement (LSCE), France (Shushi Peng, Fabienne Maignan)
SiB3-JPL	Jet Propulsion Laboratory, National Aeronautics and Space Administration (Joshua Fisher, Nicolas Parazoo)
SiBCASA	National Snow and Ice Data Center & Cooperative Institute for Research in Environmental Sciences, University of Colorado (Kevin Schaefer)
TEM6	Environmental Sciences Division, Oak Ridge National Laboratory (Dan Hayes)
TRIPLEX-GHG	Department of Biology Sciences, Institute of Environment Sciences, University of Quebec at Montreal & Laboratory for Ecological Forecasting and Global Change, College of Forestry, Northwest A&F University, Yangling China (Chanqhui Peng, Qiuan Zhu)
VEGAS	Department of Atmospheric and Oceanic Science, University of Maryland (Ning Zeng)
VISIT	National Institute for Environmental Studies, Tsukuba, Japan (Akihiko Ito)

2. Data Characteristics:

2.1. Spatial Coverage

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

Site (Region)	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Global	-180	180	90	-90

2.2 Temporal Coverage

Non-temporal data.

2.3 Data File Information

There is one data file in this data set archive: **MsTMIP_Model_Structure.csv**. The data set is in comma-separated values format (*.csv) and the file is <1 MB in size.

Table 2. Columns in the data file.

Column	Column Heading	Description
1	Category	General category of model process: Overall, Energy, Carbon, Vegetation, and Nitrogen process dynamics, corresponding to Figure 3 of Huntzinger et al. (2013). Some processes are listed in more than one category.
2	Characteristic	Name or description of the model characteristic or process.
3-23	Model Name	A value of one (1) indicates that the model considered or included a given process; a zero (0) indicates that it did not.

2.4 Companion Files

There is one additional file with this data set: MsTMIP_Model_Structure_Survey_Questions.pdf. This file contains an example of the model survey and response for the DLEM (Dynamic Land Ecosystem Model) used to produce the model structure summary data set.

3. Data Application and Derivation:

These data enable the assessment and quantification of structural uncertainty in terrestrial biosphere models. An initial intercomparison of model structural differences was performed by Huntzinger et al. (2013), which highlight similarities and differences in how models account for carbon cycle, vegetation, energy, and nitrogen cycle dynamics.

A hierarchical cluster analysis was performed on model structural attributes in order to provide a high-level visualization of the similarities and differences among the participating models. Cluster analysis, represented as dendrograms, sorted the models into groups by the level of similarity between models; models in the same branch in the cluster tree share similar attributes. Separate dendrograms were generated comparing the similarities/differences in models overall (Fig. 1), as well as how they compare in their treatment of energy, vegetation, carbon, and nitrogen dynamics (Huntzinger et al. 2013; Fig. 3).

4. Quality Assessment:

Sources of error or uncertainty for this data set are limited, but may include investigator uncertainty regarding the survey questions and limitations due to the specific survey methodology.

5. Data Acquisition Materials and Methods:

Over 20 TBMs with varying complexity and formulations are participating in the MsTMIP activity. Models vary in complexity and the way in which they simulate canopy conductance (energy and water fluxes), simulate photosynthesis and respiration (carbon fluxes), allocate carbon between soil and above- and belowground biomass (carbon pools), and model vegetation dynamics and disturbances. In order to track differences in model structure each participating modeling team completed a detailed survey specifying how their model simulates energy and water cycling, as well as carbon and vegetation dynamics. See the companion file, MsTMIP_Model_Structure_Survey_Questions.pdf, for questions used in the survey. For a given characteristic (i.e., process/attribute), a model was assigned a binary value (0 or 1) indicating whether it included a particular characteristic; a value of one (1) indicated that the model considered or included a given process, or a zero (0) indicated that it did not.

6. Data Access:

This data is 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
Telephone: +1 (865) 241-3952

7. References:

Denning, A.S. (editor) 2005. Science Implementation Strategy for the North American Carbon Program. Report of the NACP Implementation Strategy Group of the U.S. Carbon Cycle Interagency Working Group. Washington, DC: U.S. Carbon Cycle Science Program, 68 pp. http://www.carboncyclescience.us

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