



North American
Carbon Program

Modeling and Synthesis Thematic Data Center (MAST-DC) Support for North American Carbon Program Synthesis Activities



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and many forward and inverse modeling teams, inventory teams, and tower investigators

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Introduction

The North American Carbon Program (NACP) is designed to quantify the magnitudes and distributions of carbon sources and sinks, explain the processes controlling them, and produce a consistent analysis of North America's carbon budget. To accomplish these ambitious goals, NACP requires an integrated data and information management system that will enable researchers to access, understand, use, and analyze large volumes of diverse data at multiple thematic, temporal, and spatial scales.

The Modeling and Synthesis Thematic Data Center (MAST-DC) supports NACP by providing data products and data management services needed for modeling and synthesis activities. MAST-DC is working with the Synthesis Task Force to quantify and understand interannual variations of the continental carbon budget of North America since 2000 by synthesizing and intercomparing NACP observations and models.

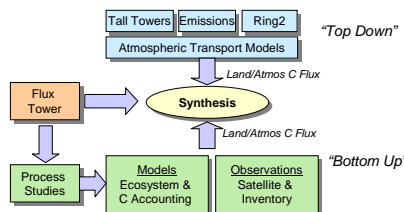
Based on NACP requirements, MAST-DC provides data products and services in a central location, in consistent and uniform grids, with common and co-registered spatial projection, in easily convertible formats.

NACP Interim Synthesis: Model-Data Comparison

MAST-DC is conducting a Model-Data Intercomparison Activity to quantify and understand spatial and temporal distributions of carbon sources, sinks, and inventories from 2000 - 2007 by synthesizing NACP data and models, from sites to regional / continental scales.

Synthesis Questions

1. What are the magnitudes, spatial distribution, and interannual variability of carbon sources and sinks during the period 2000 - 2007?
2. What are the components of carbon fluxes and pools that contribute to this variation?
3. How do carbon sources and sinks and our understanding of the underlying processes vary across scales (site - region, region - continent)?



Support for NACP: MAST-DC Products and Services

MAST-DC has compiled information, data products, and data services that facilitate modeling and synthesis activities:

1. Detailed description of 22 terrestrial biogeochemistry models (e.g., how they parameterize photosynthesis, respiration, and water balance)
2. Acquire, process, reproject, and standardize output from inverse and terrestrial biogeochemistry models
3. Acquire, process, and standardize observations from flux towers, agricultural statistics, and forest inventories
4. Document processes
5. Place information onto project Wiki and FTP area for distribution to participants

Regional - Continental Synthesis: Mac Post, Andy Jacobson, and Debbie Huntzinger, leads

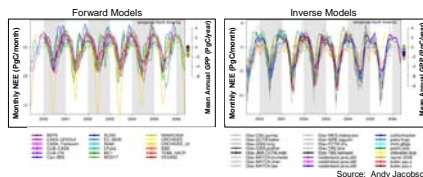
The objective of this activity is to combine observations and existing results from inverse and ecosystem models at the regional and continental scale to generate a reconciled view of the carbon cycle for North America.

For the Interim Synthesis, 24 inverse modeling groups and 22 ecosystem modeling groups contributed existing model results for 2000 - 2005. The following are preliminary results.

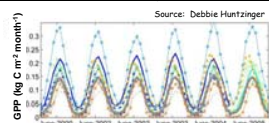
Comparison of NEE for Temperate North America: Inverse and Forward Models

Significant model-model differences in Net Ecosystem Exchange, especially among forward models.

Shapes and depths of seasonal cycle vary considerably among models. Inversions tend to have sharper peak uptake.



Comparison of Gross Primary Production for Temperate North America: Forward Models

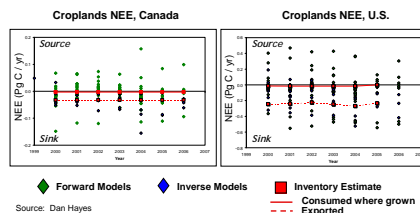
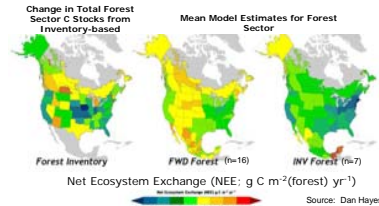


Forward models' estimates of photosynthetic uptake vary by a factor of 2 to 3

Comparison of Net Ecosystem Exchange: Inventory and Models

Use inventory-based estimates of forest C stocks to evaluate inverse and forward models. MAST-DC converted gridded model output into political state units - areas for US and Mexico and Kyoto Protocol reporting units for Canada.

Forward models predict greater NEE than the inverse models and Forest Inventory Estimates



Forward models typically predict greater NEE than inverse models for croplands in Canada and US. These preliminary results have not been corrected for consumption of harvested goods within the reporting area.

Site-Based Interim Synthesis: Peter Thornton, Kevin Schaeffer, Dan Ricciuto, and Ken Davis, leads

The objective of this activity is to establish a quantitative framework that allows NACP investigators to answer the question:

- Are the various measurement and modeling estimates of carbon fluxes at individual sites consistent with each other - and if not, why?

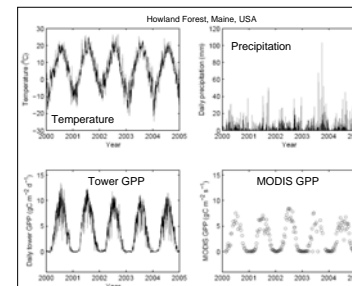
To answer this question, this activity aims to:

- Improve quantification of uncertainty for forward models and site-based measurements
- Identify strengths and weaknesses in models and measurements
- Migrate new knowledge up-scale in coordination with regional and continental-scale efforts.



Gap-Filled Meteorological Data

For the Site-Based Interim Synthesis, gap-filled meteorological data are being developed and used as driver data for bottom-up models.



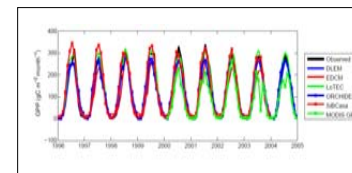
The Howland tower data are provided courtesy of AmeriFlux and Dave Hollinger, USDA, Forest Service.

Gap-Filled Flux Tower Data

For the Site-Based Interim Synthesis, gap-filled flux data and other observations (MODIS GPP) will be compared to model results.

Model-Data Intercomparison

Preliminary model-observation intercomparison for Howland tower. Model results are courtesy of the Site-level Interim Synthesis group.



MAST-DC Support to other NACP Synthesis Activities

MAST-DC provides data management support to several other NACP synthesis activities:

1. *NACP Multi-scale Synthesis and Terrestrial Model Intercomparison Project*: Debbie Huntzinger and Anna Michalak, PIs
2. *Mid-Continent Intensive Interim Synthesis*: Stephen Ogle, Scott Denning and Ken Davis, leads
3. *Non-CO₂ Greenhouse Gas Synthesis*: Steve Wofsy, Janusz Eluszkiewicz, and Arlyn Andrews, leads

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