Modeling and Synthesis Thematic Data Center (MAST-DC)

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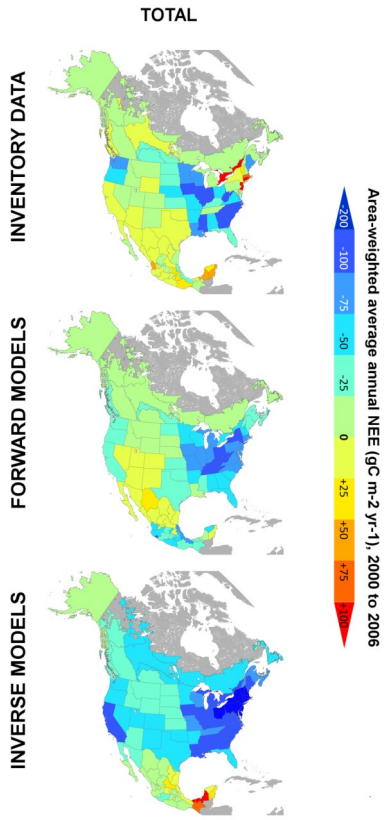
PROJECT START DATE: August, 27, 1998

PROJECT END DATE: September 30, 2012

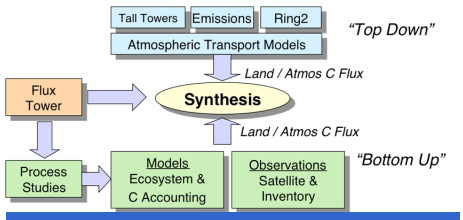
SPONSOR: National Aeronautic and Space Administration, Terrestrial Ecology Program

PARTNERS: Nearly 200 investigators from the international Carbon Program

PROJECT WEBSITE: http://nacp.ornl.gov



Mean area-weighted average annual NEE (gC m-2 yr-1), 2000 to 2006 for all land areas in each reporting zone, from inventory-based estimates against mean results from the sets of terrestrial biosphere models and atmospheric inverse models.



Compare fluxes and budgets obtained by complementary methods:

- *Bottom up inventories, Remote sensing and modeling, Atmospheric inversion and data assimilation*
- *Cross-scale: site, regional, continental*

PROJECT DESCRIPTION

The Modeling and Synthesis Thematic Data Center (MAST-DC) is a component of the data system of the North American Carbon Program (NACP; www.nacarbon.org) designed to support NACP by providing data products and data management services needed for modeling and synthesis activities. Based on specific requirements established by NACP, MAST-DC provides data products for modeling and synthesis in consistent and uniform grids, projections, and formats.

MAST-DC has compiled a wide range of observations, model input, and model output at a variety of scales (from flux towers to these regions to all of North America) in close cooperation with the NACP community. These data products have been used in several NACP-wide synthesis activities to examine the spatial and temporal distribution of carbon sources and sinks as well as the processes influencing those sources and sinks.

SIGNIFICANCE

MAST-DC provides data products and services required by NACP in a central location, with common and co-registered spatial projections, in easily converted formats. The MAST-DC frees modelers and those doing the synthesis and integration from having to perform data management functions. Consequently, the MAST-DC enables NACP participants to conduct their work more readily, facilitate the development of new model products needed by models, and assist in gaining new insights into the carbon cycle in North America.

INTERESTING FINDINGS

During the past three years, MAST-DC has coordinated the formation of several teams of NACP investigators to conduct an analysis of observations and model outputs for North America. An early part of this activity was identifying the characteristics of an integrated data product that could be used to conduct the analysis.

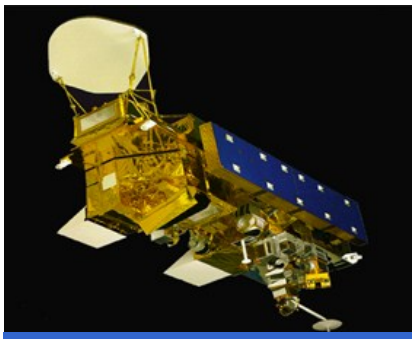
Analyses at individual flux towers indicated that the mean of the models outperforms the individual models, suggesting an ensemble model prediction approach may be the most effective. However, results from other teams revealed that there are specific cases where all models provide poor results, such as those results from agricultural systems, where nearly all models underestimate the intense carbon uptake rates observed in corn fields. Another example is in wetlands, where models generally fail to account for the effects of water table

depth.

Ground-based observations, like the respiration measurements made here, are compared with model output.

At a larger spatial scale, the NACP regional synthesis activity collected existing forward and inverse model simulations for North America. Observations were also compiled to validate the models, particularly forest and agricultural inventory data. Initial results from this intercomparison show that carbon cycle predictions are highly dependent on model structure, in particular the equations that govern photosynthesis.

The regional synthesis activity also confirmed the need for a standardized protocol, forcing data sets and validation metrics for continental to global scale model simulations. This need will be fulfilled in part by MsTIMIP, the Multi-Scale Synthesis and Terrestrial Model Intercomparison NASA-funded project, led by Debbie Huntzinger (University of Michigan) and supported by MAST-DC. This project will also be closely coordinated with the International Land Model Benchmark (ILAMB) project, a model-data intercomparison and integration project co-led by CCSI Member Dr. Forrest Hoffman. ILAMB is designed to improve the performance of land models and improve the design of new observational campaigns. At the recent NACP All Scientist meeting, 34 investigators from 17 institutions in the US and Canada expressed interest in participating in the MsTIMIP and ILAMB activities.



Remote sensing observations from the MODIS sensor are essential for driving some models and for comparing with other models.