The North American Carbon Program Regional Interim Synthesis Project

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Introduction

The North American Carbon Program (NACP) has organized a synthesis project to compare inverse and forward model estimates of North American CO2 exchange over the period 2000-2005. This regional synthesis project has posed five scientific questions:

1. What is the spatial pattern and magnitude of interannual variation in carbon fluxes during 2000-2005?
2. What are the components of carbon fluxes and pools that contribute to this variation?
3. Do model results and observations show consistent spatial patterns in response to the 2002 drought in North America?
4. From measurements and ecosystem models, can we infer what processes were affected by the 2002 drought?
5. What are the magnitudes and spatial distribution of carbon sources and sinks, and their uncertainties, during 2000-2005?

The present analysis attempts to address some of these questions. We compare 22 forward (mechanistic, bottom-up) models with 24 inverse (top-down) models to evaluate the extent of agreement regarding interannual variability of carbon exchange over North America.

Comparison of Net Ecosystem Exchange

The net ecosystem exchange (NEE) of CO2 between the terrestrial biosphere and the atmosphere, including the effects of photosynthesis, respiration, and disturbance, is directly simulated by forward (bottom-up) models and inferred by atmospheric transport inversions (top-down models). NEE fluxes from forward and inverse models are integrated across two large continental-scale regions (see figure at right). Time series of the regional fluxes are compared below.

Forward Models

Inverse Models

Summary of NEE statistics for Temperate North America

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<th>2002</th>
<th>2004</th>
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<tbody>
<tr>
<td>Forward</td>
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<tr>
<td>NEE</td>
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<tr>
<td>Inverse</td>
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<tr>
<td>NEE</td>
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All units PgC/yr for Temperate North America. Positive uptake is negative NEE.

Conclusions and Next Steps

The NACP regional interim synthesis gathered "off-the-shelf" model results in order to make a quick assessment of the state of agreement among carbon models, and between models and observations. A significant effort has been made to assemble observational constraints against which regional scale models can be evaluated, but this analysis is ongoing and results are not yet available. Current results suggest that while forward and inverse models show significant differences in mean uptake, encouraging signs of agreement in the magnitude and timing of interannual variability are emerging.

Future work will focus on indentifying mechanisms of interannual variability in forward models and in comparing model results to observational constraints. A formal model intercomparison project, the Multi-scale Terrestrial Model Intercomparison Project (MsTMIP) has also been proposed. This effort will formalize the ability to "grade" model results against available observational constraints, and provide uniform data sets for modeling teams.

Acknowledgments

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