GC33F-07 Assessment of Model Estimates of Land-Atmosphere CO_2 Exchange Across Northern Eurasia

Back to: Session: Environmental, Socioeconomic, …

Wednesday, December 17, 2014 03:09 PM - 03:22 PM
Moscone West
3003

A warming climate is altering land-atmosphere exchanges of carbon, with a potential for increased vegetation productivity and mobilization of soil carbon stores. Here we investigate land-atmosphere carbon dioxide (CO_2) dynamics through analysis of net ecosystem productivity (NEP) and the component fluxes of gross primary productivity (GPP) and ecosystem respiration (ER) and soil carbon residence time as simulated by a set of process models over a region spanning the drainage basin of northern Eurasia. The retrospective simulations were conducted over the period 1960-2009 at 0.5 degree resolution. Performance benchmarks are made through comparisons of model estimates and CO_2 fluxes derived from tower eddy covariance measurements and satellite data driven GPP estimates. The site comparisons show the timing of peak summer productivity to be well simulated. Modest overestimates in model GPP and ER are also found, which are relatively higher for two boreal forest validation sites. Averaged across the models, NEP increases by 135% of the mean (10% to 400% among the models) from the first to last ten years of record (1960-1969 vs 2000-2009), with a weakening terrestrial carbon sink indicated over recent decades. Vegetation net primary productivity (NPP) increased by 8 to 30%, contributing to soil carbon storage gains, while model mean residence time for soil organic carbon decreased by -10% (-5% to -16% among the models) due to enhanced litter decomposition and heterotrophic respiration (R_h) losses offsetting soil carbon inputs. Our analysis points to improvements in model elements controlling vegetation productivity and soil respiration as being most beneficial for reducing uncertainty in land-atmosphere CO_2 exchange. These advances require collection of new field data in key areas and the incorporation of spatial information on vegetation characteristics into models.

Authors

Michael Rawlins
University of Massachusetts Amherst
Anthony McGuire
University of Alaska Fairbanks
John Kimball
The University of Montana
Pawlok Dass
University of Massachusetts Amherst

View Related Events

Session: Environmental, Socioeconomic, and Climatic Changes in Northern Eurasia and Their Feedbacks to the Global Earth System II

Section/Focus Group: Global Environmental Change

Day: Wednesday, December 17, 2014