Geophysical Research Abstracts,
Vol. 11, EGU2009-12404, 2009
EGU General Assembly 2009

Consequences of simulating terrestrial N dynamics for projecting future terrestrial C storage

S. Zaehle (1), A.D. Friend (2), P Friedlingstein (3,4)

(1) Max Planck Institute for Biogeochemistry, Jena, Germany (soenke.zaehle@bgc-jena.mpg.de, +493641577200), (2) Department of Geography, University of Cambridge, Cambridge UK, (3) Department of Earth Sciences, University of Bristol, UK, (4) Laboratoire des Sciences du Climat et de l'Environnement, Gif-sur-Yvette, France

We present results of a new land surface model, O-CN, which includes a process-based coupling between the terrestrial cycling of energy, water, carbon, and nitrogen. The model represents the controls of the terrestrial nitrogen (N) cycling on carbon (C) pools and fluxes through photosynthesis, respiration, changes in allocation patterns, as well as soil organic matter decomposition, and explicitly accounts for N leaching and gaseous losses. O-CN has been shown to give realistic results in comparison to observations at a wide range of scales, including in situ flux measurements, productivity databases, and atmospheric CO_2 concentration data. Notably, O-CN simulates realistic responses of net primary productivity, foliage area, and foliage N content to elevated atmospheric [CO_2] as evidenced at free air carbon dioxide enrichment (FACE) sites (Duke, Oak Ridge).

We re-examine earlier model-based assessments of the terrestrial C sequestration potential using a global transient O-CN simulation driven by increases in atmospheric [CO_2], N deposition and climatic changes over the 21^{st} century. We find that accounting for terrestrial N cycling about halves the potential to store C in response to increases in atmospheric CO_2 concentrations; mainly due to a reduction of the net C uptake in temperate and boreal forests. Nitrogen deposition partially alleviates the effect of N limitation, but is by far not sufficient to compensate for the effect completely. These findings underline the importance of an accurate representation of nutrient limitations in future projections of the terrestrial net CO_2 exchanges and therefore land-climate feedback studies.