Geophysical Research Abstracts
Vol. 19, EGU2017-18758, 2017
EGU General Assembly 2017

Investigating the relative importance of nitrogen deposition on the 21st century terrestrial carbon sink

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The global terrestrial carbon sink has increased since the start of this century at a time of rapidly growing carbon dioxide emissions from fossil fuel burning. Here we test the hypothesis that increases in nitrogen deposition from fossil fuel burning and linked carbon-nitrogen interactions fertilized terrestrial ecosystems, increasing carbon uptake and storage. Using the dynamic global vegetation model CLM4.5-BGC, we perform factorial analyses, separating the effects of individual drivers to changes in carbon fluxes and sinks. Globally, we find that increases in nitrogen deposition from 1960 to 2010 increased carbon uptake by 1PgC/yr. One third of this increase can be attributed to East Asia alone, with Europe also having a significant contribution. The global, post-2000 anthropogenic nitrogen deposition effect on terrestrial carbon uptake is entirely accounted for from East Asia (increase of $\sim$0.05 PgC/yr). We will also quantify the relative effects of various other drivers on carbon exchanges such as CO_2 fertilization, climate change, and land-use and land-cover change.
This increased nitrogen deposition has served to fertilize the biosphere in recent years, but its influence on carbon sink processes may be rather short-lived due to the short lifetime of atmospheric reactive nitrogen while the influence of increased CO_2 emissions (and the CO_2 fertilization effect) will last multiple decades, a 'Faustian Bargain'.