Geophysical Research Abstracts
Vol. 18, EGU2016-9607, 2016
EGU General Assembly 2016

Small global effect on terrestrial net primary production due to increased fossil fuel aerosol emissions from East Asia during the last decade.

Michael O'Sullivan, Alex Rap, Carly Reddington, Dominick Spracklen, and Wolfgang Buermann

Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, LS2 9JT Leeds, United Kingdom (eemos@leeds.ac.uk)

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 atmospheric aerosols from fossil fuel burning have increased the diffuse fraction of incoming solar radiation and the efficiency of photosynthesis leading to increased plant carbon uptake. Using a combination of atmospheric and biospheric models, we find that changes in diffuse light associated with fossil fuel aerosol emission accounts for only 2.8% of the increase in global net primary production (1.221 PgC/yr) over the study period 1998 to 2007. This relatively small global signal is however a result of large regional compensations. Over East Asia, the strong increase in fossil fuel emissions contributed nearly 70% of the increased plant carbon uptake (21 TgC/yr), whereas the declining fossil fuel aerosol emissions in Europe and North America contributed negatively (-16% and -54%, respectively) to increased plant carbon uptake. At global scale, we also find the CO_2 fertilization effect on photosynthesis to be the dominant driver of increased plant carbon uptake, in line with previous studies. These results suggest that further research into alternative mechanisms by which fossil fuel emissions could increase carbon uptake, such as nitrogen deposition and carbon-nitrogen interactions, is required to better understand a potential link between the recent changes in fossil fuel emissions and terrestrial carbon uptake.