Geophysical Research Abstracts
Vol. 18, EGU2016-16102, 2016
EGU General Assembly 2016

Photosynthesis sensitivity to climate change in land surface models

Andrea Manrique-Sunen (1), Emily Black (1), Anne Verhoef (1), and Gianpaolo Balsamo (2)
(1) University of Reading, United Kingdom (a.manriquesunen@pgr.reading.ac.uk), (2) ECMWF, United Kingdom

Accurate representation of vegetation processes within land surface models is key to reproducing surface carbon, water and energy fluxes. Photosynthesis determines the amount of CO_2 fixated by plants as well as the water lost in transpiration through the stomata. Photosynthesis is calculated in land surface models using empirical equations based on plant physiological research. It is assumed that CO_2 assimilation is either CO_2 –limited, radiation –limited ; and in some models export-limited (the speed at which the products of photosynthesis are used by the plant) . Increased levels of atmospheric CO_2 concentration tend to enhance photosynthetic activity, but the effectiveness of this fertilization effect is regulated by environmental conditions and the limiting factor in the photosynthesis reaction.
The photosynthesis schemes at the 'leaf level' used by land surface models JULES and CTESSEL have been evaluated against field photosynthesis observations. Also, the response of photosynthesis to radiation, atmospheric CO_2 and temperature has been analysed for each model, as this is key to understanding the vegetation response that climate models using these schemes are able to reproduce. Particular emphasis is put on the limiting factor as conditions vary. It is found that while at present day CO_2 concentrations export-limitation is only relevant at low temperatures, as CO_2 levels rise it becomes an increasingly important restriction on photosynthesis.