Geophysical Research Abstracts
Vol. 12, EGU2010-7181-2, 2010
EGU General Assembly 2010

Global-scale analysis of the carbon cycle sensitivity to drought on annual scales

Tiexi Chen
Department of Hydrology and Geo-environmental Sciences,VU,Amsterdam,Netherlands(tchen@falw.vu.nl)

Guido van der Werf, A.J. (Han) Dolman
Department of Hydrology and Geo-environmental Sciences,VU University Amsterdam

Abstract: We have optimized the Carnegie-Ames-Stanford-Approach (CASA) global biogeochemical model using FLUXNET data to better predict regional carbon budgets, with a strong focus on carbon release due to drought. Correlations between net primary productivity (NPP) derived from CASA driven by MODIS FPAR and FLUXNET gross primary productivity (GPP) were high in most European and North American sites as well as NPP production of our model shows high correlation with GPP measurement with a ratio between GPP and NPP of around 0.5 for most sites.

We tested all the 60 FLUXNET sites for carbon cycle response to seasonal or annual scale drought. In particular, we focused on the drought event in Europe in 2003 which led to a substantial reduction in primary productivity. NPP generated by CASA was able to capture most of the FLUXNET signal and showed significant reduction during these drought events, illustrating that drought conditions reduced carbon uptake significantly, although, importantly, warmer spring and autumns may extend the growing season. After testing CASA's ability to model drought effect on terrestrial ecosystem for single sites including the response in heterotrophic respiration-, we ran CASA on a global scale. Our results show that the primary productivity reduced by drought shows a large variance contribution at annual scales.

We also included better constraints and more physical realism in the soil moisture model which impacts both NPP and heterotrophic respiration in CASA. This significantly improved the predicted net ecosystem exchange (NEE) patterns in Europe and North America. Improvements were most significant at grassland sites, confirming that grass ecosystem may be more sensitive to soil moisture variability than other vegetation types.