Abstract

An increase in the atmospheric concentration of carbon dioxide ([CO_2]) is having an impact on many different aspects of the climate system including the surface energy budget. Several years of climatic and biological data have been collected for soybean, at the Soybean Free Air Concentration Enrichment (SoyFACE) site in Champaign, Illinois. Using these data I calibrated the Agro-IBIS (Integrated Biosphere Simulator, agricultural version) model to simulate the crop response to a CO_2 enriched environment of 550 ppm and the ambient concentration of 375 ppm. Previously the model over predicted the CO_2 fertilization effect at 550 ppm by overestimating the leaf area index (LAI). Realistic simulated LAI values are necessary for accurate simulation of transpiration, one component of the latent heat flux. I found that improving the phenology routine and adjusting the specific leaf area parameter results in a simulated LAI value that compares with the observations within the enriched and ambient environments. I also decreased the canopy conductance an additional 30% to simulate realistic latent heat flux values at 550 ppm. After validation at the SoyFACE site, I ran Agro-IBIS over the U.S. east of the Rocky Mountains with current and elevated CO_2 concentrations. Here I show the impact that the response of soybean to elevated CO_2 is expected to have on the latent and sensible heat fluxes across this domain with some areas expected to see a significant change to both of these terms of 10 – 20%. These predicted changes to the energy budget are important and need to be considered in future projections of ecosystem response to climate change.