EXPANSION OF BIOENERGY CROPS: COMPARISON OF ITS IMPACTS ON HYDROLOGIC CYCLE FOR THREE SITES IN THE MIDWESTERN UNITED STATES

Phong Le, University of Illinois, 217-979-3549, phongle1@illinois.edu

1. Phong V. V. Le, Department of Civil and Envrionmental Engineering, University of Illinois at Urbana-Champaign
2. Praveen Kumar, Department of Civil and Envrionmental Engineering, University of Illinois at Urbana-Champaign
3. Darren T. Drewry, Max-Planck-Institut für Biogeochemie, Postfach 100164, D-07701 Jena, Germany

Large-scale conversion of agricultural landscapes of the Midwestern United States to second generation bioenergy crops such as miscanthus and switchgrass has the potential for significant impact on hydrologic cycle in the region. This impact is strongly influenced by local climate and further exacerbated by the uncertainty in the response of the vegetation under elevated CO2 and temperature. A mechanistic multi-layer canopy-root-soil model with graphical user interface is used to capture and compare the eco-physiological acclimations of bioenergy crops under climate change at three different sites in the Midwest. Predictions on hydrologic flux changes at these sites are also conducted to examine the role of spatial climate variability.

Our results suggest that at all sites, under present climate, miscanthus and switchgrass consistently utilized more water than maize. Projected higher concentrations of atmospheric CO2 (550 ppm) is likely to decrease water used for evapotranspiration of miscanthus, switchgrass, and maize. However, when projected increase in air temperature and alteration in rainfall pattern are also considered, there is a n et increase in evapotranspiration for all crops and decrease in specific surface runoff, highlighting the role of warming climate in potentially altering the water cycle under the large-scale expansion of bioenergy in the Midwest. Moreover, these changes are different from site to site, highlighting the impact of spatial local climate variability.