4b.7 Assessing hydroclimate impact of a large-scale perennial biofuel crop expansion

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Perennial bioenergy crops are a potential alternative energy source to fossil fuels that could increase U.S. energy independence and mitigate anthropogenic climate change. Spatio-temporal assessment of long-term and extreme unintended impacts on hydroclimate remains limited but is necessary for examination of large-scale sustainable deployment of this alternative energy pathway. We conduct 10-year U.S. continental scale simulations for baseline and perennial biofuel expansion (based on an abandoned/degraded cropland scenario) using WRF coupled to Noah-LSM at 20km resolution. An ensemble of simulations by different physics parameterization schemes and initial conditions are compared. A one-year experiment demonstrates the maximum averaged growing season near-surface cooling due to perennial biofuel expansion is about 0.5°C, primarily concentrated within the central U.S. and south eastern of California. However, the unintended effect on soil moisture and latent heat flux are considerable along the southern Great Plains and southeastern portions of the U.S. The spatial pattern of temperature and soil moisture impacts does not indicate direct correspondence between soil moisture reduction and thermal effects. This study demonstrates a framework of feedback assessment between land use/land cover change and water resources, as well as evaluating feasibility and long-term sustainability of large-scale deployment of perennial bioenergy crops across the continental U.S.