Predicting the Impacts of Changes in Climate and Land Use on Water Sustainability and Crop Yields

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Abstract

Climate change will affect the sustainability of water and food production. Changes in climate and land use can be quantified by synthesizing GIS and remotely-sensed data in landscape hydrology models. The Integrated Landscape Hydrology Model (ILHM) is a water- and energy-balance process-based model that simulates regional hydrology at fine resolution based on such readily available data. SALUS is a crop biophysics model that allows us to quantify the impact of changes in both climate and management on crop yields. We use these codes to simulate streamflows, groundwater levels, and crop yields across regional watersheds based on remotely sensed data including MODIS Leaf Area Index, Digital Elevation Models, land cover maps, and NEXRAD precipitation estimates, along with digitized soil survey maps, subsurface geologic maps, and station climate data. These predictions are compared to decades of measured streamflows, and groundwater levels, as well as county crop yields. We explore the relative importance of historic changes in land cover, climate, and land management practices on hydrology, and then simulate the impacts of IPCC projected climate change from the on water resources and crops. Through this analysis we examine the sustainability of resources and future crop yields under potential management strategies.