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Assessing and modelling ecohydrologic processes at the agricultural field scale

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One of the primary goals of agricultural management is to increase the amount of crop produced per unit of fertilizer and water used. World record corn yields demonstrated that water use efficiency can increase fourfold with improved agronomic management and cultivars able to tolerate high densities. Planting crops with higher plant density can lead to significant yield increases, and increase plant transpiration vs. soil water evaporation.
Precision agriculture technologies have been adopted for the last twenty years but seldom have the data collected been converted to information that led farmers to different agronomic management. These methods are intuitively appealing, but yield maps and other spatial layers of data need to be properly analyzed and interpreted to truly become valuable.
Current agro-mechanic and geospatial technologies allow us to implement a spatially variable plan for agronomic inputs including seeding rate, cultivars, pesticides, herbicides, fertilizers, and water. Crop models are valuable tools to evaluate the impact of management strategies (e.g., cover crops, tile drains, and genetically-improved cultivars) on yield, soil carbon sequestration, leaching and greenhouse gas emissions. They can help farmers identify adaptation strategies to current and future climate conditions.
In this paper I illustrate the key role that precision agriculture technologies (yield mapping technologies, within season soil and crop sensing), crop modeling and weather can play in dealing with the impact of climate variability on soil ecohydrologic processes. Case studies are presented to illustrate this concept.