Improvements to the DSSAT Cropping Systems Model for Climate Change Research

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Cropping system models have been useful tools for evaluating the effects of climate variability and change on agricultural systems. Models have been used to predict effects of changes in temperature and rainfall patterns and increases in CO_2 concentrations on crop productivity for various applications, such as estimating water and fertilizer requirements, minimizing nutrient leaching, optimizing planting dates and other environmental and economic factors. Several improvements have been recently added to DSSAT-CSM (Decision Support System for Agrotechnology Transfer, Cropping Systems Model) for release of version 4.5 in 2008. These enhancements include better evaluation of soil carbon dynamics using the Century soil organic matter model, a new soil evaporation model, addition of a tillage model, additional crop growth modules and other features. Some of these model improvements will allow better evaluation of organic carbon sequestration, dynamics of low fertility systems, till versus no-till systems, effects of drought on rainfed systems, and interactions with climate variables.

Because of the increasing interest in research on climate impacts and agricultural adaptations to climate change, a sensitivity analysis was conducted to characterize growth and yield responses of four crops that are important in the SE USA: peanut, corn, cotton, and soybean. Comparisons of the revised model simulations of biomass and grain yield responses to temperature, rainfall, and CO_2 were made with DSSAT v4.02. These sensitivity analyses included several sites in the southeast US with a range of soil types, planting dates, and varieties for the four crops. Results included changes in responses to climate relative to existing climate conditions in these sites. The results show how interactions of climate variables affect crops over a wide range of climate conditions.

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