

**COMBINING GIS, REMOTE SENSING, AND SIMULATION MODELING FOR SPATIAL ANALYSIS  
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Precision irrigation water management requires the synthesis of several informational technologies, including geographic information systems (GIS), remote sensing, and cropping system simulation models. Our objective was to develop software tools and data processing pipelines that can be used for managing data streams from remote sensing instruments, merging site-specific remote sensing data into simulation models, and implementing the models for analysis of irrigation management alternatives and irrigation scheduling. A software 'plug-in' for the open-source Quantum GIS has been developed to accomplish required geoprocessing tasks, including processing raster and vector data layers within predefined management zones and running simulation models with site-specific data. The plug-in was designed to be model independent, meaning the software can interact with the input and output files of any simulation model. Testing and refinement of these geoprocessing tools were accomplished using data from two precision irrigation experiments for surface-irrigated cotton, conducted at Maricopa, Arizona during the summers of 2009 and 2011. Canopy spectral reflectance and canopy temperature data from airborne imagers were processed within predefined management zones. Site-specific soil texture information based on field sampling was interpolated and averaged within each management zone. Spatial data were integrated into site-specific simulations with the DSSAT-CSM-CROPGRO-Cotton model. Simulated annealing optimization was used to calibrate the model uniquely for each management zone by minimizing error between measured and simulated leaf area index (LAI), as estimated from normalized difference vegetation index (NDVI) and canopy height. Site-specific cotton yield and evapotranspiration simulations were compared with observations at the field site.