THE IMPORTANCE OF PROCESS REPRESENTATION FOR SIMULATING COUPLED SURFACE-GROUNDWATER FLOW IN KARST WATERSHEDS: A COMPARISON OF SWAT, SWAT-MODFLOW AND DISCO

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The Soil and Water Assessment Tool (SWAT) is a powerful tool that can simulate the effects of land management practices on water quantity and water quality. Recently, SWAT has been coupled with the USGS groundwater flow model MODFLOW to overcome its limitations with respect to subsurface flow. In the SWAT-MODFLOW model, SWAT handles the surface and soil water component whereas MODFLOW handles the subsurface water component.

We have developed a SWAT-MODFLOW model for the Santa Fe River Basin within the framework of the USDA-NIFA funded Floridan Aquifer Collaborative Engagement for Sustainability (FACETS) project, which aims to understand land use changes needed to achieve agricultural water security while meeting environmental regulations. To guide our modeling effort we simultaneously developed two other models. We developed a stand-alone SWAT model to test the hypothesis that a SWAT-MODFLOW model can simulate groundwater contributions to streams more correctly as SWAT-MODFLOW provides a better representation of the subsurface. In addition, we developed a DisCo model in which surface and subsurface flow are coupled fully implicitly and are governed by the diffusive wave equation and the Richards' equation, respectively. While the DisCo model cannot simulate the effects of land management practices as needed for our project, it is a more-physically based flow model than SWAT-MODFLOW. As such, we expect that this model can provide insights into possible limitations of SWAT-MODFLOW. Preliminary results show all models perform well in terms of simulated stream flows. We discuss the limitations and benefits of each model. In addition, we illustrate how having multiple models for the same region was beneficial for the development of the SWAT-MODFLOW model.

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