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EVALUATION OF LUMPED, SEMI-DISTRIBUTED, AND GRIDDED HYDROLOGIC MODELS AT THE FARM SCALE IN THE MISSISSIPPI ALLUVIAL VALLEY

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Rainfall-runoff models have widely been used to accurately estimate outflows from watersheds. However, agricultural practices impacting runoff at the farm and storm scales are not well understood and as a consequence predictions of runoff (peak and volume) are highly uncertain. Additional research is needed to test and improve predictive capabilities. The relative performance of three rainfall-runoff models (LIDIA, HSPF, and GSSHA) were compared based on data from an agricultural drainage area (11.29 ha) under soybean, cotton, and winter wheat crops located in Leflore County, Mississippi. The goal is to identify the "best" of the three models which could accurately predict storm runoff under a particular application in the Mississippi Delta.

The Low Impact Development Implementation Assessment (LIDIA) model is a lumped catchment model under development by Mississippi State University's Departments of Civil & Environmental Engineering and Landscape Architecture since 2008. LIDIA simulates rainfall-runoff hydrographs from small drainage areas. LIDIA computes runoff using the Curve Number methodology and the routing hydrograph is developed using the Santa Barbara Urban method. The Hydrological Simulation Program – FORTRAN (HSPF) is a semi-distributed reservoir type model supported by the U.S Environmental Protection Agency (USEPA) and used widely since the 1980s. Hydrological routines in HSPF come from the Stanford Watershed Model (SWM) developed in the 1960s. The Gridded Surface Subsurface Hydrologic Analysis (GSSHA) is supported by the US Army Corps of Engineers since 2004. GSSHA is a physics-based, distributed, hydrologic, sediment and constituent fate and transport model. Features include two dimensional (2-D) overland flow, 1-D stream flow, 1-D infiltration, 2-D groundwater, and full coupling between the groundwater, shallow soils, streams, and overland flow.

Each model is calibrated to observed runoff measured at the drainage area outlet by the U.S. Geological Survey (USGS). Rainfall time series collected by USGS every 15-minutes from 1997 to 1999 at the site are used in this research. The models are set up using the same topographic, land cover and soil databases. This investigation is using the following statistical measures to evaluate observed and simulated runoff values: deviation of runoff volumes, percentage error in peak, residual sum of squares, total sum of square of residuals, total sum of absolute residuals, and Nash and Sutcliffe coefficient. LIDIA and HSPF models are already calibrated and the GSSHA model application is underdevelopment. The results and comparisons will be presented at the conference.

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