FRAMEWORK TO IMPROVE SIMULATION PROCESSES OF THE INTEGRATED HYDROLOGIC MODEL

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The framework for proposed improvements to simulation processes of the Integrated Hydrologic Model (IHM) are motivated by recommendations from external peer review, observations from application, synthesis of field observations, and anticipation of future water management challenges. The IHM dynamically couples HSPF with MODFLOW to simulate the surface water and groundwater systems, and feedback between these systems for uplands, water bodies, and groundwater. The IHM has been used for more than two decades to support decision-making for: water-supply planning, sustainability assessment, and operations; ecologic systems protection; and assessment of hydrologic response due to changes in water use, climate, and land use.

Insights from the stated motivations highlight the need to reduce streamflow variance error and to improve magnitude and timing of recharge to saturated groundwater. To accomplish the desired improvements, several processes within HSPF were targeted for modification. The framework for proposed improvements to HSPF includes increasing vertical discretization of the vadose zone from one zone to maximum of seven zones, adopting the Brooks-Corey model to represent soil moisture storage, replacing existing infiltration with the Green-Ampt infiltration model, and allowing dynamic transitions between infiltration-excess and saturation-excess surface runoff. Additionally, proposed HSPF improvements include adding vertical percolation between vadose zone layers that ultimately results in percolation as recharge to saturated groundwater and partitioning evapotranspiration (ET) among the vertically-discretized vadose zones and groundwater. The proposed HSPF improvements also include simulation of depth to water table with active feedback to the vadose zone layers through the Brooks-Corey model.

IHM uses integration paths to dynamically transfer mass-conserving flows, fluxes, and storages between HSPF and MODFLOW and to dynamically modify model parameters. Proposed improvements to HSPF require substantially modifying some existing and adding new IHM integration paths for both HSPF and MODFLOW. The conceptual framework was built and tested against field and theoretical results using Hydrus 1-D.

PRESENTER BIO: Dr. Ross is a Professor in the Department of Civil and Environmental Engineering at the University of South Florida with more than 40 years of experience teaching, conducting laboratory research, field studies and modeling surface-groundwater hydrology and interaction in Florida, national and international venues.