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QUANTIFYING SUBSURFACE DRAINAGE USING THE VARIABLE INFILTRATION CAPACITY MODEL

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ABSTRACT: Subsurface (tile) drainage is an important water management practice for agricultural watersheds in the Midwest because it lowers seasonally high water table levels and enables the land to be utilized for row crops. At the same time this practice poses problems for the environment because it increases the concentration of nitrates entering local bodies of water and alters streamflow patterns. The Variable Infiltration Capacity (VIC) model is a large-scale hydrologic model that was recently updated to simulate subsurface tile drainage. The VIC model calculates water and energy balances using meteorological data, such as temperature and precipitation, for individual “grid cells”. As part of this study we tested the new sub-surface drainage algorithm within the VIC model to determine its ability to adequately simulate subsurface tile drainage from Indiana fields. The model algorithm was calibrated using a single grid cell and compared to the long term record of observed drain flow data and water table height Southeast Purdue Agricultural Center (SEPAC). Commonly used model efficiency measures including the Nash-Sutcliffe Efficiency, Percent Error, and the Coefficient of Determination were calculated to determine the accuracy of the model simulations. The sensitivity of simulated drainage to model parameters was also evaluated using the Two-level Fractional Factorial approach.. The calibrated and evaluated VIC model will be used for a larger scale simulation of the Upper White River watershed in central Indiana to evaluate the role of subsurface drainage on streamflow patterns, estimate nitrate loading, and examine how climate variability will impact the quantity and seasonality of water held in the soil under different management practices such as drainage water management. . Results from this study will be used to promote the implementation of drainage water management to control nitrate pollution from subsurface drainage and aid farmers in determining seasonal operational strategies for drainage water management implementation based on climate variability.

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