ABSTRACT

Holberg, Jessica A. M.S.C.E., Purdue University, May 2015. Downward model development of the Soil Moisture Accounting loss method in HEC-HMS: Revelations concerning the role of the soil profile. Civil Engineering Professor: Venkatesh Merwade.

Despite the fact that the soil profile is known to impact streamflow, most CN-based models ignore subsurface processes. This study explores the influence of soil storage on peak flows. Two watersheds in flat, humid west-central Indiana were modeled using both the Natural Resources Conservation Service (NRCS) Curve Number and four versions of the Soil Moisture Accounting (SMA) loss methods in the United States Army Core of Engineers-developed (USACE) Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS). One watershed encompasses the Wabash and Tippecanoe Rivers' confluence; the other contains an ephemeral stream, Plum Creek. The CN-based model was developed using standard practices, but for the SMA-based model, four increasingly sophisticated SMA loss method arrangements of the two study areas were included and analyzed for summer and winter seasons. All four arrangements contain identical surface characteristics but vary in the soil profile parameters included. The first arrangement includes unlimited soil storage, the second includes limited tension zone storage, the third limits soil storage and includes groundwater parameters, and finally, the fourth includes baseflow characteristics. Results show that the streamflow from the four arrangements differs little for much of the year. However, significant differences in model results are observed when the causative storm has relatively high maximum precipitation intensity. While these results do not necessarily coincide with the results of previous studies, the departure can be explained by the greater soil profile depth in the watersheds of interest. Comparison of streamflow from both the CN-based and SMA-based models with observed streamflow data show that these models do vary in their prediction of peak flow values.