XVII[th] World Congress of the International Commission of Agricultural and Biosystems Engineering (CIGR)

Hosted by the Canadian Society for Bioengineering (CSBE/SCGAB)
Québec City, Canada June 13-17, 2010

A COMPARISON OF DRAINMOD AND SWAT FOR SURFACE RUNOFF AND SUBSURFACE DRAINAGE FLOW PREDICTION AT THE FIELD SCALE FOR A COLD CLIMATE

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CSBE100071 – Presented at ASABE's 9th International Drainage Symposium (IDS)

ABSTRACT Tile drainage reduces surface runoff, soil erosion and improves crop yields, but contributes to the loss of nutrients from agricultural fields. Therefore, it is important to accurately predict the field-scale hydrology in order to better manage water resources and ensure environmental sustainability. In this study, two widely used models, DRAINMOD and the Soil and Water Assessment Tool (SWAT), were calibrated and validated for hydrology of two tile-drained agricultural fields in the Pike River watershed of Southern Quebec. The hydrologic performance of DRAINMOD and SWAT was compared for cold-climate conditions and evaluated at seasonal and monthly time scales. Three years of hydrologic data served to calibrate and validate the model, with the year 2002/03 being used for calibration and 2004 for validation. Model predictions of surface runoff and subsurface drainage flow were compared with the measured surface runoff and subsurface drainage flow values from the two instrumented study sites. The comparison of two models was established based on their prediction accuracy. In the calibration period, DRAINMOD overestimated cumulative subsurface drainage outflow by 5 %, and SWAT underestimated cumulative subsurface drainage outflow by 26%. In the validation period, DRAINMOD was found more successful than SWAT in subsurface drainage flow prediction with R2 greater than 0.82 for both sites. Also, the prediction error statistics indicated clearly that the DRAINMOD performed well in predicting subsurface drainage outflows with different soil type in cold climatic conditions. However, the SWAT's performance model in simulating total monthly surface runoff was better than DRAINMOD during the validation period with R2 greater than 0.88. The results of this study showed that DRAINMOD was better than SWAT at simulating field scale hydrology in most cases. Additionally, the calibration of SWAT required more effort and input data.

Keywords: DRAINMOD, SWAT, field-scale hydrology, subsurface drainage flow, modelling, cold climate.