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Abstract: A practical evaluation framework is presented for analysis of two complex, process-based agricultural system models, WEPP and RZWQM. The evaluation framework combines sensitivity analysis and the uncertainty analysis techniques of first order error analysis (FOA) and Monte Carlo simulation with Latin Hypercube Sampling (LHS). WEPP model runoff, soil loss, and corn (Zea Mays L.) yield output responses in the form of expected values and error variances were determined to illustrate model prediction uncertainty. Sensitivity analysis results show the WEPP model response for runoff to be most sensitive to effective hydraulic conductivity and soil parameters used in the crusting factor adjustment. The soil loss response was most sensitive to erodibility factors and soil and management parameters influencing infiltration. The FOA did not approximate the WEPP model responses for runoff and soil loss well due to model nonlinearity. Results of RZWQM output response sensitivity to selected model input parameters are also presented. Baseline values for the parameters were measured for an experiment on a manured corn field in eastern Colorado. A modified Monte Carlo LHS technique was used to obtain parameter sets for model realizations. The model parameter sets were then analyzed separately using a linear regression analysis. In general, RZWQM output responses were most sensitive to plant growth input parameters and manure application rates. Plant nitrogen uptake and silage yield model output responses were less sensitive to nitrogen cycling and irrigation rate input parameters than what has been observed previously in field experiments. Overall, the results showed that RZWQM output responses were more sensitive to the average saturated hydraulic conductivity of the entire soil profile than to the saturated hydraulic conductivity of individual soil layers.

Keywords: Model evaluation, Monte Carlo simulation, First order analysis (FOA), Uncertainty analysis.