Evaluating the Effects of Horizontal Spatial Discretization on Interflow in the Soil Zone Using the Richards and Groundwater Flow Equations

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OBJECTIVES AND INTRODUCTION

A: Evaluate the use of the Groundwater Flow equation to represent lateral soil zone flow.

B: Evaluate the effects of discretization on lateral soil zone flow and stream seepage solutions.

- Richards equation is often used to model variably saturated flow and is considered as a benchmark for infiltration and flow comparisons.
- Much research has been completed which looks at the effects of discretization on the Richards equation vertical infiltration solution, however, very little work has been done to examine the effects of discretization on lateral flow.
- Ideally, simulation results should be reasonably consistent regardless of model grid discretization.

B: Validate results of new Soil Zone Flow Package for MODFLOW developed for GSFLOW (GSFLOW-SZF) through comparison with Richards Equation solution

- Evaluate the use of the Groundwater Flow equation to represent lateral soil zone flow.
- Evaluate performance of new MODFLOW Interflow Stream Boundary for a variety of discretizations, hydraulic conductivities, and applied precipitation rates.

METHODS

GSFLOW-SZF Conceptual Model

Test Model

Table 1: Input soil parameters for SZF and VS2DT

Table 2: Simulation Summary with parameters

RESULTS

A: Effects of Discretization

B: GSFLOW-SZF Evaluation and Sensitivity Analyses

Hydraulic Conductivity

Sensitivity Analyses

Verification of Vertical Wetting Front

Table 3: Input soil parameters for GSFLOW and VS2DT

Table 4: Summary of effects of varying grid-cell dimensions on interflow simulated by GSFLOW-SZF

Table 5: Summary of effects of varying grid-cell dimensions on interflow simulated by VS2DT

Table 6: Summary of effects of varying grid-cell dimensions on interflow simulated by GSFLOW-SZF

CONCLUSIONS

Richards equation interflow solution was strongly sensitive to the discretization

The GSFLOW-SZF interflow solution was consistent independent of discretization

Errors associated with using groundwater flow equation much less than errors associated with discretization in Richards equation

Groundwater flow equation simulated interflow with an acceptable amount of error with various:

- Discretization
- Applied precipitation rates
- Hydraulic conductivities

GSFLOW-SZF effectively simulates infiltration and interflow through the soil zone

GSFLOW-SZF simulations correlated well with the Richards Equation simulations

References Cited: