

# Coupling of two-dimensional surface flow and Saturated-unsaturated subsurface flow models

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## 1. Research purpose

This research is designed to construct rainfall flow model responding to surface undulations and infiltration of rainfall into soil for calculating exactly sediment volume in the bare area.

## 2. Construction of the flat two-dimensional overland flow model

The two-dimensional unsteady flow model based on hydraulic equation of continuity and the equation of motion is used as a basic formula. The model that asks for the flux [ $\text{m}^2/\text{sec}$ ] that flows into each grid and the depth [m] of water in each grid is built by using these formulas and the amount of osmosis [ $\text{m}/\text{sec}$ ], which are boundary conditions.

## 3. Construction of saturated and unsaturated subsurface model

Richards equation, which is a simultaneous equation between Darcy's law and equation of continuity, is used as a basic equation. The model for calculating infiltration is constructed by calculating pressure heads in the ground with the boundary conditions, water depth and infiltration volume, which are obtained through doing calculus of finite differences to Richard equation, which is applied Picard law to, and using subsurface model.

## 4. The interface between overland flow and subsurface flow

The models which are respectively structured in 2 and 3 are put into a model. When calculating surface flow, the value of the amount of osmosis of the present time was made into boundary conditions. On the other hand, when calculating subsurface flow, the depth of subsurface water calculated previously was made into boundary conditions.

## 5. Construction of saturated and unsaturated subsurface model

The model is applied to virtual field for checking the behavior of the model. Moreover, overland flow model and interface model are compared. In addition, the parameters are obtained by comparing to result 1 through applying this model to real fields (figure 1). Figure 2 is the result obtained by simulating with the parameters.

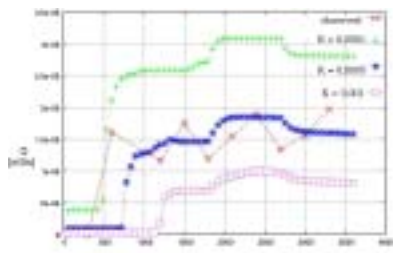


Figure 1 Result 1

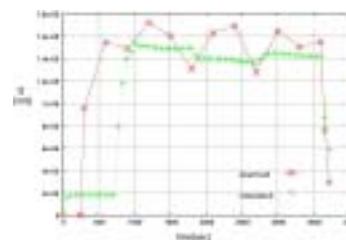


Figure2 Result 2