
Application of GIS in Analysing Spatial Patterns of Multiple Runoff Events

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Abstract

Rainfall, topography and soil characteristics are considered to control spatial redistribution of phosphorus in catchments. To advance this research, a hydrology model is needed to describe spatial variation of soil moisture dynamics and runoff source areas in multiple runoff events. This study examined whether the spatially distributed, topographically based rainfall-runoff model, TOPMODEL provides superior performance for rainfall/runoff events in maritime climate and pastoral hill lands like New Zealand. Unlike previous efforts, we evaluate the hydrological model to identify runoff source areas for each individual runoff event. Geographical information system was used to analyse the model sensitivity on pattern dynamics of runoff, water tables and soil moistures of three major runoff events (low, medium and high). The model was tested for two catchments at Waipawa in Palmerston north, New Zealand. The study confirmed that TOPMODEL give high quality results (R^2 of 84%) when validated against flow observations. Visual analysis on GIS systems showed that the predicted dynamics of variable source area and the component hydrological processes is realistic in the study area of pastoral farmlands. The TOPMODEL can be used to reflect both long-term evolutionary soil moisture content patterns and the short term forcing of flow dynamics during storm events in typical New Zealand mountainous and high rainfall volume (1200mm/year) regions.
