Hydraulic analysis of overland flow caused by temporally varying rainfall

*PING-CHENG HSIEH[1], Ming-Chang Wu[1]

1. National Chung Hsing University

With the development of human civilization and population migration, we use many different types of pervious or impervious materials to cover the original surface. As a result, the surface friction and water permeability are reduced, resulting in increased flow velocity and runoff, and thus increasing the frequency and scale of flood occurrence. Therefore, predicting changes in overland flow caused by rainfall has become an important issue.

This study intends to simulate the overland flow under different rainfall patterns by the theory of diffusion wave model. The diffusion wave equation was used as the governing equation, and an analytical solution of the water depth by the generalized integral transformation method was presented. Since the values of the parameters used in previous research for diffusion wave models vary in an extensive range. In this study, the parameters were adjusted for each location to ensure the rationality of the simulation results according to the law of mass conservation.
The results show that for the non-uniform rainfall, the peak water depth and peak flow due to the post-peak rainfall are the largest, followed by the third quarter peak rainfall; whereas the average flow velocity of the mid-peak rainfall is the largest, followed by the third quarter peak rainfall. The peak water depth, peak flow rate and average flow rate due to the double peak rainfall are the smallest among the six rainfall patterns in this study.

Keywords: overland flow, nonuniform rainfall, diffusion wave

