NUMERICAL INVESTIGATION OF FLOW AND MORPHOLOGICAL CHANGE OF PARTLY-VEGETATED OPEN-CHANNEL

SUNG-UK CHOI[1] and JINHWI LEE[2]

[1]Proffessor, Department of Civil & Environmental Engineering, Yonsei University, Shinchon-dong, Seodaemun-gu, Seoul, Korea.
(Tel: 82-2-2123-2797, Fax: 82-2-364-5300, e-mail: schoi@yonsei.ac.kr)
[2]Graduate Student, Department of Civil & Environmental Engineering, Yonsei University, Shinchon-dong, Seodaemun-gu, Seoul, Korea.
(Tel: 82-2-2123-7889, Fax: 82-2-364-5300, e-mail: guyjinh@yonsei.ac.kr)

Partly-vegetated flows mean free surface flows in a channel in which only a portion is covered by vegetation. Such flows, in a cross section, are characterized by non-homogeneity of the flow structure due to the discontinuity of the drag force by vegetation. That is, the mean velocity in the vegetated zone is reduced, while that in non-vegetated zone is increased, being resulted from mass transfer between two zones. A shear layer, generated at the interface, is known to play a key role in mass and momentum transfers between vegetated and non-vegetated zones.

This study investigates numerically the flow and morphological change in partly-vegetated flows. The cross section of the channel is assumed to be trapezoidal. The flow is calculated using the lateral distribution model, which is a balance between gravity, bottom friction, turbulence shear, and vegetation drag. The lateral distribution method predicts the distribution of the depth-averaged velocity over the cross section for a given discharge. Bedload transport is considered with the help of vectorized formula by Kovacs and Parker (1994). Then, the shape of the channel cross section is updated by solving Exner's equation. Time-dependent morphodynamic change of the channel cross section is given with re-distribution of discharge due to vegetated zone. Impacts of vegetation density on moving flow from non-vegetated to vegetated zone and morphological change are given and discussed.

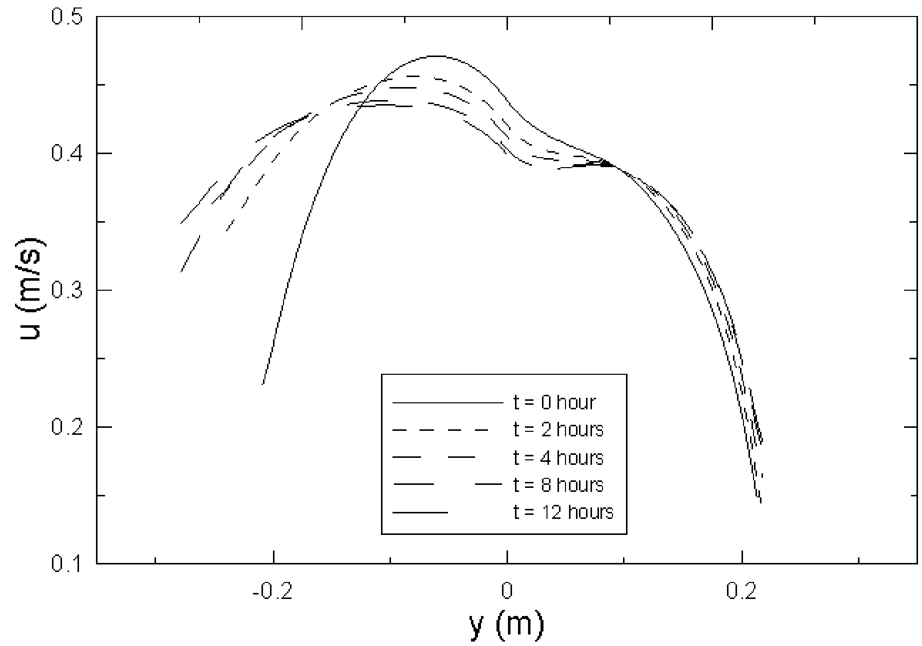

Figure 1. Change of depth-averaged velocity with time

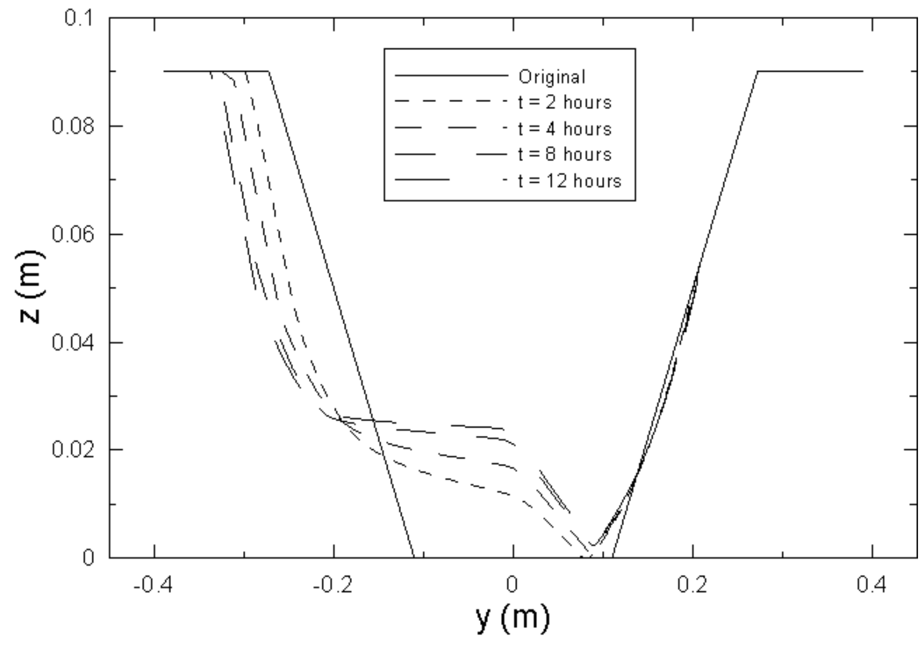

Figure 2. Change of channel cross section with time (at a vegetation density of 0.1 m^{-1})