Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 6, No. 6, p. 464-469, 2015
http://www.innspub.net

INNSPUB
RESEARCH PAPER

OPEN ACCESS

Comparing flow simulation in composite sections with vegetation coverage on the floodplains in ssiim, laboratory and phoenix models

Khansalar*, **Mohammad Reza, Dabaghmanesh, Mehdi**

Hafez Institute of Higher Education, Shiraz, Iran

Article published on June 30, 2015

Key words: Combined sections, Vegetation, Floodplains.

Abstract

There are many models for flow simulation, which according to the complications that happen in various situation, have their own precision and of course limitations. Due to this variation, choosing model type, has become one of the most important parts, in every research. One of these methods, that researchers are so interested in that, is SSIIM model. This model, in order to it's simplicity, is very functional. In this article, many aspects of SSIM model's abilities, including it's precision in flows related vegetation on floodplains, have been studied, and the achieved results have been compared with Fisher Antz and laboratory model. In the next step, we did some graphical tests on the achieve data, then we analyzed the results, and high precision of this model was confirmed.

***Corresponding Author:** Khansalar ✉ engineer_khansalar@ymail.com

Introduction

Fly over of dam or flood, may be occurred, due to the one or a combination of some geophysical events, such as flood, landslides, earthquake and severe winds. The statistics indicated that, the flyover, is one of the important factors, in destruction of the dams and floods. Obviously, among the factors, which are mentioned above, great flood, have the most important effect, on flyover. Until now, several studies have done, about flyover of flood, based on the frequency of occurrence. Despite this, the flyover due to the severe wind, should not be neglected. For this purpose, traditionally, a free height will add to the height of the dam and flood.

Understanding the features of the flow, in order to evaluate the flyover procedures, is necessary. flyover phenomenon of the waves, from the coastal structures, usually was proposed, as a theorem in designing the level of these structures, which should be considered. Due to the dependency of the parameters, and uncertainty in the nature of the phenomenon, the accurate estimate of this parameter, is not possible, during the designing. Nevertheless, several attempts are done, of the modeling the phenomenon and it's accurate estimation. Flyover of the waves, from coastal structures, is considered as the most important hydraulic responses, in designing these kinds of structures. flyover phenomenon of the waves, especially, in relation to the protection structures of the cities and facilities, such as coastal walls and dykes, become more important, because the flyover, from these structures can cause the destruction of the structures, and losses or damages. Flyover of the dam or flood, may be occurred, due to the one or a combination of some geophysical events, such as flood, landslides, earthquake and severe winds. The statistics indicated that the flyover, is one of the important factors, in destruction of the dams and flood. Flyover procedure of the waves, can define in this form: clash of the waves to the structures, escalade, and finally overflow of the water flow, from the structure. This phenomenon, can be Considered ad the factor of several destruction in coastal structures, and the existence structures in their hinterland, in the past and the present time. Due to the uncertainly in predicting the level of water design, and also in determining the design waves, in one hand, and the economic expenditure of the tall structures construction, in other hand, it is unavoidable. Several studies were done in 50 recent years, based on the flyover phenomenon of the waves, from the coasted structures. Theses studies, cause the continuous correction structures, from the coast, against the sea waves.

Existing methods, mainly, divide to the two categories of numerical methods and laboratory methods. In recent years, the laboratory methods, were used less than the numerical methods, despite of the more accordance to the nature of the phenomenon, due to the expensive expenditure of the laboratory equipment, and also the difficulty of creating the situations, similar to the situation, which can be occurred in the nature, while the numerical methods are the interest of researchers, despite of their complexity, and due to the different conditions of the wave, and different forms of the structure, in that, with small changes in program, it can be checked. In this paper, we studied the wired model, and the comparison of wired model and laboratory and hydraulic modeling of fisher Antz, and also some software studies are done, in the field of flow simulation, in combined sections with vegetation, on floodplains, mitigation, due to the occurrence of flows, in the sections of flood control, soil and water conservation, water conservation structures, and avoid filling the reservoir, can double the necessity of using the stable and permanent structures, in the nature, the security of coastal regions, greatly, is dependent on the function of the coastal structures, against the wave flyover. The wave flyover, can cause the creation of the casualties and the significant economic damage. Entry the wave flyover to the harbor and coastal promenades, can cause the creation of destruction in coastal protection structures, and also the damage of the boats, and the disconnection of the flyover, is the key issue, in designing and evaluating the security of coastal structures. Coastal wall, are designed and construct, in order to preserve the coast from the waves, and prevent the progression of the water to the coast, and also the proper use of coastal lands. In order to better understanding, about the behavior of these structures, we should provide the proper information of the flow and the transmitted wave of the flyover. The most important main questions of the present study is the following: what is the most accurate model, in flow simulation, in combined sections with vegetation on floodplains? Is there any substitute for expensive laboratory models, which has more precision? The most important purpose of the present study, is a survey on existing methods, for flow simulation, in combined sections with vegetation on floodplains. The most important hypothesis of the present study is that: we can find out the most accurate model in flow simulation, in combined channels with vegetation on floodplains through the wired model. Wired model, can be a paper substitute for the expensive laboratory models. In this study, purpose are studied the flow simulation in combined channels with vegetation on floodplains, with wired model, which is not studied yet, until now, and it is totally new, in it's kind.

Materials and methods

Dimensional numerical model

In this paper, at first and in order to verify and ensure the accuracy of use of three-dimensional numerical model, a problem is selected which is simulated before by Fisher-Antz, *et al.* (2001) in the laboratory. And its measured data have been collected, then three-dimensional modeling was performed and its results are compared. The available vegetation is assumed in a form of vertical cylinder and obtained resistance force is modeled by Drag force and Drag coefficient. The obtained resistance excess force from vegetation is added as a sink term to the right hand of Navier-Stokes momentum equations.

$$\frac{\partial U_i}{\partial t}+U_j\frac{\partial U_i}{\partial x_j}=\frac{1}{\rho}\frac{\partial}{\partial x_j}(-P\delta_{ij}-\rho\overline{u_i u_j})\ -F_i \qquad i,j=1,2,3$$

Another method in this context is to use a larger roughness coefficient as the source term in momentum equation in which obtained resistance force from vegetation is applied in the vicinity of the substrate. And its effects not be modeled on the entire depth of flow. So, in this article, equivalent cylinders and drag force are used on the entire flow depth. Experiments are performed on a film with a length of 19/5 and width of 0/91 meters.

Result and discussion

Vegetation hypothetical lab

In this section, the results of the model, is compared in comparison with the measured data in channel, with combined section, and it is presented in the figures of (1-2) to (3-2). In these figures, the results of fisher Antz research and also the observed data for flow in combined section with vegetation in two flows of 0.057 $m^3/s$and 0.041 m^3/s. The percent average relative error, in two flows of 0.057 and 0.041, in the present study, in comparison with measured data, are equal to 10.7 and 7.36, respectively, and in Fisher Antz *et al.* (2001) research, they are 15.36 and 5.43 percent, respectively, and in both cases, the precision of occurred numerical simulations, in present study, in comparison with the previous similar studies and the real data, is confirmed.

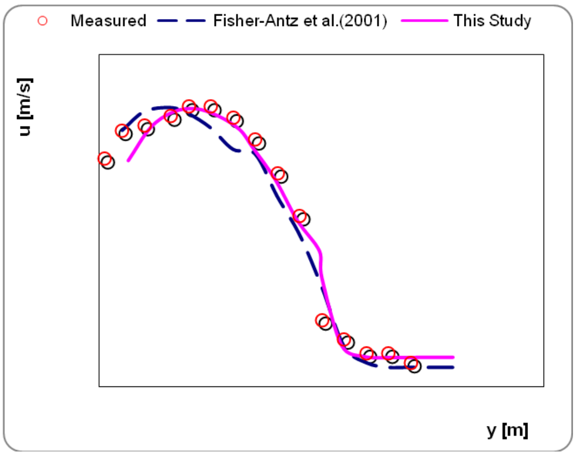


Fig. 1. Comparing the results of numerical simulations with actual observations and conclusions in this paper (Fisher Antz *el al*, 2001) in spite of the composite section vegetation Drdby 0/057.

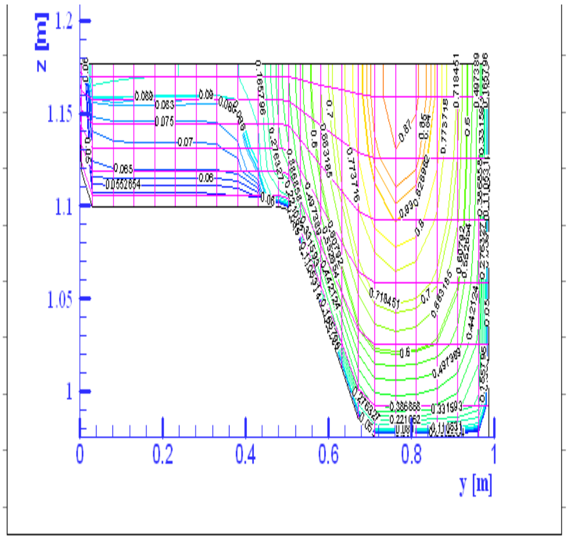


Fig. 2. Computing network at a compound rate of 0/057 in Dubai.

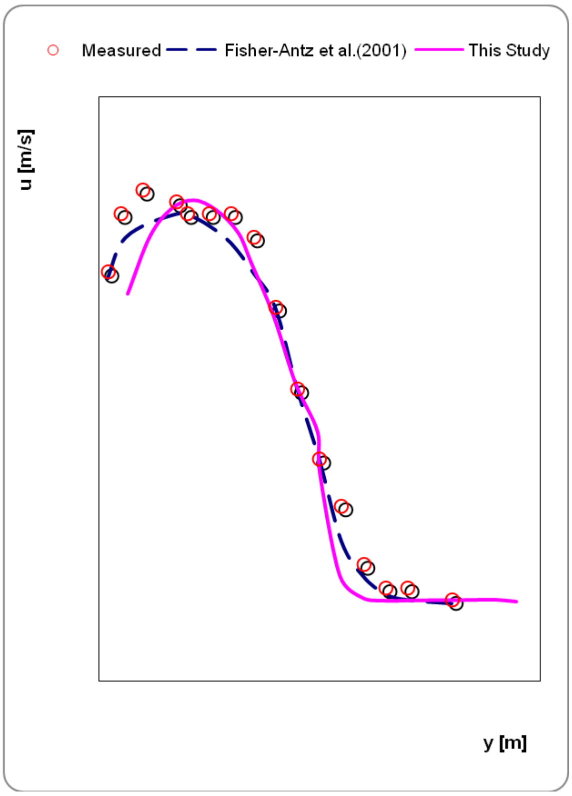


Fig. 3. Comparing the results of numerical simulations with actual observations in the present paper And results (Fisher Antz *el al*, 2001), although at a compound rate of vegetation in 0/041.

Comparison between Sim and Phoenix models has been done. In this section, to assess the accuracy of numerical model in calculations of suspended sediment in complex flows, and simulation of suspended sediment in the reservoir and investigating the removal ratio of suspended sediment in flooding of dam have been conducted. So, related data to kapunga reservoir in Tanzania are used and the model performance is compared with measured data and the results of three-dimensional of PHONICS model. (Ruther,2006). In fig.(4), the plan of dam and its pond have been shown. Suspended sediment numerical modeling and numerical solution of transfer-distribution equation are conducted in conjunction with boundary condition of substrate concentration of Van Ryan. The results of numerical modeling are evaluated by comparing the ratio of calculation performance and observations of crater of pond. In compare with average two-dimensional models, three dimensional modeling of suspended sediment are lead to more accurate and confident engineering judgment due to the deep distribution of sediment concentration. And in extracting the relations of suspended sediment and due to distribution of sediment concentration in deep, it is necessary to use three-dimensional numerical models. Especially, in dewatering from rivers and reservoirs and by using three-dimensional numerical models, we can investigate the removal efficiency of sediment from pond in different design options. The efficiency of a pond is defined as Performance Ratio and is equal to the difference of suspended sediment to pond channel to entrance suspended sediment from upstream river to 1. Performance ratio (the difference between 1 and concentration ratio in pond channel to the concentration in upstream river) is equal to 1 and indicate the removal of all suspended sediment from entrance flows to opening of pond and zero Performance ratio indicates lack of concentration reduction of entering sediments to river and entering flow to channel and if the performance ratio is greater than 1 indicates unsuitable and destructive performance of opening of pond which leads to increase sediment concentration in the inflow to the pond. In the studied dam, although the dam's substrate is covered of sand, Gravel and rubble but desert measurements show that transferred materials are often fine sand and clay. And D50 is the material of 1.2 mm substrate and for suspended sediment, it is 0.18 mm and opening of pond is located in the external arc. And the entered sediment load will be lower due to secondary flow pattern. In table (1), related data to flow are considered in five different measurement and to investigate the accuracy of numerical model, they are used. To solve the transfer-distribution equation of pollution, the second order upstream difference pattern (SOU) is used that linear interpolation in two upstream control volumes has been used. The dispersion coefficient is equal to vortex viscosity which is calculated of k-Ɛ turbulence model. For boundary condition of concentration in context, Van Ryan experimental relation is used. Boundary conditions to solve three dimensional equations of transfer-distribution is like that in the substrate of bed, downstream, output and balance, for boundary condition, symmetry boundary condition (zero gradient) is used and in water level, the concentration is assumed to be zero. And in entrance points or special injection points, a known input concentration is applied.

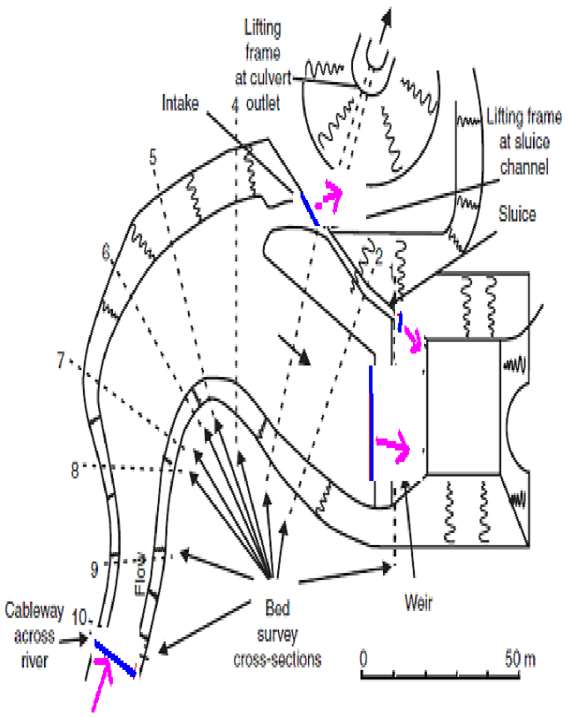


Fig. 4. The plan of Kapunga dam and its pond (Ruhther, 2006).

Table 1. Data related to flow in five measuring concentration in pond of dam and upstream.

Text	Discharge (cubic meters per second)		
	River	Valves of sediment washing	pond
1	28/4	4/2	0/99
2	15/8	6/1	1/22
3	40/7	8	3/07
4	54/7	7/2	2/2
5	38	4/8	2/96

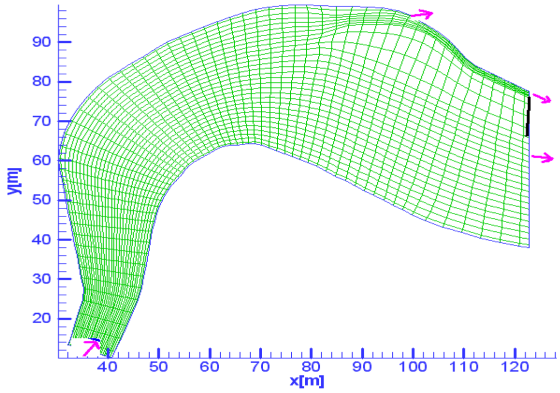


Fig. 5. Used computational network in three-dimensional model.

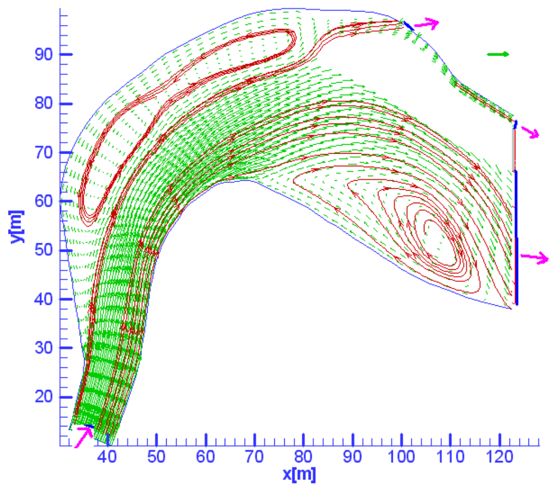
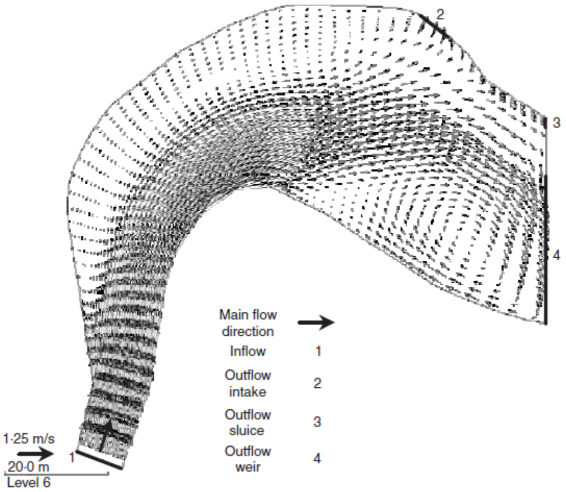


Fig. 6. Calculated flow field in present paper.

In fig.(5), the used calculation network and among figures (6) and (7), the velocity field and calculated flow lines are shown in the present study. On average, the computational grid size is 2.5 meter in length (60 volume control) and 1.25 meter in width (30 volume control) and in depth, it has 20 volume control.

In figures (6) and (7), the results of PHONICS and SSIM models are presented in flow field.



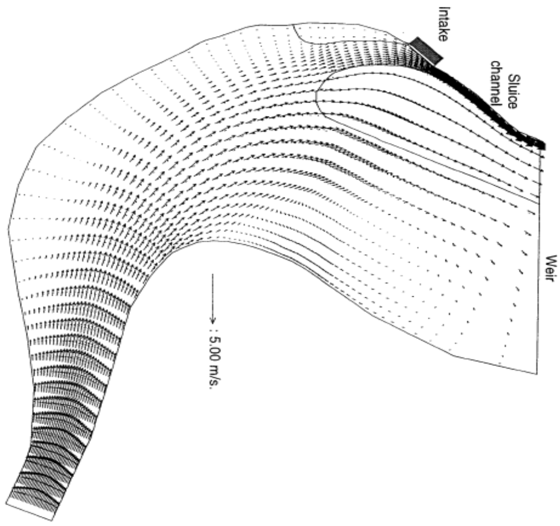


Fig. 7. Calculated flow field in PHONICS model in the research (Ruther, 2006).

Conclusion

we can observe from the presented figures of (1) to (3). That the done results of numerical modeling in this study, with the done results of numerical modeling by Fisher- Antz *et al,* 2001, and also the measured data, are in good coordination, and the precision of numerical modeling, in present study is desirable, despite of the flow complexity. The purpose of doing the simulations of this part, is the verify the accuracy of the wired model, and using of them, in complex issues of the flow in combined sections, and the results are confirmed. In order to improve the results of the paper and overcome its limitations, the following recommendations is advisable: doing the other modeling in order to study the present research and study the other kinds of flows, with laboratory model, and comparing them, with SSIIM model. In figures (6-2) and (7), the results of PHONICS model and SSIIM models are presented in Ruther (2006) thesis and it seems that conducted numerical simulation in this study is consistent with the results of other researchers. SSIIM model than PHONICS model can simulate the rotating and secondary flow pattern.

References

Cheng ST, Yen B JBES_ZMI-100-final-go for publish. Docx C, Tang WH. 1986. Wind induced overtopping risk of dams, proceeding of stochstic And risk analysis in hydraulic engineering water re sources publications 66-78.

Farhadzadeh A, Shifieefar M. 1385. Analytical studies of existing models, in overpass of the structures. eighth conference on maritime industries, November.

Jafari A, Shahidi AA. 1389. present a model for estimating the rate of flyover wave in a plat form of graver, ninth conference of Iran hydraulic, TMU.

Khakbazb. 1380. risk analysis and reliability of overpass river flood , due to the river . the third conference of Iran hydraulic.

Meftahhalghi M, Azizi A, Dehghani AA, Alhoseini NS. 1388. The energy dissipation in overflow of lace stone stairway through using impermeable plates , publication of agricultural science and natural resources 234-241.