Modeling Hydraulic of the Karoon River

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Abstract

A river system from source point to the discharge point is subjected to continuous morphological changes for example degradation or aggradations of bed River. Water structures, are applied structures that are built in different positons of water domains (rivers and seas) in onshore and offshore. The main purpose looked for in building these structures is optimum use of water domains and currents and in fact, providing of coastal destroy and unwanted damages which maybe take place in different times. In this research, hydraulical and hydrodynamical study is done about Karoon river from Mollasani to Arab Hassanar. That is, we consider the ways for decreasing coastal destroy and erosion due tofloods three. So, appointing an applied model about pattern of river currents under different conditions of the domain, we inform from effectiveness of coasts such the case study zone as a part of coastline .The present study attempts to investigate the morphological changes of the Karoon River and explore the effects of the river floods. The hydraulic performance of Karoon river demonstrates significant flood damage potential in agricultural, industrial and residential areas adjacent the river in Khouzestan plain. Therefore, flood control of Karoon river is one of the main aims for under study and construction plans in this part of country. This article presents the results of flood analysis in Karoon catchments and flood control effect of under operation and construction dams. It also presents the evaluation of structural flood control plans in downstream of dams and floodplain areas. In this regard, inundation level and inundated area was calculated by using flood dynamic routing model named MIKE11 in different situations, without and with different flood mitigation alternatives. At last, hydraulic principles dominated on the river will be considered and analyzed.

***Key words**:* Karoon river, Flood, Mike11, Modeling, Hydraulic.

1- Introduction

River is a main part of hydrology cycle which has specific characteristics. It is evident that the study of water resources in a region are critical to the economic and societal development planning and flood occurrence as one of the natural events that has always been threatening the human communities residing along the rivers. Structural flood control methods which have been noticed by human beings from past, mainly imply flood damage reduction through flood peak decrease or damageable area protection. In these methods, potential of constructing dams and river engineering projects are evaluated in flood damages reduction by identifying important and critical floodplains and flood damages are prevented by constructing civil plans such as dyke in damage reach, detention dams or flood diversion system in upstream. In recent decades, non structural flood control methods have been noticed as effective and economical methods in decreasing flood effects. These methods try to match flood condition and manage damage reduction. In simple words, structural methods make flood away from people and non structural methods make people away from flood. Non structural methods have less cost compared with structural methods and could show more effect besides each other. Anyhow, in

order to reach suitable flood control system, combined use of two methods is necessary and success rate of these methods depend on convenient flood control and crisis management. In recent decades, flood management even precedes in developing flood forecast models. In this regard, Decision Support Systems (DSS) have been developed to decide better in different situations of catchment and river (Betts et al., 2005 and Clark et al., 2005). These systems include different components such as meteohydrology, flood forecast, flood management, hydraulic of river, analysis and choice selection system and so on.

In Iran, structural flood control methods have been used from past and new methods of damage reduction have been noticed in some catchments. In this paper, Karoon river catchment is investigated as one of the high flow river in Iran. Due to significant flood damage potential in Khouzestan plain which is affected by Karoon river in flood seasons, different structural flood control solutions were concentrated. Then competitive and applicable alternatives were investigated based on hydraulic, technical and economical issues to prioritize. As more of us know, Mike11 is an applied and scientific software to analyze data in water sciences and so on. Therefore, much of our results demonstrated in curves, profiles and predicting next date in the case study zone are gotton by using this useful software.

2- The case study zone

Total area of Karoon catchment is about 65500 km^2. This catchment is situated in south west of Iran and in Zagros mountains. Mountainous and mountainside areas comprise seventy eight percent of total catchment. Other twenty two percent is Khuzestan plain.

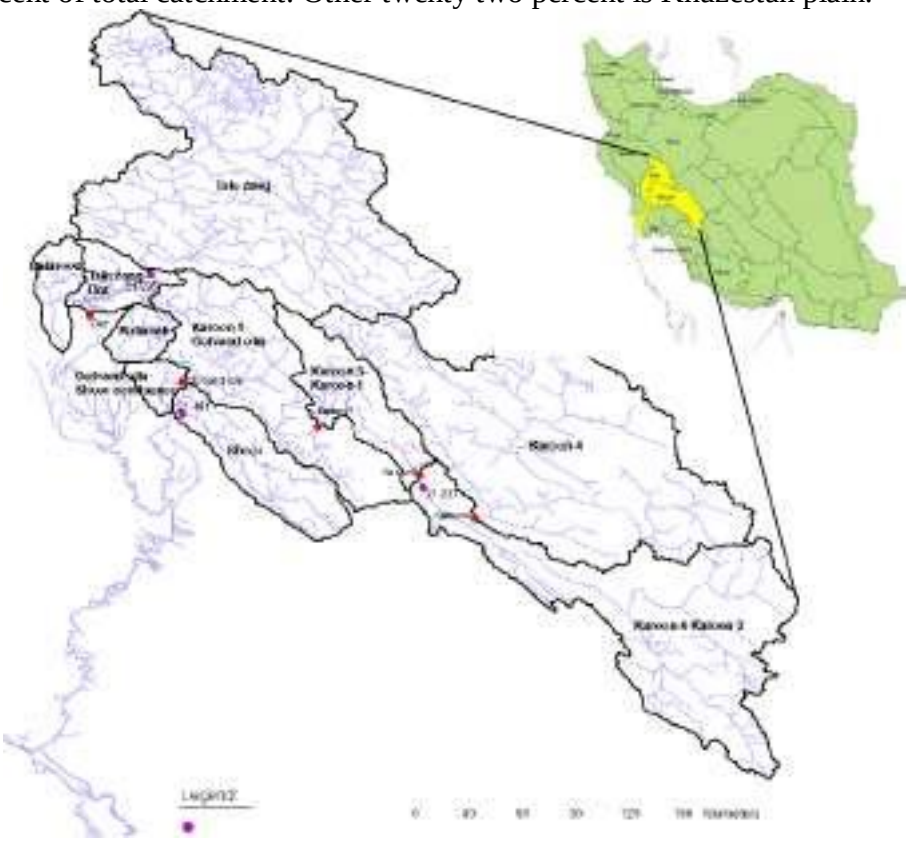

Fig. 1: The case study zone

3 - Flood hydrograph

The design flood discharge in river reaches is one of the most important parameters in flood control studies. In the Karoon river, it is necessary to determine the flood volume in addition to the flood peak discharge, because of the effects of reservoirs on flood attenuation. Therefore, the design flood can be defined as a flood hydrograph with different return periods. In these studies, at first, flood peak discharges were determined with different return period at control points by using regional flood analysis. Then flood hydrographs with different return periods were determined based on two methods. Index hydrograph method was used at the control points where a hydrometric station is available. At other control points or intermediate catchments which there are no hydrometric stations, unit hydrograph method and rainfall analysis was used and flood peak discharges were modified by the results of regional analysis. A sample of this section's results is presented in Figure (2).

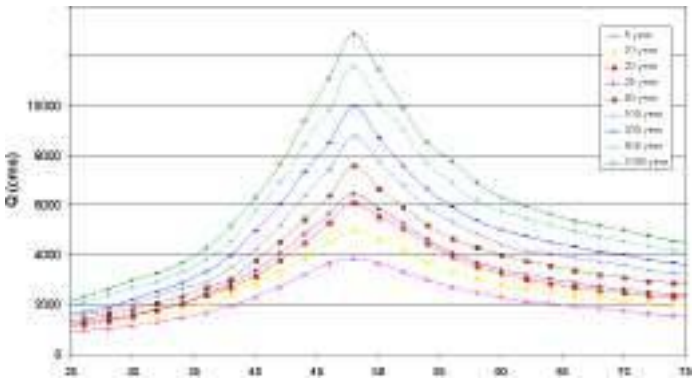

Fig. 2: Flood hydrographs with different return periods in Tale zang hydrometric station

4- Flood attenuation effect of consecutive reservoirs

According to operation of Karoon catchments dams, flood attenuation effect by reservoirs should be calculated and considered. Therefore, flood routing for different return periods was done through reservoirs system and the results are presented as reservoirs outflow hydrographs. As presented in Figure (3), mean velocity changes seasonally and it is in a critical situation; therefore it is very important to discuss all aspects coastally about prevention in this zone.

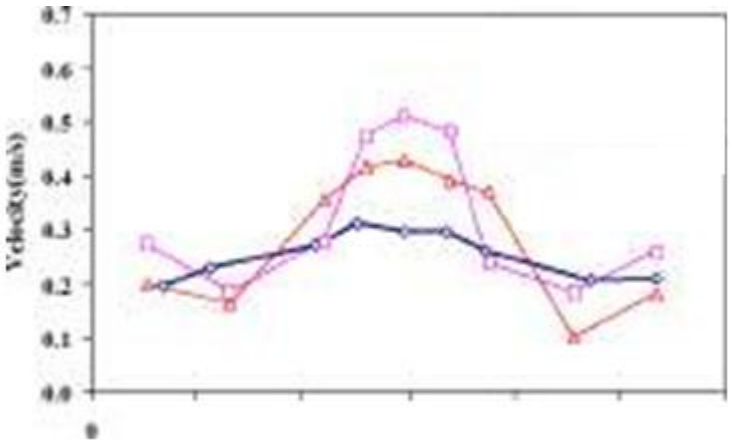

Fig. 3: Mean velocity in coastal zone of the Karoon river

As we know, the Karoon river is the biggest one in Iran and it is long passing through many ports and cities. It has much importance discussing and in regards to be considered hydraulically.

2- Flood control solutions

As mentioned before, a flood control plan which can include structural or non structural methods, decrease flood effects in different ways with different solutions. Therefore, selecting a flood mitigation plan to protect a specific area depends on the characteristics and conditions of damageable region.

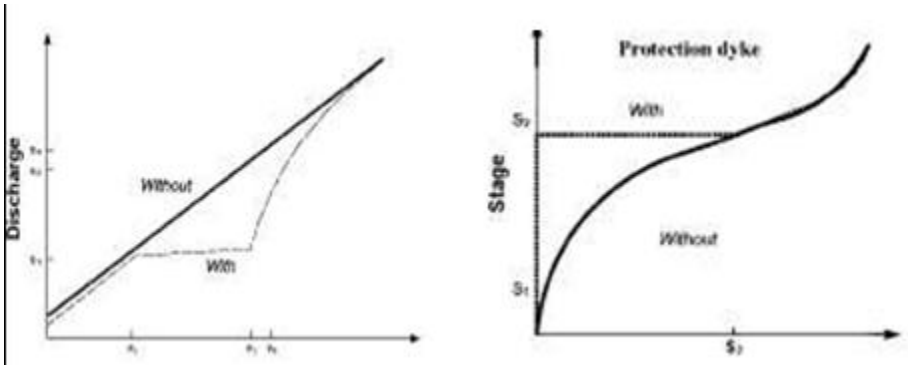

Fig. 4: Modified probability - discharge and stage - damage functions due to constructing flood mitigation plans

Conclusion

Water structures, are applied structures that are built in different positions of water domains (rivers and seas) in onshore and offshore. The main purpose looked for in building these structures is optimum use of water domains and currents and in fact, providing of coastal destroy and unwanted damages which maybe take place in different times (Camp Dresser and McKee, 1981). The interaction among different flood control options with the goal of reducing flood damages has been considered in the proposed optimization model. This study presents that floodplain vegetation result in velocity decrease in floodplain and also increase of velocity in main channel. The variation caused some rise in lateral momentum transfer and energy loss. The type and area of different land use should be determined separately to evaluate the financial damage caused by floods. Also, the portion of each land use must be estimated discretely for all reaches. These damages are related to the level of water in the floodplain and the values of these damages are not similar for different land use. In order to study this issue for different land use, a typical house with two floors and its common household equipment have been considered. Loss of life is of no monitory equivalence. But even airline industries put a value when estimating the risk of a plane crash. The estimation of this loss is a highly sensitive matter with different social reactions. By determining the density of population and the compensation value according to insurance criterion, the damage associated with the loss of life can be evaluated. At last we could say that coastal protection is a very important task to be done for prevention from damaging to these vital water resources.

ACKNOWLEDGMENTS

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References

1.Betts, H. W., Sterling, E., Clark, S. Q., Markar, M. S., Chen, M., Huang W., Flood Management Decision Making in the Yangtze River, China, 8th International River Symposium 6-9 September 2005, Brisbane, Australia.

2.Betts, H.W., Sterling, E., Clark, S.Q., Wu D., Wang J. Q., 2005. An Options Analysis System for Flood Management Decision Making in the Yangtze River Catchment, China; Third International Symposium on Flood Defence, Nijmegen, 25-27 May 2005. Netherlands.

3. Betts, H.W., Joy, C.S., Haslam, W., Hallam, A.B., Jin, X. P., 2005. Yangtze River Flood Control and Management Project Overview and Project Scope; Third International Symposium on Flood Defence, Nijemgen, 25-27 May 2005. Netherlands.

4.Camp Dresser and McKee, (1981), Daily flow model of the delaware river basin, main report, prepared for the U.S. army corps of engineers, september.

5.http://www.hec.usace.army.mil/software/hec-ras/, 2002. Yang J, Ronald D, Townsend R, Daneshfar B. 2006. Applying the HEC-RAS model and GIS techniques in river network floodplain delineation. Canadian Journal of Civil Engineering. http://www.gdrc.org/uem/disasters/1-dm_cycle.html