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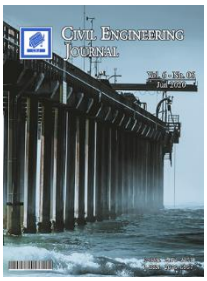

One-Dimensional Hydrodynamic Modeling of the Euphrates River and Prediction of Hydraulic Parameters

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Abstract

Forecasting techniques are essential in the planning, design, and management of water resource systems. The numerical model introduced in this study turns governing differential equations into systems of linear or non-linear equations in the flow field, thereby revealing solutions. This one-dimensional hydrodynamic model represents the varied unsteady flow found in natural channels based on the Saint-Venant Equations. The model consists of the equations for the conservation of mass and momentum, which are recognized as very powerful mathematical tools for studying an important class of water resource problems. These problems are characterized by time dependence of flow and cover a wide range of phenomena. The formulations, held up by the four-point implicit finite difference scheme, solve the nonlinear system of equations using the Newton-Raphson iteration method with a modified Gaussian elimination technique. The model is calibrated using data on the Euphrates River during the early spring flood in 2015. It is verified by its application to an ideal canal and to the reach selected at the Euphrates River; this application is also used to predict the effect of hydraulic parameters on the river's flow characteristics. A comparison between model results and field data indicates the feasibility of our technique and the accuracy of results (R^2 = 0.997), meaning that the model is ready for future application whenever field observations are available.

Keywords: Hydrodynamics; River; Surface Water; Numerical Model; Finite Element; Flow.

1. Introduction

Open channels are found in natural rivers, basins and estuaries. Many problems in water resources, river mechanics and environmental hydraulics require accurate descriptions of the flow regime parameters regime in open channels. As a result, the study of the development and management of water resources has become highly relevant for engineers. A mathematical model is a representation of the behavior of a particular system in the form of mathematical equations. By specifying parameters within mathematical models, system responses can be determined. Though they usually function as a design tool, these models may also be used for the real-time control or operation of a system. The following steps are generally involved in the development of mathematical models: derivation of governing equations; selection of solution procedures; and calibration and verification of the model.

Jacob et al. (2019) used a hydrologic-hydraulic approach to assess survey the information rare lower Bharathapuzha basin in Kerala, India. They developed a completely hydrodynamic one-dimensional (1D) waterway stream model is aligned in 1992 and validated in 1994. They then use a coupled 1D-2D flood immersion model to simulate the degree of flooding in 2002. A suitable methodology is used to derive this information from the partially cloud-secured WiFS

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