Chapter 60
Basics for Hydraulic Modelling of Flood Runoff Using Advanced Hydroinformatic Tools

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ABSTRACT

The first part of the chapter presents general and specific issues concerning the use of hydroinformatic tools in hydraulic modeling as important step in decision-making activities in extreme situations such as floods. The special importance of these issues is the fact that currently cannot conceive a project related to water management without the use of computer modeling / simulation. It is shortly presented the usual simplified schematizations of real flow systems which are applied usually for flood modeling: one-dimensional (1D), two-dimensional (2D) or her combination. Based on the general principles of continuum mechanics the fundamental equations of hydrodynamics are deducted which stay on base of the river modeling. For the 1D schemes discussed the particular forms of the basic equations. To illustrate the above explanations in the next section modeling applications for several representative case studies will be presented using three known hydrodynamic/ hydrological modeling packages, namely DUFLOW, HEC-RAS, MIKE-11.

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BASICS FOR HYDRAULIC MODELLING OF FLOOD RUNOFF USING ADVANCED HYDROINFORMATIC TOOLS

General Aspects of Construction and Execution of Hydraulic Modelling for Flood Runoff in Rivers

Hydraulic models for water management including of course flood management are essential tools for designing and analyzing of facilities, which ensure adequate flood protection without wasting financial resources through over-design or poorly conceived designs. Currently hydraulic models are integrate in concept of hydro-informatics, complex modelling and information systems for water management, which contain hydraulics, hydrology, environment engineering and use advanced information and communication technology, supported by computer- based tools (Abbott, 1979; Tagelsir, 2010). Hydroinformatic tools, including Computer-Aided Design (CAD) programs, Graphical User Interface builders, Geographic Information Systems (GIS), Hydrodynamic Modelling Packages, Code Builders, Databases, Data Analysis and Communication Tools and are used to provide support for decision making for flood and river management, urban drainage and supply systems, at all levels of management and operations providing answers among other to the following questions (Chow, 1959): - what are the most appropriate modelling systems and tools? - how to construct reliable models of the water-based systems? - how should these models be integrated into decision support systems that would help engineers and managers? Nowadays no water- related projects can be executed without hydraulic modelling supported by computer- based tools i.e. Hydroinformatic tools. It should be also noted that a Modelling Systems Development is the full life cycle development of software tools from their initial conception and mathematical basics, design, software implementation, to verification and the end-user implementation. The most important steps to building complex hydraulic models for water and flood management of riverine systems can be shown in Figure 1.

The first and very important step, to build models, is the Technical description of the physical system including usual simplified schematizations of the complex real riverine system and as well the math-

Figure 1. Principle schemes for construction and execution of models