



Some Experiences with Numerical Modelling of Overflows

Larsen, Torben; Nielsen, L.; Jensen, B.; Christensen, E.D.

Published in:

The Fifth International Symposium on Environmental Hydraulics (ISEH V)

Publication date:

2007

Document Version

Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):

Larsen, T., Nielsen, L., Jensen, B., & Christensen, E. D. (2007). Some Experiences with Numerical Modelling of Overflows. In *The Fifth International Symposium on Environmental Hydraulics (ISEH V)*

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal -

Take down policy

If you believe that this document breaches copyright please contact us at vbn@aub.aau.dk providing details, and we will remove access to the work immediately and investigate your claim.

The Fifth International Symposium on Environmental Hydraulics – 2007

Arranged by

Arizona State University and the University of Arizona under the auspices of the International Association of Hydraulic Engineering and Research (IAHR).

ABSTRACT

SOME EXPERIENCES WITH NUMERICAL MODELLING OF OVERFLOWS

T. Larsen¹, L. Nielsen², B. Jensen³ and E.D. Christensen³

¹ Aalborg University, Civil Engineering, Sohngaardsholmsvej 57, 9000 Aalborg, Denmark, e-mail: torben.larsen@civil.aau.dk

² NIRAS A/S, Sortemosevej 2, 3450 Allerød; Denmark, e-mail: lni@niras.dk

³ DHI Water & Environment, Artens Alle 5, 2650 Hørsholm, Denmark, e-mail: bjj@dhigroup.com and edc@dhigroup.com

Overflows are commonly applied in storm sewer systems to control flow and water surface level. Therefore overflows play a central role in the control of discharges of pollutants from sewer systems to the environment.

The basic hydrodynamic principle of an overflow is the so-called critical flow across the edge of the overflow. To ensure critical flow across the edge, the upstream flow must be subcritical whereas the downstream flow is either supercritical or a free jet. Experimentally overflows are well studied. Based on laboratory experiments and Froude number scaling, numerous accurate and reliable formulas for the estimation of overflows have been derived.

Numerical modelling of overflows is significantly more complicated than standard 1-dimensional river or sewer modelling. The problem is usually managed by incorporating the mentioned empirical formulas in the numerical models. If there are no standard formulas for a specific geometry, physical experiments have to be carried out.

The present study uses laboratory experiments to evaluate the reliability of two types of numerical models of overflows in sewers systems:

1. 1-dimensional model based on the extended Saint-Venant equation including the term for curvature of the water surface (the so-called Boussinesq approximation)
2. 2- and 3-dimensional so-called Volume of Fluid Models (VOF-models) based on the full Navier-Stokes equations (named NS3 and developed by DHI Water & Environment)

As a general conclusion, the two numerical models show excellent results when compared with measurements. However, considerable errors occur when inappropriate boundary conditions and grid resolutions are chosen. The paper describes the physical and numerical models and summarises the results.

Abstract accepted