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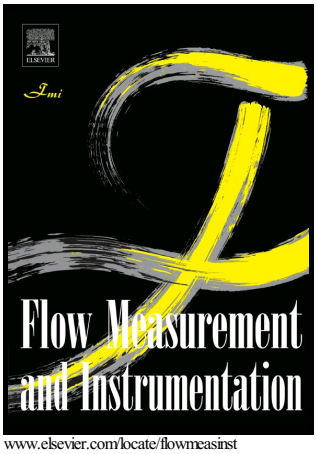

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VALIDATION OF COMPUTATIONAL FLUID DYNAMICS FOR DERIVING WEIR DISCHARGE RELATIONSHIPS WITH SCALE MODEL EXPERIMENTS AND PROTOTYPE MEASUREMENTS

Petra VAN DAAL-ROMBOUTS[1,2,*], Aldo TRALLI[3], Femke VERHAART[3], Jeroen LANGEVELD[1,4], François CLEMENS[1,3]

[1] Delft University of Technology, P.O. Box 5048, 2600 GA Delft, the Netherlands

[2] Witteveen+Bos, P.O. Box 233, 7400 AE Deventer, the Netherlands

[3] Deltares, P.O. Box 177, 2600 MH Delft, the Netherlands

[4] Partners4UrbanWater, Javastraat 104A, 6524 MJ Nijmegen, the Netherlands

*Corresponding author, p.m.m.vandaal-rombouts@tudelft.nl, + 31 6 5090 9369

Abstract

Weirs are essential structures in sewer systems. Detailed knowledge on their hydraulic performance is necessary but difficult to obtain. In this research the applicability of computational fluid dynamics (CFD) simulations for deriving reliable discharge relationships for weirs where the weir chamber geometry limits the discharged flow is investigated. A unique combination of field measurements for a combined sewer overflow, lab experiments on a scale model, and CFD simulations for the scale model and prototype is available. In the CFD simulations no prior knowledge on the hydraulic behaviour of the weir was assumed to verify the application of CFD for both scientific and engineering purposes. The results show that i) unverified CFD simulations can describe the complex hydraulic behaviour occurring in the lab experiments including a flow regime change, ii) different discharge relationships are needed for different flow conditions, iii) unverified CFD is applicable to derive discharge relationships in the disturbed flow regime where backwater effects occur, but has no added value over the standard weir equation in the undisturbed regime, and iv) unverified CFD can be applied to determine the optimal sensor location. This study supplies a quantitative support to earlier publications based on unvalidated results.