Accepted Manuscript

Influence of VOF technique, turbulence model and discretization scheme on the numerical simulation of the non-aerated, skimming flow in stepped spillways

Arnau Bayon, Juan Pablo Toro, Fabián A. Bombardelli, Jorge Matos, Petra Amparo López-Jiménez

PII: S1570-6443(16)30195-2
DOI: https://doi.org/10.1016/j.jher.2017.10.002
Reference: JHER 409

To appear in: *Journal of Hydro-environment Research*

Received Date: 13 July 2016
Revised Date: 15 October 2017
Accepted Date: 23 October 2017

Please cite this article as: A. Bayon, J.P. Toro, F.A. Bombardelli, J. Matos, P.A. López-Jiménez, Influence of VOF technique, turbulence model and discretization scheme on the numerical simulation of the non-aerated, skimming flow in stepped spillways, *Journal of Hydro-environment Research* (2017), doi: https://doi.org/10.1016/j.jher.2017.10.002

Influence of VOF technique, turbulence model and discretization scheme on the numerical simulation of the non-aerated, skimming flow in stepped spillways

Arnau Bayon,[1,*] Juan Pablo Toro,[2] Fabián A. Bombardelli,[3] Jorge Matos,[4] and Petra Amparo López-Jiménez [5]

[1]Research Institute of Water and Environmental Engineering (IIAMA). Universitat Politècnica de València, Camí de Vera, s/n, 46022, València, Spain (arbabar@iiama.upv.es)

[2]Assistant Professor, Department of Civil Engineering, Universidad Andres Bello, Santiago 8320000, Chile; formerly, Ph.D. Candidate, Department of Civil and Environmental Engineering, Univ. of California, 2001 Ghausi Hall, One Shields Ave., Davis, CA 95616. E-mail: juan.toro.l@unab.cl

[3]Department of Civil and Environmental Engineering, University of California, Davis, USA (fabianbombardelli2@gmail.com)

[4]Department of Civil Engineering, Architecture and Georesources, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais 1, 1049-001, Lisboa, Portugal (jorge.matos@tecnico.ulisboa.pt)

[5]Department of Hydraulic and Environmental Engineering, Universitat Politècnica de València, Camí de Vera, s/n, 46022, València, Spain (palopez@upv.es)

[*]Corresponding author

Abstract

An accurate description of the hydrodynamics in the non-aerated region of the skimming flow on stepped spillways is of outmost importance, particularly in small structures at large discharges. In addition, the flow features upstream of the inception point of air entrainment determine the flow behavior in the downstream self-aerated region. In this work, numerical models of the flow in the non-aerated region of stepped spillways have been developed using diverse turbulence closures and discretization schemes implemented in two CFD codes: *OpenFOAM* and *FLOW-3D*®. Partial VOF (Volume of Fluid) and "True" VOF (*TruVOF*) approaches are employed to capture the position of the free surface. The Standard, RNG and Realizable *k-ε*, in addition to the SST k-ω