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Hydrology and Earth System Sciences Discussions

Interactive comment on "CFD modelling approach for dam break flow studies" *by* C. Biscarini et al.

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General and specific comments

The submitted paper compares the application of two numerical models for the simulation of two test cases. The first model is a 2D shallow water model, the second one is a fully 3D model modelling the flow process as a two phase flow (air and water) occurring inside a regular box, including the water and part of the atmosphere. The first test case is a dam-break problem, occurring on a flat and frictionless domain, with an asymmetric dam. The second one is a 1D dam break occurring in a channel with a triangular bump downstream the dam. The conclusion of the authors, based on the test results, is that the application of a fully 3D model for the dam break simulation model is important at least for the computation of the wave formation immediately after

the collapse of the dam. This also because the authors observe, in the test results, that the SW model underestimates the peak flow of about 20% with respect to the 3D model.

According to my opinion, the conclusions drawn by the authors have weak motivation. First of all, the condition of frictionless bed with zero slope is not realistic, specially for the SW models. Even if the friction terms are negligible with respect to the inertial terms immediately after the beginning of the break, their effect on the peak discharge and mainly on the water levels shortly after the dam section can be significant. Moreover, there is experimental evidence in literature that the SW approach provides a good match between the measured and the computed water heads; see for example the experiment of Fraccarollo and Toro (1995) or other benchmark solutions shown by Aricò et al. (2007). The unsteady state velocity measurement is more difficult, but it could also questioned the relevance of high accuracy in the computation of very high velocities, when the same fixed bed hypothesis is a rough approximation of reality, close to the dam and immediately after the break. The same hypothesis of instantaneous dam break is a simplification of reality. How much 'instantaneous' must be the break in order to make relevant a 3D computation of the wave formation? This should be investigated, because I suspect that even a gradual variation of the breach of few seconds makes the results of the two models almost equivalent. According to the previous notes, I think that test case 1 should be changed with a more realistic one, where also laboratory data are available, if possible. If laboratory data are not available, the variation of the error according to same parameter (like the height-width ratio of the breach or the effective break time) could be interesting. Test 2 has the support of laboratory data, but is less significant for the generality of the conclusions.

The original contribution of the researchers in the paper is also not fully clear to me. The authors say that the 2D SW model is an open source model and they provide more details on the 3D model. The space and time discretization is provided by the OpenFOAM platform? According to which numerical scheme? The k-eïĂăturbulence

model is just an option of the OpenFOAM platform or has been specifically coded by the authors? The same questions hold for the Volume of Fluid method.

The presentation is very good and all the references are given.

The comparison of different 2D SW model results, reported in section 3.1.2, I think is not of strong interest in the paper context.

Technical corrections

Fig. 13 is too small.

References

Fraccarollo L., Toro EF. Experimental and numerical assessment of the shallow water model for two-dimensional dam-break type. J. Hydr. Res. 1995;33(6):843–64.

Aricò C., Nasello C. e T. Tucciarelli , A Marching in Space and Time (MAST) solver of the shallow water equations. Part II: the 2D model. Adv. in Water Res., vol. 30(5), 1253-1271, 2007.

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