EXPERIMENTAL AND NUMERICAL RESULTS ON THE 2D PROPAGATION OF DAM-BREAK FLOWS OVER DRY BED

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The main objective of the present study is to develop a numerical model for the simulation of 2D dam-break flow propagation over dry bed and with sediment transport. Two experimental tests were performed; one with sand and the other with pumice bed, allowing not only the comparison with the numerical results but also to check the influence of sediment mobility on the dam-break wave propagation. The experiments were carried out in a rectangular horizontal flume that includes a sudden enlargement. The free-surface time evolution was measured with pressure transducers and the experiments were recorded with two video cameras. Upstream, the initial condition was a sediment bed with water above and downstream the bed was fixed and dry.

A 2D conceptual model is developed, based on the 1D conceptual model by Leal *et al.* (2003). The model is composed by two transport layers (Fig. 1), the upper where velocity is high and sediment concentration is negligible and the lower where velocity can be small and sediment concentration can be high. In both layers velocities and sediment concentrations are considered to be uniform and the hydrostatic assumption remains valid.

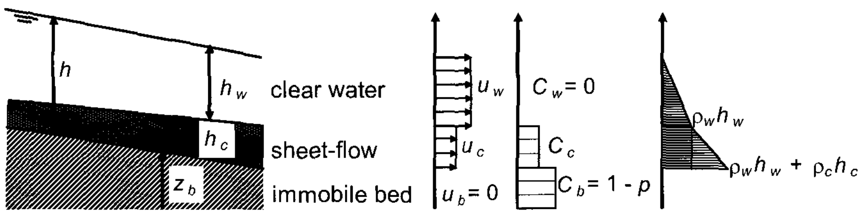

Fig. 1 Conceptual model by Leal et al. (2003).

The 2D conservation equations are presented and closure equations are proposed, based on uniform sheet-flow data by Sumer *et al.* (1996). The friction coefficient is quantified also on the basis of the sheet-flow experiments of those authors, using of the non-dimensional sediment fall velocity as a similitude parameter. The numerical scheme used to solve the set of conservation equations is a TVD version of MacCormack's scheme. Since the TVD correction is difficult to compute for all the conservation equations, a simple procedure, proposed by Leal *et al.* (2003) is used. This procedure consists in the application of the clean water TVD correction to the mixture mass and momentum equations and in the application of Jameson's artificial viscosity to the sediment mass equation.

The numerical free-surface time evolution is, in general, in good agreement with the experimental results (Fig. 2). However, some discrepancies can be identified, namely the numerical wave-front is faster than the experimental one in cross-sections near the lift-gate (points P1 to P6). Downstream, the situation is inverted, *i.e.*, the experimental wave-front celerity is faster than the numerical one. These results point out that the use of a constant friction coefficient is not sufficient to simulate adequately the wave-front position.

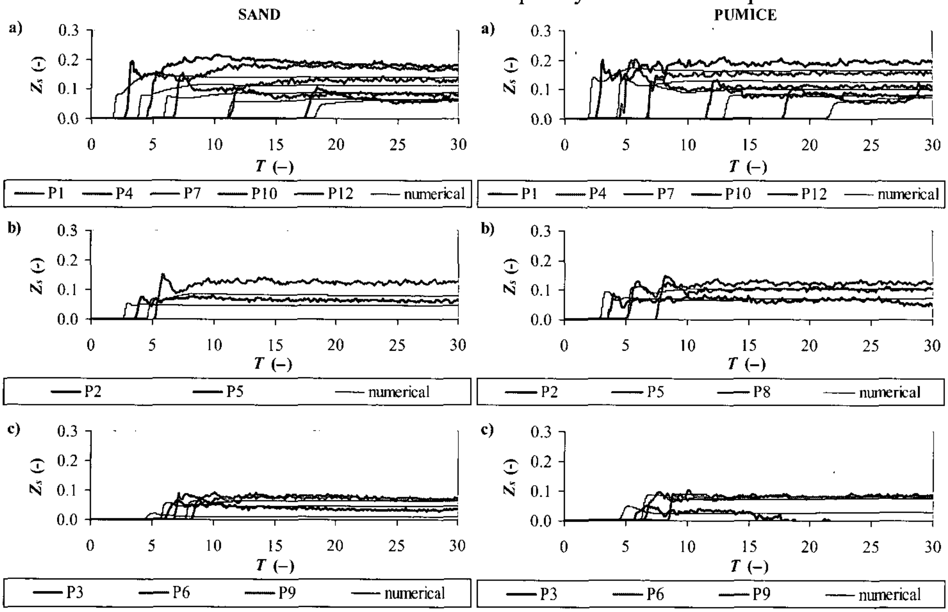

Fig. 2 Free-surface time evolution obtained experimentally and numerically in sand and pumice tests at points: a) P1, P4, P7, P10 and P12; b) P2, P5 and P8; c) P3, P6 and P9.

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