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## The flood bore problem and the mushroom jet formation in the dam-break flow

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Dam-break flows are not only an important practical problem in civil and hydraulic engineering, but also a fundamental problem of fluid mechanics. Due to property damage and the loss of numerous lives, it is critically important to have an exhaustive understanding of the landslide dam-break flow and sedimentation. The main objective of this study is a detailed analysis of the mechanisms of dam breaking flows through physical and theoretical modeling.

Our experimental work was focused on the initial stages of dam-break flow in the water channel, where a thin plate separating water at different levels is impulsively withdrawn in the vertical direction upwards, and as a result, a hydrodynamic bore is formed.

The theoretical model of the dam-break flow is based on Benney's shallow water equations. We separately studied the regimes of a breaking and non-breaking bore front. On the hydrodynamic bore, the laws of conservation of mass, momentum and energy were required to be fulfilled, contrary to the classical solutions of Ritter and Stoker, in which the law of energy was not considered at all.

The non-breaking flow includes several zones: a shock wave and a shear vortex flow after it, a contact surface and a continuous discharge zone. The bore in our solution moves faster than the classical bore, which, in turn, propagates faster than the contact surface.

The breaking bore is characterised by the generation of a "mushroom jet" structure, including a pair of vortices, oppositely directed, and a forerunner formed by the plunging jet directed forward. We found that the forerunner of the breaking bore has a speed significantly higher than the speed of the bore.

The experiments carried out in the wave flume of the Tainan Hydraulics Laboratory confirmed the theoretical predictions of the proposed dam breaking flow model for various initial conditions.

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