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Safety evaluation of buildings under flood impact

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The flood caused by a dam-break event generally contains a large amount of energy, and it can be destructive to the downstream buildings and structures. An experiment-validated three-dimensional numerical model was designed to investigate the impact of dam-break flood on structures with different arrangements. The Eulerian two-phase flow model and the smooth particle dynamics method are applied separately to solve the flow motion, and the deformation characteristics of buildings under the flood impact are evaluated by fluid-structure interaction model. An experiment is constructed to validate the numerical simulation. The results show that the structure suffers a large instantaneous impact pressure when the flood water first contacts the structure, and the value of this pressure can reach 1.5-3.0 times that of the maximum pressure after the first impact, and the maximum total pressure of the upstream building surface is about 1800N. The deformation near the door and windows is obvious, and the maximum deformation can reach 600μm, which further results in the large deformation of the gable and roof on both sides. Moreover, the arrangement of buildings has different blocking effect on flood. The back-row buildings arranged in alignment along the flow direction still has to bear 20% flood impact, and the front row buildings arranged alternately bear 90% high-speed flow impact. The structural damage is evaluated by the material failure criterion, and the weak position of buildings is identified, providing an optimal design of buildings.