



Slope Effect on Dam Break Flow over Movable Bed, Experimental Study

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Abstract

The failure of a major flood control structure may expose the surrounding population to serious risk. Such an event kind may involve rapid transients with strong interactions between flow and topography. So, to correctly simulate the consequences of a dam failure in a complex topography, this interaction should be accounted for in mathematical modeling, which should however rely on physical descriptions that are not yet completely established. Present study explores some configurations for plane movable bed with different percent of bed slope across the dam. Experiments were carried out in an ideal flume, and instrumentation of the tests performed by means of fast digital imaging through the flume. Results show that increasing in slope lead to increasing in flow velocity and therefore increasing in eroding force and volume of transported sediment. Important result is that increasing in slope lead to nonlinear variation rate of scouring and sedimentation parameters.

Keywords: Dam break, Slope effect, Experimental study, Image processing

1. INTRODUCTION

Dam break waves have been responsible for numerous losses of life (e.g. Figure 1.). Figure 1. illustrates two tragic accidents [1]. Related situations include flash flood runoff in ephemeral streams, debris flow surges and tsunami run up on dry coastal plains. In all cases, the surge front is a sudden discontinuity characterized by extremely rapid variations of flow depth and velocity. Dam failures motivated basic studies on dam break wave, including the milestone contribution by Ritter (1892) following the South Fork (Johnstown) dam disaster (USA, 1889)[2]. Physical modeling of dam break wave is relatively limited despite a few basic experiments (Table 1) [1]. In retrospect, the experiments of Schoklitsch (1917) were well ahead of their time, and demonstrated that Armin von Schoklitsch (1888–1968) had a solid understanding of both physical modeling and dam break processes [3]. For the last 40 years, there have been substantial efforts in dam break research, in particular with the European programs CADAM and IMPACT, and some American programs. These efforts were associated with the development of numerous numerical models and a few physical model studies.