MODELLING OF TSUNAMI GENERATION FROM UNDERWATER LANDSLIDES

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ABSTRACT

In an effort to initialise and test numerical models of submarine mass failures, a number of benchmark experiments have been undertaken and published in the scientific literature. These benchmarks include two-dimensional (vertical plane) and three-dimensional experiments with solid objects sliding down a submerged surface. The solid bodies are usually elliptical in cross-section or have a flat top and vertical faces. Typically water level is measured at a few points with electrical gauges. From a range of accelerations and initial submergences, an analysis provides an estimate of the predicted wave height as a function of the important physical variables.

Following this general procedure, the results from a set of laboratory experiments undertaken at the University of Canterbury are presented here. A unique feature of these experiments is that a method was developed to measure water surface variation continuously in both space and time rather than at discrete points. Water levels were obtained using an optical technique based on laser induced fluorescence, which is shown to be comparable in accuracy and resolution to traditional electrical point wave gauges. The ability to capture the spatial variations of the water surface along with the temporal changes has proven to be a powerful tool with which to study the wave generation process.

In the experiments, the solid slider density and initial submergence were varied and detailed information of wave heights, shapes, propagation speeds, and shore run-up was measured. The experiments highlight the interaction between slider kinematics and initial submergence, and the wave dynamics for waves that span the range of shallow water and deep water waves. The characteristics of the landslide motions are important and can vary widely. The experiments show that the wave generation process is very dynamic and is not amenable to being approximated as a static initial displacement.