

## Laboratory Experiments of Tsunami Runup on a Circular Island

MICHAEL J. BRIGGS,<sup>1</sup> COSTAS E. SYNOLAKIS,<sup>2</sup> GORDON S. HARKINS,<sup>1</sup>  
and DEBRA R. GREEN<sup>1</sup>

*Abstract*—Laboratory experiments of a 7.2-m-diameter conical island were conducted to study three-dimensional tsunami runup. The 62.5-cm tall island had 1 on 4 side slopes and was positioned in the center of a 30-m-wide by 25-m-long flat-bottom basin. Solitary waves with height-to-depth ratios ranging from 0.05 to 0.20 and “source” lengths ranging from 0.30 to 7.14 island diameters were tested in water depths of 32 and 42 cm. Twenty-seven capacitance wave gages were used to measure surface wave elevations at incident and four radial transects on the island slope. Maximum vertical runup measurements were made at 20 locations around the perimeter of the island using rod and transit. A new runup gage was located on the back or lee side of the island to record runup time series.

**Key words:** Tsunamis, tsunami runup, laboratory experiments, physical models, three-dimensional models, tsunami simulation, solitary waves, wavemakers, tsunami evolution, instrumentation.

### 1. Introduction

Recently, tsunamis in Indonesia and Japan caused millions of dollars in damages and killed thousands of people. On December 12, 1992, a 7.5-magnitude earthquake off Flores Island, Indonesia, killed nearly 2,500 people and washed away entire villages (YEH *et al.*, 1993; 1994). Field surveys found an average runup height near Riangkrok of 19.6 m, with a maximum height of 26 m. Reflection off Flores Island may have been partially responsible for the catastrophe at Babi Island, where 750 people were killed due to tsunami waves running up to 7.3 m above SWL. On July 12, 1993, a magnitude 7.8 earthquake off Okushiri Island, Japan, triggered a devastating tsunami with recorded runup measurements as high as 30 m. This tsunami resulted in larger property damage than any 1992 tsunamis, and it completely inundated an entire village with overland flow. Property damage was \$600 million.

When a tsunami approaches an island from deep water, it undergoes refraction, diffraction, breaking, and wave trapping. The tsunami increases in height and

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<sup>1</sup> USAE Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS 39180-6199, U.S.A.

<sup>2</sup> Department of Civil and Aerospace Engineering, University of Southern California, Los Angeles, CA, U.S.A.