Field Survey of the 1996 Irian Jaya Earthquake Tsunami in Biak Island

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Abstract. Runup data in Biak Island and its nearby islets are described with discussions of tsunami magnitude and a few characteristics such as witnessed arrival times, wave periods and wave numbers. From an engineering viewpoint, a relation between inundation depth and current velocity on land is also described with relations between inundation depth and degree of damage to houses and between sand erosion depth and current velocity in backshore region, based on data collected from the present and past tsunamis.

Key words: Runup data, inundation depth, current velocity

1. Introduction

At 05:59 GMT (14:59 local time), February 17th 1996, a large earthquake of $M_w = 8.2$ (see the Harvard University quick CMT solution shown in Table 1) occurred about 60 km off the northeast coast of Biak Island, Irian Jaya, Indonesia and generated a large tsunami. The tsunami hit Biak Island and the maximum runup height reached 7.7 m above sea level at the time on the opposite side of coast directly facing the tsunami source. In Biak Island alone, 107 persons were killed, 51 persons were missing, 55 persons were seriously injured, and more than 2,700 houses were destroyed or partially damaged by both the earthquake and the tsunami (as of March 4th, 1996). Most of the casualties and missing people were due to the tsunami.

The authors formed an international survey team with experts from Japan, Indonesia, the United States, the United Kingdom and Korea, and surveyed Biak Island and its nearby islets from 4–8th March, 1996, only two weeks after the tsunami generation.

In this paper, the state and a few characteristics of the tsunami in Biak Island and its nearby islets are briefly reported. A relation between inundation depth and current velocity on land is also discussed with relations between inundation depth and degree of damage to houses and between sand erosion depth and current velocity in a backshore region, adding data collected from past tsunamis. These relations are very useful for tsunami damage estimations.
Table I. The Harvard University quick CMT solution.

<table>
<thead>
<tr>
<th>Epicenter Depth Strike Dip Slip M₀ (× 10²⁸)</th>
<th>Mₚ</th>
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<tr>
<td>0.63°S, 137.50°E 15 km 114° 11° 91° 2.2 dyn-cm</td>
<td>8.2</td>
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Figure 1. Survey area and the epicenter.

2. Field Survey

The survey covers the north coast of Biak Island, about 100 km long from Rasaidori to Sauri; the west-south coast of Biak Island, about 140 km long from Rayori to Warari via Arnini and Biak; and a part of Padaido Islets located at the southeast of Biak Island. The survey does not cover the northwest coast of Biak Island because of bad road conditions. Figure 1 shows the survey area and the position of the epicenter. In the figure, the dotted lines are depth contours and the numerals indicate arrival times (unit: min.) of the first tsunami obtained from witnesses (see Section 3.3).

The tsunami attacked Yapen Island located at the south of Biak Island and the northeast-northwest coast of the main island of Irian Jaya, and inflicted heavy damage. But, the survey in these regions was not done because of the limited number of days and means of transportation. Hence, the present survey does not give a full image of the tsunami.