Earthquake and Tsunami Disaster in Solomon Islands, 2 April 2007



Tapurai, Simbo Is.

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Successive Tsunami Survey

- April 11-15, 2007, leaded by Dr.Tomita
- April 13-18, 2007, leaded by Prof. Nishimura
- April 20-25, 2007, leaded by Prof. Matsutomi

month	April																		
day	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Tomita team																			
Nishimura team																			
Matsutomi team																			

Air



Matters for Investigation

- Supplementary survey of tsunami height and ground deformation
- Characteristics of the damage
- Wave-reduction effect of vegetation against tsunami
- Wave-reduction effect of buildings against tsunami
- Others



Earthquake Model



Tsunami Survey Points



Survey Result of Ground Deformation

地震前(後)の満潮(干潮)位を証言等から判断し,測量. Ex.1 Kundu, Ranongga Is.

Ex.2 Vori, Ranongga Is.

調查一覧表

潮位未補正

地点	津波高 (m)	旧満潮位 (m)	旧干潮位 (m) 新満潮位 (m)	潮差 (m)	白化面位 (m)	隆 起 量 (m)	備考	
Lale	≅5.94 (B)	-	-	-	3.11	3.01	4/22 15:25	
Suava	3.76 (B)	2.97 (満·干潮	位の識別できず)	-	-	>2.29=2.97-0.68	4/22 16:28	
Kundu	3.56 (B)	2.74	2.06^{注1)}	0.68	2.12 ^{注1)}	2.45	4/23 10:20	
Vori Pt.	2.47+a (C)	1.38	0.68	0.70	-	0.86	4/23 11:30	
Vori	2.52 (A)	1.86	0.79	1.07	-	0.94	4/23 11:46	
Koriovuku	2.42 (B)	-	-	-	1.91	1.92	4/23 13:15	
Supato	1.89 (1.51(A))	1.12	0.45	0.67	-	0.37	4/23 16:28	
Ndivulani Is.	3.28 (A)	1.79^{注2)}	1.08 注2)	0.71	0.66	1.05	4/24 10:08	
Rarumana	1.32 (B)	-	0.43 ^{洼1)} ≃0.43	-	0.46^{注1)}	0.77	4/24 10:50	
Unidentified Is.	1.86+a (C)	-	0.53 ^{注3)}	-	0.96	1.20	4/24 11:25	

津波高の(A), (B), (C)は信頼度
津波高>旧満潮位(発生域,隆起を前提) → 他(海域)に高い隆起域有り
赤字は潮差(=旧満潮位-旧干潮位)(海図:MHHW-MLLW=0.4m (Gizo), 0.3m (Simbo))
白化面位は干潮位と一致するようである(注1)) → 要確認(生物屋?)
旧満・干潮位か再検討を要する(注2))
隆起した島の島影の浜では新旧の満潮位の痕跡が残る(注3))?
青字は補正済み隆起量(=白化面位または旧干潮位-平均干潮位).

Uplift/Subsidence

the figure Nishimura

Consideration on earthquake modeling

- Ranonga Island locates in the tsunami source area.
- At the west coast of Ranonga Island, the ground had uplifted, and the tsunami level was higher than the tide level before the earthquake.
 - If the tsunami level was lower than the tide level before the earthquake, it might prove that the vertical dislocation at the island was larger than that at the offshore.
- At the west coast of Simbo Island, the ground had subsided, and the first tsunami motion was ebb.
 - If the first wave motion was flood, it might prove that the absolute value of the vertical dislocation at the island was larger than that at the offshore.
- Therefore, large dislocation (both uplift and subsidence) might occur off Ranonga and Simbo Island.

Survey Result of Tsunami Height

Heavy damage at Tapurai, Simbo Is.

死者9,人口500 2軒を除き全壊

4.17m Runup

Before the tsunami (by Google Earth)

Tapurai, Simbo Island

- 浸水域の際(一般に,浸水深が小さ(流速も小さい)の建物しか残っていない.
- ただし、この建物は倒れていないが、引き波で傾いている、
- 水面が上屋に達すると流体力が増し、倒されるケースが増えると思われる.

Minor damage

- 高床の高さが低く,津波によって流された 家屋が多数.
- 一方,高床が高く,津波被害を免れてた 家屋があった。

Heavy damage

Titiana, Ghizo Island

小学校?

- 高床の高さが十分でも、柱のスパンが広いか、上屋が重い場合は地震によって被害を受ける。
- 上屋が柱からはずれ,流されていたケースあり.(浮力+流体力?)

Titiana, Ghizo Island

- 堅牢な建物は,浸水深が大きくても完全に 破壊されずに残っている.
- (ただし,浸水被害を受け,建て直しの必要あり)

Medical Compound, Ghizo

Medical Compound in Gizo Is.

New Manda in Gizo Is.

Titiana in Gizo Is.

流れが弱いとき,0.7m程度の床上 浸水では家屋は流出しない? 地震と津波で被災したと思われ る教会.

Characteristics of the damage of buildings

- In the case where the floor height was small, many buildings were washed out by the tsunami.
- There were some buildings which suffered only minor damage, in the case where the floor height was high enough.
 - Even if the floor height was high, some buildings were destroyed by the earthquake, in the case that the span was long or the covering house was heavy.
- Traditional high-floored building is suitable for tsunami hazard mitigation, but the design based on the engineering though is required.

Wave-reduction effect of vegetation against tsunami

P1

- 海岸線からの距離がほぼ等しい2地点(P1, P2)の比較
 - 海岸線付近に植生が少なNP1では,ほぼすべての家屋が流された
 - 海岸線付近に植生が多いP2では典型的な住居が残っていた

Suve, Ghizo Is.

P1

P 2

陸側

海岸付近の植生

陸側

約150m隔たる

Wave-reduction effect of solid buildings against tsunami, at Medical Compound, Gizo

P1

- Gizo病院近〈の2地点(P1, P2)の比較
 - 堅牢な建物に囲まれたP1では、小屋が流されずに残っていた
 - 堅牢な建物に囲まれていないP2ではほとんどの住居が流された

Medical Compound, Gizo

Wave-reduction effect of solid buildings against tsunami, at Malakerava I, Gizo

This glass house is still usable.

This big house is destroyed, but it might protect the glass house behind this building.

Wave-reduction effect of vegetation and solid structure

- In some cases, wave reduction effect of vegetation and solid structure was verified.
 - However, if water level reached the floor, the covering house floated up and washed.
- Vegetation and solid structure are effective to reduce the tsunami force.
 - However, those cannot prevent the damage perfectly.
- Combination with
 - Ground raising in residential zone
 - Improvement of strength of buildings

Suggestions

- Considering the countermeasure against tsunami leads to the countermeasure against raising sea level and global warming
- Restoration planning
 - Arrangement of vegetation and solid structures along the coast
 - Ground raising in residential zone
 - Improvement of strength of buildings
- Engineers thought
 - The structure should be designed against the design force.
 - e.g., earthquake, wind, storm surge, tsunami, and son on
 - Education of architecture and civil engineering