April-June 2007 VOLUME XXXIX, NUMBER 2

Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System

TSUNAMI NEWSLETTER

International Tsunami Information Centre

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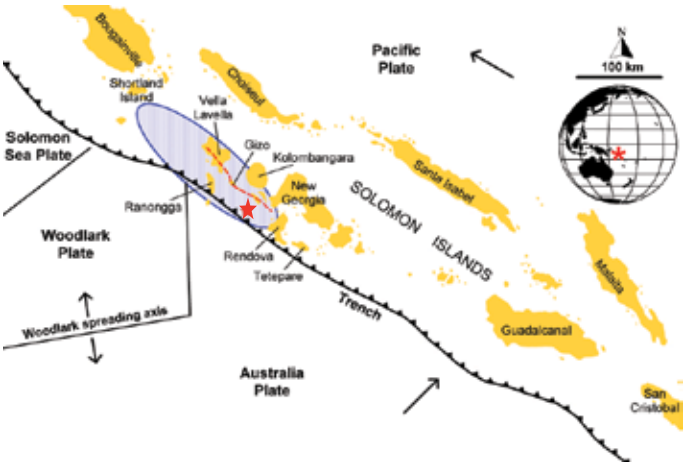
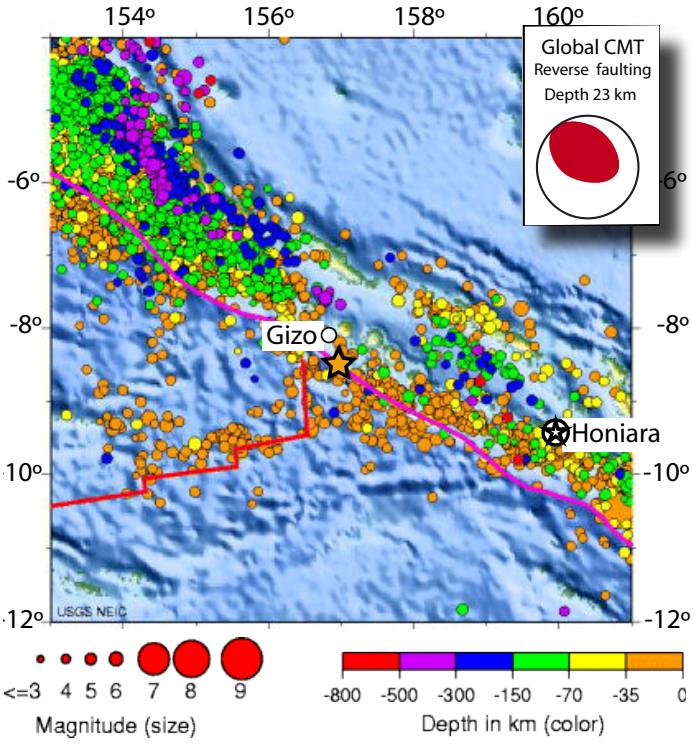
2007 Most Destructive Tsunami: SOLOMON ISLANDS 1 April 2007, 20:08 UTC, M_W= 8.0

An earthquake (Mw=8.1) occurred in the Solomon Sea (8.460° S, 157.044°E) at 20:08 UTC 1 April 2007. It was 7:39 AM 2 April local time in the Solomon Islands. The rupture zone extended 100 km west of the Solomon Island's West Province capital of Gizo (374 km from the Solomon Islands capital of Honiara) ending just south of the Shortland Islands. A large tsunami was generated and measured on various islands and tide gauges. Taken together, 52 deaths are attributed to this earth-



Red star shows earthquake's location in the upper right corner global map of the region and in the larger map, showing the plate boundaries and the source region for this event. (From McAdoo and others, Geologic Report (GR), p. 3)



Historical seismicity (1990-present) of the region, showing the size and depth of earthquakes and the current earthquake as an orange star. (Courtesty of USGS National Earthquake Information Center, NEIC). Global Centroid Moment Tensor with depth calculated at 23 kilometres.

SUMMARY OF EARTHQUAKES

1 APRIL- 30 JUNE 2007

With surface wave or moment magnitude (Mw) greater than or equal to 6.5 and a depth no greater than 100 km, or an event for which an international warning centre issues a message. Pacific Tsunami Warning Center (P) issues; Tsunami Information Bulletins (TIB), Expanding Regional Warnings (ERW), Regional Watch/Warnings (RWW) or Indian Ocean Watch Bulletins (IO). Japan Meteorological Agency (J), issues Tsunami Bulletins (TB), or Indian Ocean Tsunami Watch Information Bulletins (TWI). Epicenter, depth (from GCMT solution) and Mw from USGS (G); from Harvard (H), which changes to GCMT in July 2007, and Mw from PTWC (P) at action time. Height measurements from tide gauges peak to trough or half peak to trough as indicated, otherwise measurement is the greatest value for either inundation or runup depending on the event.

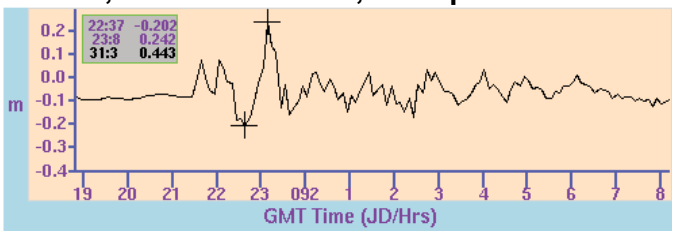
DATE	TIME (UTC)	LOCATION	EPICENTER	DEPTH (km)	M_w	PTWC (P) or JMA (J) ACTION	ACTION TIME (UTC)	TSUNAMI? DAMAGING?	MAXIMUM MEASUREMENT and LOCATION
1-2 Apr	20:40	Solomon Islands	8.460° S 157.044°E	23	8.1 (H, J 002-006, P 002-008) 8.0 (G) 7.8 (J 001, P 001)	ERW 001 NWPTA 001 ERW 002 NWPTA 002 ERW 003 NWPTA 003 ERW 004 NWPTA 004 NWPTA 006-(Cancellation) ERW 005 ERW 006 ERW 007 ERW 008-(Cancellation)	20:55 21:02 21:32 21:39 22:39 22:39 23:34 00:13 00:34 01:17 01:58 03:26 04:05	YES YES	10 m (runup) Tapurai, Simbo Island, Western Province, Solomon Islands
5 Apr	03:57	Azores Islands Region	37.306° N 24.621° W	12	6.4 (P) 6.3 (G, GCMT)	TIB	04:29	NO	
7 Apr	07:09	Azores Islands Region	37.306° N 24.494° W	12	6.3 (P) 6.1 (GCMT) 6.0 (G)	TIB	07:23	NO	
20 Apr	01:46	Southwestern Ryukyu Islands	25.710° N 125.108° E	12	6.7 (J) 6.3 (GCMT) 6.2 (G)	NWPTA	01:52	NO	
21 Apr	17:54	Aisen or Aysén Fiord Chile	45.243° S 72.648° W	12	6.2 (GCMT, P)	—	—	YES YES	7.7 m (runup) at fjord near Aisen dead and missing
13 Jun	19:30	Near Coast of Guatemala	13.554° N 90.618° W	33	7.0 (P) 6.7 (GCMT) 6.5 (G)	TIB	19:40	NO	
28 Jun	02:52	Solomon Islands	7.969° S 154.630° E	17	6.7 (GCMT, G,P)	TIB	03:07	NO	

Solomons, *continued*

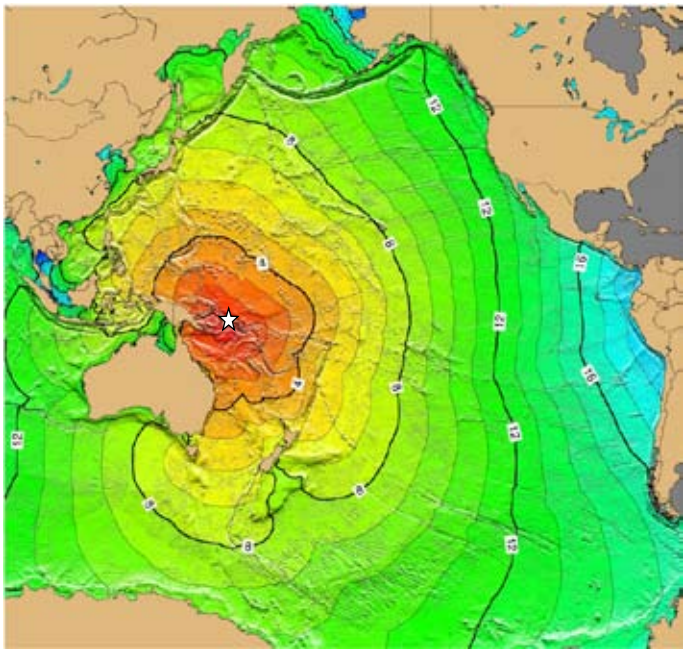
quake and tsunami. Damage extended to island populations, ecosystems and was found to vary in geologic terms from island to island.

Within minutes of the earthquake, Pacific Tsunami Warning Center (PTWC) issued an expanding regional warning for the immediate area surrounding the earthquake, and the Japan Meteorological Agency (JMA) issued a Northwest Pacific Tsunami Advisory. The tsu-

PTWC Tide gauge recording from Honiara, Solomon Islands, 2–3 April 2007



Water level record provided by PTWC from Honiara gauge, indicating maximum peak-to-trough wave height (in metres) with elapsed time depicted. Amplitude was reported as 0.20 m with a period of 62 minutes in expanding and cancellation messages.



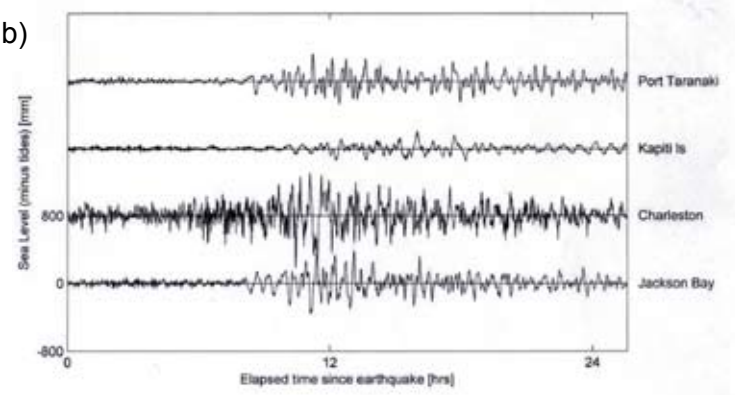
Tsunami travel time map showing approximate spread of energy from the source modelled in order to estimate arrival time of the wave in distant locations.

Tsunami observations in New Zealand

Tide gauge (Provider) Latitude, Longitude	Arrival time 2 April NZST (UTC)	Periods of waves (min)	Max wave height above mean level (cm)	Max peak-to-trough wave height (cm)	Time of peak wave NZST (UTC) *=3 April
Charleston 41.908º S, 171.433º E	17:21 (05:21)	6'-8' on top of larger 28'-30'	51	110	20:10 (08:10)
Jackson Bay (NTF-BoM) 43.957º S, 168.616º E	16:52 (04:52)	7'-11' on top of larger 27'-32'	38	84	19:55 (07:55)
New Plymouth (Port Taranaki) 39.055º S, 174.033º E	17:10 (05:10)	10'-14' on top of larger 22'-24'	33	60	19:50 (07:55)
Little Kaiteriteri (Tasman D.C.) 41.048º S, 173.027º E	18:37 (06:37)	11'-13' & 30'	18	31	21:57 (09:57)
Kapiti Is. 40.842º S, 174.938º E	18:53 (06:53)	19'	21	30	00:38* (12:38)
Anawhata 36.921º S, 174.461º E	16:40 (04:40)	30'-40'	12	20	17:20 (05:20)
Kaingaroa, Chatham Is. 43.732º S, 183.733º E	18:20 (06:20)	10'-11'	10	20	18:40 (06:40)
Sumner Head 43.570º S, 172.773º E	20:50 (08:50)	15'-18' & 22'-30'	7	12	2:22* (14:22)
Kaikoura 42.415º S, 173.703º E	20:38 (08:38)	12'-14'	7	12	2:18* (14:18)

a)

b)



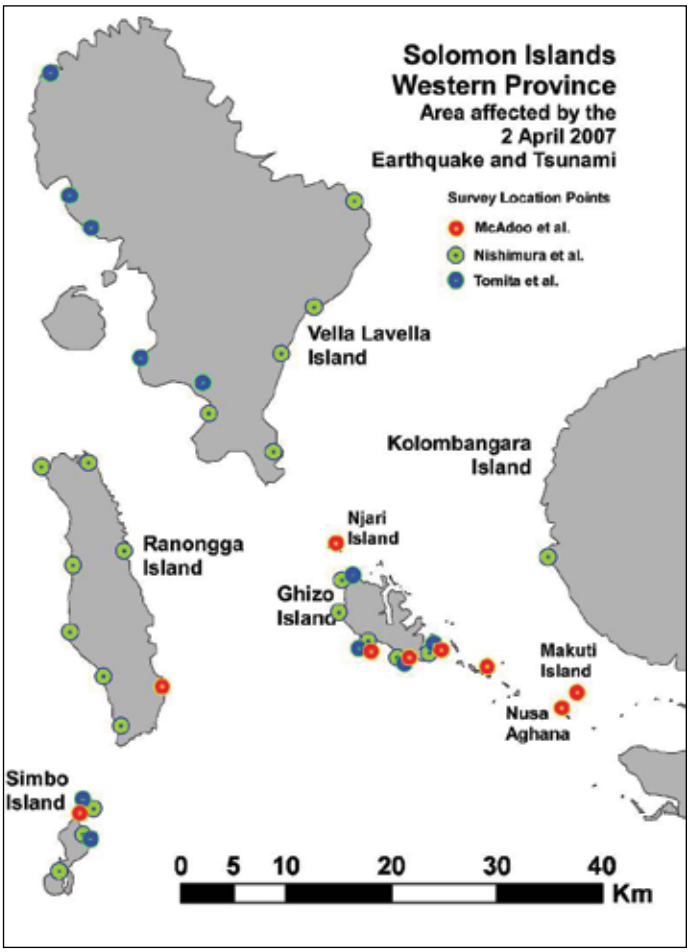
Above a) Tsunami observations in New Zealand sea-level gauges on the west coast (1 minute recording interval), showing sea level minus tides and elasped time since earthquake. Right b) New Zealand sea-level gauge response to the Gizo Tsunami 1 April 2007. The origin time of the earthquake was 08:40 2 April 2007, New Zealand Standard Time (NZST). Data provider indicated in parenthesis following tide gauge name; National Tidal Facility (Bureau of Meteorology) for Jackson Bay, Port Taranaki Ltd. for New Plymouth, Tasman DC for Little Kaiteriteri, and all others from New Zealand's National Institue of Water & Atmospheric Research Ltd. (NIWA). Both courtesy of Rob Bell at NIWA.

Solomons, *continued*

nami warning messages were revised and reflected changes in the watch warning areas as data became available. PTWC relied on both water level gauges and Deep-ocean Assessment and Reporting of Tsunami (DART) instruments to update and eventually cancel its messages. All warnings, watches and advisories were cancelled within 8 hours of the earthquake.

International teams of scientists were dispatched to cover the earthquake and conduct post-tsunami surveys. Several received surveys provide the graphics, photographs and discussion of this newsletter article, and one post-tsunami report is included in its entirety, from Woodlark Island in Papua New Guinea (*see page 7*). Except for tide record readings from other parts of the Pacific, including the records sent from New Zealand gauges, the tsunami remained regional in that it's effects were seen in the area around the Solomon Islands and Papua New Guinea.

One team of geologists, headed by Brian McAdoo, included Kelly Jackson, Jens Kruger, Michael Bonte-Gra-



Location of Solomon Islands, Western Province survey sites. In addition to McAdoo survey, color data points distinquish survey sites from two Japanese teams, Nishimura and Tomita teams. The Tomita team results were not otherwise available for this article. (McAdoo and others, GR, Figure 5, p. 8).

pentin, Andrew Moore, Willson Rafiau, Douglas Billey and Breddley Tiano, with Solomon Islands governmental geologists, representatives of South Pacific Applied Geoscience Commission (SOPAC) and local dive experts. They visited the region one month after the event and knew from other survey teams which areas to investigate further. They visited severely damaged villages on the islands of Ghizo, Ranongga and Simbo, as well as the uninhabited islands of Njari, Makuti and Nusa Aghana (*see red dots on map this page*).

The locations shared similar features (except for Ranongga); in that all had low-energy lagoons, bordered

Truck and house in Titiana, which floated approximately 50m inland by the tsunami, indicating the tsunami acted more as a swiftly rising tide than a turbulent bore. Twenty-one people died in this village. Half of the 24 children that died in this tsunami lived here or in the neightboring village of New Manra. (McAdoo and others,GR, Fig. 21, p.22).

by a barrier reef and a sandy beach. Villages were also located at natural channels in the reefs, a feature that contributed to damage. In the Ghizo Island villages of Pailongge and Titiana, structures made of thatched grass and palm fronds were lifted off foundations and floated tens of metres inland with minimal structural damage (*see photos this and next page*).

The McAdoo-led survey found that the tsunami had hit villages substantially, (Tapurai, 10 m; Pailongge, 6 m; Titiana 6 m) but with varying intensity. At Tapurai, where the barrier reef lagoon is not as well developed, all structures in the tsunami affected area were destroyed, suggesting a wave with higher turbulence.

Another team of scientists, including Yuichio Tanioka, Yuichi Nishimura, Yugo Nakamura, Yoshinobu Tsuji, Yuichi Namegaya, Mashiko Murata and Stephen Woodward, surveyed the coseismic crustal deformation on the islands of greatest impact, from 11–22 April 2007. On the islands they visited, the highest runup they measured was nine metres on the northern side of Simbo Island at the village of Tapurai. Three consectutive waves were oberved in quick succession within five minutes

of the earthquake. On Ghizo Island although the measured runup was less, averaging 5 metres in most locations along the south side, more damage and loss of life was suffered.

The earthquake and tsunami mobilized a great deal of sediment, in the lagoon, beach and even on land. As the tsunami passed through the lagoon and over the beach, it picked up sediment which it subsequently deposited on land. At Tapurai, the deposit consisted of a melange of lagoon and beach sediment combined with boulders from the hillside that backs the village. At Pailongge and Titana, the sediment was mostly derived from the lagoon and included both fine grained coral and Halimeda fragment from the beach and lagoon, along with boulders from coral colonies killed by the event. Coseismic land level changes caused further damage of the coastal ecosystem. On Ranongga Island, the 3+ metre uplift on the SE coast killed off vast stretches of coral, affecting ocean access.

At Pailongge on the south shore of Ghizo island, homes were lifted off foundations and found some distance away, still relatively intact. With a population of 76, no one died here as the residents with knowlege of tsunami gathered others including the children to higher ground. The knowlege may have been through lessons learned from the 26 December 2004 Tsunami or experience with the major tsunami in the area in 1934. (Photo from MacAdoo and others, GR, p. 14).

Mortality rates exhibited distinct variations between villages. Pailongge and Titiana villages were both hit by a tsunami with similar magnitudes, yet 13 people died in Titiana (6 of which were children under 8 years old) and none died in Pailongge. The people of Titiana are of Gilbertese (Polynesian) descent, who migrated to the Solomond in the 1950's, and have no indigenous knowledge of tsunamigenic earthquakes. Many were exploring the lagoons as it emptied with the leading depression wave, and were overwhelmed by the subsequent peak. The Melanesian populace of Pailongge, however, gathered together the oldest and youngest members of the community and headed for higher ground after the shaking stopped, demonstrating an effective use of indigenous knowledge that saved their lives.

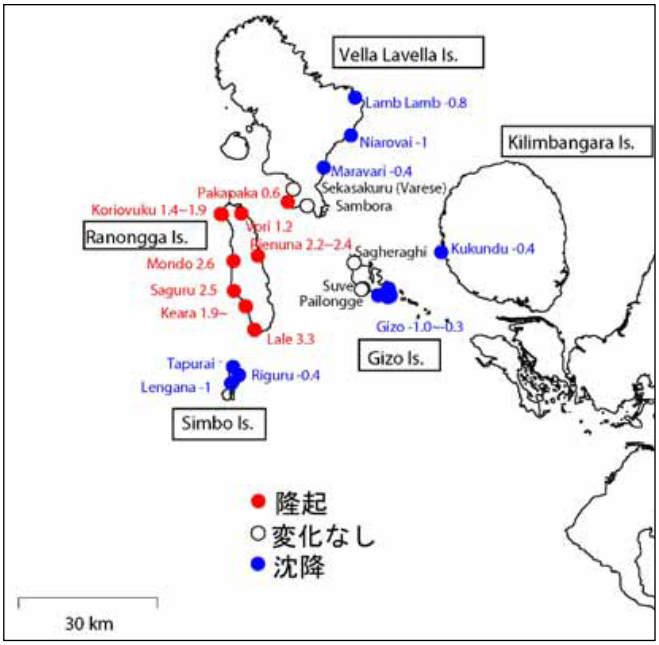
Morality Rates Solomon Islands
April 2007

	Population (% of population affected)	Number of Dead (% of village population)	Children (under 10) dead (% of dead)
Ghizo			
Gizo	3302 (77.6%)	2 (0.1%)	0
New Manra	206 (4.8%)	8 (3.9%)	5 (62.5%)
Titiana	366 (8.6%)	13 (3.6%)	8 (61.5%)
Pailongge	76 (1.8%)	0	0
Kolombangara	89 (2.1%)	0	0
Nusa Mbaruku	216 (5.1%)	10 (4.6%)	8 (80.0%)
TOTAL	4255	33	21
Simbo			
Tapurani	234 (85.4%)	7 (3.0%)	1 (14.3%)
Riguru	40 (14.6%)	2 (5.0%)	0
TOTAL	274	9	1
Ranongga			
Mondo	341 (100%)	2 (2.1%)	0
TOTAL	341	2	0
Vella Lavella			
Samboroa	319 (76.7%)	0	0
Lambulambu	97 (23.3%)	2 (2.1%)	2 (100%)
TOTAL	416		
Choisuel			
Luti	101 (24.6%)	1 (1.0%)	0
Lologae	9 (2.2%)	1 (11.1 %)	0
Sagiae	21 (5.1%)	1 (4.8%)	0
Sepa	165 (40.2%)	1 (0.6%)	0
Sasamunga	114 (27.8%)	2 (1.7%)	0
TOTAL	410	6	0
GRAND TOTAL	5696	52 (0.9%)	24 (46.2%)
Gilbertese	***788 (13.8%)***	***31 (59.6%)***	***21 (87.5%)***

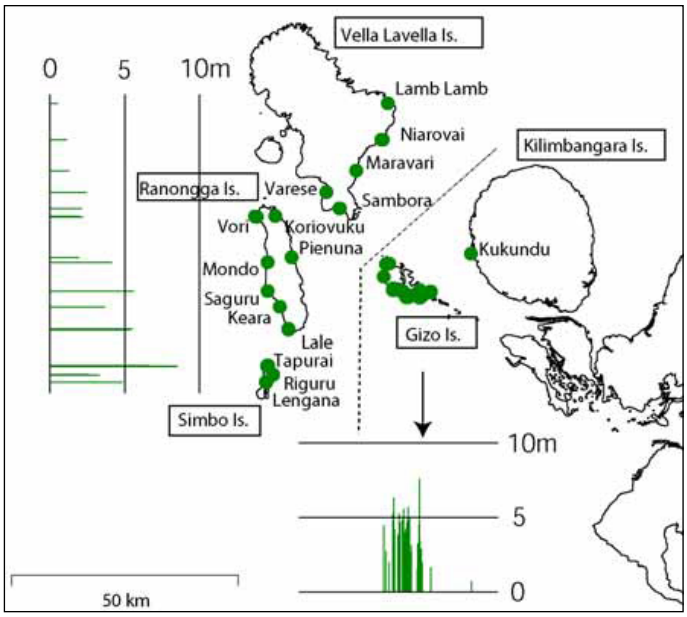
Mortality statistics. Island name in bold, followed by community name. The immigrant Gilbertese population (in italics) suffered higher per capital mortality rates than the indigenous Melanesian populations. Children also made up for a high percentage of deaths. Data from the National Disaster Management Office, Gizo. (From McAdoo and others, Solomon Island earthquake and tsunami damages reef, affects local economy, Table 1, p.7).

Solomons, *continued*

Left (2 photos), Mondo Village on Ranongga Island. The Department of Mines and Energy and SOPAC recommend that the village be moved from this ancient and active landslide complex to a safer location. (McAdoo and others, GR, p. 20).



Coseismic vertical deformation by the 2007 Solomon earthquake. The red dots represent uplift measured, the blue dots indicated measured subsidence and the white dots no change. Measurements in centimetres. (From Tanioka and others, Preliminary Report for Tsunami Field Survey for the Solomon Islands Earthquake of April 1, 2007, Fig. 6).



Tsunami height distribution. Green dots show the locations of measurements. Bars show tsunami heights at those locations. (From Tanioka and others, Preliminary Report for Tsunami Field Survey for the Solomon Islands Earthquake of April 1, 2007, Figure 3).

Photos of crustal deformation. (Directly above) Uplifted corals around Ranongga Island, an island, which one survey team concluded was completely uplifted, judging from the large area of coral flats surrounding it. Above, right, A subsided pier at Lengana Simbo Island. (From Tanioka and others, Figure 5, a and b).

Photos to the left: Vertical crustal deformation estimated from the white line, area above and close-up, below, showing the high tide level before the 2007 Solomon earthquake, indicated by red arrows. (From Tanioka and others, Preliminary Report for Tsunami Field Survey for the Solomon Islands Earthquake of April 1, 2007, Figure 7).

Report on the effects of the 2 April 2007 Tsunami in the Guasopa area (SE Woodlark Island), the Kaurai area and outlying villages and islands — Papua New Guinea

George E Clapp, Woodlark Mining Limited WML Community Relations Manager, Woodlark Island, PNG

Background

Woodlark Island, known locally as Muyuw, but named on the topographic map as Muyua, falls within the Samarai-Murua Administrative District of the Milne Bay Province of Papua New Guinea. It is situated some 440 km WSW of Ghizo Island (Solomon Islands). The island has a population of some 4700 people, who are Austronesians. The people are fishermen and at home with the sea. They have experiences with tsunami phenomena in the past.

General Guasop and SW Woodlark area

Assistant Community Relations Manager, Dilex Sebom, was sent to Guasopa on 3 April 2007. Amongst other duties, he was assigned obtaining first hand information on the effects of the tsunami of the previous day and report any damage. Guasopa is the only government station on Woodlark Island and has the island's only airstrip, which is a grassed strip with a coral limestone base and was constructed in mid-1943 by the Americans.

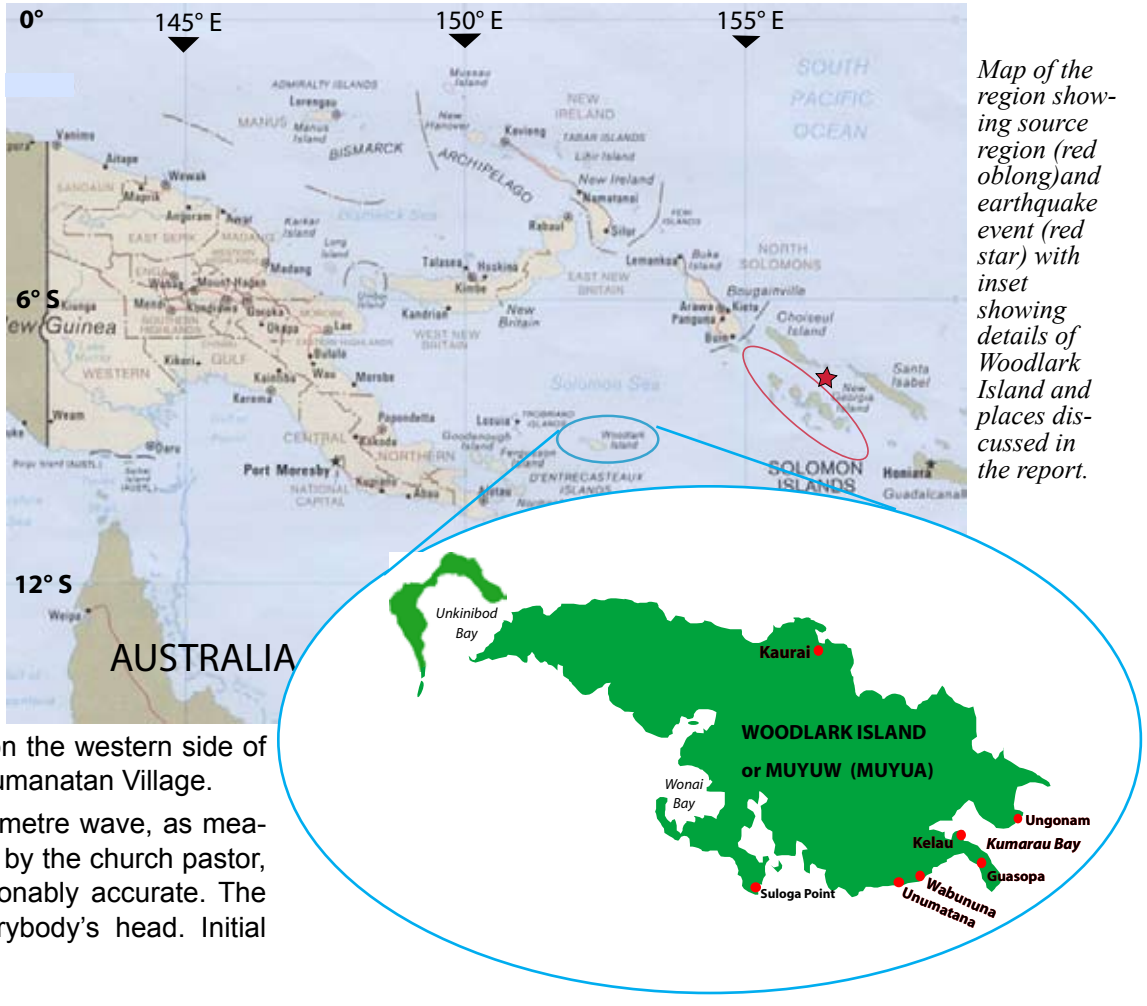
Community Relations Supervisor John Beba went by dinghy to Waviai Island, Guasopa, Unumatana and Wabununa on 4 April 2007. George Clapp went to Nasikwabu (Alcester Island) on 5 April. Their observations are summarizied as follows:

Only two villages are definitely known to have suffered significant damage; Kelau, on the western side of Kumarau Bay, and Unumanatan Village.

Kelau suffered a 2.00 metre wave, as measured on a house post by the church pastor, so thought to be reasonably accurate. The mark was above everybody's head. Initial verbal reports on 2 April 2007, were that the wave occurred at 07:00 and was 2 metres high as it approached shore, 1.00 metres when it hit shore, so the measured 2.00 metre mark would appear to be fairly accurate. Contrary to press reports, seven houses collapsed but were not washed out to sea. These houses appear to have collapsed because of wave erosion of the sand foundations. Three canoes were damaged and household utensils and other personal belongings lost, as well as some damage to gardens. One medium pig was said to have been lost. Some betel nut palms and the church were damaged.

The wave traveled about one kilometre inland (flat, swampy in parts) and washed several people with it, although they were essentially unharmed. The people could not stand up so they had to swim. Sebom walked to where the wave reached and estimated the distance to be one kilometre.

In Unumatana Village ten houses and 32 canoes were destroyed. One grave was disturbed and uncovered. Two people nearly drowned. Seven water wells were filled in by sand, big rocks from the ocean were washed up on the shore, cash was lost and 6 families lost household items and clothes. Fish that were washed into the



Map of the region showing source region (red oblong)and earthquake event (red star) with inset showing details of Woodlark Island and places discussed in the report.

Solomons, *continued*

village and the bush made the place smell. There are no reports of any injuries or deaths.

At Unumatana there were three distinct waves, and the waves are said to have been between 1.5 and 3.5 metres in height. The waves travelled inland between 200 and 400 metres. The events were estimated to have occurred between 07:30 and 09:00.

More houses at Kelau that were collapsed by the tsunami. Note that the roofs of the houses are largely intact. Collapse was almost certainly brought about by wave erosion of sand around the house stumps weakening the house structure. (Photo by Dilex Sebom, Woodlark Mining Ltd, and available on the NDGC website devoted to damage photos of this event. URL: http://www.ngdc.noaa.gov/nndc/struts/results?eq_1=48&t=101634&s=0&d=2&d=22).

No damage was reported at either Ungonam village, near the far eastern end of Woodlark Island, or Oyavata Village on the northern shore of Guasopa Harbour. At Wabununa Village, 3 kilometres to the east of Unumatana Village, everything was reported to be alright. At Guasopa itself (the government station), only a few gardens along the coasts were damaged and the airstip was undamaged. No reports had come in from Kavatana Village, 3 kilometres north of Ungonam. There were no reports of any human injuries or deaths in the SE area of Woodlark.

A report was obtained in the afternoon of 3 April that everything was fine on Budibudi Island, in the Laughlans, was Okay, apart from some lost and damaged canoes. The waves there had apparently washed inshore about 70 metres. The food gardens appeared to have escaped damage. Again there were no reports of any human injuries or deaths.

The Nasikwabu people reported that the tsunami was basically a non-event there. They experienced a couple of fairly large swells. Alcester Island lies 45 km SW of Suloga Point on Woodlark Island. Other small uninhabited islands between Woodlark were not landed on, but

Kelau villager with a fish on a string, gathered 20 or 30 metres into the bush from the beach at Kelau.

appeared undamaged; no fallen trees or other signs of large wave damage.

General Kaurai (N Central Woodlark) Area

The brief report by John Bera, CR Supervisor, who is from Kaurai village and was at Kaurai (but not on the beach) with a handheld radio when the tsunami occurred is attached. (Appendix A) No injuries or deaths were reported. The waves could well have been funnelled into the Kaurai lagoon, since the mouth of the lagoon faces directly towards the origin point of the tsunami. The report of the sea turning 'milky' is quite interesting but the cause is unknown. John was not on the

Kelau villager standing in front of his collapsed house. Note the mark on the stumps of the house on the left of the picture - this indicates how much sand was removed by the tsunami waves from where the stumps were sunk in originally about 40cm - it is NOT a mark of the wave height. Note that the roof of the collapsed house is intact - house collapse was almost certainly due to erosion of the sand foundations by wave action. Photos provided by: Dilex Sebom, Woodlark Mining Limited.

Solomons, *continued*

beach and there was no reliable estimate of the size of the waves, although he believes that it could not have been more than 1 metre or so.

Kelau village, taken from just along the bay. The camera (a cheap Olympus digital) was on zoom, so the village is actually a lot farther away than it looks. Collapsed houses can be clearly seen, but apart from that a casual glance would not identify this as a scene where a tsunami had recently gone through. Photos provided by: Dilex Sebom, Woodlark Mining Limited.

Conclusion

It seems that the 2 April 2007 tsunami in the Woodlark area consisted of a minimum of three waves and that the effects were very different from place to place. The most useful part of this report is probably the account of what happened at Kelau, where a reasonable estimate of wave height was obtained and a good report of how far the waves extended inshore and the damage they caused. Kelau may well have suffered because of deflection of the tsunami by the Guasopa Peninsula. Indeed that may well have been the case with Unumatana, the worst affected village, since the tsunami waves that hit Unumatana could have been deflected by the Guasopa Peninsula and Waviai Island was undamaged. Definitely villages where the waves were deflected appear to have suffered more than villages in the direct line with the tsunami waves. Although this was not a big tsunami event at Woodlark, it may give some useful information to tsunami experts. House damage appears to have been caused by water washing away sand around the house stumps. Canoes were washed away and/or smashed against trees. An interesting aspect is the time that events are reported to have occurred, at Kaurai, at Unumatana and at Kelau - these are definitely anomalous. (Papua New Guinea used Eastern Standard Time, the same as Queensland, Australia).

Canoe thrown into the bush and damaged by the tsunami at Unumatana. Photos provided by: John Beba, Woodlark Mining Limited.

Brief report regarding the tsunami of 2 April 2007 at Kaurai (Appendix A)

by John Beba, CR Supervisor, WML

People staying out at Kaurai Lagoon, working on the Beche-de-Mer, noticed the sea swelling and waves increasing in size as they awoke to prepare for another day's catch, on the morning of 2 April 2007.

Waves coming into the lagoon were in full force and a number of canoes washed down to the sea, where men had to rush and grab them and take them back to shore.

The sea turned milky as waves continued to pound the shoreline. Immediately people remembered the same thing that happened years back and decided amongst themselves to quickly leave the place, believing something bigger could happen any time.

As they began arriving at the village news of a possible tsunami was already spreading across the village, because Woodlark Mining Ltd. community relations supervisor, John Beba was there with a hand held radio.

The people confirmed to John Beba exactly what was happening at the beach. People were further advised not to risk going out to sea for another eighteen hours, as anything could happen anytime.

Information sources for the April 2007 Solomon Islands Tsunami (** referenced in this article*)

Asian Disaster Reduction Center, ADRC Highlights Vol. 163, 1 June 2007. *Report on the Solomon Islands Earthquake and Tsunami Investigation*. URL: *http://www.adrc.or.jp/highlights/NewsNo163.* With links to event page, and Sentinel-Asia Project entry for event through GLIDE number TS-2007-000042-SLB. URL: *http://www.adrc.or.jp/view_disaster_en.php?NationCode=90&lang=en&KEY=1044*

Solomons, *continued*

*Clapp, George E. and John Beba, *Report on effects of 02 April 2007 Tsunami in the general Guasopa (SE Woodlark Island) Area, the Kaurai Area and outlying villages and islands* [manuscript pdf file] With appendix, *Brief report regarding the Tsunami of 02 April 2007 2007-04-02 at Kaurai by Beba*. 12 p. printout with map of Woodlark and photos.

Fisher, Michael A.; Geist, Eric L.; Sliter, Ray; Wong, Florence; Reiss, Carol, and Dennis M. Mann, (2007) *Preliminary analysis of the earthquake (Mw 8.1) and tsunami of April 1, 2007, in the Solomon Islands, Southwestern Pacfic Ocean*. Science of Tsunami Hazards; 26:1, p. 3-20. URL: *http://tsunamisociety.org/261Fisher.pdf.*

*Fritz, Hermann M. and Nikos Kalligeris, (2008) *Ancestral heritage saves tribes during 1 April 2007 Solomon Islands tsunami*, Geophysical Research Letters, American Geophysical Union; No. 35, (L01607).doi: 10.1029/2007GL031654.

Gibbons, Helen and Eric Geist, *Deadly tsunami hits Solomon Islands*. Sound Waves, U.S. Department of the Interior, US Geological Survey (USGS); April 2007 (92): p. 1-2. URL: *http://soundwaves.usgs.gov/2007/04/SW200704-150.pdf.*

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*McAdoo, Brian; Fritz, Herman; Jackson, Kelly L; Kruger, Jens; Bonte-Grapentin, Michael; Moore, Andrew L.; Rafiau, Wilson B.; Billey, Douglas and Breddley Tiano, *Solomon Island Earthquake and Tsunami damages reef, affects local economy*, [no date, manuscript], 8 p.

*McAdoo, Brian; Jackson, Kelly L; Kruger, Jens; Bonte-Grapentin, Michael; Moore, Andrew L.; Rafiau, Wilson B.; Billey, Douglas and Breddley Tiano. Geological Survey of the 2 April 2007 Solomon Islands Earthquake and Tsunami. N.D. manuscript pdf file. 30 p.

Pacific Disaster Center (PDC), Earthquake, Tsunami in the Solomon Islands. PDC International Charter, "Space and Major Disasters" [website]. URL: *http://www.disasterscharter.org/disasters/CALLID_151_e.html.* Includes list of available image products; preliminary damage assessments for Ranongga Island, Simbo Island, Kolombangara Island and Ghizo Island.

*Tanioka, Yuichiro; Nishimura, Yuichi; Nakamura, Yugo; Tsuji, Yoshinobu; Namegaya, Yuichi; Murata, Masahiko; and Stephen Woodward, *Preliminary Report for Tsunami Field Survey for the Solomon Islands Earthquake of April 1, 2007,* [preprint, pdf file], 6 p.

*U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Geophysical Data Center (NGDC). "Tsunami Event–1 April 2007" [website]. Boulder, CO: NGDC; 2007. URL: *http://www.ngdc.noaa.gov/nndc/struts/results?EQ_0=3037&t=101650&s=9&d=100,91,95,93&nd=display.* Includes link to photographs, several reproduced in this newsletter.

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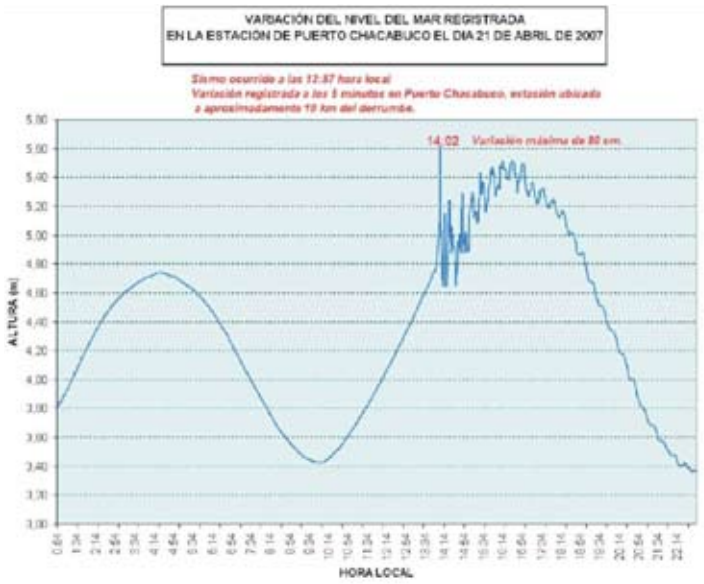
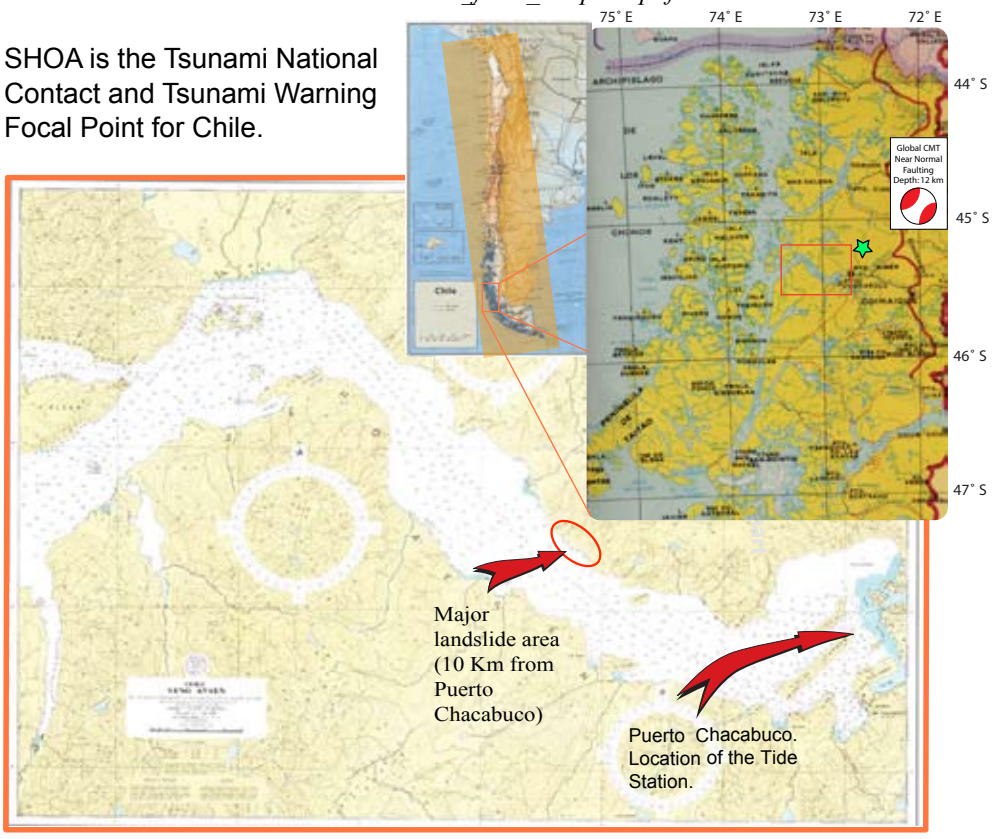
Aysén Fiord Chile, 21 April 2007, M_W= 6.2

Lieutenant Commander Andrés E. Enríquez, Head, Department of Oceanography, Servicio Hidrográfico de la Armada de Chile (SHOA). aenriquez@shoa.cl

The Servicio Hidrográfico y Oceanográfico de la Armada de Chile (SHOA) reported that a M6.2 earthquake on 21 April 2007, produced a landslide in the fjord area close to Puerto Chacabuco. The landslide generated three waves, the biggest reported was about six metres, and it affected a local area. A SHOA tide gauge, located ten kilometres from the landslide, measured a 0.8 metre variation. As of 1400 GMT, ten people were missing; most were workers from salmon aquaculture farms in the area. The event reminds us that tsunami are not solely triggered by underwater earthquakes but can also occur due to landslide. A presentation on this event cant be found on the JTIC website at *http://www.jtic.org/en/jtic/images/dlPDF/ArticlesNewsletter/aisen%20chile_fiord_21apr07.pdf.*



SHOA is the Tsunami National Contact and Tsunami Warning Focal Point for Chile.



Photos and detailed map extracted from Enriquez, Andres E. [Local tsunami in Chile 21 April 2007]. Chile: SHOA; 2007, found on the JTIC website: http://www.jtic.org/en/jtic/images/dlPDF/ArticlesNewsletter/aisen%20chile_fiord_21apr07.pdf.

Photos above show landslide occuring and the wave forming, then muddy aftermath. Far left, View of landslide area before the earthquake looking northeast. Left, wave inundating wooded area.

IOC NEWS

South Pacific National Capacity Assessments

A project entitled, "SOPAC Member Countries National Capacity Assessment:Tsunami Warning and Mitigation Systems," commenced in May 2006. The objective of project was to work with and enable South Pacific Applied Geoscience Commission (SOPAC) Member Countries to assess their ability to receive, issue and respond to tsunami warnings, which will help to identify requirements for further capacity building programs. The project was undertaken by the Australia Bureau of Meterology (BOM), Emergency Management Australia (EMA), SOPAC, and sponsored by the Australian Agency for International Development (AusAID). The project was also conducted in collaboration with the Intergovernmental Oceanographic Commission (IOC). Team visits were planned for the Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu.

The outputs to be achieved include:

Internationally recognised and detailed national assessments of requirements and capacity for an effective and durable tsunami warning and mitigation system through completion of an UNESCO/IOC questionnaire for each of the SOPAC Member Countries covered by the Activity;

Recommendations regarding any necessary improvements to assist SOPAC Member Countries to receive, communicate and respond to tsunami warnings for coastal communities more effectively; and

Information readily available to SOPAC Member Countries, SOPAC, AusAID, and potential donors to facilitate capacity building programmes for early warning of and response to tsunami events (and potentially other hazards).

The Work Plan entailed the following:

1. *Conduct Pacific Island Countries (PIC) Planning and Training Workshop at ICG/PTWS in Melbourne, May 2006.*
2. *Complete consultation and planning for expert team visits at SOPAC meetings in Honiara, September 2006.*
3. *Initiate team visits to SOPAC countries, October 2006.*
4. *Complete individual national assessments and summary report in consultation with PICs by June 2007.*

Tonga Assessment Team including members of Australia and New Zealand meteorological and emergency managment services, SOPAC, and various Tonga tsunami response organizations. May 2007.

The Australian Bureau of Meteorology will prepare a final consolidated report for submission to UNESCO/IOC, SOPAC, AusAID, and SOPAC Member Countries on the results of the survey and make recommendations to the Australian Government for any necessary further assistance to build capacity within SOPAC Member Countries.

Tsunami Warning Operations Seminar Kuala Lumpur, Malaysia, 2-3 April 2007

The seminar, "Protocols, Procedures and Best Practices for Monitoring, Evaluation and Alerting the Public," was held 2-3 April 2007, in Kuala Lumpur, Malaysia hosted by the Malaysia Meteorological Department. The Seminar was a collaborative regional capacity building activity of the IOC PTWS, World Meteorological Organization Regional Associations V and II (WMO RA-V and RA-II), South Pacific Islands Applied Science Commission (SOPAC), and South Pacific Regional Environment Programme (SPREP) that brought together the principal stakeholders, the national meteorological services as the tsunami warning focal points, and national disaster managers as the emergency response agencies, of the Southwest Pacific and South China Sea, to increase their understanding of the current tsunami warning services of the Pacific, and to identify, strategize, and plan to take action to better prepare against tsunami threats from nearby and distant tsunamis. The Seminar was led by Dr. Charles McCreery, Director of the Pacific Tsunami Warning Centre (PTWC), Dr. Laura Kong, ITIC Director, and Masahiro Yamamoto, IOC Senior Tsunami Advisor and former Director of the Japan Tsunami Warning Center. Altogether, the Seminar was attended by 84 scientists representing 27 countries, five international organizations (IOC, WMO, SOPAC, SPREP, ASEAN), and the two international tsunami

Malaysia, *continued*

warning centres providing the primary services to this region (US NOAA Pacific Tsunami Warning Center, PTWC, and Northwest Pacific Tsunami Advisory Center of the Japan Meteorological Agency, JMA NWPTAC).

Some of those gathered for the workshop, where altogether, 84 scientists representing 27 countries, and five international organizations (IOC, WMO, SOPAC, SPREP, ASEAN) attended.

The Seminar was opened by the Ministry of Science, Technology and Innovation, Malaysia Secretary General Y.B. Dato' Abdul Hanan bin Alang Endut. Welcomes were given by Dr. Yap Kok Seng, Director-General, Malaysian Meteorological Department; Dr. Laura Kong, ITIC; Dr. Peter Koltermann, IOC Tsunami Unit Head; Dr. Tokiyoshi Toya, WMO Regional Director for Asia and South-west Pacific, Mr. Noud Leenders, Senior Advisor, Community Risk Programme, SOPAC, Dr. Dean Salofa, SPREP, and Mr. Arona Ngari, President, WMO Regional Association V (South-west Pacific).

The Seminar was divided into two parts. Day 1 involved an overview of tsunami warning and mitigation systems, and the services provided by the PTWC and JMA. Presentations were made by ITIC, PTWC, Yosuke Igarashi (IOC Senior Advisor, JMA), Ed Young (USA NWS Pacific Region) and David Coetzee (New Zealand Civil Defence and Emergency Management). Topics covered that day were; tsunami hazard risk assessment, tsunami warning centre operations (including seismic and sea level monitoring), decision-making, message dissemination, tsunami emergency response (including the roles and actions of stakeholders in the government and private sector), exercises and drills, and tsunami mitigation countermeasures, education, and awareness building.

Day 2 focused on improving the PTWS and national systems. Provisional input was made to the PTWS Task Team on Messages led by Dr. McCreery. Also under discussion was planning for the future for the Southwest Pacific (SWP) and South China Sea (SCS) regions, led by Malaysia for the SCS and PTWS SWP Working Group Vice-Chair Samoa for the SWP, and facilitated by Mr. Donald Tambunan, Assistant Director and Head of Science and Technology Unit ASEAN Secretariat, SOPAC, JMA, PTWC, and ITIC.

During ICG/PTWS-XXI, an intersessional task team on messages was established to review PTWC proposed tsunami bulletin language changes, consider additional changes, and solicit input from all Member States on the potential impact of the bulletin amendments in accordance with USA NWS standards. The task team is comprised of the Chairs of PTWS Working Group (WG) 5 and IOTWS WG 5 on interoperable systems, representatives from PTWS warning centres (JMA, Russian Federation, France, Chile, Australia, New Zealand, PTWC), and the PTWS Officers, and will issue its report at the ICG/PTWS-XXII in September 2007 in Ecuador.

One of the break out groups formed to comment on the state of tsunami messaging and what improvements need to be made.

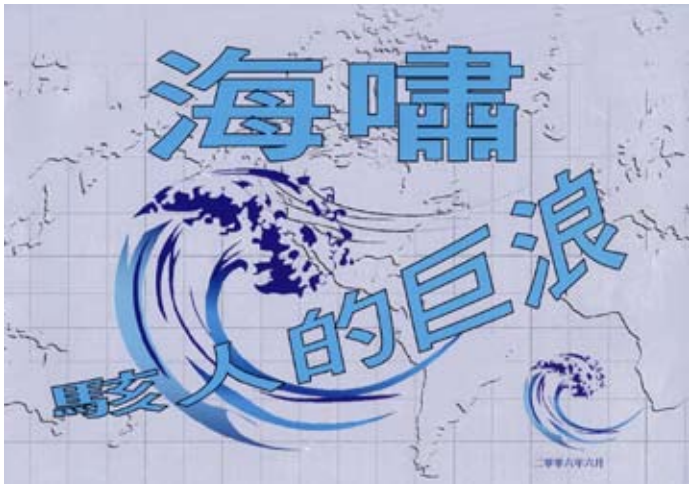
The April 2007 session had the goal of informing and obtaining feedback from countries receiving tsunami warnings from the PTWC, JMA, and/or WC/ATWC. Five breakout groups were formed to comment on the current message products that are issued, highlight inconsistencies in language and intent, comment on the methods of alert dissemination and its timeliness, recommend new content, products, or methods to include, and prioritize the urgency of the recommended actions.

In the afternoon of Day 2, participants were asked to review, identify or modify a regional strategy by reviewing prior meeting actions, reporting on progress made, and identifying new actions especially concerning end-to-end tsunami warning and preparedness, and to identify practical TWC and NDMO tools that Member States should have considering implementation costs and national/regional commitments. The meeting's action outcomes can be found on the Internet at *http://ioc3.unesco.org/ptws/documents/TWCOpsSeminar/ActionPlanning/SouthChinaSea/TWOps_SCSActionPlan.pdf*.

ICG/PTWS NEWS

Translation of *Tsunami: The Great Waves* into Chinese

Tsunami: The Great Waves, the long-standing publication of the ITIC, has been translated into Chinese by the Hong Kong Observatory. This 12-page glossy brochure provides information on what a tsunami is, how fast and how big they can be, what causes them, and describes programs undertaken to mitigate this hazard, including the development of tsunami warning centers, research programmes, and safety rules describing what to do when a tsunami attack your coastline. *Tsunami: The Great Waves* in Chinese (1st edition) is available for the first time. A second translation into a simpler form of Chinese was also undertaken and will soon be available. It is also available in English, Spanish and French. It was designed and published by ITIC, with support from the UNESCO/IOC Tsunami Programme, the USA (National Ocean and Atmospheric Administration or NOAA), France (Laboratoire de Geophysique) and



the National Marine Environment Forecasting Centre (NMEFC) of the State Oceanic Administration of China and the Hong Kong Observatory (HKO).

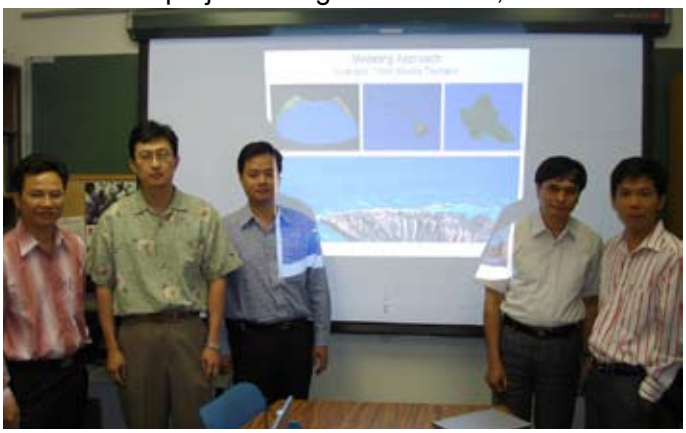
It can be found on the ITIC website at: *http://ioc3.unesco.org/itic/contents.php?id=351*.

ITIC-PTWC NEWS

Vietnam Delegation Conducts Hawaii Tsunami Study Tour

A delegation from the Government of Vietnam conducted a Hawaii Tsunami Study Tour from 14–17 May 2007, hosted by ITIC and PTWC. Led by Dr. Vu Thanh Ca, the delegates were four officials from the Vietnam Ministry of Natural Resources and Environment.

Vietnam is currently conducting a two year tsunami risk assessment project along its coastline, which entails tsunami hazard modeling and mapping activities. Preliminary studies conclude that the Vietnam coastline is at risk from potential tsunamis generated by earthquakes in the Manila Trench. It would take an estimated two hours for a Manila Trench generated tsunami to reach the Vietnam coastline. The objective of the Vietnam tsunami hazard mapping project is to construct tsunami hazard maps for the South China Sea and Vietnamese coastal areas and islands to mitigate the possible damage due to tsunami. Moreover, the tsunami hazard maps will support its Center for a Tsunami Early Warning System that is currently being constructed.



Vietnam Delegation visits Dr. Kwok Fai Cheung (second from left), Department of Ocean and Resource Engineering, University of Hawaii, on tsunami modeling and inundation projects in May 2007. The Vietnam delegation was headed by Dr. Vu Thanh Ca (fourth from left), Director of Center for Advanced Technology Application, Ministry of Natural Resources and Environment.

The delegation was provided extensive training at ITIC, PTWC, University of Hawaii (UH), and both County and State Civil Defense agencies. At the UH, the delegation was briefed by Professor Kwok Fai Cheung, Department of Ocean and Resource Engineering, on tsunami inundation modeling techniques used in Hawaii. Briefings were also provided by the IOC Global Sea Level Observing System (GLOSS) Program at the UH Sea Level Center.

ITIC Staff changes

Joining ITIC staff in April 2007 is Yohko Igarashi, a seismologist with Japan Meteorological Agency (JMA) who was seconded for a year's assignment to assist ITIC. She will assist in the areas of seismic information products and miscelleanous adminstrative tasks as assigned

ITIC news, *continued*

by Director Laura Kong. She shares in the activities of the ITIC for monitoring and recommending improvements to the PTWS tsunami warning activities. She will also support capacity building activities, and serve as an information resource on tsunamis, tsunami warning systems and tsunami mitigation.

Pictured at a going away luncheon for Alicia Estell are from left to right, Alicia Estell, Administrative Assistant, Tammy Kaitoku, IT Specialist and Webmaster, Yohko Igarashi, Visiting Seismologist, and Brian Yanagi, Office Manager and Disaster Management Specialist. and Dr. Laura Kong, Director. Not pictured Linda Sjogren, Technical Information Specialist.

Alicia Estell's last day of work at ITIC was Friday, 25 May. Her replacement is Bernee Gibo, who started working the next week. [By the end of 2007, Pilar Mudd had replaced Bernee].

USAID Intern to NWS

Ranjith George, a Civil Engineer with a Masters in Remote Sensing under contract with Science Applications International Corporation (SAIC), who is from Bangalore, India, arrived at the National Weather Service, Pacific Region Headquarters 29 May 2007. His position title is International Tsunami Notification Coordinator, and is funded from the USAID/Indian Ocean Tsunami Warning System (IOTWS). Ranjith will be helping improve the interim watch advisory service that PTWC provides to the nations of the Indian Ocean region, primarily through following up with national tsunami warning contacts to see if they are receiving PTWC's bulletins. Ranjith will also assist with completion of the Tsunami Warning Center Concept of Operations (CONOPS) Reference Guide that is being developed for the international community, which documents the US tsunami warning system.

WORKSHOP AND MEETING SUMMARIES

Japan Training Course in Seismology and Tsunami Disaster Mitigation—UNESCO lecturers, Tsukuba, Japan, April and May 2007

The International Institute of Seismology and Earthquake Engineering (IISEE) of the Building Research Institute (BRI) was originally established in 1962 to train researchers and engineers in developing countries to better mitigate against earthquake disasters in their home countries. Presently, the IISEE conducts training courses with the Japan International Cooperation Agency (JICA). More than 1,200 participants from over 90 countries have participated thus far.

The IISEE conducts annual year-long training in seismology, earthquake engineering. The seismology course covers the basics of seismic wave theory, and moves systematically onto seismological observation and analysis, earthquake source processes, and plate tectonics. The earthquake engineering course covers structural analysis and dynamics, and focuses on seismic resistant structures such as reinforced concrete and steel construction, state-of-the-art technologies of base isolation and vibration damping, and optimum seismic design techniques. The tsunami disaster mitigation course includes the seismology course, and covers tsunami-related topics such as fluid dynamics, generation and propagation of tsunami, and tsunami early warning systems.

Since 2005, participants are able to acquire a Master's Degree in Disaster Mitigation through the joint efforts of the Japan National Graduate Institute for Policy Studies (GRIPS), Japan International Cooperation Agency (JICA), Public Works Research Institute (PWRI) and BRI. In 2006, a tsunami course was added. Class size is limited to ten for the seismology and earthquake engineering concentrations and five for the tsunami mitigation programme. The programme involves nine months of classroom study (lectures, exercises, field trips), and three months of individual study with a scientific expert.

The training was offered in cooperation with UNESCO from 1963 to 1972, after which the Japanese Government continued the programmes independently. UNESCO sent experts to IISEE from 1985 to 1995, and is again providing experts in 2007. As a part of this cooperation, on 6 April 2007, Dr. Laura Kong, gave a lecture entitled "Education of tsunami disaster reduction" to participants from all three courses. She introduced the Pacific Tsunami Warning and Mitigation System (ICG/PTWS) and the Hawaii State Regional Tsunami Warning System as examples of how awareness and preparedness need to be integral components of an

ISEE training, *continued*

effective warning system. She discussed education, outreach, awareness, and public policy for tsunami disaster mitigation and distributed UNESCO educational materials such as "TsunamiTeacher." On 8-9 May 2007, Dr. Peter Koltermann, Head of the IOC Tsunami Coordination Unit in Paris, spoke on the development of early tsunami warning systems worldwide with regional systems coordinatied through IOC UNESCO.

Participants in the 2007 IISEE programme. Back row, from left to right: Netai Chandra Dey Sarker (Bangladesh) Disaster Management Bureau, Ministry of Food and Disaster Management, Prakhammintara Phuwieng (Thailand) Seismological Bureau, Thai Meteorological Department; Afsar Khan (Pakistan) Pakistan Meteorological Department (Ministry of Defense); Yushiro Fujii (Japan), IISEE, BRI; Laura Kong (USA) ITIC Director; Lasarusa Piutau Vuetibau (Fiji) Mineral Resources Department; Nobuo Hurukawa (Japan) IISEE, BRI; Esline Garaebiti (Vanuatu) Vanuatu Department of Geology, Mines and Water Resources; Bun'ichiro Shibazaki (Japan), IISEE, BRI; Zaty Aktar Binti Mokhtar (Malaysia) Seismological Division, Malaysian Meteorological Department. Front row, from left to right: Tun Lin Kyaw (Myanmar) Department of Meteorology and Hydrology; Sanjeevani Nilmini Bandara Thaldena (Sri Lanka) Geological Survey & Mines Bureau; Rami Ibrahim (Syria) Seismology Section, National Earthquake Center, Ministry of Petroleum and Mineral Resources; Norhadizah Binti Mohd Khalid (Malaysia) KLIA Meteorological Office, Malaysian Meteorological Department.

Located in Honolulu, the International Tsunami Information Centre (ITIC) was established on 12 November 1965 by the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific, and Cultural Organization (UNESCO). In 1968, the IOC first convened the International Coordination Group for the Tsunami Warning System in the Pacific (ITSU). In 2005, ITSU became the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS) so as to better convey the comprehensive approach required to reduce tsunami risks.

The 30 Member States with official Tsunami National Contacts and Tsunami Warning Focal Points are: Australia, Canada, Chile, China, Colombia, Cook Islands, Costa Rica, Democratic People's Republic of Korea, Ecuador, El Salvador, Fiji, France, Guatemala, Indonesia, Japan, Malaysia, Mexico, New Zealand, Nicaragua, Papua New Guinea, Peru, Philippines, Republic of Korea, Russian Federation, Samoa, Singapore, Thailand, Tonga, United States of America, and Vietnam.

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