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PTWS–XXIII The Twenty-Third Pacific Tsunami Warning and Mitigation System Meeting Apia, Samoa, 16-18 February 2009

The Twenty-third Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS) was held in Apia, Samoa, 16–18 February 2009 under the Session Chairmanship of Mr Giorgio de La Torre, a.i. Chairman of the ICG/PTWS. It was attended by 61 participants from 21 ICG/PTWS Member States and representatives from three organizations, and observers.

The Session reviewed progress during the intersessional period from October 2007 to February 2009 as reported by the Regional Working Groups of the South East and South West Pacific and the Working Group on Sea Level Information and Data Exchange.

The ICG reviewed the report of the Warning and Advisories providers, discussed the results of the Pacific-wide exercise, Exercise Pacific Wave '08 and planned for the next Pacific Wide Exercise in 2010.

Based on the reports of the intersessional and intrasessional Working Groups and the discussions in plenary, the ICG adopted nine recommendations on (1) Enhancing Tsunami Warning Products, (2) PTWS Exercises, (3) Official Contacts and Sharing of Information, (4) Request for IOC Review of GLOSS Terms of Reference, (5) PTWS Medium Term Strategy 2009-2013, Working Group Structure and Implementation Plan 2009-2011, (6) Steering Committee of, *continued p. 15*



ICG/PTWS-XXIII participants.

SUMMARY OF EARTHQUAKES

reported by tsunami warning centres*

1 JANUARY- 30 JUNE 2009

Advisories issued by international tsunami warning centres. The Pacific Tsunami Warning Center (P) issues: Tsunami Information Bulletins (TIB), Fixed and Expanding Regional Warnings (FRW, ERW), and Ocean-wide Watch/Warnings (TWW) for the Pacific; Tsunami Information Bulletins (TIB), Local, Regional, and Ocean-wide Tsunami Watches (LTW, RTW, TW) for the Indian Ocean; Tsunami Information Statements (TIS), Local, Regional, and Ocean-wide Watches (LTW, RTW, TW) for the wider Caribbean. The Japan Meteorological Agency (J), issues: Tsunami Advisories (NWPTA) for the Northwestern Pacific; Tsunami Watch Information (TWI) for the Indian Ocean. The West Coast/Alaska Tsunami Warning Center (A) issues: Tsunami Information Statements (TIS), Tsunami Watch/Warnings (TWW) for Canada, the US (including Puerto Rico, excluding Hawaii and US-affiliated Pacific Island countries), and the US/British Virgin Islands. Depth (from GCMT solution) epicenter and Mw from the USGS (G), and Mw from PTWC (P) at action time. Wave height and period measurements from sea level gauges reported as amplitude, peak to trough, or greatest value for either inundation or runoff as indicated.

*Compiled by The International Tsunami Information Centre, ITIC

DATE	TIME (UTC)	LOCATION	EPICENTER	DEPTH (km)	M _w	PTWC ACTION	ACTION TIME	TSUNAMI? DAMAGING?	Maximum height and place
03 Jan	19:44	Irian Jaya Region, Indonesia	0.414° S 132.885° E	18	7.6 (GCMT) 7.5 (P) 7.4 (G)	TIB (P) TIS (A) NWPTA	19:56 19:56 20:05	YES NO	0.78m (peak-to-trough) Manokwari
03 Jan	22:34	Irian Jaya Region, Indonesia	0.691° S 133.305° E	19	7.5 (P) 7.4 (GCMT) 7.2 (G)	TIB (P) TIS (A) NWPTA NWPTA 002 TIB 002 (P)	22:48 22:48 22:51 01:59 (4Jan) 02:11	NO	
15 Jan	07:27	Southeast of Loyalty Islands	22.352° S 170.635° E	26	6.8 (A, P) 6.6 (GCMT) 6.4 (G)	TIS (A) TIB (P)	07:39 07:40	NO	
15 Jan	17:50	East of the Kuril Islands	46.857° N 155.154° E	45	7.5 (A, P, J) 7.4 (GCMT) 7.3 (G)	TIB (P) TIS (A) NWPTA	18:04 18:04 18:20	YES NO	22.5 cm (peak-to-trough) Severo-Kurilsk tide gauge
19 Jan	03:35	Southeast of Loyalty Islands	22.604° S 170.881° E	15	6.6 (A, P) 6.5 (G, GCMT)	TIB (P) TIS (A)	03:47 03:47	NO	
11 Feb	17:35	Talaud Islands, Indonesia	3.902° N 126.400° E	23	7.4 (A, P, J) 7.2 (G) 7.1 (GCMT)	TIB (P) TIS (A) NWPTA	17:46 17:46 17:50	NO	
18 Feb	21:54	Kermadec Islands	27.424° S 176.330° W	38	7.3 (P, A) 6.9 (G, GCMT)	TIB (P) TIS (A)	22:04 22:03	NO	
06 Mar	10:50	North of Svalbard	80.324° N 1.853° W	12	6.5 (P,G,GCMT)	TIS (A) TIS (P)	11:01 11:44	NO	
12 Mar	23:24	South of Panama	5.686° N 82.767° W	19	6.6 (A, P) 6.3 (GCMT) 6.2 (G)	TIB (P) TIS (A)	23:34 23:34	NO	
19 Mar	18:18	Tonga Island Region	23.046° S 174.659° W	50	7.7 (A, P) 7.6 (G, GCMT)	TIS (A) FRW-Initial (P) 002 (P) 003--Cancel (P)	18:30 18:30 19:32 20:08	YES NO	0.270 m (peak-to-peak) Santa Cruz, Galapagos

Earthquake summary, *continued*

DATE	TIME (UTC)	LOCATION	EPICENTER	DEPTH (km)	M _w	PTWC (P) JMA (J), or WC/ATWC (A) ACTION	ACTION TIME (UTC)	TSUNAMI? DAMAGING?	MAXIMUM MEASUREMENT and LOCATION
07 Apr	04:24	Kuril Islands	46.049° N 151.548° E	43	6.9 (G, GCMT) 6.8 (A, P) 6.6 (M _{Jma})	TIS (A) TIB (P) NWPTA	04:37 04:36 04:36	NO	
16 Apr	14:57	South Sandwich Islands Region	60.203° S 26.858° W	24	6.7 (A, P, GCMT) 6.6 (G)	TIS (A) TIS (P)	15:15 15:20	NO	
18 Apr	19:17	Kuril Islands	46.015° N 151.427° E	49	6.8 (A, P) 6.6 (GCMT) 6.4 (G)	TIS (A) TIB (P)	19:38 19:37	NO	
28 May	08:25	North of Honduras	16.720° N 86.233° W	14	7.3 (A, GCMT, P) 7.1 (G)	LTW (P) TIS (A) LTW-Cancel	08:33 08:33 09:47	NO	
02 June	02:17	Vanuatu Islands	17.757° S 167.949° E	19	6.5 (A, P) 6.3 (G, GCMT)	TIB (P) TIS (A)	02:28 02:29	NO	
23 June	14:19	New Ireland Region, Papua New Guinea	5.157° S 153.782° E	73	6.8 (A, J, P) 6.7 (G, GCMT)	TIB (P) TIS (A) NWPTA	14:32 14:34 14:39	NO	

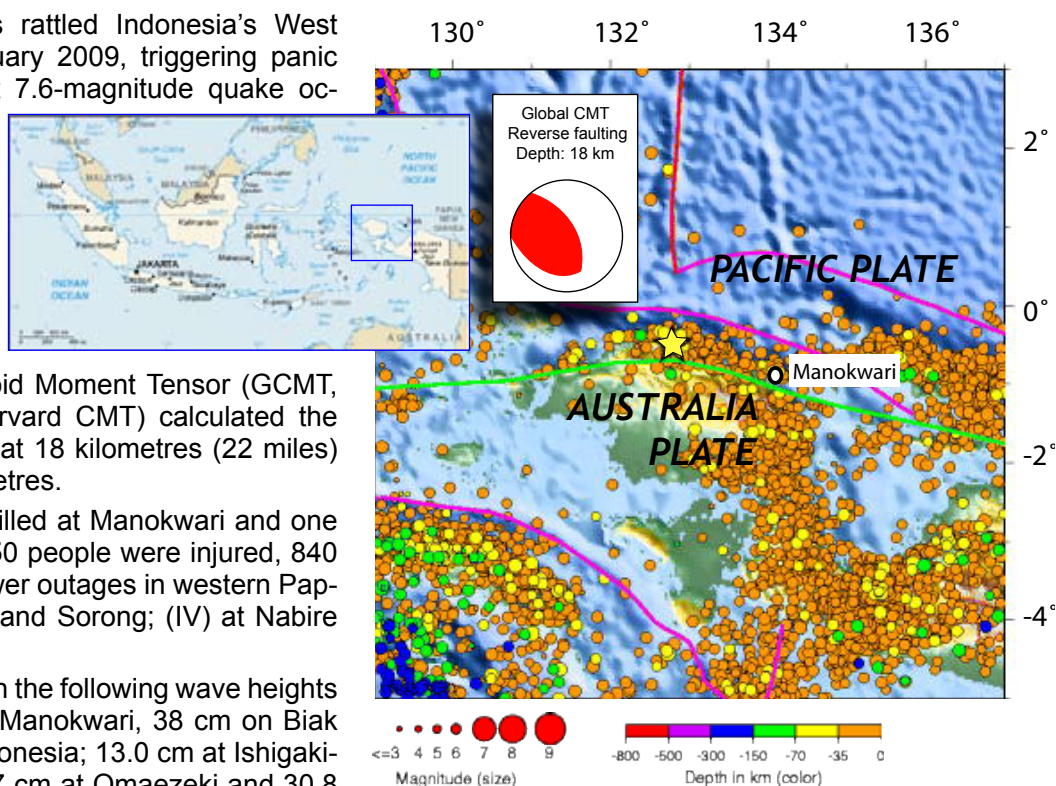
IRIAN JAYA REGION, INDONESIA 3 January 2009, 19:44 UTC, M_w=7.4

Two powerful earthquakes rattled Indonesia's West Papua province on 3 January 2009, triggering panic among residents. The first 7.6-magnitude quake occurred at 19:44 UCT (04:43 local time), about 150 kilometres northwest of the city of Manokwari. It was followed almost three hours later at 22:33 UCT by a 7.4-magnitude aftershock.

Both quakes were fairly shallow. The Global Centroid Moment Tensor (GCMT, formerly known as the Harvard CMT) calculated the depth of the first epicenter at 18 kilometres (22 miles) and the second at 19 kilometres.

At least four people were killed at Manokwari and one killed at Sorong. At least 250 people were injured, 840 buildings damaged and power outages in western Papua. Felt (VI) at Manokwari and Sorong; (IV) at Nabire and Ransiki. Felt at Ambon.

A tsunami was recorded with the following wave heights (peak-to-trough): 78 cm at Manokwari, 38 cm on Biak and 20 cm at Jayapura, Indonesia; 13.0 cm at Ishigakijima, 10.2 cm at Naha, 30.7 cm at Omaezeki and 30.8 cm at Tosashimizu, Japan; 0.8 cm on Yap, Federated States of Micronesia; 20.0 cm on Saipan, Northern Mariana Islands; 3.7 cm at Malakal, Palau; 5.2 cm on Wake Island.

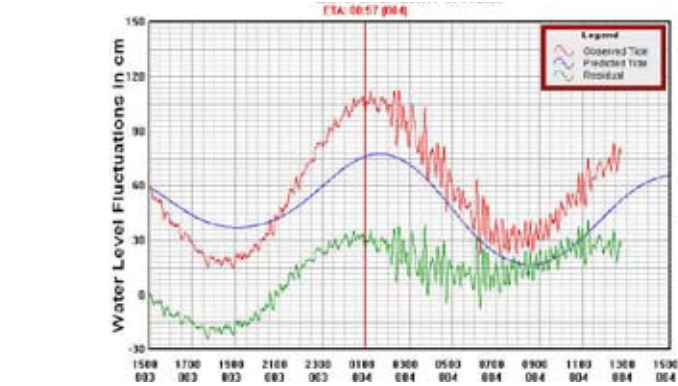


Above: Historical seismicity of the area from 1990 to the present, with recent earthquake location marked by a yellow star. Map courtesy of USGS National Earthquake Information Center (NEIC).

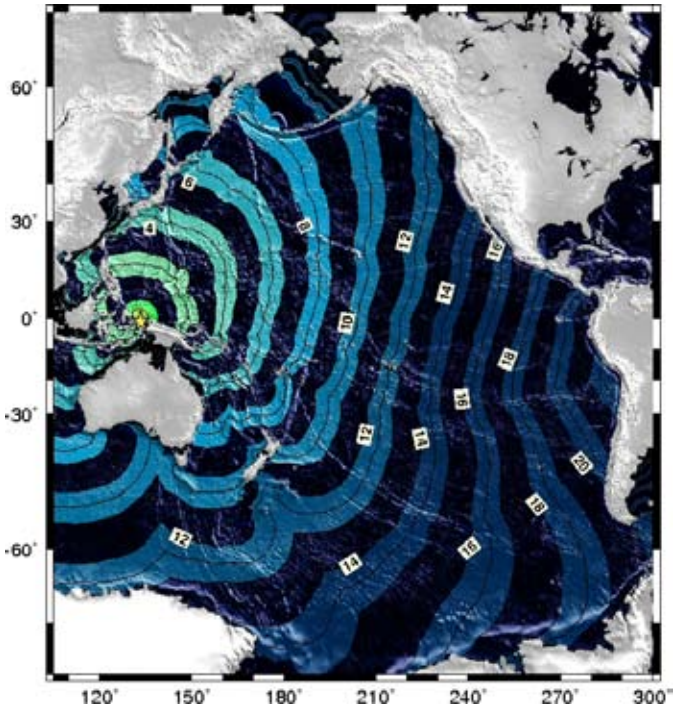
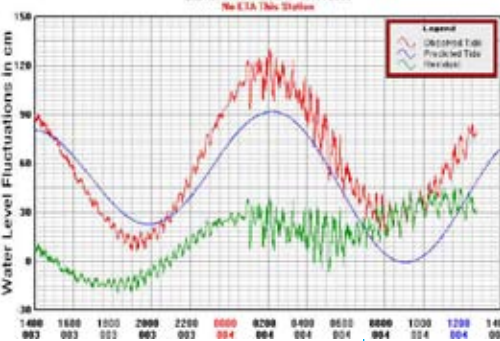
Irian Jaya earthquake, continued

This earthquake (3 January 2009, 19:43 UTC) occurred about 470 km west of the magnitude 8.2 earthquake of 17 February 1996, which produced a tsunami that was destructive on the island of Biak. At least 108 people were killed by the 1996 earthquake and associated tsunami.

Omaezaki, Japan, 00:52 UTC



Tosashimizu, Japan, 01:06 UTC



Travel time map showing estimated arrival time for hypothetical wave as based on modeled epicenter for the earthquake.

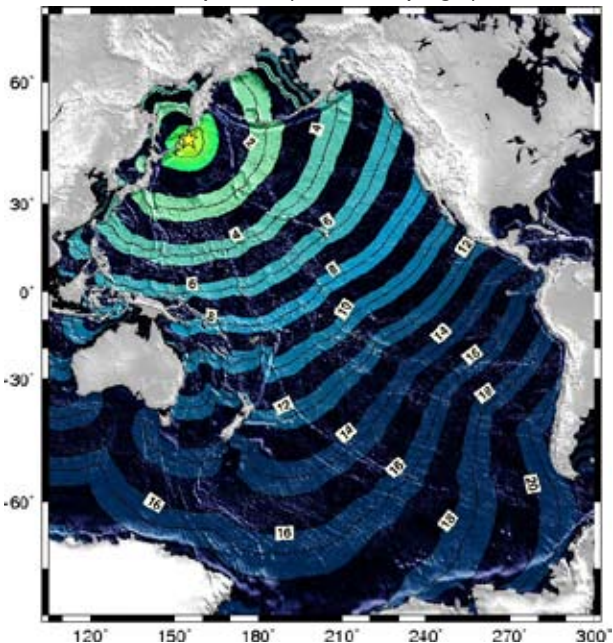
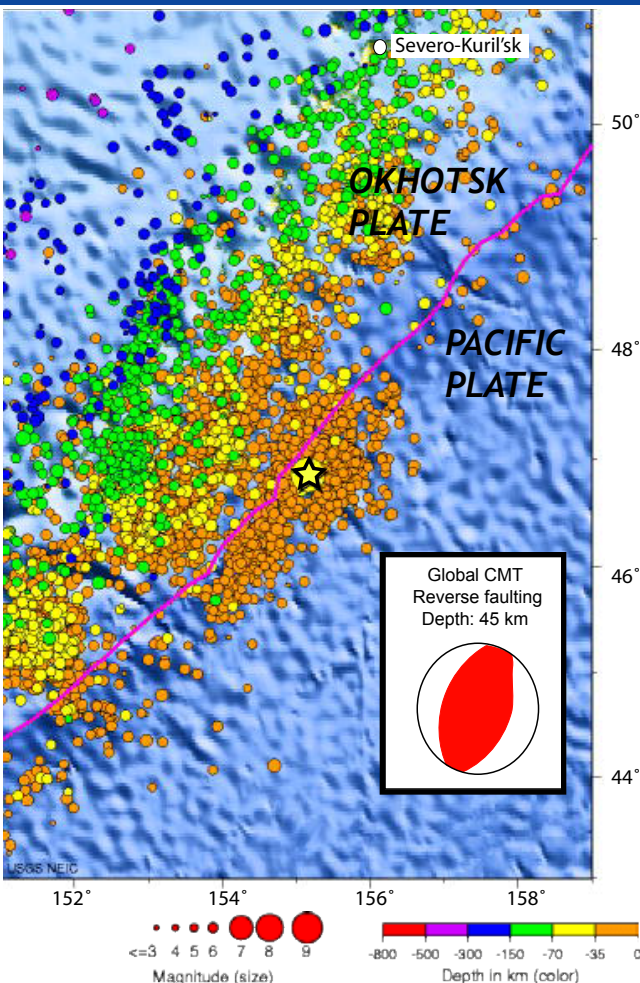
Tide gage	Peak amplitude (above sea level in cm)	Observed Initial Arrival time (UTC)	Computed Initial Arrival time (UTC)	Initial motion	Sample Interval (min)
Arena Cove, CA	4.8	10:52	09:29	rise	1
Port San Luis, CA	7.6	11:32	10:04	rise	1
Shemya, AK	?		04:41		15 (sec)
Malakal, Palua	4.0	21:11 (003)	20:59	drop	1
Kwajalein, Marshall Islands	2.9	01:48	01:09	rise	1
Pago Pago, Samoa	5.1	05:19	04:57	rise	1
Saipan, USA	10.6	23:12	No ETA	drop	1
Tosashimizu, Japan	18.5	00:52	No ETA	rise	1
Ishigakijima, Japan	8.6	23:31	23:22	rise	1
Naha, Japan	8.6	23:53	00:03	rise	1
Omaezaki, Japan	20.1	01:06	00:57	?	1
Wake Island	3.0	01:05	01:02	rise	1
Nauru, Nauru	Obs.	02:43	01:17	?	6
Betio, Taraw, Kiribati	1.5	02:11	No ETA	rise	1
Hanasaki, Japan	8.3	03:05	No ETA	?	1
Port Vila Vanuatu	4.1		02:24	?	1
Midway Island	9.3	03:18	03:16	rise	1
Yap, Micronesia	3.8	21:31	No ETA	rise	1

Above left, tide gauge records from tide stations Omaezaki and Tosashimizu in Japan, where the most significant sea level change was measured for which records were available. ‘Observed arrival time’ is the actual tsunami arrival time in UTC on gages where it could be determined. The ‘computed arrival time’ is the estimated time of arrival computed at the West Coast/Alaska Tsunami Warning Center (WC/ATWC) based on the origin time and location. The ‘sample interval’ column shows the time between samples (see graph). These records along with raw data from each tide gauge, can be obtained from the WC/ATWC website at: http://wcata-wc.arh.noaa.gov/previous.events/01-03-09-Irian_Jaya/Tsunami_01_03_09.htm. Courtesy of WC/ATWC.

East of KURIL ISLANDS 15 January 2009, 17:50 UTC, $M_W=7.3$

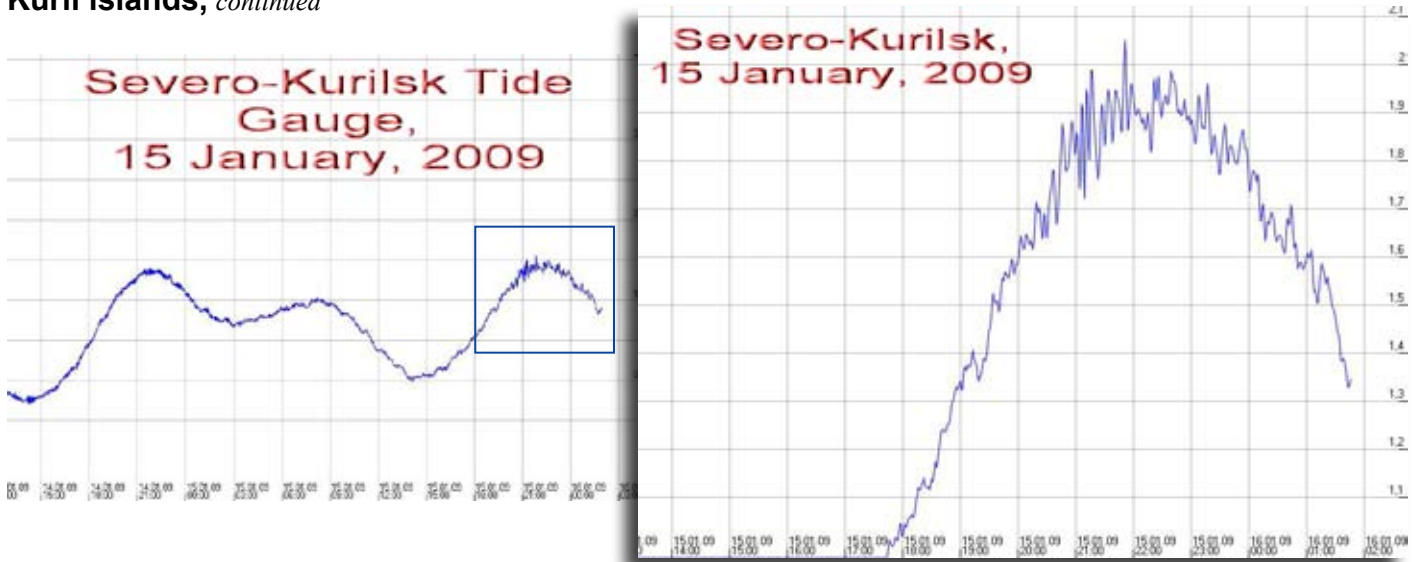
On 15 January 2009 an earthquake measuring 7.3 (USGS Moment magnitude) occurred east of the Kuril Islands at 17:50 UTC (03:50 January 16, local time near the epicenter). It was felt at Petropavlovsk- Kamchatskiy and in Hokkaido and northern Honshu. It occurred as a result of thrust faulting within the Pacific plate. The event occurred near the outer-rise of the Pacific plate about 30 km to the east of where the Pacific plate subducts beneath the Okhotsk plate.

Water level changes were recorded through various instrumentation in the Pacific (see graph). The nearest recording was made at Severo-Kuril'sk, Kuril Islands, Russia, 435 km (270 miles) north of the epicenter. The tsunami was measured there at 19:17 UTC, within two hours of the earthquake. (see next page).



Above: Historical seismicity of the area from 1990 to the present, with recent earthquake location marked by a yellow star. Map courtesy of USGS National Earthquake Information Center (NEIC). Left: Travel time map generated by WC/ATWC Below: Chart showing the locations of tsunami measurements. obtained and available from the West Coast/Alaska Tsunami Warning Center for this event. Courtesy of WC/ATWC.

Tide gage	Peak amplitude (above sea level in cm)	Observed Initial Arrival time (UTC)	Computed Initial Arrival time (UTC)	Initial motion	Sample Interval (min)
Arena Cove, CA	4.0	0221	0209	down	1
Port Orford, OR	3.0	?	0154	?	1
Ishigakijima, Japan	2.5	2301	2240	?	1
Wake Island	3.2	2152	2143	down	1
DART 21413 SE Tokyo, Japan (30.55N 152.117E)	0.5	1955	1959	rise	1
DART 21416 SE Kamchatka Peninsula, Russia (48.29N 162.05E)	1.6	1834	1836	rise	1
DART 21418 NE Tokyo, Japan (38.71 N 148.67E)	?	1904	1901	rise	1
DART 46413 E Adak, Alaska (48.87N 175.58W)	0.5	2032	2028	rise	1
Severo, Russia ***	11.1	1917	1909	rise	1

Kuril islands, *continued*

Tide record with detail of the reading from the Severo-Kurilsk tide gauge on 15 January 2009. Contributed by Tatiana Ivelskaya, Sakhalin Tsunami Warning Center, Russia, through communique on the Tsunami Bulletin Board.

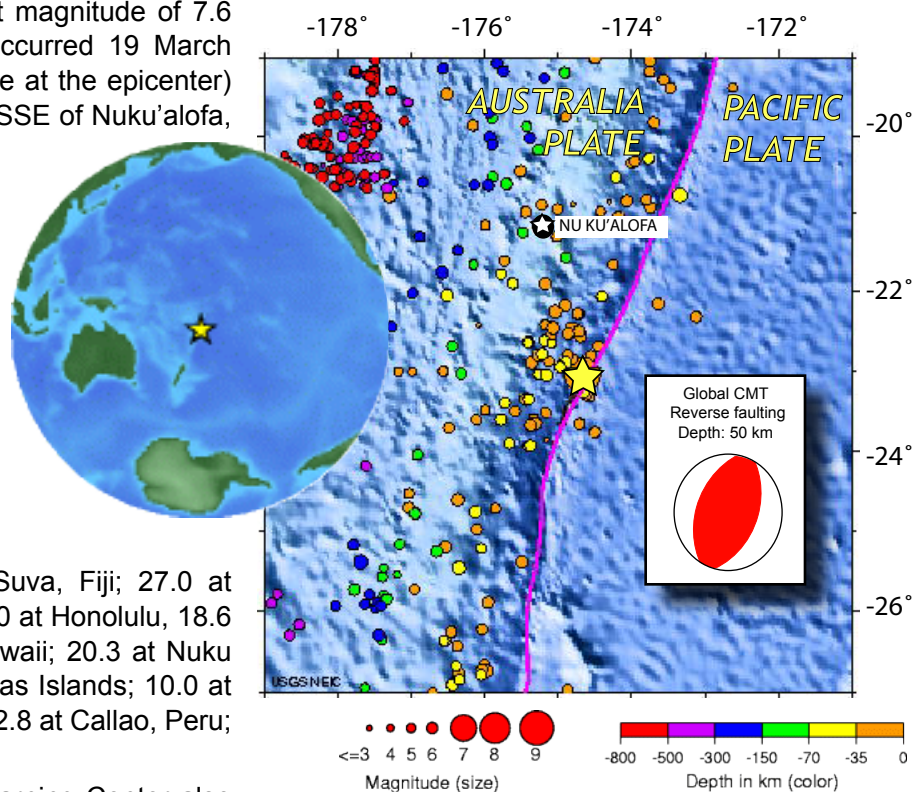
TONGA ISLAND REGION, 19 March 2009, 18:18 UTC, $M_W=7.6$

A major earthquake with a moment magnitude of 7.6 (USGS Moment magnitude, M_W) occurred 19 March 2009 at 18:18 UTC (06:18 local time at the epicenter) and was located 135 miles/220 km SSE of Nuku'alofa, Tonga.

Felt most strongly at Pangai and Nuku'alofa, but also felt at Havelu, Neiafu, and Vaini. Other felt reports from Suva, Fiji; Auckland, Taradale, Lower Hutt and Wellington, New Zealand; Apia, Samoa.

A small tsunami was generated with wave heights (peak-to-trough, in cm.) at selected tide stations as reported by the USGS as follows: 10.4 at Iquique, Chile; 17.3 at Rarotonga, Cook Islands; 5.7 at Suva, Fiji; 27.0 at Santa Cruz, Galapagos Islands; 10.0 at Honolulu, 18.6 at Kahului and 9.4 at Nawiliwili, Hawaii; 20.3 at Nuku Hiva and 14.5 at Hiva Oa, Marquesas Islands; 10.0 at Napier, New Zealand; 8.7 at Niue; 22.8 at Callao, Peru; 10.7 at Port-Vila, Vanuatu.

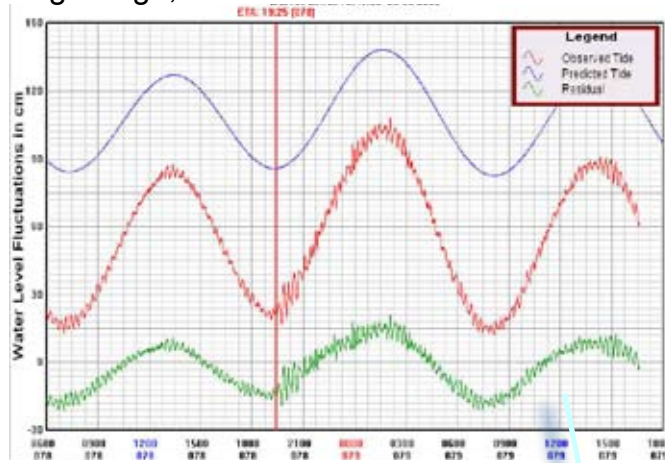
The West Coast/Alaska Tsunami Warning Center also compiled tide gauge records for this event recorded at tide gages monitored at the Tsunami Warning Centers. Many observatories provide data to the centers; such as the NOAA National Ocean Service (NOS), the University of Hawaii Sea Level Center, the Chilean Navy, and the National Tidal Facility in Australia among others. Listed



Above: Map of seismicity of the area for the year 2009, with the recent earthquake location marked by a star. Map courtesy of USGS National Earthquake Information Center.

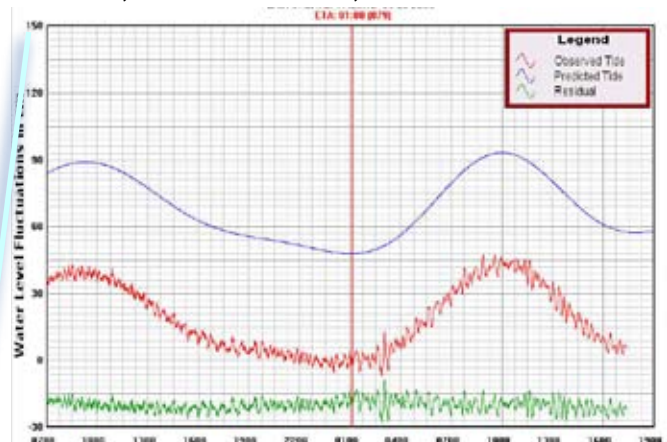
wave heights are maximum amplitude in cm (above sea level).

Pago Pago, Am.Samoa 19:25 UTC



Above: Tide record available from the WC/ATWC website at <http://wcatwc.arh.noaa.gov/previous.events/03-19-09-Tonga/PagoPago.jpg>

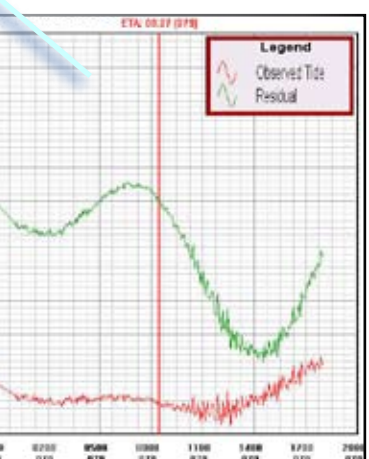
Kahului, HI 01:13 UTC, 20 March 2009



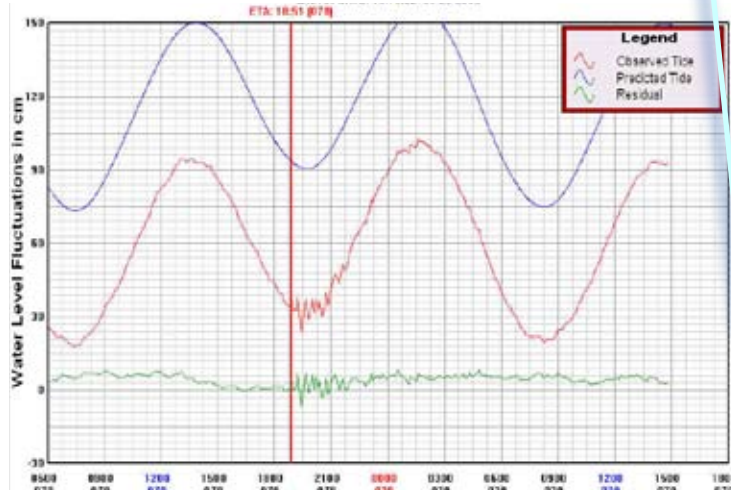
Above: Tide record for Kahului, Maui available from the WC/ATWC website at <http://wcatwc.arh.noaa.gov/previous.events/03-19-09-Tonga/Kahului%20HI.jpg>.

Below: Tide record available at <http://wcatwc.arh.noaa.gov/prehttp://wcatwc.arh.noaa.gov/previous.events/03-19-09-Tonga/Callao%20La%20Punta,%20Peru.jpg>

Callao, La Punta, PERU 08:26 UTC 20 March

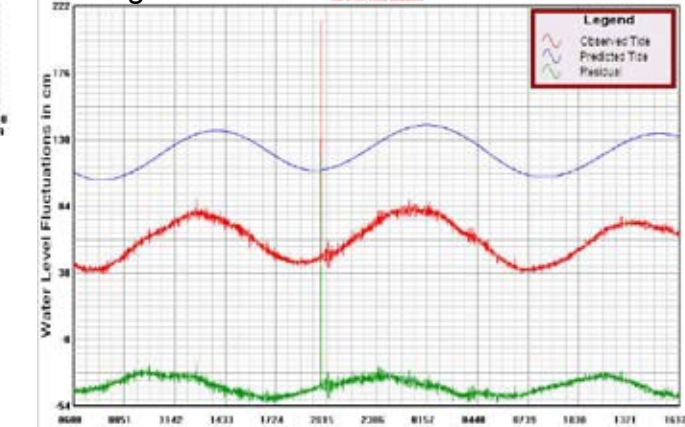


Nukualofa, TONGA 18:51 UTC



Above: Tide record available from the WC/ATWC website at <http://wcatwc.arh.noaa.gov/previous.events/03-19-09-Tonga/Nukualofa%20Tonga.jpg>. Right: Tide record available at <http://wcatwc.arh.noaa.gov/previous.events/03-19-09-Tonga/Rarotonga.jpg>

Rarotonga 20:11 UTC



Tonga, *continued*

Tide gage	Peak amplitude (above sea level in cm)	Observed Initial Arrival time (UTC)	Computed Initial Arrival time (UTC)	Initial motion	Sample Interval (min)
Tonga	6.4	1851	1851	rise	6
Niue	3.2	1900	1902	rise	2
Pago Pago	8.8	?	1925	rise	1
Suva, Fiji	4.4	1959	2006	rise	1
Rarotonga	9.4	~2012	2011	rise	1
Napier, N.Z.	7.4	?	2123	rise	0.25
Port Vila, Vanuatu	6.4	2204	2136	rise	1
Nuka Hiva, Fr. Polynesia	9.0	2338	2322		1
Rikitea	2.5	?	2327		1
Nawilwili HI	5.1	0054 3-20	0039 3-20	rise	1
Honolulu HI	3.5	0058 3-20	0040 3-20	rise	1
Kawaihae HI	6.5	0028 3-20	0040 3-20	rise	1
Kahului HI	9.5	0113 3-20	0108 3-20	rise	1
Corral, Chile	4.5	?	0651 3-20		2
Valparaiso, Chile	7.2	?	0722 3-20		2
Baltra, Ecuador	2.9	0809 3-20	0729 3-20	rise	1
Coquimbo, Chile	8.0	0800 3-20	0736 3-20		2
Caldera, Chile	7.5	?	0751 3-20		2
Antofagasta, Chile	3.1	?	0819 3-20	rise	2
Callao, La Punta, Peru	15.0	?	0826 3-20	rise	6
LaLibertad, Ecuador	6.0	?	0829 3-20		2

Graph showing the tide record summaries compiled by WC/ATWC Warning Center. Observed Arrival time is the actual tsunami arrival time in UTC on gages where it could be determined. The Computed Arrival time is the estimated time of first wave arrival as computed by WC/ATWC based on the origin time and location. The sample interval column shows the time between samples. This graph is found at <http://wcatwc.arh.noaa.gov/previous.events/>, with links to individual gauge records and data (see previous page). Courtesy of WC/ATWC.

Tsunami Event Timeline:

TONGA ISLANDS REGION, 2009-03-19 18:18:11

Issued 8 April 2009, by ITIC, http://ioc3.unesco.org/itic/files/Timeline_19mar09_v8apr09.doc

UTC Hawaii Time Time After Event

1818 UTC 0818 HST 0:00 Earthquake occurs near TONGA ISLANDS REGION (23.0S, 174.8W)

1820 UTC 0:02 NIUE MET staff feel earthquake and go to office.

1821 UTC 0821 HST 0:03 Watchstanders at PTWC are paged from: holo EQ: SW_PACIFIC: MSVF AFI

1821 UTC 0821 HST 0:03 DART 51426 SE of Tonga triggers on earthquake; tsunami @1900 UTC

1824 UTC 0824 HST 0:06 PTWC observatory message sent: 18:17:40Z MAR 19 09 LAT 23.0S LONG 174.3W MWP 7.5 (5 STATIONS)

1825 UTC 0825 HSR 0:07 DART 51425 NW of Samoa triggers on earthquake; no clear tsunami.

~1827 UTC 0:09 TONGA MET calls PTWC

1829 UTC 0829 HST 0:11 PTWC issues TSUNAMI BULLETIN NUMBER 001 (International) FIXED REGIONAL WARNING FOR TONGA / NIUE / KERMADEC IS / AMERICAN SAMOA / SAMOA / WALLIS-FUTUNA / FIJI

1830 UTC 0830 HST 0:12 WC/ATWC issues TSUNAMI INFORMATION STATEMENT 001 (International) requiring no action for WC/ATWC AR

1830 UTC 0:12 AMERICAN SAMOA MET receives incomplete FAX, Calls PTWC to confirm tsunami warning. AMERICAN SAMOA issues Warning through Emergency Alert System, (problems with issuance and dissemination being addressed). In Met office, communications

lines overloaded (fax, landlines, internet).

1831 UTC 0831 HST 0:13 PTWC issues TSUNAMI ADVISORY HAWAII 001 (Hawaii State Civil Defense).

1832 UTC 0:14 NEW CALEDONIA (Army) receives PTWS Bulletin NUMBER 001 (warning).

1833 UTC 0833 HST 0:15 RANET SMS RECEIVED (IN HAWAII) - PTWC TSUNAMI BULLETIN NUMBER 001

1833 UTC 1:15 NEW CALEDONIA High Commission of French Republic in New Caledonia/Civil Defense Defense Direction receives PTWC message by FAX

1834 UTC TONGA MET receives PTWC BULLETIN NUMBER 001 (warning)

1834 UTC 0834 HST 0:16 JOINT AUSTRALIAN TSUNAMI WARNING CENTRE issues National Tsunami Bulletin – No Threat to Australia.

1834 UTC 0834 HSR 0:16 DART 55013 Tasman Sea triggers on earthquake; no clear tsunami.

~1835-1845 UTC TONGA MET issues Urgent Tsunami Warning directly to National Radio advising people to move. Since outside working hours, most people only found out by time of cancellation.

1835 UTC 0:17 NIEW MET staff arrive at office and open communications.

1837 UTC 0:19 NIUE MET receives bulletin no.1 from PTWC by EMWIN and email.

1844 UTC 0:26 NIUE MET contacts Chief of Police (Coordinator, Niue Disaster Council)

1850 UTC 0:32 NIUE CHIEF OF POLICE arrives at Met Office.

1855 UTC 0:37 NIUE CHIEF OF POLICE issues public alert to avoid coasts for next 2 hours by national radio broadcast.

Tonga, continued

1900 UTC	0:42	TSUNAMI ARRIVAL DART 51426 – measurement @ 1904 UTC, 0.03 m amplitude (0-to-peak), 7 min period.	1934 UTC	1:16	PREDICTED TSUNAMI ARRIVAL, APIA, SAMOA
1900 UTC	0:42	NEW ZEALAND CDEM issues National Advisory, Tsunami: Potential Threat.	2005 UTC	1:47	TONGA MET call PTWC to confirm will cancel.
1910	0:52	SAMOA MET issues Tsunami Watch.	2007 UTC 1007 HST	1:49	PTWC issues TBN 003 (International) FIXED REGIONAL WARNING CANCELLATION
1918 UTC	1:00	TONG GTS TRANSMISSION SHOWING PARTIAL TSUNAMI RECORD	2009 UTC 1009 HST	1:51	PTWC issues TBN 003 (Hawaii State Civil Defense) FINAL TSUNAMI ADVISORY HAWAII
1845 UTC	0:27	PREDICTED TSUNAMI ARRIVAL, NUKUALOFA (NKFA), TONGA - not working.	2009 UTC	1:51	NIUE MET receives PTWC TBN 3 by EMWIN and email.
1847 UTC	0:29	TSUNAMI ARRIVAL TONGA (TONG, near NKFA) – MEASUREMENT @1913 UTC, 0.06 m amplitude (0-to-peak), 25 min period.	2010 UTC	0:14	NEW CALEDONIA (Army) receives PTWS TBN 003 (cancellation)
1925 UTC	1:07	PREDICTED TSUNAMI ARRIVAL, PAGO PAGO, AMERICAN SAMOA, not working	2010 UTC	1:52	NEW ZEALAND CDEM issues National Advisory, Tsunami: Threat Cancellation
1931 UTC 0931 HST	1:13	PTWC issues TBN 002 (International) SUPPLEMENT – CONFIRMED TSUNAMI GENERATED BUT HEIGHT NOT CONFIRMED/ REPORTED SINCE ONLY PARTIAL TSUNAMI RECORD RECEIVED FROM TONGA	2013 UTC 1013 HST	1:55	RANET SMS RECEIVED (IN HAWAII) - PTWC TBN 003
1933 UTC 0933 HST	1:15	PTWC issues TSUNAMI MESSAGE NUMBER 2 (Hawaii State Civil Defense) SUPPLEMENT HAWAII	2015 UTC	1:57	AMERICAN SAMOA MET issues Tsunami Warning Cancellation.
1934 UTC	0:14	NEW CALEDONIA (Army) receives PTWS Bulletin no 2 (supplement)	2015 UTC	1:57	NIUE CHIEF OF POLICE issues all clear by national radio broadcast.
1938 UTC 0938 HST	1:20	RANET SMS RECEIVED (IN HAWAII) - PTWC TSUNAMI BULLETIN NUMBER 002	???? UTC		TONGA MET issues Urgent Tsunami Warning Cancellation.
2001 UTC	1:43	NIUE GTS TRANSMISSION SHOWING VERY SMALL TSUNAMI	2020 UTC	2:02	SAMOA MET issues Tsunami Watch Cancellation.
1900 UTC	0:42	TSUNAMI ARRIVAL NIUE - MEASUREMENT @1906 UTC, 0.04 m amplitude (0-to-peak), 7.5 min period .	2026 UTC	2:08	SUVA GTS TRANSMISSION
1904 UTC	0:46	PREDICTED TSUNAMI ARRIVAL, NIUE	2003 UTC	1:45	PREDICTED TSUNAMI ARRIVAL, SUVA, FIJI.
2002 UTC	1:44	APIA GTS TRANSMISSION SHOWING NO TSUNAMI	2009 UTC	1:51	TSUNAMI ARRIVAL SUVA - MEASUREMENT @2015 UTC, 0.03m (0-to-peak), 15.5 min period.
			2106 UTC	2:48	RAROTONGA GTS TRANSMISSION
			2013 UTC	1:55	TSUNAMI ARRIVAL RAROTONGA – MEASUREMENT @2025 UTC, 0.09m (0-to-peak), 6 min period.

IOC NEWS

Global Meeting of the Intergovernmental Coordination Groups (ICGs) for Tsunami Warning Systems, Paris, France, 24 – 27 March 2009

UNESCO's Intergovernmental Oceanographic Commission sponsored a global meeting of the Intergovernmental Coordination Groups for Tsunami Warning Systems in Paris, France, 24 – 27 March 2009. The agenda was organised around the recommendations of the Working Group on Tsunamis and other Ocean Hazards Warning and Mitigation Systems (TOWS-WG) (as adopted by the IOC 41st Executive Council)(i.e. “the need to harmonize regional ICG structures to create efficiency and facilitate exchange of knowledge and information among the ICGs” IOC/EC XLI-6), as well as by the several recommendations originated from the ICGs addressing global issues and needs.

Following the welcome and opening remarks by Mr. Koichiro Matsuura, Director General of UNESCO and Mr. Javier Valladares, Chairman of IOC, brief presentation by all ICGs were made on their needs.

The agenda addressed proposing a global approach of technical issues and standards, through discussion of the various monitoring and detection systems and networks, both sea level and seismic. Sessions later the same day dealt with the technical issues surrounding risk assessment, warning communication and community preparedness.

Global meeting, *continued*

Focusing on Finding synergies: A streamlined governance for ICGs.

Recommendations made by the end of the meeting were based on break out sessions around the topics or working group structure, coordination with other IOC subsidiaries and to strengthen collaboration with other agencies. More details about this conference are available through the IOC website: http://www.ioc-unesco.org/index.php?option=com_oa&task=viewEventRecord&eventId=434

Yohko Igarashi on her two year secondment from JMA to ITIC, which ended in April 2009

by Yohko Igarashi, Seismologist, JMA; igacco@gmail.com

I was dispatched from Japan Meteorological Agency (JMA) to UNESCO/IOC/ITIC for a term of one year in April 2007, as a seismological expert. Later, my assignment was extended through March 2009. Before I went to ITIC, I read a document that said I would assist all kinds of tasks in ITIC. To tell the truth, I didn't believe it. I thought ITIC needed a little more time to decide what to assign. However, during the two years, I realized that the document was telling the truth. I could experience quite lots of kinds of work, and now, my experience in Hawaii and some other places that I could visit are great fortune and left the brightest memory.

My tasks were to assist in the ITIC's work in enhancing international cooperation in tsunami warning and mitigation activities, and especially in the technical aspects of earthquake and tsunami monitoring and warning. My first task in ITIC was to write an annex for the user's guide on various magnitudes, since there are many different kinds of magnitudes for different distance, seismic wave frequency, etc. and it could be confusing for users which one to use. The next task was to create some training materials using TTT Software and at the same time, to arrange that software for easier and more convenient use. Fine The task of finetuning the software continued till the end of my secondment, and now, we are sure it has developed greatly. After that, I took on more assignments and rather than list everything I would summarize that training and "Anatomy of Tsunami" were my main activities.

I prepared training materials for various purposes and sometimes made lectures. Some materials were genuinely for scientific lectures, and some were more practical, such as compiling disaster management methods held by local governments and distributing software and tools. As for disaster management examples, I often used Japanese municipalities' preparedness materials and once, in April 2008, Dr.



Yohko Igarashi with Dr. Laura Kong, ITIC Director and Brian Yanagi, ITIC Office Manager and Disaster Management Specialist.

Laura Kong and I visited Shizuoka Prefecture to learn their disaster management. They kindly accepted our incorporation of their preparedness materials into ITIC's training programmes, so I translated some of their materials into English and used them in the ITIC training. As for the tools, I learned and arranged Tide Tool mainly for Windows users in cooperation with PTWC and also learned Early Bird provided by WC/ATWC. Same for the TTT software. I continued working on Tide Tool till the end of the term. In the second year, I had an opportunity to attend training sessions in Malaysia and Mozambique as a lecturer. These were really impressive. Though I was a lecturer, I could learn much from the trainees, e.g. how I should talk, what topics were of interest, and so on.

"Anatomy of Tsunami" is an educational document on tsunami and tsunami mitigation systems, that I was assigned to create by the IOC. I collected as many tsunami waveforms as possible for recorded historical tsunamis. Then I selected eight historic tsunami events which had a great influence on the world's tsunami warning systems, and created the document explaining their characteristics, lessons learned, etc. with Mr. Yamamoto's help.

Finally, I would like to thank everybody. People in ITIC, NWS, PTWC in Hawaii helped me alot, not only in work but in daily life. I owe them for my delightful days in Hawaii. I also thank those in the IOC and NGDC and the director of WC/ATWC for cooperating with me on

Secondment, *continued*

some tasks, and people in Malaysia and Mozambique, lecturing together and having supported our travels. I appreciate IOC, ITIC and JMA for having provided me this great opportunity to work in ITIC. I hope I can work with people I met during these two years again in the future.

Philippine Tsunami Standard Operating Procedure (SOP) Training Summary Report

*By Brian Yanagi, Disaster Management Specialist,
International Tsunami Information Centre (ITIC);
brian.yanagi@noaa.gov*

The following summarizes Philippine training entitled, "Strengthening Tsunami Warning and Emergency Responses: Training Workshop on the Development of Standard Operating Procedures (SOP) for Indian Ocean and Southeast Asian Countries" in Manila at the Philippine Institute of Volcanology and Seismology (PHIVOLCS), which serves as the Philippines National Tsunami Warning Center (TWC). Three IOC SOP workshop trainings were undertaken as part of the mission of ITIC to support tsunami capacity building in the Pacific and Indian Oceans. Funding for the IOC workshops was provided through the UNESCAP. One week training sessions were conducted in August 2008 (Workshop #1); January 2009 (Workshop #2); and May 2009 (Workshop #3). The ITIC carries out its international tsunami information resource and capacity building activities per NOAA-UNESCO Intergovernmental Oceanographic Commission (IOC) arrangements. The Pacific Tsunami Warning Center (PTWC) is providing warning services for the Pacific Ocean, and interim services for the South China Sea Region and the Indian Ocean. The United States is a Member State of the IOC

and actively participates in various Intergovernmental Coordination Group organizations.

Participants came from PHIVOLCS, Philippine National Mapping and Resource Information Authority, Philippine Office of Civil Defense (OCD), Philippine Coast Guard, and Catholic Media Network.

Training topics, covered through plenary lectures and small group activities, were on tsunami warning and emergency response, especially:

- *Tsunami Science, Hazards, and Warning Centers, including PTWC services*
- *Warning Center Operations, Roles and Responsibilities, and Standard Operating Procedures for centers with and without active seismic monitoring capabilities*
- *Tsunami Emergency Response by Disaster Management Organizations (DMO), including Roles and Responsibilities and Standard Operating Procedures for alerting and evacuation,*
- *Tsunami Information Dissemination, including technologies and the role of media*
- *Preparedness, Education and Awareness*
- *Lessons Learned from Past Tsunamis, and Tsunami Case Studies*
- *Exercises and Drills, including Table Top Exercise carried out on Day 5 followed by post-exercise evaluation*

A course manual was compiled and distributed comprised of reference materials used in the training and small group activities.

Outcomes of the training included:

- Both PHIVOLCS and OCD did not have written, detailed tsunami SOPs to respond to local/regional/distant tsunamis. By the end of the three workshops, both agencies had successfully written customized Philippine tsunami SOPs.
- Sharing of best practices amongst international experts and Philippine participants
- Training of 37 participants from: the Philippine Institute of Volcanology and Seismology (20), the Office of Civil Defense (10), the Philippine Coastguard (2), the National Mapping and Resource Information Authority (2), the Philippine Astronomical, Atmospheric and Geophysical Services Agency (1), and the Catholic Media Network (2). PHIVOLCS is the NTWC for Philippines and OCD is the DMO.
- Plenary sessions were held covering tsunami science, hazards and warning centre operations, and emergency response and preparedness. The trainers included many examples from their working experi-



Participants of the IOC-Philippine Tsunami Standard Operating Procedure (SOP) Workshop #2 in January 2009.

Philippines, *continued*

ence in their lectures, which helped the trainees relate to their own operational experience. One complete session was devoted to briefings from the attending Philippines agencies, providing a local context to the current status of SOPs in the Philippines. On days 3 and 4 the NTWC and DMO groups broke out for more detailed training on their specialist topics before coming back together on day 5 for a tabletop exercise.



Philippine National Office of Civil Defense and National Disaster Coordination Council (NDCC). Participants fine-tune their SOPs through a real-time exercise during the last workshop.

- Near real-time Table Top Exercises were conducted in Workshop #1 and #2 involving TWC and DMO participants practicing SOPs developed during the training, and post-exercise evaluation and discussion to identify gaps and weaknesses for improvement. The tabletop exercise tested the group's understanding of SOPs for both local (<1 hour) and regional (approx 3 hours) tsunamis. For the exercise, the group split into separate NTWC and DMO teams for both local and regional tsunami. The exercise demonstrated that the Philippines' SOPs are already well developed but there are some gaps which require further attention, eg. Communications.
- A real-time functional exercise was conducted in Workshop #3 with TWC and DMO participants practicing SOP implementation from their respective 24 x 7 operations centres. "Exercise Manila Trench 2009" challenged the agencies to react to a major local earthquake southwest of Luzon, which generated a local tsunami within the Philippines and a regional tsunami within the South China Sea. TWC and DMO agencies successfully implemented their SOPs.
- Philippine TWC and DMO agencies also developed a "Strategy for the Way Forward" on the next steps (short term and long term) that need to be taken to fully develop a Philippine "end to end" tsunami early warning system.

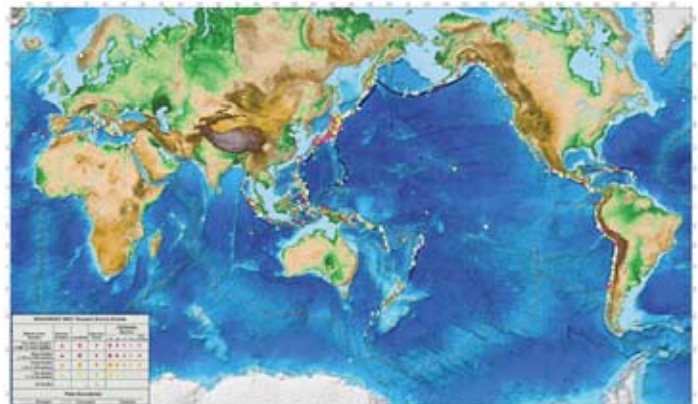
ITIC NEWS

New Map of Global Tsunami Sources, 1650 B.C. to 2008 A.D.

NOAA's National Geophysical Data Center (NGDC) and co-located World Data Center (WDC) for Geophysics and Marine Geology, Boulder and ITIC, a NOAA-UNESCO/IOC Partnership, have collaborated to produce a map showing tsunami sources. These data are from the NGDC global historical tsunami database that includes information on tsunami source events throughout the world that range in date from 1650 B.C. to A.D. 2008. The tsunami definitions are from the Tsunami Glossary 2008 published by UNESCO.

Of the 2,000 events in the NGDC tsunami database, over 1,100 confirmed tsunami source events are displayed on the map. The global distribution of these tsunami sources is 73% Pacific Ocean, 14% Mediterranean Sea, 6% Caribbean Sea and Atlantic Ocean, 5% Indian Ocean and 2% Black Sea. Most of the tsunamis were generated by earthquakes (83%) or earthquakes that were caused by landslides (6%). The remaining events were caused by landslides (2%) volcanic eruptions (6%) and unknown sources (3%).

The events in the NGDC tsunami database were gathered from the NOAA Tsunami Warning Centers (West Coast/Alaska Tsunami Warning Center and the Pacific Tsunami Warning Center), NOAA National Data Buoy Center, NOAA National Ocean Service, NOAA Pacific Marine Environmental Laboratory, U.S. Geological Survey, national and government databases and reports,



The large poster (27X36 inches) was printed in part by the Chilean Navy's SHOA. Copies can be obtained by contacting ITIC at l.kong@unesco.org.

New map, *continued*

tsunami catalogs, post-event reconnaissance reports, journal articles, newspapers, internet pages, email and other written documents. This compilation does not include sources inferred from the study of tsunami deposits. Tsunami deposits are the physical evidence left behind what a tsunami impacts a shoreline or affects submarine sediments. For a complete listing of references used in the compile the historical tsunami database, please see the NGDC website: <http://www.ngdc.noaa.gov/hazard/tsu/shmtl>.

The data in the NGDC tsunami database are continually being updated and reviewed for accuracy. Please contact NGDC (paula.dunbar@noaa.gov) or ITIC (I.kong@unesco.org) with any changes, additions, or comments.

Tsunami Warning Decision Support Tools

The following are decision support tools available free-of-charge to governments and other recognized authorities involved in tsunami warning hazard mitigation, through a variety of sources.

1. Real Time Earthquake Display (RTED) Tool - developed by US Geological Survey and the California Office of Emergency Services (California Integrated Seismic Network, CISN). This GIS display provides real-time earthquake information as broadcast by the US Geological Survey National Earthquake Information Center (NEIC). The USGS NEIC serves as the World Data Center for Seismology.

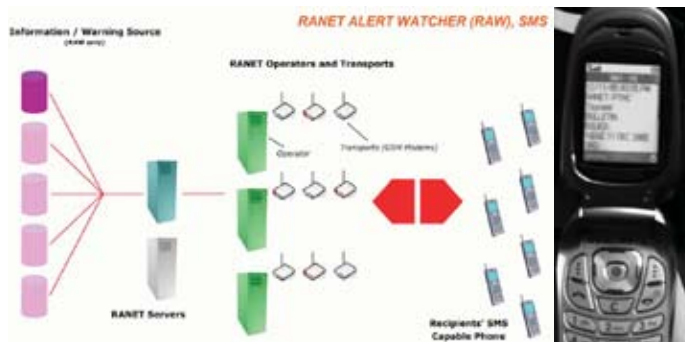
2. Tsunami Warning Operations: Sea Level Monitoring – Tide Tool and the IOC Sea Level Monitoring Facility

Tide Tool is an operations tool developed and supported by the Pacific Tsunami Warning Center to decode, display, and manipulate sea level data (coastal and DART deep-ocean stations) transmitted over the WMO Global Telecommunications System (GTS). It continuously decodes sea level in real-time and displays the time series on a computer screen, as well as station metadata and transmission information. Non-operational versions also exist for data transmissions through the Internet and for archived data.

The IOC Sea Level Monitoring Facility, developed originally under the IOC IODE Project for the ODINAFRICA sea level network in 2006, is a web-based real-time monitoring tool for sea level stations globally. The tool provides sea-level data, station status, station information, data plots, and other database services. This tool should be used with caution for operational purposes since timely web access cannot be guaranteed all over the globe during emergencies.

3. PTWC Tsunami Messages: RANET Alert Watcher SMS text message

The PTWC, through the RANET project, provides an SMS Heads-up alert to governmental tsunami warning and response agencies. The messages briefly alert the recipient that an official message (which is longer) has been sent.



The PTWC, through the RANET project, provides an SMS Heads-up alert to government authoritative tsunami warning and response agencies.

4. Tsunami Bulletin Board (TBB)

The TBB is an email list-serv that provides immediate sharing of tsunami information amongst tsunami professionals (scientists, researchers, emergency officials, and other officials). Its purpose is to provide an open, objective scientific forum for posting and discussing tsunami news, information, and research. It is not open to the media or the general public, and is not intended for advertising or activities of a commercial nature. PTWC, WC/ATWC and JMA bulletins are immediately posted to the TBB. The TBB began in 1995 and is now maintained by ITIC.

5. Tsunami Travel Time Software

The Tsunami Travel Time (TTT) software is used by the NOAA Pacific Tsunami Warning Center for its operations calculations. Map graphics are made using the open-source Generic Mapping Tools (GMT). The World Data Center for Marine Geology and Geophysics (WDC-MGG), co-located at the NOAA National Geophysical Data Center, and ITIC are providing free-of-charge, tsunami travel time calculation and display software to government organizations involved in providing tsunami warning and mitigation services. Other interested organizations and individuals are requested to obtain the software directly from the developer, Paul Wessel.

6. Tsunami Historical Database

The WDC-MGG provides extensive online, web-based and offline tools and other hazards information services. In 2009, the WDC-MGG and ITIC began distributing an enhanced offline tool (TsuDig GIS tool) that accesses the WDC database and include features of specific

Support tools, *continued*

use and interest to tsunami warning and emergency response decision-makers. Since the 1990s with the last features update in 2005, the Novosibirsk Tsunami Laboratory (NTL) has provided the WinITDB as an offline, stand-alone tool working on Windows platform; a useful feature included is a tsunami travel time calculator.

7. Google Earth Database Files

The Google Earth visualization tool can be used to display a number of tsunami-related databases. These include files for USGS-located earthquakes (in near real-time), WDC/NGDC Historical Tsunami Database as well as Significant Earthquakes and Volcanic Eruptions, the IRIS Global Seismic Network, and the PTWC-received Sea Level Network.

8. TsunamiTeacher Tsunami Resource Toolkit

TsunamiTeacher brings together materials of interest to a range of stakeholders involved in tsunami warning and mitigation. Sections cover the roles of the media, educational systems; government and private sectors. The tool is available as an electronic resource (<http://ioc3.unesco.org/TsunamiTeacher>), and in DVD format from ITIC.

Maldiv Islands SOP Training June 28 – July 2, 2009

*By Brian Yanagi, Disaster Management Specialist,
International Tsunami Information Centre (ITIC);
brian.yanagi@noaa.gov*

The following summarizes the trip taken to Male, Maldives. The trip was undertaken as part of the mission of the United Nations Development Programme (UNDP) Regional Programme, UNESCO Intergovernmental Oceanographic Commission (IOC), and ITIC to support tsunami capacity building in the Pacific and Indian Oceans. The training was organized based on

a request from UNDP Maldives to support the National Disaster Management Centre (NDMC) and the Maldives Meteorological Services (MMS), which serves as the Maldives National Tsunami Warning Centre (TWC). Moreover, the Pacific Tsunami Warning Center (PTWC) is providing warning services for the Pacific Ocean, and interim services for the South China Sea Region and the Indian Ocean.

The Maldives trip consisted of conducting training entitled, "Strengthening Tsunami Warning and Emergency Responses: Training Workshop on the Development of Standard Operating Procedures for Indian Ocean and Southeast Asian Countries," June 28 – July 2, 2009 in Male. In the past, a few representatives from Maldives have benefitted from ITIC's expertise at the regional SOP training supported by the UNDP Regional Programme in Jakarta in August 2008.

The UNDP Maldives and the Maldives Meteorological Service (MMS) provided in country coordination services. Participants came from 14 Maldivian national agencies.

Training topics, covered through plenary lectures and small group activities, were on tsunami warning and emergency response, especially:

- *Tsunami Science, Hazards, and Warning Centers, including PTWS services*
- *Warning Center Operations, Roles and Responsibilities.*
- *Tsunami Emergency Response by Disaster Management Organizations, including Roles and Responsibilities and Standard Operating Procedures for alerting and evacuation,*
- *Tsunami Information Dissemination, including technologies and the role of media*
- *Preparedness, Education and Awareness*



Participants of the Maldives National Tsunami SOP Training in June 2009.

Maldives, *continued*

- *Lessons Learned from Past Tsunamis, and Tsunami Case Studies*
- *Exercises and Drills*

A worst case scenario of a tsunami generated by an earthquake in Makran (Pakistan) which could hit the coast of Maldives in about 2.5 hours was used.

It was also noted that the NDMC was awaiting approval of the Disaster Management bill by its Parliament. The proposed bill defines roles and responsibilities of NDMC and its functions.

Outcomes of the training included:

- *Thirteen Maldivian national agencies had created new tsunami SOPs from scratch. The MMS improved their existing SOP.*
- *Sharing of best practices amongst international experts and Maldivian participants.*
- *Training of over 30 participants from TWC and DMO agencies on how to develop end-to-end standard operating procedures for tsunami early warning.*



Fourteen Maldivian national agencies created and coordinated tsunami emergency response SOPs in Male.

Future actions based on the trip include the following:

- In preparation for the inaugural IOC Indian Ocean Wave basin wide tsunami exercise on October 14, 2009, the Maldives now plans to conduct a tabletop exercise simulating response to their newly created SOPs.
- Plan follow up missions with IOC and UNDP.

PTWS XXIII, *continued*

the ICG/PTWS, (7) Seismic Data Exchange in the South West Pacific, (8) Pacific Emergency Communications and (9) Appreciation to the Government of Samoa.

The ICG re-structured its Working Groups into three Technical Working Groups on (1) Risk Assessment and Reduction, (2) Detection, Warning and Dissemination and (3) Preparedness and Readiness. To these technical groups the ICG added four Regional Working Groups (Central American on the Pacific, South East Pacific, South West Pacific and South China Sea).

The ICG approved a PTWS Medium Term Strategy 2009-2013 that describes the basic directions towards continuously improving the Pacific Tsunami Warning & Mitigation System to meet stakeholder requirements during the period 2009-2013. The three main pillars of the new strategy are:

- Risk Assessment and Reduction: hazard and risk identification and risk reduction
- Detection, Warning and Dissemination: rapid detection and warning dissemination down to the last mile
- Awareness and Response: public education, emergency planning and response.

The ICG elected new officers for the inter-sessional period, welcoming Lt. Giorgio de La Torre of Ecuador as Chairman and Mrs Filomena Nelson from Samoa and Mr Yohei Hasegawa of Japan as Vice-Chairs.

The ICG will organize the 24th session of the ICG/PTWS between October 2010 and March 2011 and noted the interest of the Russian Federation to host the 25th Session, highlighting the commemorative aspects of this Session.

RECOMMENDATIONS**ICG/PTWS Recommendation 1—Enhancing Tsunami Warning Products**

Noting that some Member States have expressed a need to review the current content, format and dissemination of the international tsunami warning messages,

Further noting that the tsunami forecasting capabilities of the international Tsunami Warning Centers (TWCs) will continue to improve in speed, accuracy, and resolution,

Considering the existing body of social science knowledge regarding effective hazard warning,

Further considering the diversity of the Member States and their tsunami warning requirements,

Acknowledging and appreciating the willingness of the international TWCs to consider changes to their products and dissemination that will improve their effectiveness and functionality,

Agrees that a Task Team composed of representatives from recipient Member States with PTWC and other regional warning centres be formed under the Working Group on Detection, Warning and Dissemination to:

PTWS XXIII, *continued*

Review the capabilities and plans of the international TWCs with respect to their operational products and product dissemination for the PTWS

Gather feedback from Member States regarding international TWC current and planned product content, format, and dissemination

Consider best practices based on social science as well as the experiences of the Member States

Consider the global harmonization of tsunami warning products and terminology

Develop recommendations to improve current products and /or develop new products

Requests the Task Team Chair to provide a report on the recommendations and any implementations at ICG/PTWS-XXIV.

(No financial implications)



Above, left to right: PTWC Director reporting on inter-sessional activities, and Delegates from USA, Tuvalu, Papua New Guinea, Nauru, New Zealand, Micronesia, and France.

ICG/PTWS Recommendation 2– PTWS Exercises

Recognizing that the PTWS requires regular testing and review,

Understanding that simulating scenarios and learning lessons from exercises is an effective way to improve preparedness,

Acknowledging the preliminary results of the Exercise Pacific Wave 08 (PACWAVE08) presented at the ICG/PTWS-XXIII meeting,

Realising that conducting the PACWAVE08 in real time allowed for better visualization of the tsunami propagation, and as a result, actions were taken, and

Noting that participating countries disseminated exercise information to emergency services for immediate actions, and

Noting that there were communications problems that arose in reaching the farthest islands within some island countries,

Recognising that the exercise was a good vehicle to

publicize awareness of tsunami preparedness,

Recognizing the continuing challenges to and opportunities for more effective tsunami early warning demonstrated by PACWAVE08,

Recommends that a third end-to-end tsunami exercise be carried out during October 2010,

Encourages the conduct of separate regional exercises that take into account regional tsunami hazards as well as regional challenges and synergies regarding tsunami preparedness, warning and response.

Decides that a Task Team be formed under Working Group 2 with the following Terms of Reference:

- (i) Review the PACWAVE08 evaluation report
- (ii) Identify lessons learned and develop recommendations based on the PACWAVE08 evaluation and submit recommendations to the PTWS Steering Committee
- (iii) Design and carry out a third end-to-end Pacific-wide exercise with the following characteristics:
 - a. *The exercise will take place preferably in the fourth quarter of 2010,*
 - b. *The exercise scenario be a major tsunami originating in the central south Pacific (e.g., Tonga-Kermadec) to complement previous scenarios in other places,*
 - c. *The exercise date be finalized by the Task Team and the exercise announced to Member States at least 180 days in advance of the exercise date,*
 - d. *The exercise manual including instructions to Member States regarding their participation and the evaluation instrument be prepared with content and structure similar to what was prepared for the previous two Pacific-wide exercises, but taking into account lessons learned and any need to collect additional information,*
 - e. *The exercise manual be distributed to Member States at least 90 days in advance of the exercise date,*
 - f. *Participating Member States be asked to complete and return the evaluation instrument no more than 90 days following the exercise,*
 - g. *The exercise be played out in real time,*
 - h. *The exercise be considered as a way to test new products from the international TWCs including graphical products.*

(No financial implications)

ICG/PTWS Recommendation 3–Official Contacts and Sharing of Information

Noting continuing difficulty in keeping multiple databases of Tsunami National Contacts and Tsunami Warning Focal Points uniform and current,

Recognising the need for a shared electronic repository to enable the publication of and access to key PTWS documents and other information by Member States,

Requests that the Secretariat urgently develop a web

PTWS XXIII, *continued*

site that provides for:

The Member States to review and update data concerning Tsunami National Contacts consistent with the UNESCO IOC rules established for such processes;

Member States to review and update data concerning Tsunami Warning Focal Points consistent with the UNESCO IOC rules established for such processes;

The IOC Tsunami Unit to make available in a timely manner official PTWS and other system documents;

Member States to publish and access documents and information that may be of relevance to the international tsunami community, and especially for the Pacific;

Parts of the website containing all Tsunami Warning Focal Point information and other protected information to be password protected and accessible by all confirmed National Contacts and Tsunami Warning Focal Points.

Provide PTWS Member States a schedule and plan for carrying out this recommendation within 60 days.

Further requests that the Secretariat urgently:

consult with the international Tsunami Warning Centers (TWCs) to consider how to use Communication Tests as a mechanism to review and update Tsunami Warning Focal Point information;

recommend and then implement an effective method in which to conduct, analyze, and report on the results of Communication Tests for the PTWS

And requests that ITIC facilitate the exchange of information in Working Groups and Task Teams during the intersessional periods.

(Financial implications to be determined)

ICG/PTWS Recommendation 4–Request for IOC Review of GLOSS Terms of Reference

Acknowledging the efforts of the GLOSS members to expand the sea level collection network and upgrade existing sites for use by the tsunami community, and

Noting the work of the GLOSS GE to enable the near real time transmission of sea level data to tsunami warning centres, and

Noting the efforts of the GLOSS GE to improve existing sampling and communication schemes in support the operational needs of the tsunami community

Noting the contribution of sea level networks not currently in GLOSS

Noting the scheduling of a workshop as recommended ICG/PTWS XXII,

Agrees in principle to support the TOWS recommendation for sea level data coordination under



Left to Right: PTWS Secretariat, PTWC Director, and delegates from Tonga, Tuvalu, and Samoa during a meeting to discuss the recommendations.

GLOSS,

Recommends that IOC review and if necessary change the GLOSS TOR to reflect the operational requirements of tsunami warning and mitigation systems.

(No financial implications)

ICG/PTWS Recommendation 5–PTWS Medium Term Strategy 2009-2013, Working Group Structure and Implementation Plan 2009-2011

Recognising that Recommendation ICG/PTWS-XXII.6 decided the formation of a Steering Committee and charged the Steering Committee to develop a Medium Term Strategy, Implementation Plan and evaluate inter-sessional Working Groups, and

Noting the reports received from the Steering Committee on a Draft PTWS Medium Strategy for the period 2009-2013, Implementation Plan 2009-2011 and Draft Working Group Structure,

Adopts the Medium Term Strategy (MTS) noting in particular the MTS is based on three pillars:

1. *Risk Assessment and Reduction*
2. *Detection, warning and Dissemination*
3. *Awareness and Response*

Requests Member States to ensure the MTS is referred to appropriate ministries in their countries, so that the MTS is acknowledged and recognised in planning and funding considerations.

Adopts the following concept for Working Groups of the ICG/PTWS:

- Technical Working Groups, that are closely aligned to those for the other ICGs,
- Regional Working Groups, charged with identifying and coordinating work specific to the region,
- Task Teams, that can be created under Technical or Regional Working Groups to conduct specific short term and well-demarcated tasks as part of the wider objectives of the Working Group.

PTWS XXIII, *continued*

Abolishes the existing inter-sessional Working Groups 1, 2, 3 and 4 and discontinues their membership,

Agrees to continue with the current Regional Working Groups and membership for:

1. *Central American Pacific Coast*
2. *South East Pacific Region*
3. *South West Pacific Region, and*

Establishes the Working Group for the South China Sea.

Decides to align the Technical Working Groups with the Medium Term Strategy, and therefore to have three Technical Working Groups as follows:

1. *Risk Assessment and Reduction*
2. *Detection, warning and Dissemination*
3. *Awareness and Response*

Agrees to the Terms of Reference for the respective Working Groups as specified in the report of the Steering Committee on the PTWS Working Group Structure (ANNEX VI TO THIS REPORT),

Decides to appoint, according to Rule 25.3 of the IOC Rules and Procedures as Chair of the Technical Working Groups 1, 2 and 3 and the Regional Working Group for the South China Sea, for the first term in office:

- *Risk Assessment and reduction:*
Dr François Schindelé (France),
- *Detection, warning and dissemination:*
Dr David McKinnie (United States),
- *Awareness and response:*
Mr David Coetzee (New Zealand), and
- *South China Sea:* Dr Mohd Rosaidi (Malaysia)

Expresses appreciation for the support by the Secretariat in preparing the PTWS Implementation Plan 2009, and Adopts the Implementation Plan 2009-2011 in principle, but;

Requests the Steering Committee to urgently review and adjust the PTWS Implementation Plan 2009-2011 where necessary, to ensure the Plan recognises and aligns with the MTS and new Working Group Structure.

Requests the IOC Exec Sec to invite nominations to all Working Groups.

(No financial implications)

ICG/PTWS Recommendation 6–Steering Committee

Recalling that the Recommendation ICG/PTWS-XXII.6 “Pacific Tsunami Warning and Mitigation System” established the Steering Committee of the PTWS with the following membership:

- a. *Elected Officers (Chair and Vice Chairs),*
- b. *Current intersessional Working Group Chairs*
- c. *Other members’ representatives by invitation*

Considering the requirement for ongoing coordination and advice on the implementation of the PTWS in the intersessional period, including strategic direction and planning, monitoring of implementation and coordination of Working Group activities.

Thanking the members of the Steering Committee for having provided drafts documents for consideration at the ICG/PTWS XXIII, namely the Draft PTWS Medium Term Strategy 2009-2013 and the Draft PTWS Working Group Structure

Decides that the ICG/PTWS Steering Committee shall continue and will exercise the responsibilities delegated to it by the ICG/PTWS, acting on its behalf in the implementation of the decisions.

Decides that the membership of the Steering Committee will be extended to be as follows:

- a. *Elected Officers (Chair and Vice Chairs),*
- b. *Technical Working Group and Regional Working Group Chairs,*
- c. *Director of PTWC, or their representative,*
- d. *Other members’ representatives by invitation of the Chair*

Decides that the ICG/PTWS Steering Committee will act in an advisory capacity to the Chair of the ICG/PTWS during the inter-sessional period.

Further decides that the Steering Committee shall hold at least one meeting during the interval between ICG/PTWS sessions. It will also meet immediately prior to the opening date of the next ICG/PTWS meeting. At this meeting the Steering Committee may propose in addition to the composition of the Elections and Recommendations Committees other sessional Working Groups. It will discuss issues to be raised and discussed at the ICG/PTWS Meeting to facilitate



Left to Right: PTWS-XXIII participants from Vanuatu, Malaysia, China Hong Kong, ITIC, Canada, Micronesia, and USA.

PTWS XXIII, *continued*

successful outcomes.

Decides that the Steering Committee shall, in the inter-sessionnal period 2009-2011, coordinate and integrate the work of ICG/PTWS, as implemented through the various working groups, teams and rapporteurs, including but not limited to:

- a. *Finalize the Draft Implementation Plan 2009–2011*
- b. *Develop a Strategy for funding PTWS activities*
- c. *Monitor performance of the PTWS*

(No financial implications)

ICG/PTWS Recommendation 7–Seismic Data Exchange in the South West Pacific

Acknowledging that a sessional meeting held during ICG/PTWS-XXIII discussed the matter of sharing of seismic data in the South West Pacific, and

Noting reports from China, Japan and Australia on plans to establish seismograph stations in the South West Pacific region over the period 2009-2010, where as some Pacific Island countries have already applied for such support and others are in the process of requesting support, and

Noting that concerned members expressed their willingness to share seismic data, and that data from stations installed by Australia is available directly from Geoscience Australia or from IRIS via the Seedlink protocol,

Recognising that technical issues (such as data exchange protocols and data bandwidth) will need to be addressed in order to achieve data sharing,

Noting that data from seismograph stations is useful for research and earthquake catalogue creation and not just tsunami warning,

Recognising Recommendation ICG/PTWS-XXII.1 on Sea-Level Measurement, Data Collection and Exchange,

Agrees that South West Pacific countries with existing or planned broadband seismograph stations share the data in real-time with their neighbours and internationally, including making the data available to Tsunami Warning Centres;

Encourages South West Pacific countries with existing or planned broadband seismograph stations to joint FDSN, use the standards developed by FDSN for data exchange and take advantage of the data archiving provided by FDSN;

Decides that a Task Team be formed under inter-sessionnal Working Group 2: Detection, warning and Dissemination to assist South West Pacific Countries achieve data sharing;

Agrees the Terms of Reference for the Task Team are:

1. *To advocate seismic data sharing in the region;*
2. *To advise South West Pacific countries on data sharing protocols, techniques and technologies;*
3. *To work with SWP Countries and donors to ensure a common data sharing policy;*
4. *To ensure the recommendations of the ICG/PTWS-XXIII Sessional Working Group on Data Exchange in the South West Pacific are achieved.*

Requests that donors are encouraged to help South West Pacific countries achieve data sharing in coordination with the proposed Task Team.

(No financial implications)



ICG/PTWS-XXIII participants.

ICG/PTWS Recommendation 8–Pacific Emergency Communications

Noting Recommendation ICG/PTWS-XXII.2, whereby it was decided to establish an inter-sessionnal Working Group on Pacific Emergency Communications with the following terms of reference:

1. To encourage member states to develop arrangements for the transmission and receipts of tsunami warning alerts from international centres, and the dissemination of alerts and public safety actions within their countries;
2. To provide a forum to identify methods and systems currently available and planned for the future for alert dissemination within Member States, and internationally across the Pacific, and between oceanic basins;
3. To consult with National Tsunami Warning Focal Points to determine appropriate requirements for the dissemination of alerts from the Tsunami Warning Centers and exchange of information for the confirmation of reception.

Confirming that the proposed program of action for the inter-sessionnal period (February 19, 2009 – ICG/PTWS XXIV) to include:

1. A study to take stock of existing communication technologies and mediums available and in use

PTWS XXIII, *continued*

around the world including the Pacific, examine gaps in regional and national warning systems, and to explore ways of how these means of communication could be used to receive and disseminate alerts.

2. To review emerging communications technologies and assess the capacity for use in regional and national warning systems.
3. Depending on the recommendation from 1 and 2, develop designs to incorporate various means of communication to enable receipt and dissemination of tsunami alerts, e.g. the issues to consider here is whether this can be replicated and well receive by member states and or whether such design is appropriate and meet local needs.
4. Explore and develop ways to promote the use of these means of communication including funding, where appropriate.
5. Investigate new partnerships, e.g. WMO, SPREP, SOPAC, ASEAN, etc. who are working on emergency communications issues.
6. Use web-based resources and information from members and compile information with firm recommendations on next steps as well as viability of using available means of communication.

Recognising the Medium Term Strategy and Working Group structure adopted by ICG/PTWS XXIII,

Confirms in view of the above Medium Term Strategy and the Working Group structure, the transition of this Working Group into a Task Team under inter-sessional

Working Group 2: Tsunami Detection, Warning, and Dissemination, and the Task Team to continue with the membership, terms of reference and programme of actions as established for the original Working Group on Pacific Emergency Communications.

Requests that the Secretariat solicit funds from donors to convene an inter-sessional meeting and Early Warning Communications Workshop during the inter-sessional period. (Financial implications to be determined).

ICG/PTWS Recommendation ICG/PTWS-XXIII.9**Appreciation to the Government of Samoa**

The Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System, expresses its gratitude and appreciation to the Government of Samoa for hosting the 23rd Session of the PTWS in Apia

The ICG:

Notes that this is the third time a small Pacific Island Member State has hosted an ICG/PTWS session. The Government of Samoa's kind hospitality highlights the importance of critical issues for the Pacific, including timely access to data, warning and advisory information, and hazard resilient coastal communities,

Notes the development of a comprehensive strategic plan and associated implementation plan to guide enhancement of tsunami warning and mitigation in the Pacific Region, and

Acknowledges Samoa's leadership as a demonstration of the commitment to PTWS that results in an effective and robust tsunami warning and mitigation system, in particular in the South West Pacific region.

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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