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COMISIÓN OCEANOGRÁFICA INTERGUBERNAMENTAL  
МЕЖПРАВИТЕЛЬСТВЕННАЯ ОКЕАНОГРАФИЧЕСКАЯ КОМИССИЯ  
اللجنة الدولية الحكومية لعلوم المحيطات  
政府间海洋学委员会

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**IOC Circular Letter N°. 2187**  
(English only)

10 March 2006

**To** : National Contacts PTWS;  
Chairman, Vice-Chairman ICG/PTWS;

**cc** : Chairman, Vice-Chairmen IOC;  
Chairman, Vice-Chairman IOC Regional Committee (WESTPAC, IOCARIBE);  
IOC Member States (Action Addresses) of the ICG/PTWS  
Permanent Delegations/Observer Missions to UNESCO of IOC PTWS Member States;  
Directors of UNESCO and IOC Regional Officers in the Pacific, Indian Ocean, Caribbean,  
and Mediterranean areas;

**Subject:** **Inauguration of Northwest Pacific Tsunami Advisory Center (NWPTAC)**  
**Start of Interim Tsunami Advisory Service for the South China Sea**

Dear Sir/Madam,

By means of this letter I am pleased to announce the inauguration of the Northwest Pacific Tsunami Advisory Center (NWPTAC) from 1 February 2006. The NWPTAC is operated by the Japan Meteorological Agency (JMA) and provides tsunami advisories for large earthquakes occurring in the northwest and a portion of the southwest Pacific. The advisories are issued to nations in the region who have designated a 7x24 Tsunami Focal Point for the receipt of official tsunami information. The Northwest Pacific Tsunami Advisory (NWPTA) is issued in conjunction with the international tsunami bulletins of the Pacific Tsunami Warning Center (PTWC), and consists of earthquake information, tsunamigenic potential, estimated wave heights and arrival times of tsunami, and observations of tsunami. A copy of the present Handbook of the Northwest Pacific Tsunami Advisory is attached for your information.

.../...

**Chairperson**

Prof. D.T. Pugh  
National Oceanographic Centre,  
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**Executive Secretary**

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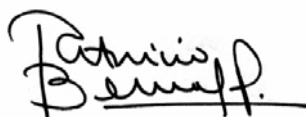
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UNITED REP. OF TANZANIA

Further, I am pleased to report on the progress toward the start of Interim Tsunami Advisory Information Services for the South China Sea region. Starting soon after 1 April 2006, the JMA, in close coordination with the PTWC, will expand the coverage of the NWPTA to include the South China Sea on an interim basis. During the XXth Session of the International Coordination Group for the Tsunami Warning System in the Pacific (now renamed the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System, ICG/PTWS), Member States requested to the PTWC and JMA to provide interim tsunami advisory services, and to prepare a Communications Plan. I am pleased to report that that JMA and PTWC are working together to augment the present Handbook of the Northwest Pacific Tsunami Advisory to include the South China Sea. Please find attached the Proposed Expanded Coverage of the NWPTAC to include the South China Sea. In order to fully commence the Service, Member States are requested to communicate their interest to the ICG/PTWS Secretariat, and to confirm a 7x24 Tsunami Focal Point for receiving the advisory bulletins.

To encourage a fuller dialogue on the tsunami and earthquake risks of the South China Sea Region and the requirements for a permanent tsunami early warning and mitigation system for this region, the IOC is pleased to inform Member States that is helping to sponsor a regional symposium planned for 27-28 April 2006 in Kuala Lumpur, Malaysia. The Roundtable Dialogue on Earthquakes and Tsunamis will be organized and hosted by the Malaysia Ministry of Science, Technology & Innovation, and will take place just prior to the meeting of the ICG/PTWS-XXI in Melbourne, Australia 1-5 May 2006. Further details on the Roundtable will be broadly circulated in the near future.

Member States wishing to receive official bulletins of the PTWC and JMA for the Northwest Pacific, including expanded coverage of the South China Sea through the NWPTAC, should submit the request in writing using the attached form to the ICG/PTWS Secretariat, Dr. Laura Kong, Director, IOC International Tsunami Information Centre, (ITIC), 737 Bishop St., Ste. 2000, Honolulu, Hawaii 96813 USA, Phone: <1> 808 532-6422, Fax: <1> 808 532 5576, Email: l.kong@unesco.org

We look forward to your earliest reply, I remain, yours sincerely,



Patricio Bernal  
Assistant Director-General, UNESCO  
Executive Secretary, IOC

Attachments: Northwest Pacific Tsunami Advisory Center Announcement, 1 February 2006  
PTWS 7/24 Tsunami Focal Point Data Form  
Proposed Expanded Coverage of the NWPTAC to include the South China Sea  
Handbook of the Northwest Pacific Tsunami Advisory, 1 February 2006

cc: Dr. Laura Kong, Director, ITIC, ICG/PTWS Secretariat  
Mr. Koichi Nagasaka, Director-General, JMA  
Dr. Charles McCreery, Director, PTWC



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Our reference: JMA06/A3/024

1 February 2006

Dr. Patricio Bernal  
Executive Secretary  
UNESCO/IOC  
1, rue Miollis, 75732 Paris Cedex 15  
France

**COPY**

Dear Dr. Bernal,

Along the conclusion of the Executive Council of the Intergovernmental Oceanographic Commission (EC/IOC), at its 37th session in 2004, the Japan Meteorological Agency (JMA) initiated operation of the regional center for the Northwest Pacific Tsunami Advisory on an interim basis on 28 March 2005. Subsequently, a status report of the preliminary operation of the center was submitted to the 20th session of the International Coordination Group for the Tsunami Warning System in the Pacific (ICG/PTWS) in October 2005.

Today, I am very pleased to inform you that, after the successful preliminary operation of the advisory service, JMA has formally inaugurated the Northwest Pacific Tsunami Advisory Center (NWPTAC) as of 1 February 2006. For the proper use of the NWPTAC advisory by recipient countries, JMA prepared a handbook to describe details on the advisory to be issued by the center, as you will find in the attachment. It would be most grateful if you could kindly distribute this handbook to the relevant member countries of ICG/PTWS.

I hope that the NWPTAC services will make a certain contribution towards further enhancement of the international activities on tsunami disaster mitigation in the Pacific.

Yours sincerely,

( Koichi Nagasaka )  
Director-General

cc: ✓ Dr. Laura Kong, Director, ITIC  
Mr. Masahiro Yamamoto, Senior Advisor, Tsunami Unit/IOC  
Capt. Rodrigo Nuñez, Chairman, ICG/PTWS  
Dr. Charles McCreery, Director, PTWC

## PTWS 7/24 TSUNAMI FOCAL POINT DATA FORM

The following information lists each country's operational contact point(s) for receiving bulletins and otherwise being contacted by the PTWC, JMA or other PTWS participants during events.. More than one contact point may be designated.

Name of Country \_\_\_\_\_

Place in Country \* \_\_\_\_\_

*\*Only if this Contact Point is not for the entire country's coast. For example, a remote island.*

### 1. Tsunami Focal Point for receiving Tsunami Bulletins

Agency name \_\_\_\_\_

Contact Person in Agency or Officer in Charge:

Name \_\_\_\_\_

Position \_\_\_\_\_

Telephone Number \_\_\_\_\_

Facsimile \_\_\_\_\_

E-mail Address: \_\_\_\_\_

Postal Address \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### 2. Designated Communication Method (operational on 7/24 basis).

Please specify GTS, Facsimile, or E-mail with the International 4-letter Location Indicator (e.g., PHEB, RJTD, etc.), the Facsimile number, or the E-mail address, respectively, in a priority order

Primary: \_\_\_\_\_

Alternate 1: \_\_\_\_\_

Alternate 2: \_\_\_\_\_

Alternate 3: \_\_\_\_\_

Alternate 4: \_\_\_\_\_

Alternate 5: \_\_\_\_\_

Please specify telephone number for voice communication, in a priority order

Primary: \_\_\_\_\_

Alternate 1: \_\_\_\_\_

Alternate 2: \_\_\_\_\_

Alternate 3: \_\_\_\_\_

### 3. Tsunami Bulletins Requested

( ) International ( ) Northwest Pacific, including South China Sea

4. Comments: \_\_\_\_\_

\_\_\_\_\_

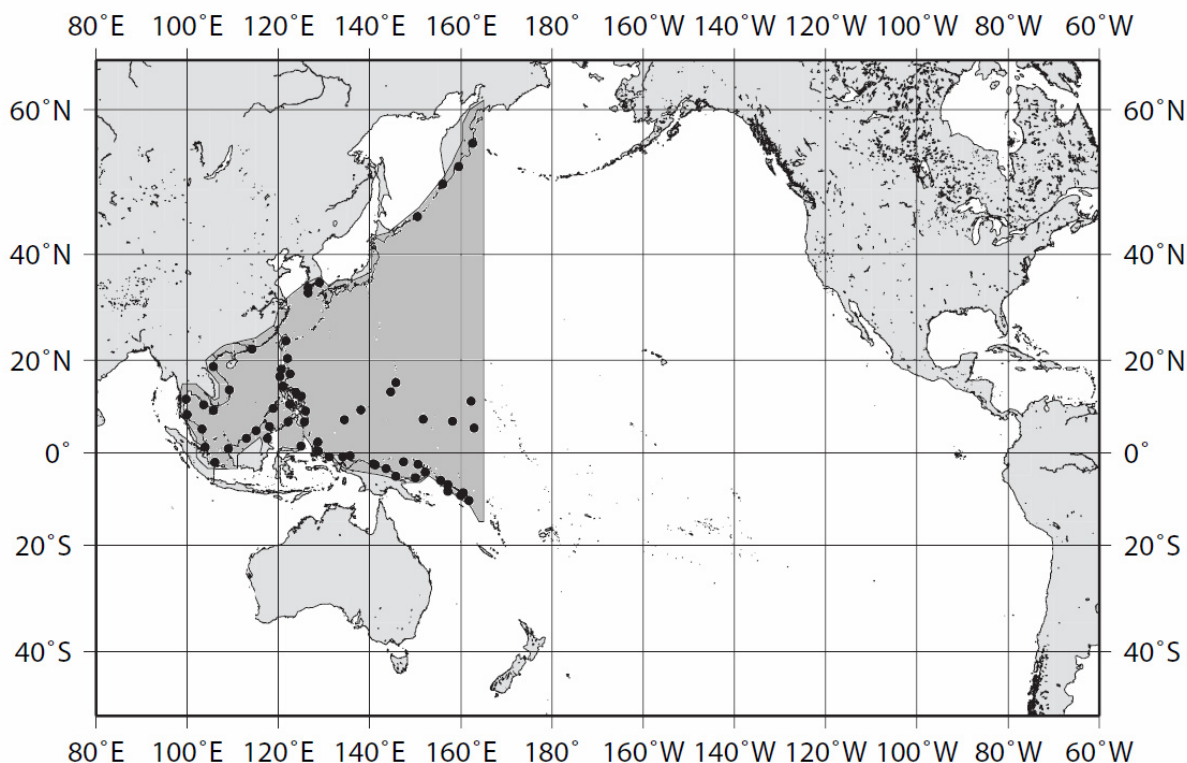
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Date: \_\_\_\_\_ Submitted by: \_\_\_\_\_

**Proposed Expanded Coverage of the NWPTAC to include the South China Sea  
Addendum to Handbook of the NWPTA Handbook**

The main text of the Handbook of the Northwest Pacific Tsunami Advisory is proposed to not be changed. Annex I and II will be replaced as indicated below so as to include the South China Sea.

**Annex I**



Shaded area in the Pacific shows the coverage of NWPTA which is issued when an earthquake with magnitude 6.5 or more occurs (The NWPTA coverage will be extended to include marginal seas of the Pacific Ocean in the future). Dots indicate forecast points for the NWPTA.

## Annex II

### Forecast Points and Coast Blocks in the North Pacific Region

Coast Block	Name of Forecast Point	Latitude	Longitude
EAST COASTS OF KAMCHTKA PENINSULA	UST_KAMCHATSK	56.1N	162.6E
	PETROPAVLOVSK_K	53.2N	159.6E
KURIL ISLANDS	SEVERO_KURILSK	50.8N	156.1E
	URUP_IS	46.1N	150.5E
SOUTH COASTS OF KOREAN PENINSULA	BUSAN	35.1N	129.0E
	NOHWA	34.2N	126.5E
	SEOGWIPO	33.2N	126.5E
EAST COASTS OF TAIWAN	HUALIEN	24.0N	121.6E
EAST COASTS OF PHILIPPINES	BASCO	20.4N	122.0E
	PALANAN	17.2N	122.6E
	LEGASPI	13.2N	123.8E
	LAOANG	12.5N	125.0E
	MADRID	09.2N	125.9E
	DAVAO	06.9N	125.7E
NORTH COASTS OF IRIAN JAYA	BEREBERE	02.5N	128.7E
	PATANI	00.4N	128.8E
	SORONG	00.8S	131.1E
	MANOKWARI	00.8S	134.2E
	WARSA	00.6S	135.8E
	JAYAPURA	02.4S	140.8E
NORTH COASTS OF PAPUA NEW GUINEA	VANIMO	02.6S	141.3E
	WEWAK	03.5S	143.7E
	MADANG	05.2S	145.8E
	MANUS_IS.	02.0S	147.5E
	RABAU	04.2S	152.3E
	KAVIENG	02.5S	150.7E
	KIMBE	05.5S	150.1E
	KIETA	06.1S	155.6E
MARIANA ISLANDS	GUAM	13.4N	144.7E
	SAIPAN	15.3N	145.8E
PALAU	MALAKAL	07.3N	134.5E
MICRONESIA	YAP_IS.	09.5N	138.1E
	CHUUK_IS.	07.4N	151.8E
	POHNPEI_IS.	07.0N	158.2E
	KOSRAE_IS.	05.5N	163.0E
MARSHALL ISLANDS	ENIWETOK	11.4N	162.3E
NORTH COASTS OF SOLOMON ISLANDS	PANGGOE	06.9S	157.2E
	AUKI	08.8S	160.6E
	KIRAKIRA	10.4S	161.9E
SOLOMON SEA	MUNDA	08.4S	157.2E
	HONIARA	09.3S	160.0E

**Annex II (Continuation)**

Proposed Forecast Points and Coast Blocks in the South China Sea, Sulu Sea and Celebes Sea

Coast Block	Name of Forecast Point	Latitude	Longitude
COASTS OF SOUTH CHINA SEA	HONG_KONG	22.3N	114.2E
COASTS OF GULF OF TONKIN	VINH	18.6N	105.7E
EAST COASTS OF INDO CHINA PENINSULA	QUI_NHON	13.7N	109.2E
	BAC_LIEU	09.3N	105.8E
GULF OF THAILAND	PRACHUAP_KHIRI KHAN	11.8N	099.8E
	SIHANOUKVILLE	10.6N	103.6E
	NAKHON_SI_THAMMARAT	08.4N	100.0E
EAST COASTS OF MALAY PENINSULA	KUARA_TERENGGANU	05.3N	103.2E
NATUNA SEA	SINGAPORE	01.3N	103.9E
	PANGKALPINANG	02.1S	106.1E
NORTHWEST COASTS OF KALIMANTAN	MUARA	05.0N	115.1E
	BINTULU	03.2N	113.0E
	SINGKAWANG	01.0N	109.0E
WEST COASTS OF PHILIPPINES	LAOAG	18.2N	120.6E
	SAN_FERNANDO	16.6N	120.3E
	MANILA	14.6N	121.0E
SULU SEA	ILOILO	10.7N	122.5E
	PUERTO_PRINCESA	09.8N	118.8E
	SANDAKAN	05.9N	118.1E
CELEBES SEA	ZAMBOANGA	06.9N	122.1E
	TARAKAN	03.3N	117.6E
	MANADO	01.6N	124.9E

# **Handbook of the Northwest Pacific Tsunami Advisory**

**Japan Meteorological Agency**

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Issued on 1 February 2006



## **1. Introduction**

Since 1978, in-depth discussions have been made by the International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) on the establishment of regional tsunami warning centers to issue tsunami advisories tailored for respective regions in the Pacific. With regard to the Northwest Pacific region, the Republic of Korea proposed at the 14th session of ICG/ITSU (Tokyo, 1993) that a center could be assumed by the Japan Meteorological Agency (JMA). This triggered a feasibility study in ICG/ITSU to set up the regional center for the Northwest Pacific.

At the 17th ICG/ITSU session (Seoul, 1999), JMA, based on the survey of the regional requirement as well as state-of-the-art technology of predicting tsunami wave height, submitted a proposal to the session to establish a regional tsunami warning center for the Northwest Pacific at JMA and the session accepted the proposal. After concentrated efforts of research and development to fully meet the requirements of the center, JMA submitted a report at the 19th ICG/ITSU session (Wellington, 2003) to demonstrate its readiness for the operation of the center. In 2004, Executive Council of the Intergovernmental Oceanographic Commission (IOC), at its 37th session (Paris, 2004), adopted a resolution to start the services of the regional center at JMA by March 2005.

On such an international consensus, JMA initiated the operation of the regional center in the Tsunami Forecast Center in the Headquarters of the Agency to provide tsunami advisories to the countries in the Northwest Pacific in March 2005. At the 20th ICG/ITSU session (Vina del Mar, October 2005), JMA reported the inauguration of the Northwest Pacific Tsunami Advisory Center (NWPTAC) and the ICG/ITSU expressed its appreciation to Japan for undertaking the responsibilities of NWPTAC. The present handbook is prepared by JMA toward the proper use of the advisories of NWPTAC by the recipient countries.

## **2. Objectives of the Advisory**

Provision of the Northwest Pacific Tsunami Advisory (NWPTA) from JMA aims at allowing recipient countries to take timely and appropriate actions against tsunami threats in conjunction with the Tsunami Bulletin from PTWC. To this end, NWPTA is expected to be user friendly and regionally tailored information on tsunamis including tsunami height forecasts. It should be noted, however, that NWPTA is nothing more than an advisory to be considered by recipients in alerting the people and announcing evacuation notices on their own responsibility.

## **3. Geographical coverage of the Advisory**

NWPTA covers the Northwest Pacific and a portion of the Southwest Pacific (see Annex I). Tsunami forecasts including tsunamigenic potential and estimated tsunami height and arrival time are given to forecast points located on the coasts within the region (see Annexes I and II). The NWPTAC is currently exploring the feasibility of extending the coverage of NWPTA over the marginal seas of the Pacific.

## **4. Timing and criteria for issuance of the Advisory**

- (1) NWPTA is issued when NWPTAC detects occurrence of an earthquake of magnitude 6.5 or greater in the area indicated in the section 3 of the present document and evaluates that it could generate tsunamis. It provides estimation on the height and arrival time of tsunamis at designated sites (forecast points) on the Northwest Pacific coasts.
- (2) When reports of tsunami observations within the NWPTA coverage areas are received by NWPTAC, the tsunami observational data is presented in the subsequent NWPTA as necessary.
- (3) When the location and magnitude of the earthquake are re-estimated using seismic data subsequently obtained and/or an unexpectedly significant tsunami is observed, NWPTA is further issued to revise the previous information.

## **5. Earthquake observation and hypocenter determination**

For forecasting of tsunamis, information on the location and magnitude of earthquakes is essentially required. JMA collects those data from global seismological networks such as IRIS/USGS\* and IRIS/IDA\*\* through the Internet. The least square method is applied for determining hypocenters with observed arrival times of P and S waves and theoretical arrival times calculated from the IASPEI91 which is used as the travel timetable. Because a depth of an earthquake is one of the determining factors in tsunami generation, JMA utilizes arrival times of various reflected phases such as depth phases (pP, sS, PcP etc) for more reliable hypocenter determination.

Although the Internet is a useful mean for international communications, availability of data is not always secured because of various communication troubles including those uncontrollable. To avoid the serious consequences of unavailability of data via the Internet, JMA receives data also from the Matsushiro Seismic Array System of Matsushiro Seismological Observatory (Nagano, Japan) and from Large Aperture Array comprised of Japanese seismological observation networks.

\*IRIS; Incorporated Research Institutions for Seismology, USGS; United States Geological Survey

\*\*IDA; International Deployment of Accelerometers

## **6. Magnitude determination**

### **(1) Determination methods**

Generation of tsunamis heavily depends on the magnitude of earthquakes. Hence, it is essential for tsunami forecast to estimate the magnitude as quickly as possible with the highest accuracy. In this regard, the *moment magnitude* ( $M_w$ ), which is derived from the long-period components of the seismic signal, is used because it is more accurate for large earthquakes than the traditional Richter magnitude. In order to obtain  $M_w$  more rapidly, NWPTAC calculates  $M_{wp}$ , which is equivalent with  $M_w$ , from the signals of the first arriving seismic P-waves using two techniques proposed by Nishimae (2002) and Tsuboi (1995).

JMA operates about 180 seismic stations to determine the location and the magnitude of earthquakes near Japan. Magnitude determined using the JMA seismic network is described as  $M_{jma}$  [Katsumata (2004), Funasaki et al. (2004)] and NWPTAC uses  $M_{jma}$  in case of an earthquake near Japan.

### **(2) References**

Nishimae, Y., K. Nakasoko, and M. Okada, Empirical formulas for quick estimation of the moment magnitude of tele-seismic earthquakes with STS2 seismometer, 2002, Technical Reports of the Matsushiro Seismological Observatory, 19, 57-79, in Japanese

Tsuboi, S., K. Abe, K. Takano, and Y. Yamanaka, Rapid Determination of  $M_w$  from Broadband P waveforms, 1995, Bull. Seism. Soc. Am., 85, 606-613

Katsumata, A. Revision of the JMA displacement magnitude, 2004, Quarterly Journal of Seismology, 67, 1-10, in Japanese

Funasaki, J. and Earthquake Prediction Information Division, Revision of the JMA velocity magnitude, 2004, Quarterly Journal of Seismology, 67, 1-10, in Japanese

## **7. Estimation of arrival time and height of a tsunami**

### **(1) Quantitative tsunami forecast technology**

JMA has introduced the tsunami forecast system with a numerical simulation technique to issue quantitative tsunami warnings. Tsunami propagations originating from various types and locations of faults have been simulated to store the calculated tsunami heights and arrival times in the database along with magnitudes and hypocenter locations. Once an earthquake occurs and its hypocenter location and magnitude is determined, the best approximation of tsunami propagation is retrieved from the database according to the earthquake data.

Tsunami propagation is calculated using the long wave theory including of effects of Coriolis

force and sea floor friction [e.g. Satake (2002)]. In the long wave theory, the assumptions that “the wavelength of tsunami is much longer than the sea depth and the wave amplitude of tsunami is much smaller than the sea depth” are used. However, these assumptions are not realistic near a coast where the sea depth is shallow. Hence, application of the numerical simulation on the long wave theory is limited to the sea area from epicenter up to a point (“**calculation point**”) of several to several ten kilometers offshore depending on the coastal topography. Tsunami height at a coast is given by converting that at the calculation point to that at a designated point on the coast (“**forecast point**”) based on the Green’s law [e.g. Satake (2002)]. Meanwhile, tsunami arrival time at the forecast point is substituted with that at the calculation point.

## (2) References

Satake, K., Tsunamis, 2002, in “International Handbook of Earthquake & Engineering Seismology”, pp. 437-451, Academic Press

## 8. Contents of the Advisory

NWPTA contains:

- (1) Earthquake information
- (2) Tsunamigenic potential
- (3) Estimated heights and arrival times of tsunami
- (4) Observations of tsunami

Dates and times in NWPTA are given in Universal Time Coordinated (UTC). Examples of the NWPTA are presented in Annex III.

### (1) Earthquake Information

- a. Origin time (UTC)
- b. Coordinates (latitude and longitude) of the epicenter
- c. Location (name of geographical area)
- d. Depth (only for the earthquake occurring at a depth of 100 km or more)
- e. Magnitude (“(MJMA)” is attached in case the magnitude is MJma. )

### (2) Tsunamigenic potential

NWPTAC evaluates tsunamigenic potential of the earthquake occurring in the sea areas at a depth of less than 100 km, according to the following criteria adopted by PTWC:

- a.  $M > 7.8$  Possibility of a destructive ocean-wide tsunami
- b.  $7.8 \geq M > 7.5$  Possibility of a destructive regional tsunami within 1000km of the epicenter
- c.  $7.5 \geq M > 7.0$  Possibility of a destructive local tsunami within 100km of the epicenter
- d.  $7.0 \geq M \geq 6.5$  Very small possibility of a destructive local tsunami

### (3) Estimated heights and arrival times of tsunami

Tsunami heights and arrival times are estimated for each of the forecast points and listed in groups of coast blocks. Each forecast point is identified by the name of a nearby major city and its latitude/longitude (in 0.1 degree) indicated along with the name. Forecast points used in NWPTA are chosen from PTWC’s warning points designated at the ICG/PTWS. Also, a forecast point should be chosen near a calculation point.

Estimated tsunami heights are indicated only for the forecast points at where tsunamis of 0.5 m or greater are expected to reach. Tsunami heights are classified in categories ranging from “less than 1m” to “greater than 10 m”; namely “0.5m”; “1m”; “2m”; “3m”; “4m”; “6m”; “8m”; and “ $\geq 10m$ ”. When tsunami heights of less than 0.5 m are forecasted at all the forecast points, “NO TSUNAMIS WITH A HEIGHT OF 0.5 METER OR OVER ARE EXPECTED AT ANY OF THEM” is described in NWPTA.

### (4) Observations of tsunami

When tsunami waves are actually recorded at tidal stations which are telemetrically linked to

NWPTAC within the coverage of NWPTA (see Annex III), those observational data are provided as necessary, including the height of the largest wave in 0.1 m unit (the height of the largest wave is defined as the half of the vertical length from the trough to the crest of the wave).

## **9. Status of the Advisory**

NWPTA, along with the bulletins from PTWC, should be regarded as an advisory for the recipient countries for their protective actions against the tsunami hazard. The accuracy of the estimation of heights and arrival times of tsunamis in NWPTA as well as the time required for the forecast operation depend on the availability of seismic data and the technologies of hypocenter determination and quantitative tsunami forecasting. It is highly advisable, therefore, that the recipient countries should make the best use of NWPTA with thorough understanding of the technological background of the Advisory as described below.

- a. NWPTAC makes its utmost effort to disseminate NWPTA as quickly as possible. However, the people needs to be alerted in advance of the receipt of NWPTA in case of occurrence of a strong earthquake in the vicinity of their coasts, considering that tsunamis might be generated and reach the coasts in the shortest time.
- b. NWPTAC determines the location and magnitude of earthquakes with the global seismic data received in real time from the Live Internet Seismic Server (LISS) operated by USGS. In case of malfunction of LISS or communication troubles with the Internet, NWPTAC will perform its operation using the data from the Matsushiro Seismic Array System of Matsushiro Seismological Observatory (Nagano, Japan) as well as the data from Large Aperture Array comprised of Japanese seismological observation networks. However, lack of information under these circumstances could lead to delayed issuance of NWPTA and affect the accuracy of estimation of tsunami heights and arrival times as well as the evaluation of tsunamigenic potential.
- c. Estimated heights of tsunami are derived from the database of tsunami waves which have been calculated for each of the forecast points settled on the coastal regions, by using the quantitative tsunami forecast system of JMA. However, actual tsunami heights may change depending on the coastal topography. Further, we should note that the tsunami heights might also be critically varied by the sea bed topography which is hardly considered in the numerical simulation of tsunamis.
- d. Tsunami arrival times are estimated taking into account the sea-bed topography and assuming that the epicenter is located in the midst of the segment concerned. Tsunamis do not necessarily travel outward evenly in all directions from their source. Further, travel time of tsunamis may be affected by the topographical features of the coasts and sea-bed which are not considered in the simulation. Therefore, even though the arrival time of a tsunami at each forecast point is given on a minute time scale, the time does not mean that they are estimated with the accuracy of such a time scale. Tsunamis may arrive at coasts earlier or later than the estimated arrival times in NWPTA.
- e. NWPTA does not refer to the cancellation of its warnings in its subsequent issues. Because, NWPTAC is of the view that its warnings should be officially cancelled by the countries concerned on their own responsibility, on the ground that tsunamis varies depending on the coastal terrains.
- f. In case of significant difference in the evaluation of severity of tsunami between the PTWC's bulletin and NWPTA, severer one should be adopted.
- g. The operational system for NWPTA in JMA is duplicated in case of partial malfunction of the system. However, possibility of a serious failure in the system cannot be totally excluded.

In case NWPTA is not issued due to such an unforeseen emergency, the recipient countries/organizations of NWPTA should take appropriate actions according to the bulletins from PTWC.

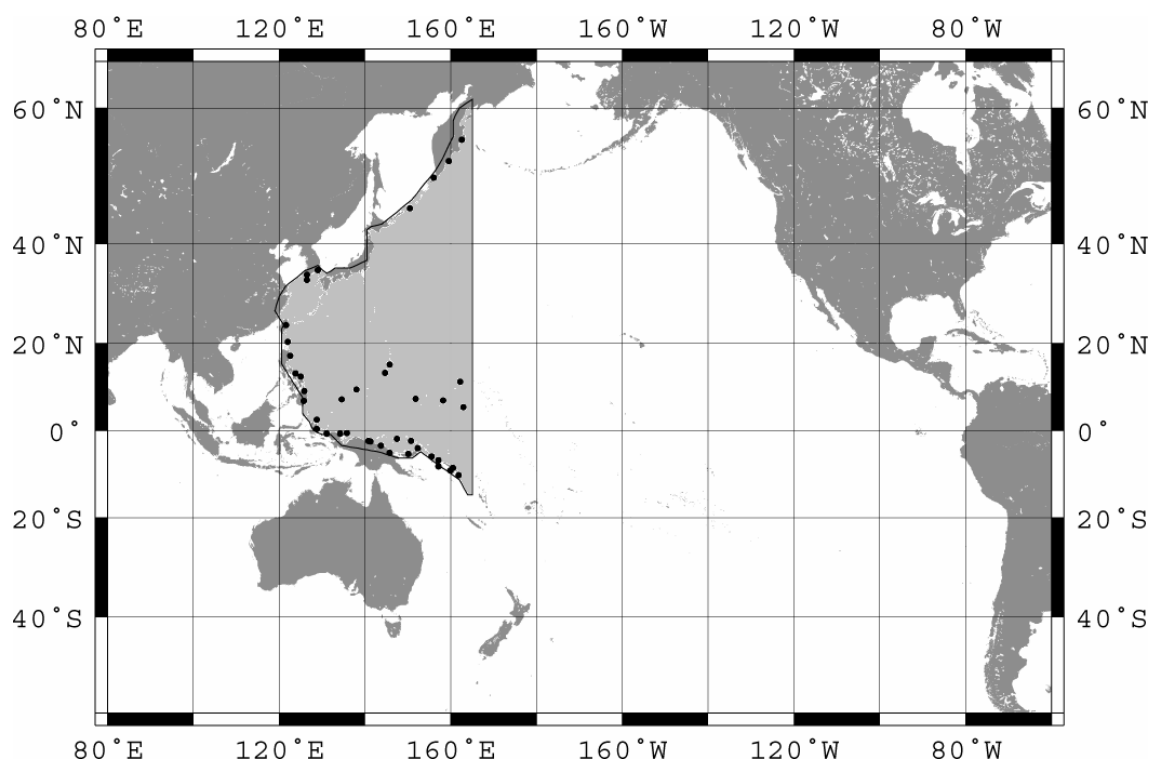
#### **10. Means of dissemination**

Although NWPTA is to be provided basically via GTS, e-mail and facsimile are also considered depending on the circumstances of the recipient countries.

NWPTAC will conduct a communications test approximately on a quarterly basis to verify that communications links to the recipient organizations are functioning properly. An announcement will be made by NWPTAC in advance of the communications test. A sample message of the communications test is shown in Annex III (Example 6). After the test, please be sure to acknowledge the test message to:

**Facsimile:** +81-3-3215-2963 and/or **E-mail:** hokusei@eqvol.kishou.go.jp

## Annex I



Shaded area in the Pacific shows the coverage of NWPTA which is issued when an earthquake with magnitude 6.5 or more occurs (The NWPTA coverage will be extended to include marginal seas of the Pacific Ocean in the future). Dots indicate forecast points for the NWPTA.

## Forecast Points and Coast Blocks

Coast Block	Name of Forecast Point	Latitude	Longitude
EAST COASTS OF KAMCHTKA PENINSULA	UST_KAMCHATSK	56.1N	162.6E
	PETROPAVLOVSK_K	53.2N	159.6E
KURIL ISLANDS	SEVERO_KURILSK	50.8N	156.1E
	URUP_IS	46.1N	150.5E
SOUTH COASTS OF KOREAN PENINSULA	BUSAN	35.1N	129.0E
	NOHWA	34.2N	126.5E
	SEOGWIPO	33.2N	126.5E
EAST COASTS OF TAIWAN	HUALIEN	24.0N	121.6E
EAST COASTS OF PHILIPPINES	BASCO	20.4N	122.0E
	PALANAN	17.2N	122.6E
	LEGASPI	13.2N	123.8E
	LAOANG	12.5N	125.0E
	MADRID	09.2N	125.9E
	DAVAO	06.9N	125.7E
NORTH COASTS OF IRIAN JAYA	BEREBERE	02.5N	128.7E
	PATANI	00.4N	128.8E
	SORONG	00.8S	131.1E
	MANOKWARI	00.8S	134.2E
	WARSA	00.6S	135.8E
	JAYAPURA	02.4S	140.8E
NORTH COASTS OF PAPUA NEW GUINEA	VANIMO	02.6S	141.3E
	WEWAK	03.5S	143.7E
	MADANG	05.2S	145.8E
	MANUS_IS.	02.0S	147.5E
	RABAU	04.2S	152.3E
	KAVIENG	02.5S	150.7E
	KIMBE	05.5S	150.1E
	KIETA	06.1S	155.6E
MARIANA ISLANDS	GUAM	13.4N	144.7E
	SAIPAN	15.3N	145.8E
PALAU	MALAKAL	07.3N	134.5E
MICRONESIA	YAP_IS.	09.5N	138.1E
	CHUUK_IS.	07.4N	151.8E
	POHNPEI_IS.	07.0N	158.2E
	KOSRAE_IS.	05.5N	163.0E
MARSHALL ISLANDS	ENIWETOK	11.4N	162.3E
NORTH COASTS OF SOLOMON ISLANDS	PANGGOE	06.9S	157.2E
	AUKI	08.8S	160.6E
	KIRAKIRA	10.4S	161.9E
SOLOMON SEA	MUNDA	08.4S	157.2E
	HONIARA	09.3S	160.0E

## Example of NWPTA

### Example (1) - When tsunami with a height (crest to mean) of 0.5m or over is expected

WEPA40 RJTD 240904

TSUNAMI BULLETIN NUMBER 001

ISSUED BY NWPTAC(JMA)

ISSUED AT 0859Z 24 MAR 2005

PART 01 OF 01 PARTS

HYPOCENTRAL PARAMETERS

ORIGIN TIME:0858Z 24 MAR 2005

PRELIMINARY EPICENTER:LAT 3.0SOUTH LON148.0EAST

EASTERN CAROLINE ISLANDS, MICRONESIA

PACIFIC BASIN

MAG:8.2

EVALUATION

THERE IS A POSSIBILITY OF A DESTRUCTIVE OCEAN-WIDE TSUNAMI

THIS INFORMATION BULLETIN IS FOR

EAST COASTS OF PHILIPPINES

NORTH COASTS OF IRIAN JAYA

NORTH COASTS OF PAPUA NEW GUINEA

ESTIMATED TSUNAMI ARRIVAL TIME AND ESTIMATED TSUNAMI WAVE HEIGHT

EAST COASTS OF PHILIPPINES

LOCATION	COORDINATES	ARRIVAL TIME	HEIGHT
LEGASPI	13.2N 123.8E	1257Z 24 MAR	0.5M

NORTH COASTS OF IRIAN JAYA

LOCATION	COORDINATES	ARRIVAL TIME	HEIGHT
MANOKWARI	00.8S 134.2E	1116Z 24 MAR	1M
WARSA	00.6S 135.8E	1046Z 24 MAR	1M
JAYAPURA	02.4S 140.8E	1002Z 24 MAR	3M

NORTH COASTS OF PAPUA NEW GUINEA

LOCATION	COORDINATES	ARRIVAL TIME	HEIGHT
VANIMO	02.6S 141.3E	0953Z 24 MAR	2M
WEWAK	03.5S 143.7E	0931Z 24 MAR	4M
MADANG	05.2S 145.8E	0935Z 24 MAR	8M
MANUS_IS.	02.0S 147.5E	0858Z 24 MAR	4M
RABAU	04.2S 152.3E	1000Z 24 MAR	2M

HEIGHT - CREST TO MEAN IN METERS

HOWEVER AT SOME COASTS, PARTICULARLY THOSE NEAR THE EPICENTER, HIGHER TSUNAMIS MAY ARRIVE EARLIER THAN OUR ESTIMATION AT THE NEARBY

FORECAST POINTS

AUTHORITIES SHOULD BE AWARE OF THIS POSSIBILITY

THIS WILL BE THE FINAL INFORMATION UNLESS THERE ARE CHANGES ABOUT THE POTENTIAL OF TSUNAMI GENERATION BY RE-EVALUATION OF THE EARTHQUAKE OR THERE ARE REPORTS ON TSUNAMI OBSERVATIONS



### Annex III (Continuation)

**Example (2) - When no tsunami with a height of 0.5 meter or over is expected at any forecast points**

WEPA40 RJTD 100743

TSUNAMI BULLETIN NUMBER 001

ISSUED BY NWPTAC(JMA)

ISSUED AT 0739Z 10 JAN 2005

PART 01 OF 01 PARTS

HYPOCENTRAL PARAMETERS

ORIGIN TIME: 0724Z 10 JAN 2005

PRELIMINARY EPICENTER: LAT7.0NORTH LON138.0EAST

WESTERN CAROLINE ISLANDS, MICRONESIA

CAROLINE ISLANDS TO GUAM

MAG:6.6

EVALUATION

THERE IS A VERY SMALL POSSIBILITY OF A DESTRUCTIVE LOCAL TSUNAMI

ESTIMATION AT THE FORECAST POINTS - NO TSUNAMIS WITH A HEIGHT OF 0.5  
METER OR OVER ARE EXPECTED AT ANY OF THEM

HOWEVER AT SOME COASTS, PARTICULARLY THOSE NEAR THE EPICENTER, HIGHER  
TSUNAMIS MAY ARRIVE EARLIER THAN OUR ESTIMATION AT THE NEARBY  
FORECAST POINTS

AUTHORITIES SHOULD BE AWARE OF THIS POSSIBILITY

THIS WILL BE THE FINAL INFORMATION UNLESS THERE ARE CHANGES ABOUT THE  
POTENTIAL OF TSUNAMI GENERATION BY RE-EVALUATION OF THE EARTHQUAKE OR  
THERE ARE REPORTS ON TSUNAMI OBSERVATIONS

## Annex III (Continuation)

### Example (3) - When the earthquake occurs in inland areas

WEPA40 RJTD 100743

TSUNAMI BULLETIN NUMBER 001

ISSUED BY NWPTAC(JMA)

ISSUED AT 0739Z 10 JAN 2005

PART 01 OF 01 PARTS

HYPOCENTRAL PARAMETERS

ORIGIN TIME: 0724Z 10 JAN 2005

PRELIMINARY EPICENTER: LAT7.0NORTH LON138.0EAST

WESTERN CAROLINE ISLANDS, MICRONESIA

CAROLINE ISLANDS TO GUAM

MAG:6.6

EVALUATION

THERE IS NO POSSIBILITY OF A TSUNAMI

THIS WILL BE THE FINAL INFORMATION UNLESS THERE ARE CHANGES ABOUT THE  
POTENTIAL OF TSUNAMI GENERATION BY RE-EVALUATION OF THE EARTHQUAKE OR  
THERE ARE REPORTS ON TSUNAMI OBSERVATIONS

### Example (4) - When depth of the earthquake exceeds 100km

WEPA40 RJTD 100743

TSUNAMI BULLETIN NUMBER 001

ISSUED BY NWPTAC(JMA)

ISSUED AT 0739Z 10 JAN 2005

PART 01 OF 01 PARTS

HYPOCENTRAL PARAMETERS

ORIGIN TIME: 0724Z 10 JAN 2005

PRELIMINARY EPICENTER: LAT7.0NORTH LON138.0EAST

WESTERN CAROLINE ISLANDS, MICRONESIA

CAROLINE ISLANDS TO GUAM

FOCAL DEPTH:120KM MAG:6.6

EVALUATION

THERE IS NO POSSIBILITY OF A TSUNAMI

THIS WILL BE THE FINAL INFORMATION UNLESS THERE ARE CHANGES ABOUT THE  
POTENTIAL OF TSUNAMI GENERATION BY RE-EVALUATION OF THE EARTHQUAKE OR  
THERE ARE REPORTS ON TSUNAMI OBSERVATIONS

**Example (5) - Amendment of the Advisory**

WEPA40 RJTD 240934

TSUNAMI BULLETIN NUMBER 002

ISSUED BY NWPTAC (JMA)

ISSUED AT 0929Z 24 MAR 2005

PART 01 OF 01 PARTS

HYPOCENTRAL PARAMETERS (REVISION)

ORIGIN TIME: 0858Z 24 MAR 2005

PRELIMINARY EPICENTER: LAT 3.5SOUTH LON 148.2EAST

EASTERN CAROLINE ISLANDS, MICRONESIA

PACIFIC BASIN

MAG: 8.3

EVALUATION

THERE IS A POSSIBILITY OF A DESTRUCTIVE OCEAN-WIDE TSUNAMI

THIS INFORMATION BULLETIN IS FOR

EAST COASTS OF PHILIPPINES (REVISION)

NORTH COASTS OF IRIAN JAYA (REVISION)

NORTH COASTS OF PAPUA NEW GUINEA (REVISION)

ESTIMATED TSUNAMI ARRIVAL TIME AND ESTIMATED TSUNAMI WAVE HEIGHT

EAST COASTS OF PHILIPPINES

LOCATION	COORDINATES	ARRIVAL TIME	HEIGHT
LEGASPI	13.2N 123.8E	(ALREADY ARRIVED)	
DAVAO	06.9N 125.7E	1237Z 24 MAR	1M (ADDITION)

NORTH COASTS OF IRIAN JAYA

LOCATION	COORDINATES	ARRIVAL TIME	HEIGHT
MANOKWARI	00.8S 134.2E	1116Z 24 MAR	0.5M (REVISION)
WARSA	00.6S 135.8E	1046Z 24 MAR	1M
JAYAPURA	02.4S 140.8E	1002Z 24 MAR	3M

NORTH COASTS OF PAPUA NEW GUINEA

LOCATION	COORDINATES	ARRIVAL TIME	HEIGHT
VANIMO	02.6S 141.3E	0953Z 24 MAR	2M
WEWAK	03.5S 143.7E	0931Z 24 MAR	4M
MADANG	05.2S 145.8E	0935Z 24 MAR	8M
MANUS IS.	02.0S 147.5E	0858Z 24 MAR	4M
RABAU	04.2S 152.3E	(CANCELLATION)	

HEIGHT - CREST TO MEAN IN METERS

HOWEVER AT SOME COASTS, PARTICULARLY THOSE NEAR THE EPICENTER, HIGHER TSUNAMIS MAY ARRIVE EARLIER THAN OUR ESTIMATION AT THE NEARBY FORECAST POINTS

AUTHORITIES SHOULD BE AWARE OF THIS POSSIBILITY

MEASUREMENTS OR REPORTS ON TSUNAMI

LOCATION	COORDINATES	ARRIVAL TIME	HEIGHT
LEGASPI	13.2N 123.8E		
		MAXIMUM TSUNAMI WAVE 0810Z 10 JAN	0.5M

MAXIMUM TSUNAMI WAVE HEIGHT-- HALF OF HEIGHT FROM THE TROUGH TO THE CREST

THIS WILL BE THE FINAL INFORMATION UNLESS THERE ARE CHANGES ABOUT THE POTENTIAL OF TSUNAMI GENERATION BY RE-EVALUATION OF THE EARTHQUAKE OR THERE ARE REPORTS ON TSUNAMI OBSERVATIONS

### Annex III (Continuation)

#### Example (6) - Communications test message

WEPA40 RJTD 240934

COMMUNICATION TEST

ISSUED BY NWPTAC(JMA)

ISSUED AT 0929Z 24 MAR 2005

THIS IS A TEST INFORMATION

TEST MESSAGE IS FORWARDED TO EACH RECIPIENT ORGANIZATION  
IN ORDER TO EXAMINE THE COMMUNICATION

#### Acknowledge form for reception of the NWPTA test message

Acknowledge Form for reception of the NWPTA test message

1. Name of country

2. Recipient organization

3. Responsible office

4. Officer in charge

Name:

5. Reception status of the NWPTA test message

(1) GTS

• Received	( )	time of receipt (UTC):	h	m
• Failed to receive	( )			
• Not registered	( )			

(2) E-mail

• Received	( )	time of receipt (UTC):	h	m
• Failed to receive	( )			
• Not registered	( )			

(3) Facsimile

• Received	( )	time of receipt (UTC):	h	m
• Failed to receive	( )			
• Not registered	( )			

**Excerpts from the summary reports of the relevant sessions of ICG/ITSU**

	Page
Summary Report of the ICG/ITSU-XIV Session (1993) ~ the ICG/ITSU-XV II Session (1999)	1
Summary Report of the ICG/ITSU-XVIII Session (2001)	2
Summary Report of the ICG/ITSU-XIX Session (2003)	3
Summary Report of the IOC/EC-XXXVII Session (2004)	4

### **Summary Report of the ICG/ITSU-XIV Session (1993)**

- 90 The Representative of Korea proposed the establishment of the Far East Tsunami Warning Center. One of the possible locations for the Center could be at the Japan Meteorological Agency. The Representative of Japan informed the Group that much discussion and consensus among the Member States concerned would be necessary to establish the Center and obtain additional tide and seismic data from and improve communications with the concerned countries in the are of Japan, Yellow and East China Seas for the tsunami warning service.
- 91 After a discussion in which many Member States participated, **the Group agreed** that it would be desirable for the Member States bordering on these Seas to discuss the possibility of establishing a Far East Tsunami Warning Center. Japan was requested to advise the Secretary of the results of any discussions, so that if appropriate, the issue can be included as Agenda Item at ITSU-XV.

### **Summary Report of the ICG/ITSU-XV Session (1995)**

- 96 **The Group received** the comments of the Delegate of Japan relative to the proposal made by the Delegate of the Republic of Korea at ITSU-XIV, regarding the establishment of a Far East Tsunami Warning Centre and its possible location at the Japan Meteorological Agency. There were a number of concerns open for discussion: the area of responsibility of the Centre, communications for warnings and the need for additional seismic and tidal data which would be required to support the operations of the Centre.

### **Summary Report of the ICG/ITSU-XVI Session (1997)**

- 77 The Delegate of Japan reported on the progress made in relation to the establishment of the Far East Tsunami Centre in JMA. In the case of a regional centre he expressed concern on communication problems, especially on transmission of seismic signals to determine the hypocenters. Trying to solve this problem, JMA is considering to arrange a questionnaire survey within the countries of the region in order to identify problems, needs and requirements for a regional centre. The Delegate of USA expressed appreciation for the Japanese initiative due to the fact that PTWC cannot be operationally effective for this region.
- 78 The Delegate of the Republic of Korea thanked Japan for the initiative underway, and expressed his willingness to participate and co-operate in it.
- 79 **The Group recognized** the effort made by Japan, expressed its appreciation for it and encouraged it to continue the progress of this activity.

### **Summary Report of the ICG/ITSU-XVII Session (1999)**

- 110 The Delegate of Japan recalled the discussions held at ITSU-XVI regarding the establishment of the Far East Centre. In response to ITSU-XVI recommendations, Japan Meteorological Agency conducted a survey of 6 Member States of the Western Pacific on the interest and possibility to provide seismic and tidal observational data to JMA for facilitating early tsunami warning.
- 111 The survey showed the interest of the Member States and their readiness to collaborate with Japan on this important initiative. The Member States requested Japan to include in tsunami forecasts information on the location and the magnitude of the earthquake, the estimated times of the first tsunami arrival and the forecast of estimated tsunami heights.

- 112 JMA began to operate its new tsunami forecasting system in April 1999. This system has the capability to make forecasts of tsunamis caused by the earthquakes for surrounding coastal areas. In 2000, it will be able to issue a tsunami forecast and after minor modifications of the system transmit it automatically to the Member States concerned.
- 113 **The Group expressed deep appreciation** to Japan for its efforts in providing for the surrounding coastal areas, the estimated tsunami height and times of the first wave arrival caused by the earthquake in the sea between the Asian continent, Korean peninsula and Japan. The tsunami forecast would be transmitted through Global Telecommunications System (GTS) to the Member States concerned, in accordance with the ITSU Communication Plan. **The Group advised** that the possibility of using the Internet should also be considered.
- 114 **The Group recommended** that information on tsunamis provided by Japan should be transmitted to responsible national authorities directly.
- 115 **The Group endorsed** Japan's proposal and **adopted**, in principle, the procedure to issue the tsunami forecast as given in Annex IX. **The Group urged** the Member States concerned to ensure that a transmitted tsunami forecast be relayed to Member States securely and rapidly, in accordance with the ITSU Communication Plan. **The Group requested** the IOC Executive Secretary to inform the Governments of China and the Democratic People's Republic of Korea of the developments and invite them to join the system.
- 116 **The Group further urged** Japan to continue considering the possibility of expanding the centre's functions to the coastal areas in and around the Yellow Sea, the East China Sea and the Western North Pacific. **The Group supported** the need for a regional workshop with the participation of all countries concerned to discuss actions to be taken for the smooth running of the system.

#### **Summary Report of the ICG/ITSU-XVIII Session (2001)**

- 120 The Delegate of Japan reported that on 15 January 2001, the Japan Meteorological Agency (JMA) partially began operations of the Regional Tsunami Warning Centre (Doc. IOC/ITSU-XVIII/7 Japan) to provide the tsunami forecasts in the sea between the Asian continent, Korean Peninsula and Japan to overseas authorities concerned. The JMA prepared and distributed a '*Handbook for Tsunami Forecast in the Japan Sea*' with the explanation of the procedure for the effective utilization of forecasts.
- 121 The next stage will be the expansion of the target area to the Northwestern Pacific. Its boundaries will be determined later. The Delegate of Japan explained that real-time seismic waveform data in the target area are indispensable for determining the hypocenters accurately and quickly (Doc. IOC/ITSU-XVIII/21). The JMA is proceeding with a study on optimal distribution of seismographic stations, considering the tsunami travel time to each coast.
- 122 The Delegate of Japan explained that JMA was planning to include tsunami heights and arrival times in the content of the forecast like those for the sea between the Asian continent, Korean Peninsula and Japan. By executing numerical simulation for various cases, the characteristics of tsunamis on each coast will be obtained and used to set up the forecast areas. For that purpose, the JMA is going to carry out many simulations and analyse the results.
- 123 **The Group expressed** deep appreciation to Japan and **invited** the country to continue its efforts. Member States were encouraged to co-operate with Japan in the acquisition of real-time seismic

waveform data in the target areas.

- 124 The Delegate of Japan explained that at this stage there is no need for a regional workshop to discuss actions to be taken for the smooth running of the system. The Group decided to come back to this issue when the target area of the Far East TWC is expanded and experience gained.

### **Summary Report of the ICG/ITSU-XIX Session (2003)**

- 185 This Agenda Item was introduced by Mr. Noritake Nishide (Japan). He recalled the Earthquake that occurred on 25 September 2003 in Hokkaido, Japan. He then proceeded to provide information on the tsunami warning centre based at JMA and its activities. In Document IOC/ITSU-XIX/13, Japan explained the present status of technical improvement of determining earthquake location using LISS (Live Internet Seismic Server) data. Japan also presented the quick determination method for Mw using P wave according to the same document.
- 186 Mr. Nishide explained Japan's quantitative tsunami forecast method for local and distant tsunami as described in the National Report of Japan, and provided information on Japan's tide gauge network for tsunami observation in detail as information for Sea Level Enhancement discussed under Agenda item 3.6.
- 187 Responding to a question from Australia, Japan explained about the reliability of LISS for the operational tsunami warning system as follows: there are almost no problems because data of about 20 stations can usually be used for hypocenter determination of large earthquakes even if some stations may drop, but, it is not appropriate for the operational tsunami warning system to rely only on LISS because LISS uses the Internet.

### **Summary Report of the IOC/EC-XXXVII Session (2004)**

#### Resolution EC-XXXVII.4

#### **THE INTERNATIONAL CO-ORDINATION GROUP FOR THE TSUNAMI WARNING SYSTEM IN THE PACIFIC**

The Executive Council,

**Recalling** that the IOC Tsunami Programme is a high priority programme of the Commission,

#### **Appreciating:**

- (i) the support of Chile, France, New Zealand, Republic of Korea and USA to the IOC Tsunami Programme in 2002–2003 through Trust Fund and in-kind contributions,
- (ii) the support of the USA in hosting and co-funding the operation of the International Tsunami Information Centre (ITIC) in Hawaii, and of Chile for the post of ITIC Associate Director,
- (iii) the establishment of the North-western Pacific Tsunami Information Centre by Japan in 2004\*,



**Considering** the Summary Report, Resolution and Recommendations of the 19th Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific (ITSU-XIX), held in Wellington, New Zealand, from 29 September to 2 October 2003, and the progress achieved by the ICG in the implementation of the ITSU Programme at the national and international levels,

**Welcoming** the studies in support of the development of sub-regional tsunami warning systems for the Central American Pacific Coast and for the South-west Pacific and Indian Ocean, and the possible development of a comprehensive tsunami hazard-reduction programme,

**Endorses** the Summary Report and Resolution **and adopts** the Recommendations of ITSU-XIX;

*\*) Japanese fiscal year (April 2004 ~ March 2005)*