



International Civil Aviation Organization

**FIRST MEETING OF THE ASIA/PACIFIC METEOROLOGICAL
ADVISORIES AND WARNINGS IMPLEMENTATION TASK FORCE
(METWARN/1 TF/1)**

Bangkok, Thailand, 23 – 25 March 2011

Agenda Item 2: Review educational material

- a) **Monitoring the developments of IAVWOPSG and METWSG with reference to guidance on radioactive cloud and Tsunami**

PROVISION OF TSUNAMI WARNINGS

(Presented by United States)

SUMMARY

This paper presents the established roles and responsibilities of international organizations for the provision of tsunami warnings.

1. INTRODUCTION

1.1 The International Civil Aviation Organization (ICAO) is interested in developing a capability to provide aerodrome warnings for tsunami to potentially affected airports

1.2 Aerodrome warnings for tsunamis would be used to support airport safety in locations which may be impacted by a tsunami

1.3 A tsunami is generated when geologic events cause large, rapid movements of the sea that displace the water column. This swift change creates a series of high energy waves that radiate outward from the source. Locations nearest to the source will be impacted within minutes. Locations farther away may not see impacts for hours. Any coast can be impacted by a tsunami. Some areas are at a much greater risk than others due to the proximity to tsunami sources and sea floor. Impacts vary from site to site depending on a location's unique bathymetric and topographical characteristics.

2. CURRENT PROVISION OF TSUNAMI PRODUCTS

2.1 The United Nations Educational, Scientific and Cultural Organization's (UNESCO) Intergovernmental Oceanographic Commission (IOC), its Intergovernmental Coordination Groups (ICGs) for the Pacific Ocean, Indian Ocean, and Caribbean Sea Tsunami Systems, and their Working Groups and Task Teams are the primary mechanism for International input and coordination for Tsunami Warning Services (TWS). International responsibilities of the U.S. TWS are determined by agreement and in coordination with IOC tsunami programs. Significant changes to international

products must be made in coordination with the appropriate ICG or Member States affected before implementation.

Based on the observations on the WAFS trial gridded forecasts of icing, turbulence and cumulonimbus clouds (Appendix I), the following findings are brought to the attention of the group:

2.2 International tsunami products are defined in accordance with protocols agreed to by the regional UNESCO/IOC ICGs. For all regions, the international TWC products are issued as guidance to designated national authorities. They are not intended as guidance to the public although they may be disseminated to the public through news organizations and are publicly available through the TWC websites. A list of products contained in Appendix A to this Information Paper. A User's Guide to tsunami products and services along with examples of Tsunami products is listed in Appendix B.

2.3 International Tsunami Centers

2.3.1 United States Tsunami Warning Centers

NOAA operates two TWCs in support of providing tsunami information. The West Coast/Alaska Tsunami Warning Center (WC/ATWC), located at Palmer, Alaska, and the Pacific Tsunami Warning Center (PTWC), located at Ewa Beach, Oahu, Hawaii, are responsible for the preparation and dissemination of tsunami warning, advisory, watch, and information products to their respective Area of Responsibility (AOR). For the Pacific, PTWC and WC/ATWC will issue warnings, watches, and information statements. WC/ATWC will also issue advisories for the west coast of Canada. For the Indian Ocean and Caribbean Sea, the PTWC will issue only watches and information.

2.3.2 Japan Meteorological Agency

The Director of the Earthquake and Tsunami Observations Division within the Seismological and Volcanological Department of JMA administers the Tsunami Warning Center in Japan.

- The JMA National Center in Tokyo has mission responsibility as: National tsunami warning center (started in 1952)
- International Advisory service for the Northwest Pacific (through JMA/NWPTAC, since 2005)
- Interim Tsunami Watch Provider for the Indian Ocean (with USA PTWC, since 2005)
- Interim Tsunami Advisory Center for the South China Sea as part of the expanded coverage of the NWPTAC (with USA PTWC, since 2006)

2.3.3 Northwest Pacific Tsunami Advisory Center (NWPTAC)

The NWPTAC issues only one kind of message, the Northwest Pacific Tsunami Advisory. With the NWPTA, the following information is given:

- earthquake focal parameters
- earthquake tsunamigenic potential, such as a local, regional, or ocean-wide
- tsunami possibility
- estimated height and arrival time of tsunami at agreed-upon forecast points
- observations of the tsunami

3. NATIONAL TSUNAMI WARNING FOCAL POINTS

3.1 Each Country must designate a Tsunami Warning Focal Point (TFWP), or official contact point (or points) for receiving Tsunami Warning Center bulletins. This designated official provides a single authority to eliminate confusion resulting from conflicting information disseminated to the public from multiple authorities.

3.2 The TWFP is designated by an ICG member state for rapidly receiving and issuing tsunami event information. The TWFP is responsible for notifying the emergency authority such as civil defense or other designated agency responsible for public safety of the event characteristics (earthquake and/or tsunami), in accordance with the procedures of the Tsunami Response Plan.

4. RECOMMENDATION

4.1 ICAO should work with the IOC to implement a capability to use the existing IOC/ICG structure to disseminate Tsunami products to International Aviation Authorities. This must include appropriate training for both TWFPs and Aviation authorities so appropriate responses to tsunami products can be developed for low-lying airports in the event of a tsunami product issuance.

Appendix A – Tsunami Products and Product Codes

Tsunami Products and Product Codes

NOAA Pacific Tsunami Warning Center (PTWC, PHEB)

NOAA West Coast / Alaska Tsunami Warning Center (WC/ATWC, PAAQ)

TWC	WMO/AWI PS Product Codes	Product Name	Product Explanation	Coverage
PTWC	WEPA40 PHEB TSUPAC	Tsunami Bulletin	Tsunami Warnings and Watches [$> M7.5$]; Test	Pacific
	WEPA42 PHEB TIBPAC	Tsunami Bulletin	Tsunami Information Bulletin [$M6.5$ to 7.5]	
	WEHW40 PHEB TSUHWX	Tsunami Message	Tsunami Warning, Watch, or Advisory for Hawaii Civil Defense [Hawaii source, $> M6.8$; Pacific source, $> M7.5$]	Hawaii
	WEHW42 PHEB TIBHWX	Tsunami Information Statement	Tsunami Information Statement for Hawaii Civil Defense [Pacific source, $M6.5$ to 7.5]	
	SEHW70 PHEB EQIHWX	Tsunami Seismic Information Statement	Tsunami Seismic Information Statement [Hawaii source, up to $M6.8$]	
	WEHW50 PHEB TSUHW1	Public Tsunami Message	Public Tsunami Warnings [Hawaii source, $> M6.8$]	
	WECA41 PHEB TSUCAX	Tsunami Message	Tsunami Watch [$> M7.0$; Atlantic source $> M7.8$]; Test	Caribbean
	WECA43 PHEB TIBCAx	Tsunami Information Statement	Tsunami Information Statement [$M6.0$ to 7.0 ; Atlantic source $M6.5$ to 7.8]	
	WEIO21 PHEB TSUIOX	Tsunami Bulletin	Tsunami Watch [$> M7.0$]; Test	Indian Ocean
	WEIO23 PHEB TIBIOX	Tsunami Bulletin	Tsunami Information Bulletin [$M6.5$ to 7.0]	
WC/ATWC	WEPA41 PAAQ TSUWCA	Tsunami Message	Tsunami Warnings, Watches, and Advisories [$> M7.0$]; Test	Alaska, British Columbia, Canada, and US West Coast
	WEPA43 PAAQ TIBWCA	Tsunami Information Statement	Tsunami Information Statement [$M6.5$ to 7.0]	
	WEAK51 PAAQ TSUAK1	Public Tsunami Message	Public Tsunami Warnings, Watches, and Advisories [$> M7.0$]	

WEAK53 PAAQ TIBAK1	Public Tsunami Information Statement	Public Tsunami Information Statement [M6.5 to 7.0]	
SEAK71 PAAQ EQIAKX	Tsunami Seismic Information Statement	Tsunami Seismic Information Statement [Alaska, < M6.5]	
SEUS71 PAAQ EQIWOC	Tsunami Seismic Information Statement	Tsunami Seismic Information Statement [US West Coast & BC, < M6.5]	
WEXX20 PAAQ TSUAT1	Tsunami Message	Tsunami Warnings, Watches, and Advisories [> M6.4]; Test	Puerto Rico/Virgin Islands, US East, Gulf, and Eastern Canadian Provinces
WEXX22 PAAQ TIBAT1	Tsunami Information Statement	Tsunami Information Statement [M6.0 to 6.4]	
WEXX30 PAAQ TSUATE	Public Tsunami Message	Public Tsunami Warnings, Watches, and Advisories [> M6.4]	
WEXX32 PAAQ TIBATE	Public Tsunami Information Statement	Public Tsunami Information Statement [M6.0 to 6.4]	
SEXX60 PAAQ EQIAT1	Tsunami Seismic Information Statement	Tsunami Seismic Information Statement [< M6]	

Appendix B – User Guides and Example

User Guides serve as key reference manuals for participants of the TWS within a specific region. They provide a general overview of the nature of tsunamis and a brief history of the warning service, and may list the sea level and seismometer stations which transmit data to the TWCs responsible for the region. The Guides also provide examples of TWC tsunami products, list product dissemination routes, and provide a summary of the criteria used to issue alerts.

Links to User Guides, their respective regions, and the agency(ies) responsible for maintaining the document are listed in the Table below.

Link to User Guide	Region	Responsible Agency
http://wcatwc.arh.noaa.gov/ops/opsmanual.pdf	WC/ATWC AOR	WC/ATWC
http://itic.ioc-unesco.org/images/docs/ptwsusersguide_12aug10_draft.pdf	Pacific Ocean and marginal seas	PTWC, JMA, WC/ATWC, ITIC, IOC
http://www.ioc-tsunami.org/index.php?option=com_oe&task=viewDocumentRecord&docID=6747&lang=en	Indian Ocean	PTWC, JMA, IOC
http://www.ioc-tsunami.org/index.php?option=com_oe&task=viewDocumentRecord&docID=6354&lang=en	Caribbean Sea and adjacent regions outside of WC/ATWC AOR	PTWC, IOC

Example of Tsunami Message

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WEXX20 PAAQ 131000
TSUAT1
BULLETIN
TSUNAMI MESSAGE NUMBER 2
NWS WEST COAST/ALASKA TSUNAMI WARNING CENTER PALMER AK
600 AM AST SUN JAN 13 2008
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...THIS MESSAGE IS FOR TEST PURPOSES TO SHOW AN EXAMPLE
WEXX20 MESSAGE...
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...A TEST TSUNAMI WARNING IS IN EFFECT FOR PUERTO RICO AND THE
VIRGIN ISLANDS...
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...A TEST TSUNAMI ADVISORY IS IN EFFECT FOR THE NORTH CAROLINA -
VIRGINIA - MARYLAND - DELAWARE - NEW JERSEY - NEW YORK -
CONNECTICUT - RHODE ISLAND - MASSACHUSETTS - NEW HAMPSHIRE
- MAINE - NEW BRUNSWICK - NOVA SCOTIA AND NEWFOUNDLAND
COASTAL AREAS FROM DUCK NORTH CAROLINA TO LA MANCHE
NEWFOUNDLAND...
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...THIS MESSAGE IS INFORMATION ONLY FOR U.S. AND CANADIAN
ATLANTIC AND GULF OF MEXICO COASTAL REGIONS NOT INCLUDED IN
THE AREAS LISTED ABOVE...
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RECOMMENDED ACTIONS

A TSUNAMI HAS BEEN GENERATED WHICH COULD CAUSE DAMAGE TO THE WARNING AND/OR ADVISORY REGIONS LISTED IN THE HEADLINE. PERSONS IN LOW-LYING COASTAL AREAS SHOULD BE ALERT TO INSTRUCTIONS FROM THEIR LOCAL EMERGENCY OFFICIALS. EVACUATIONS ARE ONLY ORDERED BY EMERGENCY RESPONSE AGENCIES.

- PERSONS IN TSUNAMI WARNING COASTAL AREAS SHOULD MOVE INLAND TO HIGHER GROUND.
- PERSONS IN TSUNAMI ADVISORY AREAS SHOULD MOVRE OUT OF THE WATER... OFF THE BEACH AND OUT OF HARBORS AND MARINAS.

THIS MESSAGE IS BASED ON EARTHQUAKE DATA... OBSERVED TSUNAMI AMPLITUDES... HISTORICAL INFORMATION AND FORECAST MODELS.

A TSUNAMI HAS BEEN OBSERVED AT THE FOLLOWING SITES

LOCATION LAT LON TIME AMPL

SAN JUAN - PR 18.5N 66.1W 1145UTC 2.0M/6.6FT

TIME - TIME OF MEASUREMENT

AMPL - TSUNAMI AMPLITUDES ARE MEASURED RELATIVE TO NORMAL SEA LEVEL.
IT IS ...NOT... CREST-TO-TROUGH WAVE HEIGHT.
VALUES ARE GIVEN IN BOTH METERS(M) AND FEET(FT).

PRELIMINARY EARTHQUAKE PARAMETERS

MAGNITUDE 8.2
TIME 0455 EST JAN 13 2008
0555 AST JAN 13 2008
0955 UTC JAN 13 2008

LOCATION 19.5 NORTH 68.6 WEST
130 MILES/209 KM NW OF MAYAGUEZ PUERTO RICO
180 MILES/290 KM NW OF SAN JUAN PUERTO RICO
DEPTH 16 MILES/25 KM

THE PACIFIC TSUNAMI WARNING CENTER IN EWA BEACH HAWAII WILL ISSUE MESSAGES FOR AREAS IN THE CARIBBEAN OUTSIDE PUERTO RICO AND THE VIRGIN ISLANDS.

TSUNAMI WARNINGS MEAN THAT A TSUNAMI WITH SIGNIFICANT WIDESPREAD INUNDATION IS IMMINENT OR EXPECTED. WARNINGS INDICATE THAT WIDESPREAD DANGEROUS COASTAL FLOODING ACCOMPANIED BY POWERFUL CURRENTS IS POSSIBLE AND MAY CONTINUE FOR SEVERAL HOURS AFTER THE INITIAL WAVE ARRIVAL.

TSUNAMI ADVISORIES MEAN THAT A TSUNAMI CAPABLE OF PRODUCING STRONG CURRENTS OR WAVES DANGEROUS TO PERSONS IN OR VERY NEAR THE WATER IS IMMINENT OR EXPECTED. SIGNIFICANT WIDESPREAD INUNDATION IS NOT EXPECTED FOR AREAS UNDER AN ADVISORY. CURRENTS MAY BE HAZARDOUS TO SWIMMERS... BOATS... AND COASTAL STRUCTURES AND MAY CONTINUE FOR SEVERAL HOURS AFTER THE INITIAL WAVE ARRIVAL.

MESSAGES WILL BE ISSUED EVERY 30 MINUTES OR MORE FREQUENTLY IF THE SITUATION WARRANTS. THE TSUNAMI ALERT WILL REMAIN IN EFFECT UNTIL FURTHER NOTICE. REFER TO THE INTERNET SITE WCATWC.ARH.NOAA.GOV FOR MORE INFORMATION.