IOTWMS Service Definition Proposes modifications

Robert Greenwood
Bureau of Meteorology
robert.greenwood@bom.gov.au

unesco
Intergovernmental Oceanographic Commission

IOTWMS Service Definition

- Latest version 4.0 of Feb 2019 at http://www.ioc-tsunami.org/index.php?option=com_oe&task=viewDocumentRecord&docID=24771
- Sep 2019 WG2 Recommendations
  - Adding a clarification at the end of point 10 that "This does not preclude TSPs from issuing SL-2 bulletins in situations that they have assessed as causing threat to the IOTWMS CFZs for earthquakes less than M8.0".
  - Updating the word "Revised" with "Updated" in the IOTWMS TSP bulletins and templates
  - Adding an additional KPI target nil for unnecessary bulletins (no action required – already existed in version 4.0)
- Dec 2020 WG2 Recommendation
  - Additional TSP products for maritime community
- Nov 2021 WG2 Recommendation
  - Added guidance regarding issuing of service level 2 products for non-seismic and complex source events.
  - Changed "pre-run model scenarios" from fixed text to variable to account for different threat assessment techniques.
  - Clarification to performance reporting were made to use USGS final solution of M6.8+ for uniform reporting amongst 3 TSPs.
  - Defined targets (traffic lights) for performance reporting

Proposed Update
IOTWMS Service Definition to V5.0

10. Service Level 2: If the earthquake is within 100km depth and:

- occurred in the Indian Ocean source zone, or
- has a magnitude ≥ 8.0 and occurred in the Pacific Ocean or South Atlantic Ocean source zones. This does not preclude TSPs from issuing SL-2 bulletins for earthquakes less than magnitude 8.0 that they have assessed as causing threat to the IOTWMS CFZs.

an TSP threat assessment shall be carried out followed by the issuing of exchange bulletins of Type 2 No Threat / Potential Threat, Type 3 Confirmed Threat and Type 4 Final Bulletin as the situation mandates (Service Level 2 products), plus the corresponding public bulletins.

Proposed Update
IOTWMS Service Definition to V5.0

```
NOTIFICATION:
IOTWMS-TSP INDIA HAS JUST ISSUED TSUNAMI BULLETIN NUMBER 2 FOR
THE INDIAN OCEAN, BASED ON THE FOLLOWING EARTHQUAKE EVENT:
/* (REVISED) to be added only after a magnitude change since previous message */
MAGNITUDE:    9.0 MWP (REVISED)                    /* EQ magnitude and type */
DEPTH:        10 KM                                /* EQ depth */
LATITUDE:     7.20N                                /* EQ latitude */
LONGITUDE:    92.90E                               /* EQ longitude */
LOCATION:     NICOBAR, INDIA                       /* EQ location */
```

```
NOTIFICATION:
IOTWMS-TSP INDIA HAS JUST ISSUED TSUNAMI BULLETIN NUMBER 2 FOR
THE INDIAN OCEAN, BASED ON THE FOLLOWING EARTHQUAKE EVENT:
/* (UPDATED) to be added only after a magnitude change since previous message */
MAGNITUDE:    9.0 MWP (UPDATED)                    /* EQ magnitude and type */
DEPTH:        10 KM                                /* EQ depth */
LATITUDE:     7.20N                                /* EQ latitude */
LONGITUDE:    92.90E                               /* EQ longitude */
LOCATION:     NICOBAR, INDIA                       /* EQ location */
```

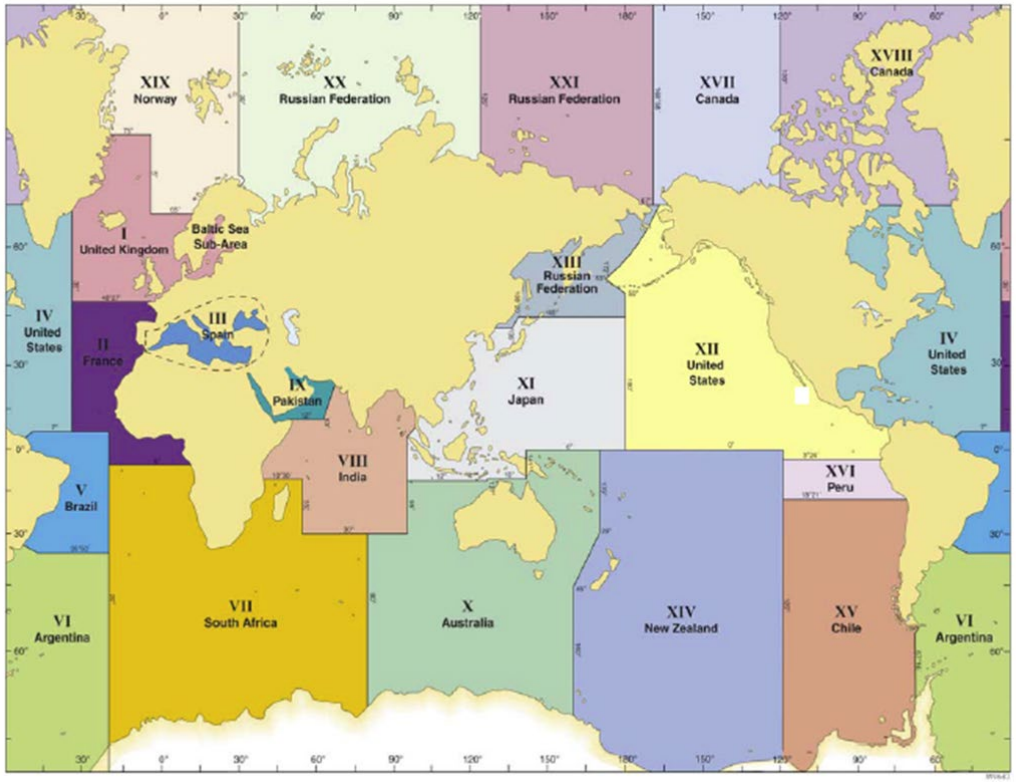
unesco
Intergovernmental Oceanographic Commission

Maritime Community TSP Products

- Known as TSP NAVAREA Bulletins
- Help NAVAREA coordinators in tsunami events
  - In response to discussions between representatives of the International Hydrographic Organization (IHO) and the IOC
  - To improve the accuracy and consistency of messages issued by the NAVAREA coordinators for tsunami events.
- Requirements and specs
  - Listed in the 2019 TOWS-WG Task Team Tsunami Watch Operations proposal here
  - The 12th ICG/IOTWMS 9-12 Mar 2019 recommended for TSPs in IOTWMS to implement
  - The 30th IOC Assembly 26 Jun- 4 Jul 2019 approved the ICG recommendations
  - The action to implement was adopted in the WG2 workplan at the ICG/IOTWMS Integrated Meetings, 29 Sep – 2 Oct 2019

NAVAREA codes

IOTWMS covers 5 NAVAREAs of VII, VIII, IX, X, XI



COUNTRY	NAVAREA	Indian Ocean Area
AUSTRALIA	X	East
BANGLADESH	VIII	North
COMOROS	VII	West
DJIBOUTI	IX	Northwest
FRANCE (Indian Ocean Territories)	VIII	West
INDIA	VIII	Northwest
INDONESIA	XI	North
IRAN	IX	Northwest
KENYA	VII	West
MADAGASCAR	VII	West
MALAYSIA	XI	North
MALDIVES	VIII	West
MAURITUS	VIII	West
MOZAMBIQUE	VII	West
MYANMAR	VIII	North
OMAN	IX	Northwest
PAKISTAN	IX	Northwest
SEYCHELLES	VIII	West
SINGAPORE	XI	North
SOMALIA	VIII	West
SOUTH AFRICA	VII	West
SRI LANKA	VIII	North
TANZANIA	VIII	West
THAILAND	XI	North
TIMOR-LESTE	XI	East
UNITED ARAB EMIRATES	IX	Northwest
UNITED KINGDOM (Indian Ocean Territories)	VIII	West
YEMEN	IX	Northwest

unesco
Intergovernmental Oceanographic Commission

Proposed Update
IOTWMS Service Definition to V5.0

3. Through bilateral agreements, NTWCs may request TSPs to directly send TSP exchange products to them.

4. Through agreement with IHO, TSPs are asked to provide NAVAREA products each time Potential Threat, Confirmed Threat, ND Final bulletins are issued in the agreed format as per Annexure 7.

5. TSP **public products** shall consist of a combination of textual bulletins, graphics and public web sites.

Example – Potential Threat

TSP AUSTRALIA TSUNAMI BULLETIN NUMBER 1 FOR

NAVAREA VII, NAVAREA VIII, NAVAREA X, NAVAREA XI

EAST INDIAN OCEAN, NORTH INDIAN OCEAN, SOUTHWEST INDIAN OCEAN, WEST INDIAN OCEAN

TSUNAMI THREAT MESSAGE ISSUED BY TSUNAMI SERVICE PROVIDER AUSTRALIA IN SUPPORT OF THE UNESCO/IOC INDIAN OCEAN TSUNAMI WARNING AND MITIGATION SYSTEM AT 0016 UTC Monday 01 May 2015.
A TSUNAMI IS POSSIBLE TO BE GENERATED BY A MAGNITUDE 8.9 EARTHQUAKE THAT OCCURRED NEAR SOUTH OF BALI, INDONESIA [10.00S, 115.97E] AT 0000 UTC 01 May 2015.
HAZARDOUS TSUNAMI WAVES ARE FORECAST FOR SOME COASTS OF AUSTRALIA, FRANCE (INDIAN OCEAN TERRITORIES), INDONESIA, MADAGASCAR, MAURITIUS, SOUTH AFRICA, SRI LANKA, TIMOR-LESTE
TSUNAMI WAVES ARE NOT A HAZARD TO SHIPS IN DEEP WATER BUT CAN CAUSE STRONG CURRENTS AND RAPID SEA LEVEL CHANGES IN SHALLOW WATER, AS WELL AS INUNDATION OF THE COAST. SHIPS APPROACHING THE COAST SHOULD CONSULT LOCAL AUTHORITIES REGARDING LOCAL CONDITIONS AND ADVICES.

IOTWMS Medium Term Strategy

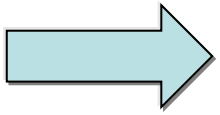
- Responses to non-seismic and complex source tsunamis are a clear requirement of the Medium Term Strategy
  - Web Link: Here
  - Page 11: 2nd Strategic objective in 2.2.2.2 Regional Tsunami Threat Information states: “Strengthen detection and warning capability through further scientific development and development of knowledge bases, including for atypical source tsunamis, and through education and trainingUpdates for different threat assessment techniques”
  - Page 13: 1st Strategic objective in 3.2.2.3 Regional Earthquake and Tsunami Detection states: “Enhance and maintain seismic and sea level monitoring capability to meet identified tsunami warning requirements including for tsunamis for atypical sources”

Proposed Update
IOTWMS Service Definition to V5.0

11. Service Level 2 products may also be issued for non-seismic and complex source events if a regional or ocean wide scale tsunami has been generated or there is reason to believe one may have been generated. This is an area for future development and is not a current requirement. Due to the nature of non-seismic and complex source events and the limitations of current operational setups there it is high likelihood that many of them will not be detected in a timely manner. If a TSP chooses to respond to a non-seismic and complex source event, they should modify the standard templates as per Annexure-5.

TSP Australia Bulletin Examples: Notification Message

```
--------------------------------------------------------------------------
-
TSUNAMI BULLETIN NOTIFICATION MESSAGE NUMBER 1 IOTWMS TSUNAMI
SERVICE PROVIDER AUSTRALIA [JATWC] ISSUED AT 1046 UTC THURSDAY 13
FEBRUARY 2020
--------------------------------------------------------------------------
-
TO:   INDIAN OCEAN NATIONAL TSUNAMI WARNING CENTRES [NTWCs]
FROM: IOTWMS-TSP AUSTRALIA

NOTIFICATION:
IOTWMS-TSP AUSTRALIA HAS JUST ISSUED TSUNAMI BULLETIN NUMBER 1 FOR
THE INDIAN OCEAN, BASED ON THE FOLLOWING EARTHQUAKE EVENT:

MAGNITUDE:   6.9 MWP
DEPTH:       145KM
TYPE:        LANDSLIDE
DATE:        13 FEB 2020
ORIGIN TIME: 1033 UTC
LATITUDE:    45.65N
LONGITUDE:   148.99E
LOCATION:    KURIL ISLANDS

TO VIEW THE BULLETIN GO TO THE IOTWMS-TSP AUSTRALIA WEBSITE AT:

http://reg.bom.gov.au/tsunami/rtsp/index.shtml

NOTE: THIS IS A RESTRICTED-ACCESS WEBSITE CONTAINING TECHNICAL DATA
FOR NATIONAL TSUNAMI WARNING CENTRES ONLY. IT IS NOT FOR GENERAL
PUBLIC ACCESS.

GENERAL PUBLIC INFORMATION FOR THIS EVENT IS AVAILABLE FROM:

JOINT AUSTRALIAN TSUNAMI WARNING CENTRE [JATWC] BUREAU OF
METEOROLOGY MELBOURNE, AUSTRALIA http://www.bom.gov.au/tsunami

END OF NOTIFICATION MESSAGE
--------------------------------------------------------------------------
-
```



```
--------------------------------------------------------------------------
TSUNAMI BULLETIN NOTIFICATION MESSAGE NUMBER 1 IOTWMS TSUNAMI SERVICE
PROVIDER AUSTRALIA [JATWC] ISSUED AT 1046 UTC THURSDAY 13 FEBRUARY 2020
--------------------------------------------------------------------------
TO:   INDIAN OCEAN NATIONAL TSUNAMI WARNING CENTRES [NTWCs]
FROM: IOTWMS-TSP AUSTRALIA

NOTIFICATION:
IOTWMS-TSP AUSTRALIA HAS JUST ISSUED TSUNAMI BULLETIN NUMBER 1 FOR THE
INDIAN OCEAN, BASED ON THE FOLLOWING EVENT:

TYPE:        LANDSLIDE
DATE:        13 FEB 2020
ORIGIN TIME: 1033 UTC
LATITUDE:    45.65N
LONGITUDE:   148.99E
LOCATION:    KURIL ISLANDS

TO VIEW THE BULLETIN GO TO THE IOTWMS-TSP AUSTRALIA WEBSITE AT:

http://reg.bom.gov.au/tsunami/rtsp/index.shtml

NOTE: THIS IS A RESTRICTED-ACCESS WEBSITE CONTAINING TECHNICAL DATA FOR
NATIONAL TSUNAMI WARNING CENTRES ONLY. IT IS NOT FOR GENERAL PUBLIC
ACCESS.

GENERAL PUBLIC INFORMATION FOR THIS EVENT IS AVAILABLE FROM:

JOINT AUSTRALIAN TSUNAMI WARNING CENTRE [JATWC] BUREAU OF METEOROLOGY
MELBOURNE, AUSTRALIA http://www.bom.gov.au/tsunami

END OF NOTIFICATION MESSAGE
--------------------------------------------------------------------------
```

TSP Australia Bulletin Examples: Type 2 No Threat Bulletin

-
TSUNAMI BULLETIN NUMBER 1 (TYPE-II THREAT ASSESSMENT BULLETIN)
IOTWMS TSUNAMI SERVICE PROVIDER AUSTRALIA (JATWC)
ISSUED AT 1214 UTC Friday 02 August 2019

-

... NO TSUNAMI THREAT IN THE INDIAN OCEAN ...

This bulletin applies to areas within and bordering the Indian Ocean. It is
issued in support of the UNESCO/IOC Indian Ocean Tsunami Warning and Mitigation
System (IOTWMS).

1. EARTHQUAKE TSUNAMI SOURCE INFORMATION
IOTWMS-TSP AUSTRALIA has detected an earthquake a landslide with the following details:

Magnitude: 7.1 Mwp
Depth: 69km
Date: 02 Aug 2019
Origin Time: 1203 UTC
Latitude: 7.47S
Longitude: 104.58E
Location: Southwest of Sumatra, Indonesia

2. EVALUATION
Based on pre-run model scenarios a tsunami travel time threat assessment, there is NO THREAT to countries in the Indian Ocean.

3. ADVICE
This bulletin is being issued as advice. Only national/state/local authorities and disaster management officers have the authority to make decisions regarding the official threat and warning status in their coastal areas and any action to be taken in response.

4. UPDATES
No further bulletins will be issued by IOTWMS-TSP AUSTRALIA for this event
unless other information becomes available.

Other IOTWMS-TSPs may issue additional information at:
IOTWMS-TSP INDIA:
http://www.incois.gov.in/Incois/tsunami/eqevents.jsp
IOTWMS-TSP INDONESIA: http://rtsp.bmkg.go.id

5. CONTACT INFORMATION
IOTWMS-TSP AUSTRALIA
Joint Australian Tsunami Warning Centre (JATWC)
Bureau of Meteorology
GPO BOX 1289 Melbourne, Victoria, Australia, 3001
http://reg.bom.gov.au/tsunami/rtsp

END OF BULLETIN

TSP Australia Bulletin Examples: Type 2 Potential Threat Bulletin

---

TSUNAMI BULLETIN NUMBER 1 (TYPE-II THREAT ASSESSMENT BULLETIN)
IOTWMS TSUNAMI SERVICE PROVIDER AUSTRALIA (JATWC)
ISSUED AT 1509 UTC Sunday 19 August 2018

... POTENTIAL TSUNAMI THREAT IN THE INDIAN OCEAN ...

This bulletin applies to areas within and bordering the Indian Ocean. It is
issued in support of the UNESCO/IOC Indian Ocean Tsunami Warning and Mitigation
System (IOTWMS).

1. EARTHQUAKE TSUNAMI SOURCE INFORMATION
IOTWMS-TSP AUSTRALIA has detected an earthquake a volcanic eruption at Mt Rumble with the following details:

Magnitude: 7.0 Mwp
Depth: 12km
Date: 19 Aug 2018
Origin Time: 1456 UTC
Latitude: 8.47S
Longitude: 116.69E
Location: Sumbawa Region, Indonesia

2. EVALUATION
Earthquakes of this size are capable of generating tsunamis. However, so far there is no confirmation about the triggering of a tsunami.

An investigation is under way to determine if a tsunami has been triggered. This TSP will monitor sea level gauges and report if any tsunami wave activity has occurred.

Based on pre-run model scenarios a tsunami travel time threat assessment, the zones listed below are POTENTIALLY UNDER THREAT.

3. TSUNAMI THREAT FOR THE INDIAN OCEAN
For this event all locations within 3 hours are considered under Threat.

The list below shows the forecast arrival time of the first wave estimated to exceed 0.5m amplitude at the beach in each zone, and The amplitude of the maximum beach wave predicted for the zone. Zones where the estimated wave amplitudes are less than 0.5m at the Beach are not shown.

The list is grouped by country (alphabetic order) and ordered according to the earliest estimated times of arrival at the beach.

Please be aware that actual wave arrival times may differ from those below, and the initial wave may not be the largest. A tsunami is a series of waves and the time between successive waves can be five minutes to one hour.

The threat is deemed to have passed two hours after the forecast time for last exceedance of the 0.5m threat threshold for a zone. Dangerous conditions should be expected to continue for a minimum of 5 hours after the predicted arrival time. As local conditions can cause a wide variation in tsunami wave action, CANCELLATION of national warnings and ALL CLEAR determination must be made by national/state/local authorities.

INDONESIA		
NTB SUMBAWA B	1512Z 19Aug2018	0.51m
NTB LOMBOK-TIMUR S	1527Z 19Aug2018	0.51m
NTB LOMBOK-TENGAH	1542Z 19Aug2018	0.51m
NTB SUMBAWA S	1545Z 19Aug2018	0.51m
NTB LOMBOK-BARAT S	1546Z 19Aug2018	0.51m
BALI KLUNGKUNG P.NUSAPENIDA	1549Z 19Aug2018	0.51m
BALI DENPASAR PANTAI-SANUR	1555Z 19Aug2018	0.51m
BALI BADUNG PANTAI-KUTA	1555Z 19Aug2018	0.51m

4. ADVICE
This bulletin is being issued as advice. Only national/state/local authorities and disaster management officers have the authority to make decisions regarding the official threat and warning status in their coastal areas and any action to be taken in response.

5. UPDATES
Additional bulletins will be issued by IOTWMS-TSP AUSTRALIA for this event
as more information becomes available.

Other IOTWMS-TSPs may issue additional information at:
TSP INDIA: http://www.incois.gov.in/Incois/tsunami/eqevents.jsp
TSP INDONESIA: http://rtsp.bmkg.go.id

6. CONTACT INFORMATION
IOTWMS-TSP AUSTRALIA
Joint Australian Tsunami Warning Centre (JATWC)
Bureau of Meteorology
GPO BOX 1289 Melbourne, Victoria, Australia, 3001
http://reg.bom.gov.au/tsunami/rtsp

END OF BULLETIN

TSP Australia Bulletin Examples: Type 3 Confirmed Threat Bulletin

---

TSUNAMI BULLETIN NUMBER 2 (TYPE-III CONFIRMED THREAT BULLETIN)
IOTWMS TSUNAMI SERVICE PROVIDER AUSTRALIA (JATWC)
ISSUED AT 1345 UTC Sunday 05 August 2018

... CONFIRMED TSUNAMI THREAT IN THE INDIAN OCEAN...

This bulletin applies to areas within and bordering the Indian Ocean. It is
issued in support of the UNESCO/IOC Indian Ocean Tsunami Warning and Mitigation
System (IOTWMS).

1. EARTHQUAKE TSUNAMI SOURCE INFORMATION
IOTWMS-TSP AUSTRALIA has detected an earthquake a volcanic eruption at Mt Rumble with the following details:

Magnitude: 7.0 Mwp
Depth: 25km
Date: 05 Aug 2018
Origin Time: 1146 UTC
Latitude: 8.56S
Longitude: 116.49E
Location: Sumbawa Region, Indonesia

2. EVALUATION
Sea level observations have confirmed that a TSUNAMI WAS GENERATED.
Maximum wave amplitudes observed so far:

Benoa	INDONESIA	8.83S 115.33E	0.01m	05 Aug 12:45 UTC
Lembar	INDONESIA	8.70S 116.07E	0.13m	05 Aug 13:08 UTC

Based on pre-run model scenarios a tsunami travel time threat assessment, the zones listed below are POTENTIALLY UNDER THREAT.

3. TSUNAMI THREAT FOR THE INDIAN OCEAN
For this event all locations within 3 hours are considered under Threat.

The list below shows the forecast arrival time of the first wave estimated to exceed 0.5m amplitude at the beach in each zone, and the amplitude of the maximum beach wave predicted for the zone.
Zones where the estimated wave amplitudes are less than 0.5m at the beach are not shown.

The list is grouped by country (alphabetic order) and ordered according to the earliest estimated times of arrival at the beach.

Please be aware that actual wave arrival times may differ from those below, and the initial wave may not be the largest. A tsunami is a series of waves and the time between successive waves can be five minutes to one hour.

The threat is deemed to have passed two hours after the forecast time for last exceedance of the 0.5m threat threshold for a zone.
Dangerous conditions should be expected to continue for a minimum of 5 hours after the predicted arrival time. As local conditions can cause a wide variation in tsunami wave action, CANCELLATION of national warnings and ALL CLEAR determination must be made by national/state/local authorities.

INDONESIA		
NTB SUMBAWA B	1202Z 05Aug2018	0.51m
NTB LOMBOK-TIMUR S	1217Z 05Aug2018	0.51m
NTB LOMBOK-TENGAH	1232Z 05Aug2018	0.51m
NTB SUMBAWA S	1235Z 05Aug2018	0.51m
NTB LOMBOK-BARAT S	1236Z 05Aug2018	0.51m
BALI KLUNGKUNG P.NUSAPENIDA	1239Z 05Aug2018	0.51m
BALI DENPASAR PANTAI-SANUR	1245Z 05Aug2018	0.51m
BALI BADUNG PANTAI-KUTA	1245Z 05Aug2018	0.51m

4. ADVICE
This bulletin is being issued as advice. Only national/state/local authorities and disaster management officers have the authority to make decisions regarding the official threat and warning status in their coastal areas and any action to be taken in response.

5. UPDATES
Additional bulletins will be issued by IOTWMS-TSP AUSTRALIA for this event
as more information becomes available.

Other IOTWMS-TSPs may issue additional information at:
TSP INDIA: http://www.incois.gov.in/Incois/tsunami/eqevents.jsp
TSP INDONESIA: http://rtsp.bmkg.go.id

6. CONTACT INFORMATION
IOTWMS-TSP AUSTRALIA
Joint Australian Tsunami Warning Centre (JATWC)
Bureau of Meteorology
GPO BOX 1289 Melbourne, Victoria, Australia, 3001
http://reg.bom.gov.au/tsunami/rtsp

END OF BULLETIN

TSP Australia Bulletin Examples: Type 4 Final Bulletin

TSUNAMI BULLETIN NUMBER 5 (TYPE-IV FINAL BULLETIN)
IOTWMS TSUNAMI SERVICE PROVIDER AUSTRALIA (JATWC)
ISSUED AT 1448 UTC Sunday 05 August 2018

... FINAL TSUNAMI BULLETIN FOR THE INDIAN OCEAN ...

1. EARTHQUAKE TSUNAMI SOURCE INFORMATION
IOTWMS-TSP AUSTRALIA has detected an earthquake with the following details:

Magnitude: 7.0 Mwp
Depth: 25km
Date: 05 Aug 2018
Origin Time: 1146 UTC
Latitude: 8.56S
Longitude: 116.49E
Location: Sumbawa Region, Indonesia

2. EVALUATION
Data from sea-level gauges confirmed that a tsunami was generated.

The expected period of significant tsunami waves is now over for all threatened
Indian Ocean countries, based on IOTWMS-TSP AUSTRALIA modelling.

Because local conditions can cause a wide variation in tsunami wave action,
CANCELLATION of national warnings and ALL CLEAR determination must be made by
national/state/local authorities. Please be aware that dangerous currents can
continue for several hours after the main tsunami waves have passed.

3. TSUNAMI WAVE OBSERVATIONS
Listed below are maximum wave amplitudes recorded at the specified locations.
Note that wave amplitude is measured relative to normal sea level; it is NOT
the crest-to-trough wave height.

Benoa	INDONESIA	8.83S 115.33E	0.01m	05 Aug 12:45 UTC
Lembar	INDONESIA	8.70S 116.07E	0.13m	05 Aug 13:08 UTC

4. ADVICE
This bulletin is being issued as advice. Only national/state/local authorities
and disaster management officers have the authority to make decisions regarding
the official threat and warning status in their coastal areas and any action to
be taken in response.

5. UPDATES
No further bulletins will be issued by IOTWMS-TSP AUSTRALIA for this event unless
additional information becomes available.

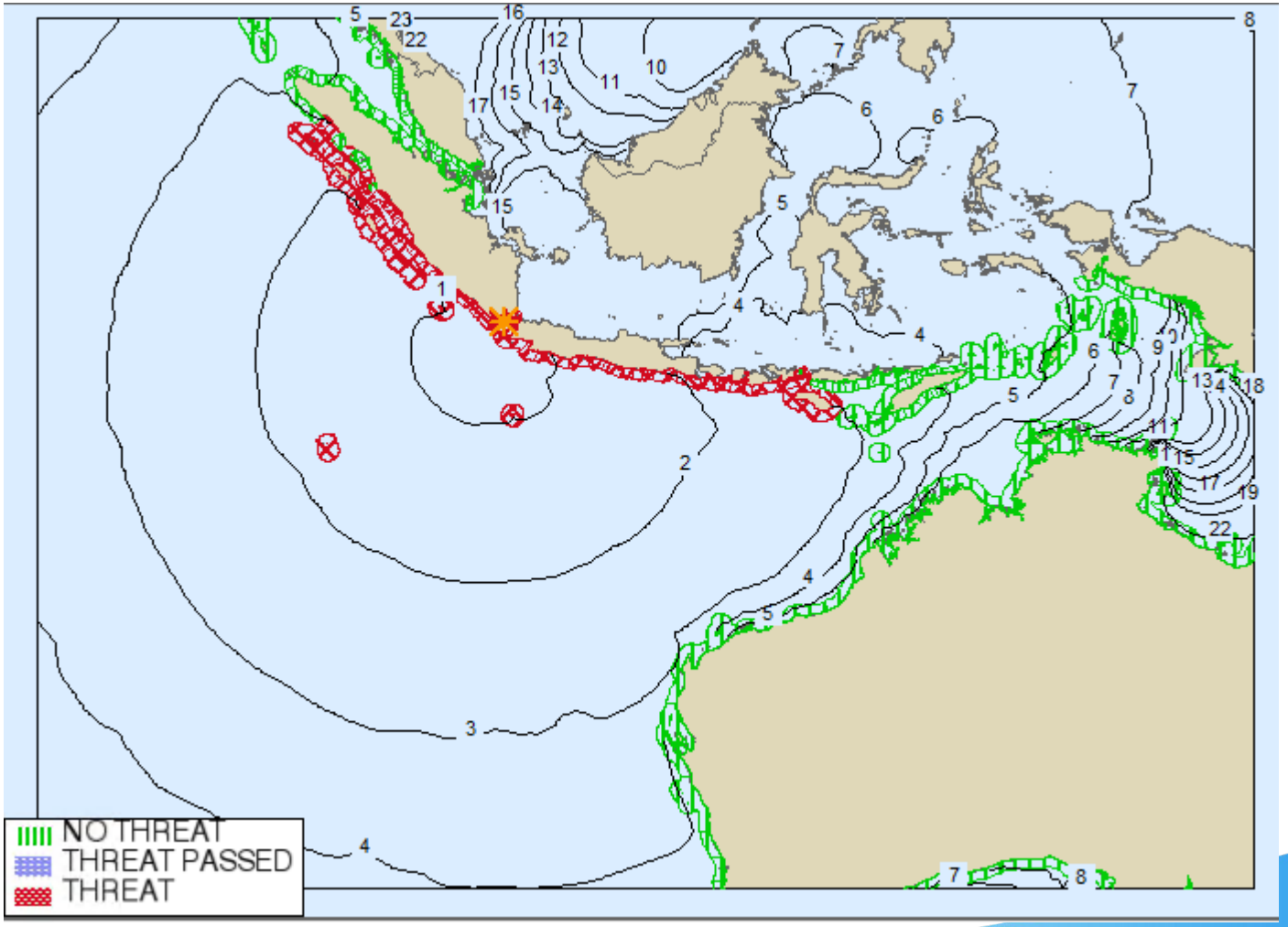
Other IOTWMS-TSPs may issue additional information at:
TSP INDIA: http://www.incois.gov.in/Incois/tsunami/eqevents.jsp
TSP INDONESIA: http://rtsp.bmkg.go.id

6. CONTACT INFORMATION
IOTWMS-TSP AUSTRALIA
Joint Australian Tsunami Warning Centre (JATWC)
Bureau of Meteorology
GPO BOX 1289 Melbourne, Victoria, Australia, 3001
http://reg.bom.gov.au/tsunami/rtsp

END OF BULLETIN

Example of TSP Australia assessment for a non-seismic event

Assign threat area to all zones within 3 hours tsunami travel time.



unesco
Intergovernmental Oceanographic Commission

Proposed Update
IOTWMS Service Definition to V5.0

No.	Key Performance Indicator	Target Value
1	Elapsed time from earthquake to issuance of first Earthquake Bulletin	10 minutes^
2	Probability of detection of ~~Indian Ocean~~ earthquakes with Mw>=6.8 (USGS final value) in the IOTWMS ESZ	100%
3	Accuracy of earthquake magnitude	0.3 *^
4	Accuracy of earthquake hypocenter depth	30 km *^
5	Accuracy of earthquake hypocenter location	30 km *^
6	Elapsed time from earthquake to issuance of first Threat Assessment Bulletin	20 minutes^
7	Probability of detection of tsunami above threat threshold	100%
8	Accuracy of the tsunami forecast amplitude/height	Factor of 2
9	Number of false or incorrect bulletins issued	0
10	Accuracy of time arrival of tsunami (0.02m amplitude)	Within 5% of travel time #
11	Accuracy of time of arrival of 1st significant wave (0.1m)	Within 5% of travel time
12	Accuracy of threat threshold exceedance	Within 5% #
13	Percent of IO countries issued a timely product as defined above	100%
14	Elapsed time from any product issuance to potential receipt by NTWC Contact	5 minutes ##
15	Percent of regular Comms Tests participated in	100%

^ Only earthquakes where the USGS final value is >=M6.8 are considered for reporting purposes

Clarifications to Performance Reporting

- KPI 9
  - Test/Exercise Bulletins issued live by mistake
  - Bulletin Issued outside of standard operating procedures e.g. for event outside of the IOTWMS ESZ or with a Magnitude <M6.5
  - Bulletin Issued for M6.5 or above but USGS final solution is less than M6.2

Clarifications to Performance Reporting

Define "traffic light" target values.

	Service Level 1 EQ Bulletins					Service Level 2 Threat / No Threat Bulletins			General
TSP	KPI 1 ET First EQ Bull Target: 10 mins (% met)	KPI 2 POD EQs GE M6.8 Target: 100%	KPI 3 EQ Mag Target: 0.3 (% met)	KPI 4 EQ Depth Target: 30 km (% met)	KPI 5 EQ Location Target: 30 km (% met)	KPI 6 ET First Threat Bull Target: 20 mins (% met)	KPI 7 POD Tsunami Waves Target: 100%	KPI 8 Tsunami Height Accuracy Target: Factor of 2	KPI 9 False / Incorrect Bulletins Issued Target: 0
Meets Target	<10 min	100%	<0.3	<30 km	<30 km	<20 min	100%	50-200%	0
Near Target	10-15 min	90-100%	0.3-0.45	30-45 km	30-45 km	20-30 min		25-50% or 200-400%	1
Misses Target	>15 min	<90%	>0.45	>45 km	>45 km	>30 min	<100%	>400% or <25%	2+

Thank you

Robert Greenwood
Bureau of Meteorology
robert.greenwood@bom.gov.au

unesco
Intergovernmental
Oceanographic
Commission