2nd March 2016 Southwest of Sumatra Earthquake and Tsunami Event

Post-Event Assessment of the Performance of the Indian Ocean Tsunami Warning and Mitigation System
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UNESCO 2017
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**Supplement**

Tsunami Service Provider Bulletins and Maps
1. **INTRODUCTION**

The magnitude 7.8 earthquake that occurred to the southwest of Sumatra, Indonesia on 2\textsuperscript{nd} March 2016 met the criteria established by the IOC Working Group on Tsunami and Other Hazards Related to Sea-Level Warning and Mitigation Systems (IOC/TOWS-WG-VIII(3)) and adopted by the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWMS) to conduct a post-event assessment of the performance of the IOTWMS. These criteria are:

- One or more Tsunami Service Providers (TSP) predicted tsunami waves of at least 1 metre amplitude for one or more countries, or
- Waves of at least 1 metre amplitude were observed but not predicted by any TSP,
- Over and above this trigger level, the final decision to implement a survey should be decided by the regional Tsunami Information Centre (TIC) in consultation with the ICG Steering Group and Secretariat taking into consideration whether the tsunami resulted in a national response in one or more countries.

In the case of the 2\textsuperscript{nd} March 2016 event, three TSPs predicted tsunami waves of at least 0.5 metre amplitude resulting in a national response in two countries. The Indian Ocean Tsunami Information Centre (IOTIC), the IOTWMS Steering Group and the IOTWMS Secretariat have therefore decided to initiate a post-event performance survey.

An online post-event assessment questionnaire to evaluate the performance of the IOTWMS and to provide a benchmark of the present status of the system was circulated on 30 April 2016. The questionnaire addressed six main areas of an end-to-end warning system, including upstream and downstream components. These are:

- The IOTWMS Tsunami Service Providers (TSP)
- National Actions
- National Response
- Monitoring and Modelling
- Community Preparedness
- Capacity Development Requirements

Fourteen (58\%) IOTWMS Member States submitted responses to the ‘Post-Event Assessment Questionnaire: Southern Sumatra Tsunami, 2 March 2016’, however, only thirteen (54\%) of these responses contained responses to the questions posed in the aforementioned questionnaire.

**Table-1. Member State responses to survey**

<table>
<thead>
<tr>
<th>Member States with valid response</th>
<th>Member States without valid response</th>
<th>Member states with no response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Australia</td>
<td>1. Timor-Leste</td>
<td>1. Bangladesh</td>
</tr>
<tr>
<td>2. India</td>
<td></td>
<td>2. Comoros</td>
</tr>
<tr>
<td>3. Indonesia</td>
<td></td>
<td>3. France (Reunion)</td>
</tr>
<tr>
<td>4. Iran</td>
<td></td>
<td>4. Madagascar</td>
</tr>
<tr>
<td>5. Kenya</td>
<td></td>
<td>5. Malaysia</td>
</tr>
<tr>
<td>7. Pakistan</td>
<td></td>
<td>7. Mozambique</td>
</tr>
<tr>
<td>8. Mauritius</td>
<td></td>
<td>8. Oman</td>
</tr>
<tr>
<td>10. Singapore</td>
<td></td>
<td>10. Yemen</td>
</tr>
<tr>
<td>11. South Africa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Sri Lanka</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Tanzania</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Of the 30 mandatory questions or sub-questions, there was an average response rate of 81%.

<table>
<thead>
<tr>
<th>Member State</th>
<th>Number of Mandatory Questions Responded</th>
<th>% of Mandatory Questions Responded</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Australia</td>
<td>26</td>
<td>87%</td>
</tr>
<tr>
<td>2. India</td>
<td>25</td>
<td>83%</td>
</tr>
<tr>
<td>3. Indonesia</td>
<td>25</td>
<td>83%</td>
</tr>
<tr>
<td>4. Iran</td>
<td>24</td>
<td>80%</td>
</tr>
<tr>
<td>5. Kenya</td>
<td>24</td>
<td>80%</td>
</tr>
<tr>
<td>6. Myanmar</td>
<td>23</td>
<td>77%</td>
</tr>
<tr>
<td>7. Pakistan</td>
<td>23</td>
<td>77%</td>
</tr>
<tr>
<td>8. Mauritius</td>
<td>23</td>
<td>77%</td>
</tr>
<tr>
<td>9. Seychelles</td>
<td>24</td>
<td>80%</td>
</tr>
<tr>
<td>10. Singapore</td>
<td>20</td>
<td>67%</td>
</tr>
<tr>
<td>11. South Africa</td>
<td>27</td>
<td>90%</td>
</tr>
<tr>
<td>12. Sri Lanka</td>
<td>26</td>
<td>87%</td>
</tr>
<tr>
<td>13. Tanzania</td>
<td>27</td>
<td>90%</td>
</tr>
</tbody>
</table>

Table-2: Question response rates of countries that submitted the questionnaire

Out of these 13 countries, five (39%) countries’ NTWCs (Australia, India, Indonesia, Seychelles, and Sri Lanka) issued a tsunami warning and tsunami related information to other agencies. Only two (15%) countries (Australia, Indonesia) reported that a tsunami warning and tsunami related information was issued to the public. Only in these two countries people were evacuated.
2. **COUNTRY REPORTS**

2.1 **AUSTRALIA**

2.1.1 **Information from Tsunami Service Providers**

Australia received the first information about the earthquake from Geoscience Australia at 12:56 UTC. National Tsunami Warning Centre (NTWC) Australia received the notification message from all three TSPs. From TSP Australia via GTS, while from TSP India and Indonesia via GTS and email. No fax and SMS were reported received from the TSPs by NTWC Australia.

<table>
<thead>
<tr>
<th>TSP Australia</th>
<th>TSP India</th>
<th>TSP Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Notification</strong></td>
<td><strong>Received</strong></td>
<td><strong>Notification</strong></td>
</tr>
<tr>
<td>Message GTS</td>
<td>GTS</td>
<td>Message GTS</td>
</tr>
<tr>
<td>1: (13:06)</td>
<td>13:07</td>
<td>1: (12:56)</td>
</tr>
<tr>
<td>4: (14:58)</td>
<td>14:58</td>
<td></td>
</tr>
<tr>
<td>5: (15:06)</td>
<td>15:06</td>
<td></td>
</tr>
<tr>
<td>6: (15:59)</td>
<td>15:59</td>
<td></td>
</tr>
<tr>
<td><strong>In UTC</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table-3. NTWC Australia receipt times of TSP notification messages*
All of the three TSP’s websites were accessible by NTWC Australia. Status reports were reported to all TSPs. The Joint Australia Tsunami Warning Centre (JATWC) as NTWC submitted national status reports by using the online feedback form, which was disseminated to all TSPs. NTWC Australia also received the earthquake information from the Pacific Tsunami Warning Centre (PTWC) and the United States Geological Survey (USGS).

2.1.2 National Action

NTWC Australia also calculated the earthquake parameters as follows:

<table>
<thead>
<tr>
<th>Origin Time (UTC)</th>
<th>Location (Lat. and Long.)</th>
<th>Depth</th>
<th>Magnitude</th>
<th>Type of Mag.</th>
<th>Time UTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Estimate</td>
<td>12:49</td>
<td>5.05S; 94.37E</td>
<td>0</td>
<td>8.1</td>
<td>Mwp 12:56</td>
</tr>
<tr>
<td>2nd Estimate</td>
<td>12:49</td>
<td>4.9S; 94.23E</td>
<td>0</td>
<td>7.8</td>
<td>Mwp 13:34</td>
</tr>
</tbody>
</table>

*Table-4. Earthquake parameters calculated by NTWC Australia*

JATWC has its own capability to detect earthquake and tsunami, determine and issue national tsunami warning. JATWC initiated its Standard Operating Procedures (SOPs) based on its own earthquake information.

After receiving the first notification message, NTWC Australia took the following actions, which were independent of TSP advice:

- 13:15 ➔ Contacted WA Department of Fire and Emergency Services (DFES)
- 13:20 ➔ Contacted Australia Federal Police at Christmas Island
- 13:22 ➔ Contacted Australia Federal Police at Cocos Island

The Australian NTWC issued tsunami warning and tsunami related information to other agencies using Phone, SMS, email, Fax and others, Bureau of Meteorology public website and registered users' website for state/territory emergency authorities.

The tsunami warning and tsunami related information was sent to:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Type of Information released</th>
<th>Information released to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:12</td>
<td>Tsunami Watch for Australia</td>
<td>Public, DMO, Government and other response agencies, and Media</td>
</tr>
<tr>
<td>13:14</td>
<td>Cocos Islands Marine Warning</td>
<td></td>
</tr>
<tr>
<td>13:15</td>
<td>Christmas Island Marine Warning</td>
<td></td>
</tr>
<tr>
<td>13:17</td>
<td>Western Australia Tsunami Watch</td>
<td></td>
</tr>
<tr>
<td>13:18</td>
<td>National Tsunami Warning Summary for Australia</td>
<td></td>
</tr>
<tr>
<td>13:38</td>
<td>Western Australia Tsunami Watch Cancellation</td>
<td></td>
</tr>
<tr>
<td>15:44</td>
<td>Cocos Island Warning Cancellation</td>
<td></td>
</tr>
<tr>
<td>15:46</td>
<td>Christmas Island Warning Cancelation</td>
<td></td>
</tr>
<tr>
<td>15:53</td>
<td>Final National Warning Summary for Australia</td>
<td></td>
</tr>
<tr>
<td>16:01</td>
<td>National Tsunami Event Summary</td>
<td></td>
</tr>
</tbody>
</table>

*Table-5. Tsunami information issued by NTWC Australia*
The Australian NTWC issued tsunami warning and tsunami related information to the public without tsunami wave height forecast. The communication to the public was done through: Public radio; Public television; Twitter; RSS; Website; Police; and door to door announcement.

The Australian NTWC and Disaster Management Organisation (DMO) also communicated the tsunami warning and tsunami related information to the Media (television and radio) especially to National Broadcaster (Australian Broadcasting Corporation, ABC) and commercial radio stations; all major free-to-air television networks, as well as Sky News Australia. The information was sent via email and fax. Information broadcasted by the media was breaking news and running text on television. ABC recorded a post event interview with NTWC staff.

The warning was cancelled at 15:46 because no waves were observed above the national tsunami warning threshold for 2 hours after the expected arrival time. The cancellation was communicated via email, fax, Bureau of Meteorology (BoM) public website, GTS and Twitter.

The only problems they are having was the 1300 TSUNAMI telephone service (recorded messages) was not working. Both the mobile phone network and the public website functioned normally with no issue of being overloaded or broken.

2.1.3 National Response

Australia has formal national SOP for tsunami response. The National Disaster Management Organization (NDMO) is not the authority for emergency response, each state and territory has its own emergency response authority for leading emergency response at the jurisdictional level. Throughout the event there was communication via telephone between JATWC and responsible DMOs, and between JATWC and NDMO (Australian Government Crisis Coordination Centre or AGCCC).

There were actions taken by the local DMOs, however, the time of the actions was not reported. In Christmas Island two Australia Federal Police (AFP) officers were dispatched to a clear people from the frequented beach areas and residents of Kampong (a Malay community on the waterfront at Flying Fish Cove) were briefed and encouraged to remain indoors. In Cocos Islands, the warning was broadcasted over VHF radio encouraging recreational boaters to move away from the harbour limits and to advise personnel in the water to clear the area. In both islands (Christmas Island and Cocos Islands) there was no communication with the NDMO other than standard reporting lines within the AFP organisation. In Western Australia, the Department of Fire and Emergency Services (DFES) situation analysis officer began upward reporting procedures but the tsunami watch was cancelled before this was completed.

There were beach and immediate foreshore evacuations in both Christmas and Cocos Islands, but the time of evacuation was not reported. In Christmas Island less than five persons were evacuated from Flying Fish Cove, Lily Beach, and Ethel Beach (beach and immediate foreshore areas only). In Cocos Islands less than five people were also evacuated from the harbour and beaches. Although there was no inundation map available for the evacuation area, the evacuation went smoothly due to only staying away from the immediate foreshore evacuation being required for Marine Warning.

2.1.4 Monitoring and Modelling

During the event sea level data was monitored by the NTWC. The sea level stations monitored included: Cocos Island; Christmas Island; DART 23401; DART 56001; and DART 56003. All stations were monitored via GTS and the JATWC sea-level-data visualization tool. The sea level station at Tanahbala was monitored though the IOC sea level monitoring facility. No numerical model tsunami scenarios (deep-ocean propagation or coastal inundation models) were used during the event.

2.1.5 Community Preparedness

On the scientifically assessed level of tsunami hazard, level of community awareness of the hazard, and level of pre-existing community tsunami preparedness of the five main communities affected by the event (ranking 0=none to 4=very high).
<table>
<thead>
<tr>
<th></th>
<th>Level of scientifically known tsunami hazard</th>
<th>Level of Community Awareness of the known tsunami hazard</th>
<th>Level of tsunami preparedness before the event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocos Islands</td>
<td>4</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Christmas Island</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Western Australia</td>
<td>4</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

**Table-6.** Community awareness and preparedness in Australia

There have been community preparedness activities prior to the event in these area:

<table>
<thead>
<tr>
<th></th>
<th>Tsunami Education in Schools</th>
<th>Shelter Facilities</th>
<th>Tsunami Exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocos Islands</td>
<td>x</td>
<td>x</td>
<td>IOWave14</td>
</tr>
<tr>
<td>Christmas Island</td>
<td>x</td>
<td></td>
<td>IOWave14</td>
</tr>
<tr>
<td>Western Australia</td>
<td>x</td>
<td></td>
<td>IOWave14</td>
</tr>
</tbody>
</table>

**Table-7.** Community preparedness activities in Australia

There was government support to these areas in the form of hazard mapping.

2.1.6 Capacity Development Requirement

In regard to training and other assistance from IOC, the representative of the DMOs of the three areas was involved in the IOTWMS SOP workshop in May 2016. In addition, there will also be national initiatives for further SOP training.

2.1.7 Other information

1. The questions do not suit countries like Australia, where NTWC has independent capability to TSP, NDMO is not responsible for issuing warnings (NTWC/JATWC authority) or emergency response (DMOs at regional level are the authorities).

2. In the questionnaire, there is a need for place/space for general comments to ensure to be able to capture valuable information.

3. In the preparedness section there is a need to differentiate between public and government response agencies (i.e. possible to have well prepared authorities initiate and guide community responses, while community themselves not necessarily aware and prepared).

4. In Section C Q4 of the questionnaire, even if the answer is yes, NDMO in Australia does not convey or provide guidance to DMOs at regional/local level.

5. In options for response, the NTWCs capability to monitor sea level should be recognized.
2.2 INDIA

2.2.1 Information from Tsunami Service Providers

India received the first information about the earthquake from Indian Tsunami Early Warning Centre at 12:56 UTC. NTWC India received the notification message from all three TSPs via email, fax, GTS and SMS. Receipt times of the first notification messages were at 13:07 from TSP Australia, at 12:56 from TSP India, and at 13:21 from TSP Indonesia. All notification messages were received at the following times:

<table>
<thead>
<tr>
<th>TSP Australia</th>
<th>Notification Message</th>
<th>Received GTS</th>
<th>Received Email</th>
<th>Received SMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4: (14:58)</td>
<td>15:03</td>
<td>14:58</td>
<td>14:58</td>
<td></td>
</tr>
<tr>
<td>5: (15:06)</td>
<td>15:09</td>
<td>15:06</td>
<td>15:12</td>
<td></td>
</tr>
<tr>
<td>6: (15:59)</td>
<td>16:04</td>
<td>15:59</td>
<td>03:36 (+1)</td>
<td></td>
</tr>
<tr>
<td>7: (16:57)</td>
<td>17:04</td>
<td>16:58</td>
<td>03:37 (+1)</td>
<td></td>
</tr>
</tbody>
</table>

In UTC

Table-8. NTWC India receipt times of TSP Australia notification messages

No information received by fax from TSP Australia was reported.

<table>
<thead>
<tr>
<th>TSP India</th>
<th>Notification Message</th>
<th>Received GTS</th>
<th>Received Fax</th>
<th>Received Email</th>
<th>Received SMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: (12:56)</td>
<td>13:03</td>
<td>12:58</td>
<td>15:26</td>
<td>12:59</td>
<td></td>
</tr>
</tbody>
</table>

In UTC

Table-9. NTWC India receipt times of TSP India notification messages
No information received by email and SMS from TSP Indonesia was reported. All of the three TSP websites were accessible by NTWC India. No status reports were reported by NTWC India to the TSPs. NTWC India also did not receive earthquake information from other sources.

2.2.2 National Action

NTWC India calculated the earthquake parameters as follows:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Origin Time (UTC)</th>
<th>Location (Lat. and Long.)</th>
<th>Depth</th>
<th>Magnitude</th>
<th>Type of Mag</th>
<th>Time (UTC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Estimate</td>
<td>12:49</td>
<td>5.06S; 94.17E</td>
<td>10</td>
<td>7.9</td>
<td>M</td>
<td>12:52</td>
</tr>
<tr>
<td>2nd Estimate</td>
<td>12:49</td>
<td>4.87S; 94.17E</td>
<td>22</td>
<td>7.8</td>
<td>Mw (mB)</td>
<td></td>
</tr>
</tbody>
</table>

Table-11. Earthquake parameters calculated by NTWC India

There was no action taken before receiving information message from TSPs. After receiving the first notification message, NTWC Australia took the following actions independent of TSP advice:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Type of Information released</th>
<th>Information released to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:55</td>
<td>1st Bulletin with earthquake Information and qualitative tsunami threat information</td>
<td>National, Provincial and District Disaster Management Authorities</td>
</tr>
<tr>
<td>13:02</td>
<td>2nd Bulletin with No-Threat for India</td>
<td></td>
</tr>
<tr>
<td>15:17</td>
<td>Final bulletin with No-Threat for India and updated sea level information</td>
<td></td>
</tr>
</tbody>
</table>

Table-12. Tsunami information issued by NTWC India
The Indian NTWC issued tsunami warning and tsunami related information to other agencies using Phone, SMS, email, Fax and website.

The Indian NTWC did not issue tsunami warning and tsunami related information to the public.

The Indian NTWC and DMO are responsible to communicate to the media. The National Media House was informed of the tsunami warning and tsunami related information. The information was shared by telephone, SMS and website. Information broadcasted by the media was breaking news and running text in television at 13:05 UTC.

There was no warning issued in India as there was no threat, the final bulletin was issued at 15:17 UTC via website, SMS, Fax and email.

2.2.3 National Response

India has formal national SOPs for tsunami response but no action was taken. There was communication between the NTWC and NDMO. INCOIS maintained communication with DMO and MHA during the event. The NDMO also maintained communication with local/regional DMO to convey message and guidance/instruction. No action was required to be taken by the local/regional DMO.

There was no evacuation during the event.

2.2.4 Monitoring and Modelling

During the event sea level data was monitored by the NTWC. The sea level stations monitored included: Tanahbala; Cocos Island; and Christmas Island. The stations were monitored through IOC Sea level monitoring facility and the Indian Tsunami Early Warning Centre (ITEWC) has its own software for accessing, acquiring and analysis of national and international sea level stations.

The Indian NTWC uses tsunami numerical model for estimation of threat level.

2.2.5 Community Preparedness

There was no community evacuation during the event. However, there have been community preparedness activities prior to the event in the vulnerable communities in coastal provinces in India through participatory evacuation planning, evacuation maps, shelter facilities as well as exercises in IOWave09, IOWave11, and IOWave14. There was also government support to the vulnerable communities in coastal provinces in form of vertical evacuation shelters, hazard mapping and evacuation route mapping.

2.2.6 Capacity Development Requirement

In regard to training events and other assistance from IOC, the NTWC, NDMO, and other response agency would like to have media awareness training; community awareness and preparedness training, exercise and drills training and standard operating procedures training.

2.3 INDONESIA

2.3.1 Information from Tsunami Service Providers

Indonesia received the first information about the earthquake from the detection and analysis of its SeisComP3 system at 12:52 UTC. NTWC Indonesia also received the notification message from all three TSPs: TSP Australia at 13:07, TSP India at 12:58 and TSP Indonesia at 13:21. The notification messages were received via GTS and email. Subsequent notification message were as follows:
All of the TSP’s websites were accessible to NTWC Indonesia. No status reports were sent to the TSPs. NTWC Indonesia also did not receive earthquake information from other sources.

2.3.2 National Action

NTWC Indonesia calculated the earthquake parameters, but the survey did not request information on the estimation details. There was also action taken before receiving TSP messages, but no detail information was requested in the survey.

After receiving the first notification message, NTWC Indonesia took the following actions:

- 12:55  NTWC update earthquake parameter, Estimation Tsunami Arrival (ETA) and Estimation Wave Height (EWH)
- 13:00  NTWC disseminate bulletin 2
- 14:18  TSP Indonesia disseminate bulletin 2

The Indonesian NTWC issued tsunami warning and tsunami related information to other agencies using SMS, email, Fax, warning receiver system (WRS), website, GTS, and social media (Facebook and Twitter). The tsunami warning and tsunami related information was sent to:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Type of Information released</th>
<th>Information released to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:54</td>
<td>Bulletin 1</td>
<td>NDMO, LDMO, Media at national and local level</td>
</tr>
<tr>
<td>13:00</td>
<td>Bulletin 2</td>
<td></td>
</tr>
<tr>
<td>15:31</td>
<td>Bulletin 3</td>
<td></td>
</tr>
<tr>
<td>15:33</td>
<td>Bulletin 4</td>
<td></td>
</tr>
</tbody>
</table>

Table-14. Tsunami information issued by NTWC Indonesia
The Indonesian NTWC issued a tsunami warning and tsunami related information to the public without providing a tsunami wave height forecast. The communication to the public was done through telephone, SMS, cell phone broadcast, public radio; public television; Twitter; website; sirens; public announcement system; police; and Warning Receiver System (WRS).

Information released to the public was:

<table>
<thead>
<tr>
<th>Type information released to the public</th>
<th>Issued by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press conference to the media</td>
<td>NTWC (BMKG Headquarter)</td>
</tr>
<tr>
<td>Press conference to the BMKG website</td>
<td>NTWC (BMKG Headquarter)</td>
</tr>
<tr>
<td>Live interview via television</td>
<td>NTWC (BMKG Headquarter and BMKG Regional)</td>
</tr>
<tr>
<td>Live interview via radio</td>
<td>NTWC (BMKG Headquarter and BMKG Regional)</td>
</tr>
<tr>
<td>Answering question related the event</td>
<td>NTWC (BMKG Headquarter and BMKG Regional)</td>
</tr>
<tr>
<td>via telephone</td>
<td></td>
</tr>
</tbody>
</table>

Table-15. Public tsunami information issued by NTWC Indonesia

The Indonesian NTWC and DMO also communicated the tsunami warning and tsunami related information to the media (television and radio). The media that received information from the NTWC were: TRANS7; MNC; TRANSTV; RCTI; NET-TV; ANTV; TV ONE; GLOBAL TV; METRO TV; INDOSIAR; TVRI; KOMPAS; I-NEWS; and SCTV. The information was sent via email, fax, SMS, WRS, website, and social media. The time of the first broadcast was 13:05 UTC. The types of broadcasts included stop press; breaking news; running text; press conference; and live interview.

The warning was cancelled at 15:33 UTC because the detected sea level observation at Cocos Island (14:15 UTC) was 0.1 m and at Padang (14:40 UTC) was 0.05 m. This condition triggered the decision to issue the final bulletin. The final bulletin was sent via SMS, email, Fax, WRS, website, and social media.

2.3.3 National Response

Indonesia does not have formal national SOPs for tsunami response. However, there are actions taken by the NDMO:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Action Taken by NDMO</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:12</td>
<td>Received Bulletin 1 from NTWC</td>
</tr>
<tr>
<td>12:55</td>
<td>NDMO contacted the Local DMO in Mentawai, West Sumatra; Aceh and Lampung to confirm the occurrence of the earthquake, to confirm victims of the earthquake, the damage area and community reaction.</td>
</tr>
<tr>
<td>13:01</td>
<td>Received Bulletin 2 from NTWC</td>
</tr>
<tr>
<td>15:31</td>
<td>Received Bulletin 3 from NTWC</td>
</tr>
<tr>
<td>15:33</td>
<td>Received Bulletin 4 from NTWC</td>
</tr>
</tbody>
</table>

Table-16. Actions taken by NDMO Indonesia
There was no communication maintained between the NDMO and the NTWC during the event. However, the NDMO maintained communication with the local DMO to provide information and guidance/instruction.

There was action taken by the local disaster management office:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Action Taken by LDMO</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:50</td>
<td>Local DMO of Padang Panjang contacted the BMKG regional office on the earthquake parameters</td>
</tr>
<tr>
<td>12:55</td>
<td>Received Bulletin 1 from NTWC</td>
</tr>
<tr>
<td>12:56</td>
<td>Received information from the NTWC via WhatsApp, and WRS</td>
</tr>
<tr>
<td>13:00</td>
<td>Received Bulletin 2 from NTWC</td>
</tr>
<tr>
<td>13:10</td>
<td>Disseminate information and guidance to the community to evacuate via Siren and Radio</td>
</tr>
<tr>
<td>15:58</td>
<td>Teleconference with local DMO</td>
</tr>
<tr>
<td>15:31</td>
<td>Received Bulletin 3 from NTWC</td>
</tr>
<tr>
<td>15:33</td>
<td>Received Bulletin 4 from NTWC</td>
</tr>
<tr>
<td>15:40</td>
<td>Guide the community to return based on the cancelation message from NTWC</td>
</tr>
<tr>
<td>17:54</td>
<td>Update the real condition in the community</td>
</tr>
</tbody>
</table>

**Table-17. Actions taken by LDMO Indonesia**

There were also evacuations by the community as follows:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Area Evacuated</th>
<th>Estimated Number of People Evacuated</th>
</tr>
</thead>
<tbody>
<tr>
<td>19:50</td>
<td>Kecamatan Bungus Teluk Kabung</td>
<td>44% of Population</td>
</tr>
<tr>
<td>19:50</td>
<td>Kecamatan Nanggola</td>
<td>44% of Population</td>
</tr>
<tr>
<td>19:50</td>
<td>Kecamatan Padang Utara</td>
<td>50% of Population</td>
</tr>
<tr>
<td>19:50</td>
<td>Kecamatan Koto Tangah</td>
<td>23% of Population</td>
</tr>
<tr>
<td>19:50</td>
<td>Desa Tuapejat dan Dusun Mapadegat (Sipora Utara)</td>
<td>80% of Population</td>
</tr>
<tr>
<td>20:49</td>
<td>Siberut Selatan (Muara Siberut)</td>
<td>50% of Population</td>
</tr>
<tr>
<td>20:49</td>
<td>Siberut Tengah (Saibi)</td>
<td>80% of Population</td>
</tr>
<tr>
<td>20:49</td>
<td>Siberut Utara (Sikabaluan)</td>
<td>50% of Population</td>
</tr>
<tr>
<td>20:49</td>
<td>Siberut Barat (Betaet)</td>
<td>0% of Population</td>
</tr>
<tr>
<td>20:49</td>
<td>Siberut Barat Daya (Pepei dan Katurei)</td>
<td>90% of Population</td>
</tr>
</tbody>
</table>

**Table-18. Community evacuations in Indonesia**
It was reported that there were inundation maps available for the evacuated areas created by AIFDR/PVMBG; however the local people do not have the inundation map yet.

The evacuation reported went smoothly and there were self-evacuation before the warning was issued. Areas that self-evacuated were:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Area Evacuated</th>
<th>Estimated Number of People Evacuated</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:50</td>
<td>Desa Tuapejat dan Dusun Mapadegat (Sipora Utara)</td>
<td>80% from population</td>
</tr>
<tr>
<td>12:50</td>
<td>Desa Sioban (Sipora Selatan)</td>
<td>90% from population</td>
</tr>
<tr>
<td>12:50</td>
<td>Desa Bosua (Sipora Selatan)</td>
<td>90% from population</td>
</tr>
<tr>
<td>12:50</td>
<td>Kecamatan Sikakap (Desa Sikakap dan Taikako)</td>
<td>65% from population</td>
</tr>
<tr>
<td>12:50</td>
<td>Kecamatan Pagai Utara (Desa Saumanganyak, Desa Betumonga, Desa Silabu)</td>
<td>65% from population</td>
</tr>
<tr>
<td>12:50</td>
<td>Kecamatan Pagai Selatan (Desa Malakopak)</td>
<td>75% from population</td>
</tr>
</tbody>
</table>

Table-19. Self-evacuations in Indonesia

2.3.4 Monitoring and Modelling

During the event sea level data was monitored by the NTWC. The sea level stations monitored included: Cocos Island; Christmas Island; Tanahbala; Padang; Teluk Dalam; Meluaboh; Seblat; Sabang; and Colombo. All of these were monitored through the IOC Sea level monitoring facility. The station in Tanahbala; Padang; Teluk Dalam Christmas Island; Selat; and Sabang were also monitored via the BIG sea level website.

The Indonesian NTWC also used numerical model tsunami scenario (deep-ocean propagation and/or coastal inundation models) during the event, among other Model Tsunami Easywave based on tsunami deep-ocean propagation.

2.3.5 Community Preparedness

On the scientifically assessed level of tsunami hazard, level of community awareness of the hazard and level of pre-existing community tsunami preparedness of the five main community affected by the event (ranking 0=none and 4=very high).

<table>
<thead>
<tr>
<th>Community</th>
<th>Level of scientifically known tsunami hazard</th>
<th>Level of Community Awareness of the known tsunami hazard</th>
<th>Level of tsunami preparedness before the event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mentawai Island</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Padang</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Table-20. Community awareness and preparedness in Indonesia
There have been community preparedness activities prior to the event in these area:

<table>
<thead>
<tr>
<th>Community</th>
<th>Tsunami Education in Schools</th>
<th>Participatory Evacuation Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mentawai Island</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Padang</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

Table-21. Community preparedness activities in Indonesia

There were also government support to these areas in form of tsunami signage, vertical evacuation, hazard mapping and evacuation route mapping.

2.3.6 Capacity Development Requirement

In regard to training events and other assistance from IOC, the training needs include seismic training; sea level training; risk assessment training; standard operating procedure training, inundation modelling training; media awareness training; community awareness training; and exercise and drills training.

2.3.7 Joint Rapid Assessment

On 2nd March 2016 around 2:00pm local time a strong earthquake felt around West Sumatra and Bengkulu. The earthquake was significant enough to trigger the Indonesian Tsunami Warning System. A rapid assessment was conducted on a participatory and voluntary-basis by the various agencies involved in the development of the Indonesian Tsunami Warning System, from start to finish. The rapid assessment was developed into a detailed study which finalized into a report one year later. This allowed for better understanding of the challenges and improvements achieved in the InaTEWS. The report is acknowledged as one of its kind to date.

The assessment team comprised of over 20 institutions, and involved more than 70 scientists and DRR practitioners in Indonesia, with various resources support. The team was divided into five groups, which were tasked to assess the National Tsunami Warning Center (BMKG), National Disaster Management Agency (BNPB), Local Disaster Management Agency (BPBD), National Media, and Community Responses. The assessment aimed to assess whether the Indonesian Tsunami Warning System had effectively responded to the 2nd March 2016 event.

Unlike previous assumptions, the challenges identified from the assessment were not only in the downstream or culture part of the system, but also at the earliest process, in the upstream. The earthquake source was later identified as the Wharton-basin earthquake, magnitude 8.3, 10 km depth, with epicenter around 682 km Southwest Mentawai Island, West Sumatra. The epicenter was beyond the Sunda trench, and not included in the warning center's scenario database. The warning was put out in less than 5 minutes, in accordance with the current SOP. However, the outputs of the warning product had generated confusion as well as created panic and misinterpretations, including via the national televisions and social media.

The achievements include the consistent services that the NTWC maintained, for e.g. launching bulletin 1 (Peringatan Dini 1) in less than 5 minutes. However due to the events for this particular scenario the NTWC did not have enough time to provide the necessary information on which area is exposed to tsunami threats and therefore needs to be evacuated. Other achievements include the success of self-evacuations conducted in the Mentawai Islands that had previously experienced the 2010 Mentawai tsunamis. The evacuations were encouraged through an automatic broadcast of warning through SMS directly to the local communities who have access to Telkomsel mobile network. However in other part of the island, including Sipora, the capital of the district, the mobile network was disturbed, hence the communities in this island had to rely on other sources, for e.g.
siren and warning through television, which were received extremely late, i.e. around one hour after the event.

2.4 IRAN

2.4.1 Information from Tsunami Service Providers

Iran received the first information about the earthquake by email at 12:56 UTC. NTWC Iran received the notification message from all three TSPs: TSP Australia at 13:07, TSP India at 12:56 and TSP Indonesia at 13:21. NTWC Iran received the notification messages via email only. The subsequent notification messages were received as follows:

<table>
<thead>
<tr>
<th>TSP Australia</th>
<th>TSP India</th>
<th>Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notification</td>
<td>Received</td>
<td>Notification</td>
</tr>
<tr>
<td>Message</td>
<td>Email</td>
<td>Message</td>
</tr>
<tr>
<td>4: (14:58)</td>
<td>14:58</td>
<td></td>
</tr>
<tr>
<td>5: (15:06)</td>
<td>15:06</td>
<td></td>
</tr>
<tr>
<td>6: (15:59)</td>
<td>15:59</td>
<td></td>
</tr>
<tr>
<td>7: (16:57)</td>
<td>16:57</td>
<td></td>
</tr>
</tbody>
</table>

*In UTC*

Table 22. NTWC Iran receipt times of TSP notification messages

All of the three TSP’s websites were accessible by NTWC Iran. No status reports were submitted to the TSPs. NTWC Iran also did not receive any information on the earthquake from other sources.

2.4.2 National Action

NTWC Iran did not calculate the earthquake parameters at the national level, and there was no action taken before or after receiving TSP notification messages. No tsunami warning and tsunami related information was sent to the public.

2.4.3 National Response

Iran does have formal national SOPs for tsunami response. However, there was no action taken by the NDMO and no evacuation by the community.

2.4.4 Monitoring and Modelling

No sea level data were monitored and no tsunami scenario numerical model was used by the NTWC. The NTWC knows how to monitor the IOC seal level facility.

2.4.5 Community Preparedness

No communities were affected by this event.
2.4.6 Capacity Development Requirement

In regard to training events and other assistance from IOC, some of the training needs include seismic training; sea level training; risk assessment training; SOP training, inundation modelling training; media awareness training; community awareness training; and exercise and drills training.

2.5 KENYA

2.5.1 Information from Tsunami Service Providers

Kenya received the first information about the earthquake by email from the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES) at 12:49 UTC. NTWC Kenya also received the notification messages from TSP Australia and TSP Indonesia via email only. No notification messages were received from TSP India. The subsequent notification messages were received as follows:

<table>
<thead>
<tr>
<th>TSP Australia</th>
<th>TSP Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notification Message</td>
<td>Received Email</td>
</tr>
<tr>
<td>1: (13:06)</td>
<td>13:21</td>
</tr>
<tr>
<td>2: (13:25)</td>
<td>14:19</td>
</tr>
<tr>
<td>4: (14:58)</td>
<td>15:53</td>
</tr>
<tr>
<td>5: (15:06)</td>
<td></td>
</tr>
<tr>
<td>6: (15:59)</td>
<td></td>
</tr>
<tr>
<td>7: (16:57)</td>
<td></td>
</tr>
</tbody>
</table>

*In UTC*

Table-23. NTWC Kenya receipt times of TSP notification messages

All of the three TSP’s websites were accessible by NTWC Kenya. No status reports were submitted to the TSPs with the comments ‘systems partially down on our side’. NTWC Kenya also received information on the earthquake from RIMES.

2.5.2 National Action

NTWC Kenya did not calculate the earthquake parameters at the national level. After receiving the first notification message, NTWC Kenya sent information to the National Oceanographic Data Centre (NODC) after all notification messages: 13:25 UTC; 14:28 UTC; 15:58 UTC; and 16:24 UTC. No tsunami warning and tsunami related information was sent to other agencies or the public.

2.5.3 National Response

Kenya does not have formal national SOPs for tsunami response. There were no actions taken by the NDMO. There were no evacuations by the community.
2.5.4 Monitoring and Modelling

No sea level data were monitored and no tsunami scenario numerical models were used by the NTWC. The NTWC know how to monitor sea level data using Tide Tool.

2.5.5 Community Preparedness

No communities were affected by this event.

2.5.6 Capacity Development Requirement

In regard to training events and other assistance from IOC, some of the training needs include seismic training; sea level training; risk assessment training; SOP training, inundation modelling training; media awareness training; community awareness training; and exercise and drills training.

2.6 MAURITIUS

2.6.1 Information from Tsunami Service Providers

Mauritius received the first information about the earthquake from TSP India at 13:01 UTC. NTWC Mauritius also received the notification message from TSP Australia at 13:08 UTC and TSP Indonesia at 13:21. The subsequent notification messages were received as follows:

<table>
<thead>
<tr>
<th>TSP Australia</th>
<th>TSP India</th>
<th>TSP Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notification Message</td>
<td>Received GTS</td>
<td>Received Fax</td>
</tr>
<tr>
<td>4: (14:58)</td>
<td>14:58</td>
<td>15:00</td>
</tr>
<tr>
<td>5: (15:06)</td>
<td>15:06</td>
<td>15:44</td>
</tr>
<tr>
<td>6: (15:59)</td>
<td>15:59</td>
<td>16:13</td>
</tr>
<tr>
<td>7: (16:57)</td>
<td>16:57</td>
<td>17:01</td>
</tr>
</tbody>
</table>

*Table-24. NTWC Mauritius receipt times of TSP notification messages*

Note: Notification messages for this event from all TSPs were also available through emails and fax. However, the reception times have not been logged.

All of the three TSP's websites were accessible by NTWC Mauritius. No status reports were submitted to the TSPs. NTWC Mauritius also received information on the earthquake from the California Integrated Seismic Network (CISN).

2.6.2 National Action

NTWC Mauritius did not calculate the earthquake parameters at the national level, and no action was taken before receiving TSP messages. After receiving the first notification message, NTWC Mauritius undertook the following actions:
<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Action Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:10</td>
<td>Accessed the TSP websites</td>
</tr>
<tr>
<td>13:15</td>
<td>Director Meteorological Services &amp; NTWC informed</td>
</tr>
<tr>
<td>13:17</td>
<td>National Disaster Risk Reduction and Management Center informed</td>
</tr>
<tr>
<td>13:20</td>
<td>Started monitoring of tide gauges</td>
</tr>
<tr>
<td>13:20</td>
<td>Continue receipt of messages from TSPs</td>
</tr>
<tr>
<td>13:20</td>
<td>Earthquake information to NDRMC</td>
</tr>
<tr>
<td>15:40</td>
<td>Tsunami watch bulletin issued to NDRRMC</td>
</tr>
<tr>
<td>16:30</td>
<td>Special communique for state of sea</td>
</tr>
<tr>
<td>17:15</td>
<td>No tsunami Bulletin (End of Tsunami Watch)</td>
</tr>
</tbody>
</table>

**Table-25. Actions taken by NTWC Mauritius**

No tsunami warning and tsunami related information was sent to other agencies or the public.

### 2.6.3 National Response

Mauritius has formal national SOPs for tsunami response. There were actions taken by the national disaster management office.

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Action Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>15:40</td>
<td>National Emergency Operation Command (NEOC) Level 1 activated</td>
</tr>
<tr>
<td>15:40</td>
<td>Coordination with Police Information and Operation Room</td>
</tr>
<tr>
<td>15:40</td>
<td>Coordination with and advised the National Coast Guard to be on alert and to liaise with its post in Mauritius, Rodrigues St. Brandon and Agalega</td>
</tr>
<tr>
<td>16:34</td>
<td>Liaise with Ministries of Fisheries</td>
</tr>
<tr>
<td>16:34</td>
<td>Liaise with Ministry of Tourism</td>
</tr>
<tr>
<td>16:34</td>
<td>Liaise with Police Operation Room and office of the Chief Executive, Port Mathurin, Rodrigues</td>
</tr>
<tr>
<td>16:36</td>
<td>Liaise with Port Authority</td>
</tr>
</tbody>
</table>

**Table-26. Actions taken by NDMO Mauritius**

The NDMO maintained communication with the NTWC via regular debriefs and telephone updates. The NDMO also maintained communication with the LDMO to convey guidance and instruction. There were no evacuations by the community.
2.6.4 Monitoring and Modelling
NTWC monitored the sea level data in Cocos Island and Christmas Island via Tide Tool and IOC Sea Level Monitoring Facility.

2.6.5 Community Preparedness
No communities were affected by this event.

2.6.6 Capacity Development Requirement
In regard to training events and other assistance from IOC, some of the training needs include seismic training; sea level training; risk assessment training; SOP training, inundation modelling training; media awareness training; community awareness training; and exercise and drills training.

2.6.7 Other information
This earthquake did not generate widespread destructive tsunami waves. Consequently, the tsunami watch bulletin was targeted to only the National Disaster Risk Reduction and Management Council (NDRRMC). However, some information on the event was given to radio broadcasters to reassure the population that there was no destructive tsunami.

2.7 MYANMAR

2.7.1 Information from Tsunami Service Providers
Myanmar received the first information about the earthquake from Earthquake Data Processing of SeisComP3 System at 12:55 UTC. NTWC Myanmar also received the notification message from TSP Australia, TSP India, and TSP Indonesia. The subsequent notification messages were received as follows:

<table>
<thead>
<tr>
<th></th>
<th>TSP Australia</th>
<th>TSP India</th>
<th>TSP Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notification</td>
<td>Received</td>
<td>Received</td>
<td>Received</td>
</tr>
<tr>
<td>Message</td>
<td>Fax</td>
<td>Email</td>
<td>Message</td>
</tr>
<tr>
<td>4: (14:58)</td>
<td>14:58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5: (15:06)</td>
<td>16:20</td>
<td>15:06</td>
<td></td>
</tr>
<tr>
<td>6: (15:59)</td>
<td>16:21</td>
<td>15:59</td>
<td></td>
</tr>
<tr>
<td>7: (16:57)</td>
<td>17:16</td>
<td>18:57</td>
<td></td>
</tr>
</tbody>
</table>

| In UTC |

Table-27. NTWC Myanmar receipt times of TSP notification messages

All of the three TSP’s websites were accessible by NTWC Myanmar. No status reports were submitted to the TSPs. NTWC Myanmar also received information on the earthquake from RIMES
and other website such as USGS, Geo Forschungs Zentrum (GFZ), and European-Mediterranean Seismological Centre (EMSC).

2.7.2 National Action

NTWC Myanmar calculated the earthquake parameter at the national level as follows:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Action Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:49:47</td>
<td>Check the RTSP India (bulletin 2) for tsunami threat country and area</td>
</tr>
<tr>
<td>12:49:48</td>
<td>Check the RTSP Australia (bulletin 2)</td>
</tr>
<tr>
<td>12:49:48</td>
<td>Check the RTSP Indonesia (bulletin 2) for potential tsunami threat in India Ocean</td>
</tr>
<tr>
<td>12:55:00</td>
<td>Check the RTSP Australia (bulletin 4 and 5)</td>
</tr>
<tr>
<td>13:03</td>
<td>Check the RTSP India (bulletin 2) for tsunami threat country and area</td>
</tr>
<tr>
<td>13:25</td>
<td>Check the RTSP Australia (bulletin 2)</td>
</tr>
<tr>
<td>14:19</td>
<td>Check the RTSP Indonesia (bulletin 2) for potential tsunami threat in India Ocean</td>
</tr>
<tr>
<td>14:35</td>
<td>Check the all of RTSP information, Earthquake parameter, focal mechanism</td>
</tr>
<tr>
<td>14:50</td>
<td>Check the sea level data</td>
</tr>
<tr>
<td>15:22</td>
<td>Check the RTSP India (bulletin 3)</td>
</tr>
<tr>
<td>15:48</td>
<td>Check the RTSP Indonesia (bulletin 3 and 4)</td>
</tr>
<tr>
<td>15:53</td>
<td>Check the RTSP Indonesia (bulletin 3 and 4)</td>
</tr>
<tr>
<td>15:59</td>
<td>Check the RTSP Australia (bulletin 6)</td>
</tr>
<tr>
<td>18:57</td>
<td>Check the RTSP Australia (bulletin 7)</td>
</tr>
</tbody>
</table>

Table-28. Earthquake parameters calculated by NTWC Myanmar

Table-29. Actions taken by NTWC Myanmar

No tsunami warning and tsunami related information was issued to other agencies or the public.

2.7.3 National Response

Myanmar has formal national SOPs for tsunami response. There were actions taken by the NDMO. There were no evacuations by the community.
2.7.4 Monitoring and Modelling

The NTWC monitored the sea level data at Sabang Station, Port Blair, Sittwe, Moulmein, and Haing Gyi Kyun through the Tide Tool and the IOC Sea Level Monitoring Facility.

2.7.5 Community Preparedness

No communities were affected by this event.

2.7.6 Capacity Development Requirement

In regard to training events and other assistance from IOC, some of the training needs include seismic training; sea level training; risk assessment training; SOP training, inundation modelling training; media awareness training; community awareness training; and exercise and drills training.

2.8 PAKISTAN

2.8.1 Information from Tsunami Service Providers

NTWC Pakistan received the notification message from TSP Australia (13:07), TSP India (12:56), and TSP Indonesia (13:21). The subsequent notification messages were received as follows:

<table>
<thead>
<tr>
<th>TSP Australia</th>
<th>TSP India</th>
<th>TSP Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notification</td>
<td>Received</td>
<td>Notification</td>
</tr>
<tr>
<td>Message</td>
<td>GTS</td>
<td>Message</td>
</tr>
<tr>
<td>4: (14:58)</td>
<td>14:58</td>
<td></td>
</tr>
<tr>
<td>5: (15:06)</td>
<td>15:06</td>
<td></td>
</tr>
<tr>
<td>6: (15:59)</td>
<td>16:11</td>
<td>15:59</td>
</tr>
<tr>
<td>7: (16:57)</td>
<td>17:13</td>
<td>16:57</td>
</tr>
</tbody>
</table>

*In UTC*

Table-30. NTWC Pakistan receipt times of TSP notification messages

All of the three TSP’s websites were accessible by NTWC Pakistan. No status reports were submitted to the TSPs. NTWC Pakistan also received information on the earthquake from RIMES and other website such as USGS, GFZ, and EMSC.

2.8.2 National Action

NTWC Pakistan calculated the earthquake parameter at the national level as follows:

<table>
<thead>
<tr>
<th>Origin Time (UTC)</th>
<th>Location (Lat. and Long.)</th>
<th>Depth</th>
<th>Magnitude</th>
<th>Type of Mag.</th>
<th>Time UTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:49:48</td>
<td>5.04 S; 94.36 E</td>
<td>10 km</td>
<td>7.2</td>
<td>Mb</td>
<td>13:07</td>
</tr>
</tbody>
</table>

Table-31. Earthquake parameters calculated by NTWC Pakistan
No actions were taken before receiving information from the TSPs.
After receiving the notification message from the TSPs the NTWC Pakistan undertook the following actions:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Action Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:14</td>
<td>Earthquake parameters sent to the responsive authorities through SMS</td>
</tr>
</tbody>
</table>

Table-32. Actions taken by NTWC Pakistan

No tsunami warning and tsunami related information was issued to other agencies or the public.

2.8.3 National Response
Pakistan has formal national SOPs for tsunami response. There were no actions taken by the NDMO. The NDMO maintained communication with the NTWC via telephone contact. There was also communication to the LDMO via telephone to convey information. There was no evacuation by the community.

2.8.4 Monitoring and Modelling
NTWC monitored the sea level data in Cocos and Christmas Island using the IOC Seal Level Monitoring Facility.

2.8.5 Community Preparedness
No communities were affected by this event.

2.8.6 Capacity Development Requirement
In regard to training events and other assistance from IOC, some of the training needs includes seismic training; sea level training; risk assessment training; SOP training, inundation modelling training; media awareness training; community awareness training; and exercise and drills training.

2.9 SEYCHELLES

2.9.1 Information from Tsunami Service Providers
Seychelles received the first information about the earthquake from the TSP India at 12:56 UTC. NTWC Seychelles also received the notification message from TSP Australia (13:06), TSP India (12:56), and TSP Indonesia (13:19). The subsequent notification messages were received as follows:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>TSP Australia</th>
<th>TPS India</th>
<th>TSP Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Notification Message</td>
<td>Received GTS</td>
<td>Received Email</td>
</tr>
</tbody>
</table>
Table-33. NTWC Seychelles receipt times of TSP notification messages

All of the three TSP’s websites were accessible by NTWC Seychelles. No status reports were submitted to the TSPs. NTWC Seychelles also received information on the earthquake from TV Channel CNN.

2.9.2 National Action

NTWC Seychelles did not calculate the earthquake parameters at the national level and no action were taken before receiving information from the TSPs.

After receiving the notification message from the TSP, the NTWC Seychelles undertook the following actions:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Action Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:55</td>
<td>Contacted the head of Early Warning, the Director of National Meteorological Services (NMS) and the Division of Risk and Disaster Management</td>
</tr>
<tr>
<td>14:40</td>
<td>Sent out an advisory</td>
</tr>
</tbody>
</table>

Table-34. Actions taken by NTWC Seychelles

A tsunami warning and tsunami related information was issued to the Division of Risk and Disaster management (DRDM), media (television and radio) on the advisory of the threat at 14:40 UTC by phone, email and fax. No tsunami warning and tsunami related information was sent to other agencies or the public.

The warning was cancelled at 3:00 UTC +1 (3rd of March) via phone, email, and fax.

2.9.3 National Response

Seychelles have formal national SOPs for tsunami response. There were no actions taken by the NDMO. The NDMO maintained communication with the NTWC via telephone with updated information provided. There was also information communicated to the LDMO via telephone. There were no evacuations by the community.

2.9.4 Monitoring and Modelling

The NTWC monitored the sea level data using the IOC Seal Level Monitoring Facility, but did not mention the specific station names that were viewed in the survey.
2.9.5 Community Preparedness

No communities were affected by this event.

2.9.6 Capacity Development Requirement

In regard to training events and other assistance from IOC, some of the training needed includes seismic training; sea level training; risk assessment training; inundation modelling training; community awareness training; and exercise and drills training.

2.10 SINGAPORE

2.10.1 Information from Tsunami Service Providers

Singapore received the first information about the earthquake from the TSP India at 12:59 UTC. NTWC Singapore also received the notification message from TSP Australia, TSP India, and TSP Indonesia. The subsequent notification messages were received as follows:

<table>
<thead>
<tr>
<th>TSP Australia</th>
<th>Received GTS</th>
<th>Received Fax</th>
<th>Received Email</th>
<th>Received SMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4: (14:58)</td>
<td>14:58</td>
<td>15:01</td>
<td>14:59</td>
<td>14:59</td>
</tr>
<tr>
<td>5: (15:06)</td>
<td>15:06</td>
<td>15:23</td>
<td>15:07</td>
<td>15:07</td>
</tr>
<tr>
<td>6: (15:59)</td>
<td>15:59</td>
<td>16:03</td>
<td>16:00</td>
<td>16:00</td>
</tr>
<tr>
<td>7: (16:57)</td>
<td>16:57</td>
<td>17:05</td>
<td>16:58</td>
<td>16:58</td>
</tr>
</tbody>
</table>

*In UTC*

Table-35. NTWC Singapore receipt times of TSP Australia notification messages

<table>
<thead>
<tr>
<th>TSP India</th>
<th>Received GTS</th>
<th>Received Email</th>
<th>Received SMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: (12:56)</td>
<td>12:58</td>
<td>12:57</td>
<td>12:59</td>
</tr>
<tr>
<td>2: (13:03)</td>
<td>13:05</td>
<td>13:04</td>
<td>13:05</td>
</tr>
<tr>
<td>3: (15:22)</td>
<td>15:23</td>
<td>15:23</td>
<td>15:23</td>
</tr>
</tbody>
</table>

*In UTC*

Table-36. NTWC Singapore receipt times of TSP India notification messages
<table>
<thead>
<tr>
<th>TSP Indonesia</th>
<th>Notification Message</th>
<th>Received GTS</th>
<th>Received Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: (13:19)</td>
<td>13:21</td>
<td>13:22</td>
<td></td>
</tr>
<tr>
<td>2: (14:18)</td>
<td>14:19</td>
<td>14:19</td>
<td></td>
</tr>
<tr>
<td>3: (15:48)</td>
<td>15:49</td>
<td>15:49</td>
<td></td>
</tr>
<tr>
<td>4: (15:53)</td>
<td>15:53</td>
<td>15:54</td>
<td></td>
</tr>
</tbody>
</table>

*In UTC*

Table-37. NTWC Singapore receipt times of TSP Indonesia notification messages

All of the three TSP’s websites were accessible by NTWC Singapore. No status reports were submitted to the TSPs and no other information on the earthquake was received from other sources.

2.10.2 National Action

NTWC Singapore calculated the earthquake parameter at the national level.

<table>
<thead>
<tr>
<th>Origin Time (UTC)</th>
<th>Location (Lat. and Long.)</th>
<th>Depth</th>
<th>Magnitude</th>
<th>Type of Mag</th>
<th>Time (UTC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Estimate</td>
<td>12:49:50</td>
<td>4.67S; 94.66E</td>
<td>0</td>
<td>7.49</td>
<td></td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Estimate</td>
<td>12:49:53</td>
<td>4.25S; 94.16E</td>
<td>36</td>
<td>7.75</td>
<td></td>
</tr>
</tbody>
</table>

*Table-38. Earthquake parameters calculated by NTWC Singapore*

There was no action taken before receiving information from TSPs and no action was taken after receiving the notification message from the TSP. No tsunami warning and tsunami related information was issued to other agencies or to the public.

2.10.3 National Response

Singapore has formal national SOPs for tsunami response. There were no actions taken by the NDMO. The NDMO maintained communication with the NTWC. There was no action taken by the LDMO and no evacuation by the community.

2.10.4 Monitoring and Modelling

No sea level data were monitored.

2.10.5 Community Preparedness

No communities were affected by this event.

2.10.6 Capacity Development Requirement

In regard to training events and other assistance from IOC, some of the training needs include seismic training; risk assessment training; standard operating procedures training; and media awareness training.
2.11 SOUTH AFRICA

2.11.1 Information from Tsunami Service Providers

South Africa received the first information about the earthquake from TSP Australia at 13:07 UTC. NTWC South Africa also received the notification message from TSP India (12:58) and TSP Indonesia (13:21). The subsequent notification messages were received as follows:

<table>
<thead>
<tr>
<th>Notification Message</th>
<th>Received GTS</th>
<th>Received Email</th>
<th>Received SMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4: (14:58)</td>
<td>14:58, 14:59</td>
<td>14:58, 14:58, 14:59</td>
<td>14:59</td>
</tr>
<tr>
<td>5: (15:06)</td>
<td>15:06, 15:08</td>
<td>15:06, 15:07, 15:08</td>
<td>15:07</td>
</tr>
<tr>
<td>6: (15:59)</td>
<td>15:59, 16:01</td>
<td>15:59, 16:00, 16:01</td>
<td>16:00</td>
</tr>
<tr>
<td>7: (16:57)</td>
<td>16:57, 16:59</td>
<td>16:58, 16:57, 16:59</td>
<td>16:58</td>
</tr>
</tbody>
</table>

Table-39. NTWC South Africa receipt times of TSP Australia notification messages

<table>
<thead>
<tr>
<th>Notification Message</th>
<th>Received GTS</th>
<th>Received Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: (12:56)</td>
<td>12:58, 13:01</td>
<td>12:58, 13:01</td>
</tr>
</tbody>
</table>

Table-40. NTWC South Africa receipt times of TSP India notification messages

<table>
<thead>
<tr>
<th>Notification Message</th>
<th>Received GTS</th>
<th>Received Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>2: (14:18)</td>
<td>14:19, 14:20</td>
<td>14:19, 14:20</td>
</tr>
<tr>
<td>4: (15:53)</td>
<td>15:54, 15:54</td>
<td>15:54, 15:54</td>
</tr>
</tbody>
</table>

Table-41. NTWC South Africa receipt times of TSP Indonesia notification messages
All of the three TSP’s websites were accessible by NTWC South Africa. The status report was submitted to the TSP Australia at 13:25 UTC and other information on the earthquake was received from USGS.

2.11.2 National Action

NTWC South Africa did not calculate the earthquake parameters at the national level, and no action was taken before receiving TSP messages. Actions taken after receiving the TSP message were:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Action Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:07</td>
<td>Mr Rae (SAWS Chief forecaster) receives first AMMC/BOM sms at 1307UTC while in his office</td>
</tr>
<tr>
<td>13:08</td>
<td>Mr Rae phones National Forecast Office (NFC) to advise/alert forecasters, as per SOP. Mr Rae informs forecast team that he will contact NDMC (National Disaster Management) and the local Council For Geoscience (CGS) as per SOP</td>
</tr>
<tr>
<td>13:10</td>
<td>Mr Rae accesses USGS site for world map of event, to gain an idea of the location of the event, relative to the Indian ocean basin</td>
</tr>
<tr>
<td>13:12</td>
<td>Mr Rae phones Ms Grobbelaar at CGS as per SOP. As SA Weather Service is not expert in the field of earthquakes and tsunami events, CGS assesses each situation individually and provides a risk assessment (tuned to South Africa) for SAWS and NDMC</td>
</tr>
<tr>
<td>13:17</td>
<td>As per SAWS SOP, Mr Rae phones Mr Pillay at NDMC to confirm that he was also receiving the GTS/email messages (confirmed, yes). CGS also receiving GTS/email messages for event (confirmed)</td>
</tr>
<tr>
<td>13:25</td>
<td>(1) Mr Pillay sends email notification to Mr Ken Terry, National Head NDMC (short status briefing), (2) Mr Rae accesses Australian BoM site to await reporting/logging of country status--pending assessment from CGS</td>
</tr>
<tr>
<td>13:32</td>
<td>CGS, having assessed the situation, send assessment report (via email) to SAWS and NDMC jointly. Assessment is: no threat/risk for South African shores.</td>
</tr>
<tr>
<td>13:33</td>
<td>(1) Mr Rae informs NFC forecasters telephonically--no alert for SA (2) 1333 to 1335 Mr Rae populates SA country alert status (no threat) on Australian site.</td>
</tr>
<tr>
<td>13:41</td>
<td>Email (to SAWS and NDMC received from CGS (Ms Grobbelaar)--could not access Indonesian site; therefore email is a qualifier note to mention that CGS assessment based on the 7.9 magnitude of event reported by Australia and India (CGS unable to confirm/verify magnitude as initially reported by Indonesia in the early reports, i.e. 8.3 magnitude)</td>
</tr>
<tr>
<td>14:00</td>
<td>Mr Rae (SAWS Chief Forecaster), emails SAWS General Manager: Operations, as well as Senior Manager: Forecasting as a courtesy, informing them that existing SOP followed and that the 'country status' is deemed to be 'no threat' by CGS.</td>
</tr>
</tbody>
</table>

Table-42. Actions taken by NTWC South Africa
No tsunami warning and tsunami related information was issued to other agencies or to the public.

2.11.3 National Response

South Africa has formal national SOPs for tsunami response. Actions taken by the NDMO included:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Action Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:17</td>
<td>Pillay (NDMC) confirms telephonically with SAWS that the alert communications (GTS/email) are indeed being received at NDMC (SOP requires confirmation of same from NDMC and CGS)</td>
</tr>
<tr>
<td>13:25</td>
<td>Via email, Mr Pillay (NDMC) informs National Head of NDMC, Mr Ken Terry (as well as appropriate Executives at NDMC) of the unfolding event and that SAWS, CGS and NDMC are maintaining contact and monitoring further related messages regarding the event.(as per SOP). Similar information relayed from NDMC to Provincial DM structures (PDMC).</td>
</tr>
</tbody>
</table>

Table-43. Actions taken by NDMO South Africa

The NDMO maintains communication with the NTWC as per the joint SOPs between South African Weather Service (SAWS), National Disaster Management Centre (NDMC) and Council for Geoscience (CGS) explicitly requires prompt and ongoing mutual communication, via one or more of email, telephone, sms or WhatsApp during such an event (see C(2) (1) and B (3) 5 and 6). The National Head of NDMC also alerted/briefed by NDMC staff at 13h25UTC.

There was also communication with the local disaster management office on conveying guidance and instruction. No action was taken at the local level and no community evacuation.

2.11.4 Monitoring and Modelling

No sea level data were monitored.

2.11.5 Community Preparedness

No communities were affected by this event.

2.11.6 Capacity Development Requirement

In regard to training events and other assistance from IOC, some of the training needs include sea level training; risk assessment training; inundation modelling; and community awareness and preparedness training.

2.11.7 Other Information

It is important to note that, while the South African National Disaster Management Centre (NDMC) as well as that of the South African Council for Geoscience (CGS) have their international counterparts, possessing similar mandates to those centres in overseas countries, the status of the SA Weather Service (SAWS) is somewhat different:

SAWS mandate is a purely meteorological one, both in terms of public good as well as commercial activities and products. SAWS preforms a traditional role, in terms of meteorological information gathering as well as being the sole authoritative voice regarding extreme weather-related alerts. However, these roles and functions do not extend to include either seismic monitoring or alerts regarding seismic events (and their possible consequences).
Notwithstanding the above, SAWS is however completely committed to fulfilling a critical support role as a 24/7 "communications relaying agency" (due to the 24/7 nature of our business) for tsunami-related alerts. SAWS, NDMC and CGS have jointly agreed to work collaboratively as a team to monitor incoming tsunami-related alerts from the three international centres (AMMC, WIIX and DEMS). SAWS monitors communications and relays’ country statuses online. CGS perform the science of seismic risk/threat assessment and provide an expert opinion as to the relative level of domestic risk. In the event of a tangible tsunami threat, this "potential disaster" falls squarely within the ambit of the National Disaster Management Act, whereupon NDMC would alert Provincial PDMC structures, issue media statements, arrange evacuations etc. as such, the above, mutually agreed roles and responsibilities are captured in a formal SOP, which is updated/revised at intervals, as required.

Note though, at the current time our country has no access to any near-real time tsunameter buoy data in the southern Indian Ocean, which is really a critical deficiency in all these activities (there is a lack of real time information feedback). To the best of my knowledge there is not yet any such instrumentation deployed in the Mid Indian Ocean within our austral latitudes.

2.12 SRI LANKA

2.12.1 Information from Tsunami Service Providers

Sri Lanka received the first information about the earthquake at 13:00 UTC but no information on the source. NTWC Sri Lanka also received the notification message from TSP Australia (13:10), TSP India (13:00), and TSP Indonesia (13:20). The subsequent notification messages were received as follows:

<table>
<thead>
<tr>
<th>Notification Message</th>
<th>Received GTS</th>
<th>Received Email</th>
<th>Received SMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: (13:06)</td>
<td>13:10</td>
<td>13:10</td>
<td>13:10</td>
</tr>
<tr>
<td>4: (14:58)</td>
<td>15:00</td>
<td>15:01</td>
<td></td>
</tr>
<tr>
<td>5: (15:06)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6: (15:59)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7: (16:57)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table-44. NTWC Sri Lanka receipt times of TSP Australia notification messages*

<table>
<thead>
<tr>
<th>Notification Message</th>
<th>Received GTS</th>
<th>Received Email</th>
<th>Received SMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: (12:56)</td>
<td>12:59</td>
<td>12:59</td>
<td>12:59</td>
</tr>
<tr>
<td>2: (13:03)</td>
<td>13:03</td>
<td>13:05</td>
<td>13:05</td>
</tr>
<tr>
<td>3: (15:22)</td>
<td>15:22</td>
<td>15:23</td>
<td>15:23</td>
</tr>
</tbody>
</table>

*Table-45. NTWC Sri Lanka receipt times of TSP India notification messages*
All of the three TSP’s websites were accessible by NTWC Sri Lanka. Status report was reported to the all TSPs. NTWC Sri Lanka also received information on the earthquake from the Global Disaster Alert and Coordination System (GDACS), USGS, and the Media.

2.12.2 National Action

NTWC Sri Lanka did not calculate the earthquake parameter at the national level, and no action was taken before receiving TSP messages. Actions taken after receiving the TSP message were:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Action Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:00</td>
<td>Clarified with NTWC</td>
</tr>
<tr>
<td>13:05</td>
<td>Informed responsible agencies</td>
</tr>
<tr>
<td>13:15</td>
<td>Informed vulnerable communities</td>
</tr>
</tbody>
</table>

The NTWC issued tsunami warning and tsunami related information was issued to media, military and police. The warning was issued via Phone, fax, sms, email, and VPN network, intra agency network (IGN).

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Type of Information</th>
<th>Agencies Information Released to</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:20</td>
<td>Earthquake information</td>
<td>Media</td>
</tr>
<tr>
<td>13:20</td>
<td>Earthquake information</td>
<td>Military</td>
</tr>
<tr>
<td>13:20</td>
<td>Earthquake information</td>
<td>Police</td>
</tr>
</tbody>
</table>

The warning was cancelled at 13:59 UTC with the reason of NTWC and RTWC information and was sent via Fax, TEI, IGN. No tsunami warning was issued to the public or to the Media.
2.12.3 National Response
Sri Lanka has formal national SOPs for tsunami response. Actions taken by the NDMO included:

<table>
<thead>
<tr>
<th>Time (UTC)</th>
<th>Action Taken by National Disaster Management Office</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clarification on the information</td>
</tr>
<tr>
<td></td>
<td>Informed the public about the information</td>
</tr>
<tr>
<td></td>
<td>Cancelation of the warning</td>
</tr>
<tr>
<td></td>
<td>Inform all vulnerable communities regarding the information through Media</td>
</tr>
</tbody>
</table>

Table-49. Actions taken by NDMO Sri Lanka

The NDMO maintains communication with the NTWC. There was also communication with the local disaster management office on conveying guidance and instruction. No action was taken at the local level and no community evacuation.

2.12.4 Monitoring and Modelling
No sea level data were monitored.

2.12.5 Community Preparedness
No community affected by this event.

2.12.6 Capacity Development Requirement
In regard to training events and other assistance from IOC, some of the training needs include seismic training; sea level training; risk assessment training; inundation modelling; SOP training; media awareness training, and community awareness and preparedness training.

2.12.7 Other information
SMS is considered the fastest way for the warning.

2.13 TANZANIA

2.13.1 Information from Tsunami Service Providers
Tanzania received the first information about the earthquake at 13:07 UTC by email but no information on the source. NTWC Tanzania also received the notification message from TSP Australia (13:07 by email) and TSP Australia website. Only information from TSP Australia was reported.

<table>
<thead>
<tr>
<th>TSP Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notification Message</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>1: (13:06)</td>
</tr>
<tr>
<td>2: (13:25)</td>
</tr>
<tr>
<td>3: (13:36)</td>
</tr>
<tr>
<td>4: (14:58)</td>
</tr>
<tr>
<td>5: (15:06)</td>
</tr>
<tr>
<td>6: (15:59)</td>
</tr>
<tr>
<td>7: (16:57)</td>
</tr>
</tbody>
</table>

*In UTC*

Table-50. NTWC Tanzania receipt times of TSP Australia notification messages
All of the three TSP’s websites were accessible by NTWC Tanzania. Status report was not reported due it didn't create a bulletin notifying the occurrence of the earthquake and a potential for Tsunami to NDMO as stipulated in the integrated NTWC-NDMO SOPs; the SOPs are yet to be adapted by NTWC operators.

NTWC Tanzania did not received any information from TSP India and Indonesia this might due to the information notification were sent to an email account.

NTWC Tanzania also received information on the earthquake from RIMES.

2.13.2 National Action
NTWC Tanzania did not calculate the earthquake parameter at the national level, and no action was taken before receiving TSP messages. No actions taken after receiving the TSP message.

2.13.3 National Response
Tanzania has formal national SOPs for tsunami response. No action was taken by the NDMO.
No communication between the NDMO with the NTWC during the event. There was no communication with the LDMO on conveying guidance and instruction. No action was taken at the local level and no community evacuation.

2.13.4 Monitoring and Modelling
No sea level data were monitored.

2.13.5 Community Preparedness
No community affected by this event.

2.13.6 Capacity Development Requirement
In regard to the training events and other assistance from IOC, some of the training needs include sea level training; community awareness and preparedness training and exercise and drills training.

2.13.7 Other information
Important notes and facts on Tanzania NTWC capacity of operators;

1. Tanzania NTWC has satisfactory human resources (and have good idea on how to respond to tsunami threat), but many have not adopted/owned the tsunami SOPs (especially the integrated NTWC-NDMO SOPs as developed during the November 2015 workshop in Hyderabad, India).

2. Operational step-by-step SOPs, which were long developed and recently updated by NTWC expert who attended Hyderabad workshop, needs to be further developed to fit in the integrated SOP mentioned above (this will enable any operator on duty to respond accordingly to tsunami events at NTWC).

3. Tanzania NTWC doesn't have expertise in accessing sea level data.

4. Overall, Tanzania need a convenient and yet effective tsunami threat response example being the integrated NTWC-NDMO SOPs, the operations also need to be refined and simplified.

3. PERFORMANCE REPORT

3.1 TSUNAMI SERVICE PROVIDERS
The mean average time of when countries were first notified by any source was 13:01 UTC, twelve minutes after the official earthquake time. The range of when countries were first notified by any
source was 46 minutes, from 12:49 UTC (Kenya) until 13:35 UTC (Pakistan). Two (15%) countries received their first notification within five minutes of the official earthquake time; seven (54%) countries received their first notification within 10 minutes of the official earthquake time; and four (31%) countries received their first notification 15 minutes or more after the official earthquake time.

- Of the 103 notifications sent via GTS by the three TSPs, ninety-seven (94%) were received within five minutes of being sent.
- Of the 28 notifications sent via fax by the three TSPs, 12 (43%) were received within five minutes of being sent.
- Of the 136 notifications sent via email by the three TSPs, 126 (93%) were received within five minutes of being sent.
- Of the 36 notifications sent via SMS by the three TSPs, 33 (92%) were received within five minutes of being sent.
- Of the 303 notifications sent via GTS, fax, email, and SMS by the three TSPs, 268 (88%) were received within five minutes of being sent.

All 12 countries (100%) —not including Australia— received a notification from TSP Australia. They received the notification through various communication means (email, fax, GTS, or SMS). Only two countries (Seychelles and Singapore) reported that the notifications were received through all the communication means. The mean average time of notification receipt was 13:07 UTC, 18 minutes after the official earthquake time (12:49 UTC).

TSP Australia sent seven unique notifications (13:05, 13:25, 13:36, 14:58, 15:06, 15:59, and 16:57 UTC) via four methods of communication (GTS, Fax, email, SMS). Nine (69%) Countries received at least one notification via GTS from TSP Australia. Of the 55 GTS notifications, 52 (95%) were received within five minutes of being sent. Four (31%) countries received at least one notification via fax from TSP Australia. Of the 25 fax notifications, 7 (36%) were received within five minutes of being sent. Eleven (85%) countries received at least one notification via email from TSP Australia. Of the 71 email notifications, 64 (91%) were received within five minutes of being sent. Four (31%) countries received at least one notification via SMS from TSP Australia. Of the 24 notifications, 21 (92%) were received within five minutes of being sent.

Below is the breakdown of the number of countries receiving notification message from TSP Australia based on the communication means.

<table>
<thead>
<tr>
<th>TSP Australia</th>
<th>Bulleting No</th>
<th>Received GTS</th>
<th>Received Fax</th>
<th>Received Email</th>
<th>Received SMS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>7 (58%)</td>
<td>4 (33%)</td>
<td>11 (92%)</td>
<td>4 (33%)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>7 (58%)</td>
<td>3 (25%)</td>
<td>11 (92%)</td>
<td>4 (33%)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>7 (58%)</td>
<td>3 (25%)</td>
<td>11 (92%)</td>
<td>4 (33%)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>7 (58%)</td>
<td>3 (25%)</td>
<td>11 (92%)</td>
<td>3 (25%)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>6 (50%)</td>
<td>4 (33%)</td>
<td>9 (75%)</td>
<td>3 (25%)</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7 (58%)</td>
<td>4 (33%)</td>
<td>9 (75%)</td>
<td>3 (25%)</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>7 (58%)</td>
<td>4 (33%)</td>
<td>9 (75%)</td>
<td>3 (25%)</td>
</tr>
</tbody>
</table>

Table-51. Countries that received notification messages from TSP Australia (out of 12 countries —not including Australia)
Eight out of 12 countries (67%) —not including India— received a notification from TSP India. They received the notification through various communication means (email, fax, GTS, or SMS). However, no countries reported having received it through all the communication means. The mean average time of notification receipt was 12:57 UTC, eight minutes after the official earthquake time (12:49 UTC).

TSP India sent three unique notifications (12:56, 13:03, and 15:22 UTC) via four methods of communication (GTS, Fax, email, SMS). Seven (53.9%) countries received at least one notification via GTS from TSP India. Of the 21 notifications, 18 (85.7%) were received within five minutes of being sent. One (7.7%) Member State received at least one notification via fax from TSP India. Of the three notifications, three (100%) were received within five minutes of being sent. Ten (76.9%) countries received at least one notification via email from TSP India. Of the 30 notifications, 27 (90%) were received within five minutes of being sent. Three (23.1%) countries received at least one notification via SMS from TSP India. Of the nine notifications, 9 (100%) were received within five minutes of being sent. Kenya and Tanzania did not report receiving any notification from TSP India through any means of communication.

<table>
<thead>
<tr>
<th>Bulletin No</th>
<th>Received GTS</th>
<th>Received Fax</th>
<th>Received Email</th>
<th>Received SMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6 (50%)</td>
<td>0 (0%)</td>
<td>9 (75%)</td>
<td>2 (17%)</td>
</tr>
<tr>
<td>2</td>
<td>6 (50%)</td>
<td>0 (0%)</td>
<td>9 (75%)</td>
<td>2 (17%)</td>
</tr>
<tr>
<td>3</td>
<td>6 (50%)</td>
<td>0 (0%)</td>
<td>9 (75%)</td>
<td>2 (17%)</td>
</tr>
</tbody>
</table>

Table-52. Countries that received notification messages from TSP India (out of 12 countries —not including India)

All 12 countries (100%) —not including Indonesia— received a notification from TSP Australia. They received the notification through various communication means (email, fax, GTS, or SMS). The mean average time of notification receipt was 13:17 UTC, 28 minutes after the official earthquake time (12:49 UTC).

TSP Indonesia sent four unique notifications (13:19, 14:19, 14:58, and 15:53 UTC) via four methods of communication (GTS, Fax, email, SMS). Seven (54%) countries received at least one notification via GTS from TSP Indonesia. Of the 27 notifications, 27 (100%) were received within five minutes of being sent. One (8%) Member State received at least one notification via fax from TSP Indonesia. Of the two notifications, zero (0%) were received within five minutes of being sent. Nine (69%) countries received at least one notification via email from TSP Indonesia. Of the 35 notifications, 35 (100%) were received within five minutes of being sent. Nine (69%) countries received at least one notification via SMS from TSP Indonesia. Of the three notifications, three (100%) were received within five minutes of being sent. Below is the breakdown of the number of countries receiving notification message from TSP Indonesia based on the communication means.
### Table-53. Countries that received notification messages from TSP Indonesia (out of 12 countries — not including Indonesia)

<table>
<thead>
<tr>
<th>Bulleting No</th>
<th>Received GTS</th>
<th>Received Fax</th>
<th>Received Email</th>
<th>Received SMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6 (50%)</td>
<td>0 (0%)</td>
<td>9 (75%)</td>
<td>1 (8%)</td>
</tr>
<tr>
<td>2</td>
<td>6 (50%)</td>
<td>1 (8%)</td>
<td>9 (75%)</td>
<td>1 (8%)</td>
</tr>
<tr>
<td>3</td>
<td>6 (50%)</td>
<td>1 (8%)</td>
<td>9 (75%)</td>
<td>1 (8%)</td>
</tr>
<tr>
<td>4</td>
<td>5 (42%)</td>
<td>0 (0%)</td>
<td>8 (67%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

### Table-54. Countries that accessed the TSP websites

<table>
<thead>
<tr>
<th>TSP Australia Website</th>
<th>TSP India Website</th>
<th>TSP Indonesia Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 (92%)</td>
<td>12 (100%)</td>
<td>11 (92%)</td>
</tr>
</tbody>
</table>

### Table-55. Countries that provided status reports to the TSP websites

<table>
<thead>
<tr>
<th>TSP Australia Website</th>
<th>TSP India Website</th>
<th>TSP Indonesia Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 (25%)</td>
<td>2 (17%)</td>
<td>2 (17%)</td>
</tr>
</tbody>
</table>

Almost all countries accessed the TSP website:

Most of the country did not provide status report to the TSP. Three countries that reported their status are Australia, South Africa, and Sri Lanka.

Eight out of 13 countries (62%) countries received some form of earthquake information from sources other than TSPs. Of the eight countries that received ‘other’ information, one (13%) received information from PTWC, four (50%) received information from USGS, three (38%) received information from RIMES, one (13%) received information from GFZ, one (13%) received information from CISN, one (13%) received information from CNN, one (13%) received information from GDACS, and one (13%) received information from the media.

### 3.2 NATIONAL ACTIONS

Six (46%) countries stated that they calculated earthquake parameters at the national level. This included, but was not limited to location, depth, and magnitude calculations. Along with the aforesaid calculations, the questionnaire requested the time (UTC) when the calculation was made and how magnitude was calculated. Indonesia did not include any calculations or data relating to the earthquake parameters they calculated. Of the six countries that calculated earthquake parameters, five (84%) provided data for first and second estimations; Pakistan was the only Member State to provide one estimation (the first estimation).
According to USGS, the tsunami was generated by a Mw 7.8 earthquake (4.908°S 94.275°E), at 12:49 on 02/03/2016. The data in the table below provided the summary of the calculated parameters by the countries.

<table>
<thead>
<tr>
<th>Country / Organisation</th>
<th>Calculation Time (UTC)</th>
<th>Longitude</th>
<th>Latitude</th>
<th>Depth</th>
<th>Magnitude</th>
<th>Magnitude Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>USGS</td>
<td>12:49</td>
<td>94.275°E</td>
<td>4.908°S</td>
<td>7.8</td>
<td>Mw</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>12:56</td>
<td>94.37°E</td>
<td>5.05°S</td>
<td>0</td>
<td>8.1</td>
<td>Mwp</td>
</tr>
<tr>
<td>India</td>
<td>12:52</td>
<td>94.17°E</td>
<td>5.06°S</td>
<td>10</td>
<td>7.9</td>
<td>M</td>
</tr>
<tr>
<td>Myanmar</td>
<td>94.28°E 10 km</td>
<td>4.86°S</td>
<td></td>
<td>6.9</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>Pakistan</td>
<td>13:07</td>
<td>94.36°E</td>
<td>5.04°S</td>
<td>10 km</td>
<td>7.2</td>
<td>M</td>
</tr>
<tr>
<td>Singapore</td>
<td>94.66°E 0 km</td>
<td>4.67°S</td>
<td></td>
<td>0</td>
<td>7.49</td>
<td></td>
</tr>
</tbody>
</table>

Table-56: Summary of earthquake parameters calculated by USGS and Member States

Four (31%) countries (Australia, Indonesia, Kenya, and Myanmar) reported that they took action before receipt of a TSP notification.

Five (39%) countries’ NTWCs (Australia, India, Indonesia, Seychelles, and Sri Lanka) issued a tsunami warning and tsunami related information to other agencies and/or the public. Of these five countries, four (80%) issued the warning via telephone, four (80%) issued the warning via SMS, five (100%) issued the warning via email, five (100%) issued the warning via fax, and four (80%) issued the warning via another method. Indonesia did not utilise the telephone to issue a warning and the Seychelles did not utilise SMS or another non-defined method.

Out of the five countries, only two (15%) countries (Australia, Indonesia) reported that a tsunami warning and tsunami related information was issued to the public. Seychelles and Sri Lanka reported that no tsunami warning was issued to the public; however, both answered the question on the method of disseminating the tsunami warning to the public by public radio and television.

Four out of the five countries who responded to the question on issuing a tsunami warning and tsunami related information to other agencies and/or the public, zero (0%) reported that they forecast tsunami wave height.

Four (31%) countries (Australia, Indonesia, Seychelles and Sri Lanka) reported that they used the following methods to disseminate tsunami warnings to the public; two (50%) disseminated warnings
via telephone; two (50%) disseminated via SMS; two (50%) disseminated via mobile phone; four (100%) disseminated via public radio; four (100%) disseminated via public television; two (50%) disseminated via Twitter; two (50%) disseminated via Facebook; two (50%) disseminated via RSS; three (75%) disseminated via website; one (25%) disseminated via siren; one (25%) disseminated via public announcement system; zero (0%) disseminated via public call centre; two (50%) disseminated via police; one (25%) disseminated via door-to-door announcement; and one (25%) disseminated via warning receiver system.

<table>
<thead>
<tr>
<th></th>
<th>Australia</th>
<th>Indonesia</th>
<th>Seychelles</th>
<th>Sri Lanka</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telephone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile Phone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Radio</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Television</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twitter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facebook</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Website</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Siren</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Announcement System</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Call Centre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Police</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Door-to-door</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warning Receiver System</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table-56. Dissemination methods of tsunami warnings to the public

Three (23%) countries' (Australia, India, and Indonesia) NTWC or NDMO disseminated tsunami warnings to the national media. Australia and Indonesia utilised both television and radio to broadcast tsunami warnings, whereas India utilised only television. The methods of disseminating tsunami warnings to the media in Australia were email and fax. The methods of disseminating tsunami warnings to the media in India were telephone, SMS, and through a website. The methods of disseminating tsunami warnings to the media, utilised by Indonesia, were email, fax, SMS, WRS, website, and social media.

Of the five (39%) countries that issued some form of tsunami warning, four (80%) countries cancelled these warnings within three hours after the official earthquake time (12:49). Seychelles cancelled their warning approximately 14 hours after the official earthquake time. Of the five (39%) countries
that issued some form of tsunami warning, one (20%) Member State (Australia) experienced communication problems with distributing the tsunami warning or cancellation information, reporting that ‘1300 tsunami telephone service (recorded messages) was not working’.

<table>
<thead>
<tr>
<th></th>
<th>Australia</th>
<th>India</th>
<th>Indonesia</th>
<th>Seychelles</th>
<th>Sri Lanka</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancellation time (UTC)</td>
<td>15:46</td>
<td>15:17</td>
<td>15:33</td>
<td>03:00 (+1 Day)</td>
<td>13:59</td>
</tr>
<tr>
<td>Email</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Fax</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Website</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>GTS</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Twitter</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
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</tr>
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</table>

Table-57. Dissemination methods of tsunami warnings to the media

3.3 NATIONAL RESPONSE

Eleven countries (85%) indicated having national SOPs or plans for tsunami response. Five (39%) countries reported that their NDMO or equivalent agency took some form of action in response to the earthquake event. Eight (62%) countries reported that their NDMO (or equivalent) and NTWC maintained in communication throughout the event. Eight (62%) countries reported that their NDMO (or equivalent) and local/regional/provincial DMO maintained communication throughout the event. Three (23%) countries reported that their local/regional/provincial DMO took some form of action in response to the earthquake.

Two countries reported doing evacuations (Australia and Indonesia). Ten people from two areas were evacuated in Australia. Indonesia reported 10 areas were evacuated but did not provide information on the number of people. Indonesia reported that people in some areas self-evacuated before a warning was issued. Six specific areas were highlighted as areas in which self-evacuation prior to a formal warning was observed; 80% of the population from Desa Tuapejet dan Dusan Mapadegat (Sipora Utara); 90% of the population from Desa Sioban (Sipora Selatan); 90% of the population from Desa Bosua (Sipora Selatan); 65% of the population from Desa Sikakap dan Taikako (Kecanatan Sikakap); 65% of the population from Desa Saumanganyak, Desa Betumonga, Desa Silabu (Kecamatan Pagal Utara); and 75% of the population from Desa Malakopak (Kecamatan Pagal Selatan).
Both Australia and Indonesia reported that evacuation process went smoothly.

3.4 MONITORING AND MODELLING

Seven (54%) countries reported that sea level data was monitored throughout the event. The table immediately below depicts which stations were monitored and the monitoring method employed. One (14%) Member State (Seychelles) reported that they monitored sea level data throughout the event but provided no clarification on which stations data were monitored and the method employed to monitor the said stations. The table on the next page shows the station monitored by the six countries.

Three (23%) countries (India, Indonesia, Tanzania) NTWCs used tsunami scenario numerical models during the event.
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</table>

Table-58. Sea Level station monitoring
3.5 COMMUNITY PREPAREDNESS

Seven (54%) countries (Australia, India, Indonesia, Myanmar, Pakistan, Mauritius, and Sri Lanka) reported that community preparedness activities had taken place prior to the event. Two (15%) countries (Seychelles, Singapore), by not completing the question associated to this particular data, failed to report whether community preparedness activities had taken place or had not taken place. Four (31%) countries (Iran, Kenya, South Africa, and Tanzania) reported that no community preparedness activities had taken place prior to the event.

3.6 CAPACITY DEVELOPMENT REQUIREMENTS

Twelve countries indicated which training from IOC will be useful for NTWC, NDMO and other organisations. Fifty-four percent (54%) indicated seismic training and media awareness, 61% indicated sea level training and inundation modelling, 69% on risk assessment and standard operating procedures, 76% on exercise and drill training, and 84% on community awareness training.

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<td>Tanzania</td>
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Table-59. Requests for capacity development training by Member States
Table 59. Requests for capacity development training by Member States continued
2nd March 2016 Southwest of Sumatra Earthquake and Tsunami Event
Post-Event Assessment of the Performance of the Indian Ocean Tsunami Warning and Mitigation System

Supplement
Tsunami Service Provider Bulletins and Maps
2nd March 2016 Southwest of Sumatra Earthquake and Tsunami Event

Post-Event Assessment of the Performance of the Indian Ocean Tsunami Warning and Mitigation System

Supplement
Tsunami Service Provider Bulletins and Maps

UNESCO 2017
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INTRODUCTION

This document contains all of the Tsunami Service Provider (TSP) products generated and issued during the 2nd March 2016 earthquake and tsunami, 800 km southwest of Sumatra, Indonesia.
1. EARTHQUAKE INFORMATION

RTSP AUSTRALIA has detected an earthquake with the following preliminary information:

Magnitude: 7.9 Mwp
Depth: 0km
Date: 02 Mar 2016
Origin Time: 1249 UTC
Latitude: 4.91S
Longitude: 94.24E
Location: SOUTHWEST OF SUMATRA, INDONESIA

2. EVALUATION

RTSP AUSTRALIA is evaluating this earthquake to determine if a tsunami has been generated. Further information on this event will be available at http://reg.bom.gov.au/tsunami/rtsp.

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

Additional bulletins will be issued by RTSP AUSTRALIA for this event.
as more information becomes available.

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

In case of conflicting information from RTSPs or the IAS (PTWC, JMA), the more conservative information should be used for safety.

5. CONTACT INFORMATION
RTSP AUSTRALIA
Joint Australian Tsunami Warning Centre (JATWC)
Bureau of Meteorology
GPO BOX 1289 Melbourne, Victoria, Australia, 3001

END OF BULLETIN

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

1. EARTHQUAKE INFORMATION
RTSP AUSTRALIA has detected an earthquake with the following details:

Magnitude:  7.9 Mwp
Depth:      0km
Date:       02 Mar 2016
Origin Time: 1249 UTC
Latitude:   4.91S
Longitude:  94.24E
Location:   SOUTHWEST OF SUMATRA, 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 RTSP will monitor sea level gauges and report if any tsunami wave activity has occurred.

Based on pre-run model scenarios, the zones listed below are POTENTIALLY UNDER THREAT.

3. TSUNAMI THREAT FOR THE INDIAN OCEAN
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. 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.

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### FRENCH SOUTHERN AND ANTARCTIC LANDS

**LLE SAINT-Paul** 1816Z 02Mar2016  0.51m

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<td>MALI KYUN</td>
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</table>
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 RTSP AUSTRALIA for this event as more information becomes available.

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

In case of conflicting information from RTSPs or the IAS (PTWC, JMA), the more conservative information should be used for safety.

6. CONTACT INFORMATION
RTSP AUSTRALIA
Joint Australian Tsunami Warning Centre (JATWC)
Bureau of Meteorology
GPO BOX 1289 Melbourne, Victoria, Australia, 3001

END OF BULLETIN

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TSP Australia Bulletin 3 (1336 UTC)

IDY68501

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TSUNAMI BULLETIN NUMBER 3
REGIONAL TSUNAMI SERVICE PROVIDER - RTSP AUSTRALIA (JATWC)
Issued at: 1336 UTC Wednesday 02 March 2016
--------------------------------------------------------------------------------------------------------

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

1. EARTHQUAKE INFORMATION
RTSP AUSTRALIA has detected an earthquake with the following details:

Magnitude:   7.8 Mwp
Depth:       0km
Date:        02 Mar 2016
Origin Time: 1249 UTC
Latitude:    4.90S
Longitude:   94.23E
Location:    SOUTHWEST OF SUMATRA, 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 RTSP will monitor sea level gauges and report if any tsunami wave activity has occurred.

Based on pre-run model scenarios, the zones listed below are POTENTIALLY UNDER THREAT.

3. TSUNAMI THREAT FOR THE INDIAN OCEAN
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. 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.

AUSTRALIA
COCOS ISLAND 1355Z 02Mar2016 0.51m
CHRISTMAS ISLAND 1433Z 02Mar2016 0.51m

INDIA
INDIRA POINT 1448Z 02Mar2016 0.51m
KOMATRA & KATCHAL ISLAND 1454Z 02Mar2016 0.51m
CAR NICOBAR 1503Z 02Mar2016 0.51m
LITTLE ANDAMAN 1527Z 02Mar2016 0.51m
NORTH SENTINEL ISLAND 1531Z 02Mar2016 0.51m
PORT BLAIR 1544Z 02Mar2016 0.51m

INDONESIA
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SUMBAR KEPULAUAN-MENTAWAI P.SIPORA 1344Z 02Mar2016 0.51m
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SUMUT NIAS-SELATAN P.TANAHMASA 1348Z 02Mar2016 0.51m
SUMUT NIAS B 1349Z 02Mar2016 0.51m
SUMUT NIAS-SELATAN P.NIAS 1352Z 02Mar2016 0.51m
NAD SIMEULUE P.SIMEULUE 1355Z 02Mar2016 0.51m
BENGKULU BENGKULU-UTARA P.ENGGANO 1358Z 02Mar2016 0.51m
NAD ACEH-SINGKIL KEP.BANYAK 1405Z 02Mar2016 0.51m
SUMBAR PESISIR-SELATAN S 1407Z 02Mar2016 0.51m
SUMUT NIAS T 1407Z 02Mar2016 0.51m
SUMBAR PESISIR-SELATAN U 1413Z 02Mar2016 0.51m
SUMUT MANDAILING-NATAL U 1414Z 02Mar2016 0.51m
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BENGKULU BENGKULU-SELATAN 1415Z 02Mar2016 0.51m
BENGKULU KAUR 1418Z 02Mar2016 0.51m
BENGKULU BENGKULU-UTARA U 1418Z 02Mar2016 0.51m
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SUMUT NIAS-SELATAN P.PINI 1420Z 02Mar2016 0.51m
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SUMBAR PADANG-PARIAMAN S 1423Z 02Mar2016 0.51m
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SUMBAR AGAM 1430Z 02Mar2016 0.51m
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SUMBAR PASAMAN-BARAT 1434Z 02Mar2016 0.51m
NAD ACEH-JAYA 1435Z 02Mar2016 0.51m
LAMPUNG TANGGAMUS B 1435Z 02Mar2016 0.51m
NAD NAGAN-RAYA 1436Z 02Mar2016 0.51m
NAD ACEH-SELATAN S 1437Z 02Mar2016 0.51m
BANTEN LEBAK 1438Z 02Mar2016 0.51m
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NAD KOTA-BANDA-ACEH 1439Z 02Mar2016 0.51m
LAMPUNG TANGGAMUS T 1440Z 02Mar2016 0.51m
JABAR SUKABUMI PELABUHAN-RATU 1440Z 02Mar2016 0.51m
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SUMUT TAPANULI-TENGAH U 1441Z 02Mar2016 0.51m
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JATIM LUMAJANG  1545Z 02Mar2016  0.51m
JATIM JEMBER  1545Z 02Mar2016  0.51m

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YALA  1524Z 02Mar2016  0.51m
MATARA  1525Z 02Mar2016  0.51m
KATTANKUDI  1527Z 02Mar2016  0.51m
HIKKADUWA  1536Z 02Mar2016  0.51m
ANAITIVU  1540Z 02Mar2016  0.51m
PULMODDAI  1542Z 02Mar2016  0.51m
COLOMBO  1543Z 02Mar2016  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 RTSP AUSTRALIA for this event as more information becomes available.

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RTSP INDIA: http://www.incois.gov.in/Incois/tsunami/eqevents.jsp

In case of conflicting information from RTSPs or the IAS (PTWC, JMA), the more conservative information should be used for safety.

6. CONTACT INFORMATION
RTSP AUSTRALIA
Joint Australian Tsunami Warning Centre (JATWC)
Bureau of Meteorology
GPO BOX 1289 Melbourne, Victoria, Australia, 3001

END OF BULLETIN--------------------------------------
TSP Australia Bulletin 4 (1458 UTC)

IDY68501

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TSUNAMI BULLETIN NUMBER 4
REGIONAL TSUNAMI SERVICE PROVIDER - RTSP AUSTRALIA (JATWC)
Issued at: 1458 UTC Wednesday 02 March 2016
--------------------------------------------------------

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

1. EARTHQUAKE INFORMATION
RTSP AUSTRALIA has detected an earthquake with the following details:

- Magnitude: 7.9 Mwp
- Depth: 0km
- Date: 02 Mar 2016
- Origin Time: 1249 UTC
- Latitude: 4.91S
- Longitude: 94.24E
- Location: SOUTHWEST OF SUMATRA, INDONESIA

2. EVALUATION
Earthquakes of this size are capable of generating tsunamis. There has been confirmation of a small tsunami being triggered.

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

Based on pre-run model scenarios, the zones listed below are POTENTIALLY UNDER THREAT.

3. TSUNAMI THREAT FOR THE INDIAN OCEAN
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. 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.

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<th>Location</th>
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<th>Wave Height</th>
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<td>Coral Bay</td>
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FRENCH SOUTHERN AND ANTARCTIC LANDS

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**INDIA**

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<td>PORT BLAIR</td>
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TIMOR-LESTE
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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 RTSP AUSTRALIA for this event as more information becomes available.

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

In case of conflicting information from RTSPs or the IAS (PTWC, JMA), the more conservative information should be used for safety.

6. CONTACT INFORMATION
RTSP AUSTRALIA
Joint Australian Tsunami Warning Centre (JATWC)
Bureau of Meteorology
GPO BOX 1289 Melbourne, Victoria, Australia, 3001

END OF BULLETIN
---------------------------------------------------------------------
TSP Australia Bulletin 5 (1506 UTC)

IDY68501

---------------------------------------------------------------------
TSUNAMI BULLETIN NUMBER 5
REGIONAL TSUNAMI SERVICE PROVIDER - RTSP AUSTRALIA (JATWC)
Issued at: 1506 UTC Wednesday 02 March 2016
---------------------------------------------------------------------

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

1. EARTHQUAKE INFORMATION
RTSP AUSTRALIA has detected an earthquake with the following details:

  Magnitude: 7.9 Mwp
  Depth:     0km
  Date:      02 Mar 2016
  Origin Time: 1249 UTC
  Latitude: 4.91S
  Longitude: 94.24E
  Location: SOUTHWEST OF SUMATRA, INDONESIA

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

  Cocos Island  AUSTRALIA  12.10S  96.89E  0.05m  02 Mar 14:17 UTC
  Christmas Island AUSTRALIA  10.40S 105.67E  0.08m  02 Mar 14:50 UTC

Based on pre-run model scenarios, the zones listed below are POTENTIALLY UNDER THREAT.

3. TSUNAMI THREAT FOR THE INDIAN OCEAN
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
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. 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.

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TIMOR-LESTE
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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 RTSP AUSTRALIA for this event as more information becomes available.

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

In case of conflicting information from RTSPs or the IAS (PTWC, JMA), the more conservative information should be used for safety.

6. CONTACT INFORMATION

RTSP AUSTRALIA

Joint Australian Tsunami Warning Centre (JATWC)

Bureau of Meteorology

GPO BOX 1289 Melbourne, Victoria, Australia, 3001


END OF BULLETIN

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

1. EARTHQUAKE INFORMATION
RTSP AUSTRALIA has detected an earthquake with the following details:

Magnitude: 7.8 Mwp
Depth: 0km
Date: 02 Mar 2016
Origin Time: 1249 UTC
Latitude: 4.90S
Longitude: 94.23E
Location: SOUTHWEST OF SUMATRA, INDONESIA

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

- Cocos Island, Australia: 12.10S 96.89E, 0.05m, 02 Mar 14:17 UTC
- Christmas Island, Australia: 10.40S 105.67E, 0.09m, 02 Mar 15:00 UTC
- Deep Ocean Buoy 23401, Nicobar Isla: 8.90N 88.50E, 0.01m, 02 Mar 15:15 UTC
- Deep Ocean Buoy 56001, Indian Ocean: 13.99S 110.10E, 0.01m, 02 Mar 15:25 UTC

Based on pre-run model scenarios, the zones listed below are POTENTIALLY UNDER THREAT.

3. TSUNAMI THREAT FOR THE INDIAN OCEAN
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. 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.

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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 RTSP AUSTRALIA for this event as more information becomes available.

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

In case of conflicting information from RTSPs or the IAS (PTWC, JMA), the more conservative information should be used for safety.

6. CONTACT INFORMATION
RTSP AUSTRALIA
Joint Australian Tsunami Warning Centre (JATWC)
Bureau of Meteorology
GPO BOX 1289 Melbourne, Victoria, Australia, 3001

END OF BULLETIN

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

1. EARTHQUAKE INFORMATION
RTSP AUSTRALIA has detected an earthquake with the following details:

Magnitude: 7.8 Mwp
Depth: 0km
Date: 02 Mar 2016
Origin Time: 1249 UTC
Latitude: 4.90S
Longitude: 94.23E
Location: SOUTHWEST OF SUMATRA, 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 RTSP 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.
Cocos Island   AUSTRALIA    12.10S  96.89E    0.05m    02 Mar 14:17 UTC
Christmas Island   AUSTRALIA    10.40S 105.67E    0.09m    02 Mar 15:00 UTC
Deep Ocean Buoy 23401 NICOBAR ISLA  8.90N  88.50E    0.01m    02 Mar 15:15 UTC
Deep Ocean Buoy 56001 INDIAN OCEAN 13.99S 110.10E    0.01m    02 Mar 15:30 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 RTSP AUSTRALIA for this event unless additional information becomes available.

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

In case of conflicting information from RTSPs or the IAS (PTWC, JMA), the more conservative information should be used for safety.

6. CONTACT INFORMATION
RTSP AUSTRALIA
Joint Australian Tsunami Warning Centre (JATWC)
Bureau of Meteorology
GPO BOX 1289 Melbourne, Victoria, Australia, 3001

END OF BULLETIN

-----------------------------------------------
TSP AUSTRALIA MAPS

TSP Australia Location Map for Bulletin 1 (EQ Magnitude 7.9)
TSP Australia Threat Map for Bulletins 2 and 4-5 (EQ Magnitude 7.9)
TSP Australia Travel Time Map for Bulletin 2-7 (EQ Magnitude 7.8-7.9)
TSP Australia Threat Map for Bulletin 3 and 6-7 (EQ Magnitude 7.8)
TSP INDIA BULLETINS

TSP India Bulletin 1 (1256 UTC)

This information requires expert interpretation and is intended as guidance for NTWCs only and NOT for public use

RTSP-INDIA-20160302-1249-001  (TYPE - I)

--------------------------------------------------------------------------------

BULLETIN 1

REGIONAL TSUNAMI ADVISORY SERVICE PROVIDER RTSP INDIA (ITEWC)

issued at: 1256 UTC Wednesday 02 March 2016

--------------------------------------------------------------------------------

... PRELIMINARY EARTHQUAKE INFORMATION ...

1. EARTHQUAKE INFORMATION

RTSP INDIA detected an earthquake with the following preliminary information:

Magnitude: 7.9 M
Depth: 10 km
Date: 02 Mar 2016
Origin Time: 12 49 UTC
Latitude: 5.06 S
Longitude: 94.17 E
Location: Southwest of Sumatra, Indonesia

2. EVALUATION

Earthquakes of this size sometimes have potential to generate Ocean-wide tsunamis that can be destructive along the entire coastline of Indian ocean. Authorities in the region should be aware of this possibility. 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. RTSP INDIA will monitor sea level gauges near epicenter and report if any tsunami wave activity has occurred.
3. ADVICE

This Bulletin is being issued as an advice. Only national/state/local authorities and disaster management offices have the authority to make decisions regarding the official threat status in their coastal area and any action to be taken in response.

4. UPDATES

Additional bulletins will be issued by RTSP INDIA for this event as more information becomes available.

Other RTSPs may issue additional information at:
RTSP INDONESIA: http://rtsp.bmkg.go.id

In case of conflicting information from RTSPs or the IAS (PTWC, JMA), the more conservative information should be used for safety.

5. CONTACT INFORMATION

Indian Tsunami Early Warning Centre (ITEWC)
Indian National Centre for Ocean Information Services (INCOIS)
Address: "Ocean Valley", Pragathi Nagar (BO), Nizampet (SO), Hyderabad - 500 090, India.
Tel: 91-40-23895011
Fax: 91-40-23895012
Email: tsunami@incois.gov.in
Website: www.incois.gov.in

END OF BULLETIN

-----------------------------------------------------------------------
TSP Indian Bulletin 2 (1303 UTC)

This information requires expert interpretation and is intended as guidance for NTWCs only and NOT for public use.

RTSP-INDIA-20160302-1249-002 (TYPE - II)

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BULLETIN 2
REGIONAL TSUNAMI ADVISORY SERVICE PROVIDER RTSP INDIA (ITEWC)
issued at: 1303 UTC Wednesday 02 March 2016
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... POTENTIAL TSUNAMI THREAT IN THE INDIAN OCEAN ...

1. EARTHQUAKE INFORMATION (Revised)

RTSP INDIA detected an earthquake with the following parameters:

Magnitude: 7.9 M (Major)
Depth: 10 km
Date: 02 Mar 2016
Origin Time: 1249 UTC
Latitude: 5.06 S
Longitude: 94.17 E
Location: Southwest of Sumatra, Indonesia

2. EVALUATION

Earthquakes of this size sometimes have potential to generate 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 RTSP will monitor sea level gauges and report if any tsunami wave activity has occurred.

Based on pre-run model scenarios, the zones listed below are POTENTIALLY UNDER THREAT.
3. TSUNAMI THREAT FOR THE INDIAN OCEAN

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. 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

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<thead>
<tr>
<th>Zone</th>
<th>Time</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUMBAR Kepulauan-Mentawai P.Siberut</td>
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<td>1.6 m</td>
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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 RTSP INDIA for this event as more information becomes available.

Other RTSPs may issue additional information at:
RTSP INDONESIA: http://rtsp.bmkg.go.id

In case of conflicting information from RTSPs or the IAS (PTWC, JMA), the more conservative information should be used for safety.
6. CONTACT INFORMATION

Indian Tsunami Early Warning Centre (ITEWC)
Indian National Centre for Ocean Information Services (INCOIS)
Address: "Ocean Valley", Pragathi Nagar (BO), Nizampet (SO),
Hyderabad - 500 090, India.
Tel: 91-40-23895011
Fax: 91-40-23895012
Email: tsunami@incois.gov.in
Website: www.incois.gov.in

END OF BULLETIN
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TSP India Bulletin 3 (1522 UTC)

This information requires expert interpretation and is intended as guidance for NTWCs only and NOT for public use.

RTSP-INDIA-20160302-1249-003 (TYPE - IV)

By

BULLETIN 3
REGIONAL TSUNAMI ADVISORY SERVICE PROVIDER - RTSP INDIA (ITEWC)
issued at: 1522 UTC Wednesday 02 March 2016

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

1. EARTHQUAKE INFORMATION (Revised)

RTSP INDIA detected an earthquake with the following parameters:

Magnitude:  7.8 M (Major)
Depth:  10 km
Date:  02 Mar 2016
Origin Time:  1249 UTC
Latitude:  5.06 S
Longitude:  94.17 E
Location:  Southwest of Sumatra, Indonesia

2. EVALUATION

Real-time measurements of wave activity indicated that no significant tsunami was generated. When no major waves have occurred at least for two hours after the estimated arrival time then local authorities can assume that the threat is passed.

As local conditions can cause a wide variation in tsunami wave action CANCELLATION of
national warnings and the ALL CLEAR decision /all clear determination must be made by national/state/local authorities.

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 RTSP INDIA for this event unless additional information becomes available.

Other RTSPs may issue additional information at:
RTSP INDONESIA: http://rtsp.bmkg.go.id

In case of conflicting information from RTSPs or the IAS (PTWC, JMA), the more conservative information should be used for safety.

5. CONTACT INFORMATION

Indian Tsunami Early Warning Centre (ITEWC)
Indian National Centre for Ocean Information Services (INCOIS)
Address:"Ocean Valley", Pragathi Nagar (BO), Nizampet (SO), Hyderabad - 500 090, India.
Tel: 91-40-23895011
Fax: 91-40-23895012
Email: tsunami@incois.gov.in
Website: www.incois.gov.in

END OF BULLETIN

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TSP INDIA MAPS

TSP India Location Map for Bulletin 1 (EQ Magnitude 7.9)
TSP India Threat Map for Bulletin 2 (EQ Magnitude 7.9)
TSP India Directivity Map for Bulletin 2 (EQ Magnitude 7.9)

TSP Travel Time Map for Bulletin 2 (EQ Magnitude 7.9)
TSP INDONESIA BULLETINS

TSP Indonesia Bulletin 1 (1319 UTC)

RTSP-InaTEWS-20160302-1319-001

TSUNAMI BULLETIN NUMBER 1 (TYPE-I)
REGIONAL TSUNAMI SERVICE PROVIDER - RTSP INDONESIA (InaTEWS-BMKG)
issued at 1319 UTC, Wednesday, 02 March 2016

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... EARTHQUAKE INFORMATION BULLETIN ...

1. EARTHQUAKE INFORMATION
RTSP INDONESIA has detected an earthquake with the following preliminary information:

   Magnitude : 8.3 (Mw)
   Depth      : 10km
   Date       : 02 Mar 2016
   Origin Time: 12:49:41 UTC
   Latitude   : 5.16S
   Longitude  : 94.05E
   Location   : Southwest of Sumatra, Indonesia

2. EVALUATION
RTSP INDONESIA is evaluating this earthquake to determine if a tsunami has been generated.

Further information on this event will be available at:
http://rtsp.bmkg.go.id

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
Additional bulletins will be issued by RTSP INDONESIA for this event as more information becomes available.

Other RTSPs may issue additional information at:
RTSP INDIA:      http://www.incois.gov.in/Incois/tsunami/eqevents.jsp

In case of conflicting information from RTSPs or the IAS (PTWC, JMA), the more conservative information should be used for safety.

5. CONTACT INFORMATION
THE AGENCY FOR METEOROLOGY CLIMATOLOGY AND GEOPHYSICS (BMKG)
InaTEWS – Indonesian Tsunami Early Warning System
Address: Jl. Angkasa I no.2 Kemayoran, Jakarta, Indonesia, 10720
Tel.: +62 (21) 4246321/6546316
Fax: +62 (21) 6546316/4246703
P.O. Box 3540 Jakarta
Website:  http://rtsp.bmkg.go.id/publicbull.php
          http://www.bmkg.go.id
          http://inatews.bmkg.go.id
E-Mail:  inartsp@bmkg.go.id
         monitrtwp@bmkg.go.id

END OF BULLETIN
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TSP Indonesia Bulletin 2 (1418 UTC)

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TSP-InaTEWS-20160302-1418-002

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TSUNAMI BULLETIN NUMBER 2 (TYPE-II)

IOTWS TSUNAMI SERVICE PROVIDER INDONESIA (InaTEWS-BMKG)

issued at 1418 UTC, Wednesday, 02 March 2016

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... 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 (IOTWS).

1. EARTHQUAKE INFORMATION (updated)

TSP INDONESIA has detected an earthquake with the following details:

Magnitude : 7.8 (Mw)
Depth : 10km
Date : 02 Mar 2016
Origin Time: 12:49:47 UTC
Latitude : 4.92S
Longitude : 94.39E
Location : Southwest of Sumatra, 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, the zones listed below are POTENTIALLY UNDER THREAT.

3. TSUNAMI THREAT FOR THE INDIAN OCEAN
The list below shows the forecast arrival time of the first wave estimated to exceed 0.5m amplitude at the beach in each zone (or a different threshold nominated by an NTWC), and the amplitude of the maximum beach wave predicted for the zone. Zones where the estimated wave amplitudes are less than the threshold amplitude 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. 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.

**AUSTRALIA**

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**INDIA**

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**INDONESIA**

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</table>
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 TSP INDONESIA for this event as more information becomes available.

Other TSPs may issue additional information at:
TSP INDIA: http://www.incois.gov.in/Incois/tsunami/eqevents.jsp

6. CONTACT INFORMATION
THE AGENCY FOR METEOROLOGY CLIMATOLOGY AND GEOPHYSICS (BMKG)
InaTEWS – Indonesian Tsunami Early Warning System
Address: Jl. Angkasa I no.2 Kemayoran, Jakarta, Indonesia, 10720
Tel.: +62 (21) 4246321/6546316
Fax: +62 (21) 6546316/4246703
P.O. Box 3540 Jakarta
Website: http://rtsp.bmkg.go.id/publicbull.php
E-Mail: inartsp@bmkg.go.id
monitrtp@bmkg.go.id

END OF BULLETIN
TSUNAMI BULLETIN NUMBER 3 (TYPE-III)
IOTWS TSUNAMI SERVICE PROVIDER INDONESIA (InaTEWS-BMKG)
issued at 1548 UTC, Wednesday, 02 March 2016

... 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 (IOTWS).

1. EARTHQUAKE INFORMATION (updated)
IOTWS-TSP INDONESIA has detected an earthquake with the following details:

Magnitude : 7.8 (Mw)
Depth      : 10km
Date       : 02 Mar 2016
Origin Time: 12:49:47 UTC
Latitude   : 4.92S
Longitude  : 94.39E
Location   : Southwest of Sumatra, Indonesia

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

<table>
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<th>LOCATION</th>
<th>COUNTRIES</th>
<th>LAT</th>
<th>LON</th>
<th>AMPL(m)</th>
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<td>PADANG</td>
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</tbody>
</table>
Based on pre-run model scenarios, the zones listed below are POTENTIALLY UNDER THREAT.

3. TSUNAMI THREAT FOR THE INDIAN OCEAN

The list below shows the forecast arrival time of the first wave estimated to exceed 0.5m amplitude at the beach in each zone (or a different threshold nominated by an NTWC), and the amplitude of the maximum beach wave predicted for the zone. Zones where the estimated wave amplitudes are less than the threshold amplitude 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. 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.

<table>
<thead>
<tr>
<th>Country</th>
<th>Location</th>
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<td>INDIA</td>
<td>INDIRA POINT</td>
<td>15:14z 02Mar2016</td>
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<td>KOYYAM</td>
<td>17:33z 02Mar2016</td>
<td>0.56m</td>
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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 IOTWS-TSP INDONESIA for this event as more information becomes available.

Other IOTWS-TSPs may issue additional information at:
IOTWS-TSP INDIA: http://www.incois.gov.in/Incois/tsunami/eqevents.jsp

6. CONTACT INFORMATION
IOTWS-TSP INDONESIA:
The Agency for Meteorology Climatology and Geophysics (BMKG)
InaTEWS - Indonesian Tsunami Early Warning System
Address: Jl. Angkasa I no.2 Kemayoran, Jakarta, Indonesia, 10720
Tel.: +62 (21) 4246321/6546316
Fax: +62 (21) 6546316/4246703
P.O. Box 3540 Jakarta
Website: http://rtsp.bmkg.go.id/publicbull.php
http://www.bmkg.go.id
http://inatews.bmkg.go.id
E-Mail: inartsp@bmkg.go.id
monitrtwp@bmkg.go.id

END OF BULLETIN
TSP Indonesia Bulletin 4 (1553 UTC)

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TSUNAMI BULLETIN NUMBER 4 (TYPE-IV)
IOTWS TSUNAMI SERVICE PROVIDER INDONESIA (InaTEWS-BMKG)
issued at 1553 UTC, Wednesday, 02 March 2016

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... FINAL TSUNAMI BULLETIN FOR 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 (IOTWS).

1. EARTHQUAKE INFORMATION
IOTWS-TSP INDONESIA detected an earthquake with the following details:

Magnitude : 7.8 (Mw)
Depth      : 10km
Date       : 02 Mar 2016
Origin Time: 12:49:47 UTC
Latitude   : 4.92S
Longitude  : 94.39E
Location   : Southwest of Sumatra, 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 IOTWS-TSP INDONESIA 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.

<table>
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<tr>
<th>LOCATION</th>
<th>COUNTRIES</th>
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<th>LON</th>
<th>AMPL(m)</th>
<th>TIME(UTC)</th>
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<td>PADANG</td>
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<td>00.95S</td>
<td>100.37E</td>
<td>0.05</td>
<td>14:40</td>
<td>Mar 02, 2016</td>
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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 IOTWS-TSP INDONESIA for this event unless additional information becomes available.

Other IOTWS-TSPs may issue additional information at:

- IOTWS-TSP INDIA: http://www.incois.gov.in/Incois/tsunami/eqevents.jsp

6. CONTACT INFORMATION

IOTWS-TSP INDONESIA:
THE AGENCY FOR METEOROLOGY CLIMATOLOGY AND GEOPHYSICS (BMKG)
InaTEWS - Indonesian Tsunami Early Warning System
Address: Jl. Angkasa I no.2 Kemayoran, Jakarta, Indonesia, 10720
Tel.: +62 (21) 4246321/6546316
Fax: +62 (21) 6546316/4246703
P.O. Box 3540 Jakarta
Website: http://rtsp.bmkg.go.id/publicbull.php
              http://www.bmkg.go.id
http://inatews.bmkg.go.id
E-Mail: inartsp@bmkg.go.id
       monitrtwp@bmkg.go.id

END OF BULLETIN
TSP INDONESIA MAPS

TSP Indonesia Threat Map for Bulletin 1 (EQ Magnitude 8.3)

TSP Indonesia Threat Map for Bulletin 2-3 (EQ Magnitude 7.8)

TSP Indonesia Travel Time Map for Bulletin 2-4 (EQ Magnitude 7.8)
TSP Indonesia Maximum Sea Surface Height Map for Bulletin 2-4 (EQ Magnitude 7.8)
TSP Indonesia Threat Map for Bulletin 4 (EQ Magnitude 8.3)

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<td>Operational Sea-Level Stations. 1983</td>
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<td>The Determination of Polychlorinated Biphenyls in Open-ocean Waters. 1984</td>
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<td>Global Sea-Level Observing System (GLOSS) Implementation Plan. 1990</td>
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<td>37</td>
<td>Tsunami Glossary - A Glossary of Terms and Acronyms Used in the Tsunami Literature</td>
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<td>The Oceans and Climate: A Guide to Present Needs. 1991</td>
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<td>Design and Implementation of some Harmful Algal Monitoring Systems. 1996</td>
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<td>Use of Standards and Reference Materials in the Measurement of Chlorinated Hydrocarbon Residues. 1996</td>
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<td>Equatorial Segment of the Mid-Atlantic Ridge. 1996</td>
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<td>Global Temperature Salinity Profile Programme: Overview and Future. 1998</td>
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<td>L'état actuel de l'exploitation des pêcheries maritimes au Cameroun et leur gestion intégrée dans la sous-région du Golfe de Guinée (cancelled)</td>
<td>1999</td>
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<td>Cold water carbonate mounds and sediment transport on the Northeast Atlantic Margin. 1998</td>
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<td>Multidisciplinary Study of Geological Processes on the North East Atlantic and Western Mediterranean Margins (9th training-through-research cruise, June-July 1999). 2000</td>
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<td>R. Revelle Memorial Lecture, 2006: Global Sea Levels, Past, Present and Future. 2007</td>
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<td>Bruun Memorial Lectures, 2003: Gas Hydrates – a potential source of energy from the oceans. 2003</td>
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Vol.1 The polymetallic nodule ecosystem of the Eastern Equatorial Pacific Ocean / Ecosystème de nodules polymétalliques de l’océan Pacifique Est équatorial

Vol.2 Annotated photographic Atlas of the echinoderms of the Clarion-Clipperton fracture zone / Atlas photographique annoté des échinodermes de la zone de fractures de Clarion et de Clipperton

Vol.3 Options for the management and conservation of the biodiversity — The nodule ecosystem in the Clarion Clipperton fracture zone: scientific, legal and institutional aspects

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85 Tsunami Glossary

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92. 27 February 2010 Chile Earthquake and Tsunami Event – Post-Event Assessment of PTWS Performance (Pacific Tsunami Warning System). 2010

93. Exercise CARIBE WAVE 11 / LANTEX 11—A Caribbean Tsunami Warning Exercise, 23 March 2011

94. Cold seeps, coral mounds and deep-water depositional systems of the Alboran Sea, Gulf of Cadiz and Norwegian continental margin (17th training-through-research cruise, June–July 2008)

95. International Post-Tsunami Survey for the 25 October 2010 Mentawai, Indonesia Tsunami


97. Exercise PACIFIC WAVE 11: A Pacific-wide Tsunami Warning and Communication Exercise, 9–10 November 2011


99. Exercise INDIAN OCEAN WAVE 2011 – An Indian Ocean-wide Tsunami Warning and Communication Exercise, 12 October 2011


   Vol. 2 Summary Report. 2013


111. Integrated Regional Assessments in support of ICZM in the Mediterranean and Black Sea Basins. 2014

112. 11 April 2012 West of North Sumatra Earthquake and Tsunami Event - Post-event Assessment of IOTWS Performance


   Vol. 1 Manual

115. Oceanographic and Biological Features in the Canary Current Large Marine Ecosystem. 2015 (revised in 2016)

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   Vol 1: Transboundary Large Marine Ecosystems; Supplement: Individual Governance Architecture Assessment for Fifty Transboundary Large Marine Ecosystems
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120. Status and Trends in Primary Productivity and Chlorophyll from 1996 to 2014 in Large Marine Ecosystems and the Western Pacific Warm Pool, Based on Data from Satellite Ocean Colour Sensors

121. Exercise Indian Ocean Wave 14, an Indian Ocean wide Tsunami Warning and Communications Exercise, 9–10 September 2014

122. Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas. Sixth Communication Test Exercise (CTE6), 29 July 2015.
   Vol. 1: Exercise Manual
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123. Preparing for the next tsunami in the North-Eastern Atlantic, the Mediterranean and Connected Seas – Ten years of the Tsunami Warning System (NEAMTWS)

124. Indicadores Marino Costeros del Pacífico Sudeste / Coastal and Marine Indicators of the Southeast Pacific (SPINCAM)

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