Indian Ocean Tsunami Warning & Mitigation System (IOTWS)

Immediate Past Chair ICG/IOTWS: Rick Bailey (Australia)
The landscape in 2004...

- Tsunami risk considered low
- Very limited seismic observations to detect
- Very limited real-time sea level observations to verify
- No tsunami warning system to forecast
- No national tsunami warning contact points to inform
- Community unaware and not prepared
INTERNATIONAL COMMITMENT

- World Conference Disaster Reduction, Kobe, January'05
- Ministerial Declaration, Phuket, January'05
- 1st International Meeting for Development of a Tsunami Warning & Mitigation System for the Indian Ocean within a Global Framework, Paris, March'05
- 2nd International Meeting for Development of a Tsunami Warning & Mitigation System for the Indian Ocean, Mauritius, April'05
- UN General Assembly (Resolutions 61/132 and 62/91) Mandate to UNESCO/IOC
- Interim Advisory Service (IAS) provided by PTWC/USA and JMA/Japan 2005-13
**SUPPORT**

* Indian Ocean Consortium (UNESCO/IOC, WMO, ISDR, UNDP, UNEP, OCHA, IFRC, World Bank)
* UN Flash Appeal Fund
  * National capacity assessments, tide-gauges...
* UNESCAP
* CTBTO
* US NOAA (PTWC, ITIC), Japan/JMA, Germany (GFZ, GIZ), Australian Bureau of Meteorology, Norway, ……
* Donors: USAID, AusAID, ……
  …and many more!
Intergovernmental Coordination Group
Indian Ocean Tsunami Warning & Mitigation System (ICG/IOTWS):

* Formed by IOC Assembly, Paris, June 2005
* Has 1st Meeting in Australia, August 2005
* Last met 10th Meeting in Oman, March 2015
* New Chair is Srinivasa Kumar (India)
* ICG/IOTWS Secretariat located in Perth, funded by Australia
Only two ICG/IOTWS Working Groups now supporting the 3 Pillars:

1. Tsunami Risk, Community Awareness and Preparedness
2. Tsunami Detection, Warning & Dissemination

New: NW Indian Ocean Regional WG
PASSION...the people
RTSP Products
Coastal Zone Threat Level Display and Tsunami Forecast Table

JATWC Regional Tsunami Watch Provider Services for the Indian Ocean
The Joint Australian Tsunami Warning Centre is operated by the Australian Bureau of Meteorology and Geoscience Australia

Recent Events
30:07 UTC 03 April 2011
SOUTH OF JAVA, INDONESIA
Tsunami Bulletin 03:54UTC 05 Apr 2011
30:06 UTC 03 April 2011
SOUTH OF JAVA, INDONESIA
Tsunami Bulletin 06:30UTC 05 Apr 2011
No Tsunami Bulletin 06:00UTC 06 Apr 2011
Tsunami Bulletin 02:30UTC 06 Apr 2011
No Tsunami Bulletin 02:31UTC 06 Apr 2011
Tsunami Bulletin 02:39UTC 06 Apr 2011
Tsunami Bulletin 02:47UTC 06 Apr 2011
81:46 UTC 11 March 2011
NEAR EAST COAST OF HONSHU, JAPAN
No Tsunami Bulletin 02:44UTC 06 Apr 2011
No Tsunami Bulletin 02:31UTC 05 Apr 2011
No Tsunami Bulletin 01:15UTC 05 Apr 2011
32:23 UTC 27 March 2011
NEAR EAST COAST OF HONSHU, JAPAN
No Tsunami Bulletin 01:14UTC 05 Apr 2011
No Tsunami Bulletin 01:07UTC 05 Apr 2011

SOUTH OF JAVA, INDONESIA

[Map showing coastal zone and threat level display]
Bulletin type 3 – Confirmed Tsunami Threat with Observations Bulletin

RTWP-JATWC-20110209-0555-003

TSUNAMI BULLETIN NUMBER 3
REGIONAL TSUNAMI WATCH PROVIDER - RTWP AUSTRALIA (JATWC)
issued at 0555 UTC Wednesday 09 February 2011

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

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

Magnitude: 9.0 Mwp
Depth: 10km
Date: 09 Feb 2011
Origin Time: 0500 UTC
Latitude: 7.20N
Longitude: 92.90E
Location: Nicobar, India

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

Nicobar (India) 12.34N 91.65E 0520Z 09 Feb 2011 2.7m
Padang (Indonesia) 3.34S 93.42E 0550Z 09 Feb 2011 1.3m

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

UNESCO/IOC Indian Ocean Tsunami Warning & Mitigation System
Regional Tsunami Service Provider - AUSTRALIA
Status of National Tsunami Warnings Issued by Countries Around Indian Ocean

<table>
<thead>
<tr>
<th>Countries</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Unknown</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>Unknown</td>
</tr>
<tr>
<td>Cambodia</td>
<td>Unknown</td>
</tr>
<tr>
<td>China</td>
<td>Unknown</td>
</tr>
<tr>
<td>India</td>
<td>Unknown</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Unknown</td>
</tr>
<tr>
<td>Iran</td>
<td>Unknown</td>
</tr>
<tr>
<td>Japan</td>
<td>Unknown</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Unknown</td>
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<tr>
<td>Maldives</td>
<td>Unknown</td>
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<tr>
<td>Mauritius</td>
<td>Unknown</td>
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<tr>
<td>Mozambique</td>
<td>Unknown</td>
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<tr>
<td>Myanmar</td>
<td>Unknown</td>
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<tr>
<td>Nepal</td>
<td>Unknown</td>
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<tr>
<td>Pakistan</td>
<td>Unknown</td>
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<tr>
<td>Philippines</td>
<td>Unknown</td>
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<tr>
<td>Singapore</td>
<td>Unknown</td>
</tr>
<tr>
<td>Taiwan</td>
<td>Unknown</td>
</tr>
<tr>
<td>Thailand</td>
<td>Unknown</td>
</tr>
<tr>
<td>Timor-Leste</td>
<td>Unknown</td>
</tr>
<tr>
<td>Yemen</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

Largest measured Tsunami wave amplitude as of

<table>
<thead>
<tr>
<th>Location</th>
<th>Country</th>
<th>Maximum Amplitude</th>
<th>Time Occurred</th>
</tr>
</thead>
</table>

Magnitude:
Time:
Location: No current earthquake
ACHIEVEMENTS

Risk assessment and reduction

ComMIT training

Workshops
ACHIEVEMENTS
Seismic monitoring network

2004

Indian Ocean Seismic Network, 2004
- Broadband Seismometer
  All data are shared internationally in near real-time.

2014

IOTWS Seismic Network, October 2014
- Broadband Seismometer
  All data are shared internationally in near real-time.
ACHIEVEMENTS

Sea level monitoring network

2004

Indian Ocean Sea Level Network, 2004

Sea Level Gauge

All data are shared internationally in near real-time.

2014

IOTWS Sea Level Network, October 2014

Tsunameter

Sea Level Gauge

All data are shared internationally in near real-time.
ACHIEVEMENTS
2011 Launch
Interoperable "System of Systems"
Tsunami Service Providers (TSPs)
India, Indonesia, Australia

Tsunami threat forecast information via Registered User web sites for NTWCs
ACHIEVEMENTS

National Tsunami Warning Centres (NTWCs)
Tsunami Warning Focal Points (TWFPs)

Sovereignty principle…….

to avoid conflicting information and

to ensure appropriate response,
national tsunami warnings should

only be issued by the
recognised national authority

Annual NTWC, DMO, media
SOP training workshops
"THE LAST MILE"

ACHIEVEMENTS

Community awareness and response

Indian Ocean Tsunami Information Centre (IOTIC)

International Tsunami Information Centre (ITIC)

Tourism

Emergency services

Schools

Community evacuation planning
ACHIEVEMENTS

Community preparedness


Communications tests every six months

National and local drills
Performance Monitoring
Year 1: Oct 2011 to Oct 2012
* SL1 EQ Bulletins: 53
* SL2 No Threat Bulletins: 7 (7 events)
* SL2 Threat Bulletins: 17 (4 events)

Years 2 and 3: Nov 2012 to Feb 2015 (2.3 yrs)
* SL1 EQ Bulletins: 134 (~58 per year av.)
* SL2 No Threat Bulletins: 12 (12 events)
* SL2 Threat Bulletins: 3 (1 event)
<table>
<thead>
<tr>
<th>KPI 1</th>
<th>KPI 2</th>
<th>KPI 3a</th>
<th>KPI 3b</th>
<th>KPI 3c</th>
<th>KPI 4</th>
<th>KPI 5</th>
<th>KPI 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>ET First EQ Bull</td>
<td>POD IO EQs</td>
<td>EQ Mag</td>
<td>EQ Depth</td>
<td>EQ Location</td>
<td>ET First Threat Bull</td>
<td>POD Tsunami Waves</td>
<td>Tsunami Height Accuracy</td>
</tr>
<tr>
<td>Target: 10 mins</td>
<td>Target: 100%</td>
<td>Target: 0.3</td>
<td>Target: 30km</td>
<td>Target: 30km</td>
<td>Target: 20 mins</td>
<td>Target: 100%</td>
<td>Target: Factor of 2</td>
</tr>
<tr>
<td>13 mins</td>
<td>100%</td>
<td>0.1</td>
<td>27km</td>
<td>38km</td>
<td>21 mins</td>
<td>100%</td>
<td>8</td>
</tr>
</tbody>
</table>

- **Meets Target**
- **Near Target**
- **Misses Target**
## TSP Australia KPIs (2)
### IOTWS Years 2 and 3: Nov 2012 to Feb 2015

<table>
<thead>
<tr>
<th>Service Level 1</th>
<th>Service Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>KPI 1</strong> ET First EQ Bull</td>
<td><strong>KPI 4</strong> ET First Threat Bull</td>
</tr>
<tr>
<td>Target: 10 mins</td>
<td>Target: 20 mins</td>
</tr>
<tr>
<td><strong>KPI 2</strong> POD IO EQs</td>
<td><strong>KPI 5</strong> POD Tsunami Waves</td>
</tr>
<tr>
<td>Target: 100%</td>
<td>Target: 100%</td>
</tr>
<tr>
<td><strong>KPI 3a</strong> EQ Mag</td>
<td><strong>KPI 3b</strong> EQ Depth</td>
</tr>
<tr>
<td>Target: 0.3</td>
<td>Target: 30km</td>
</tr>
<tr>
<td><strong>KPI 3c</strong> EQ Location</td>
<td><strong>KPI 3c</strong> EQ Location</td>
</tr>
<tr>
<td>Target: 30km</td>
<td>Target: 30km</td>
</tr>
<tr>
<td><strong>KPI 4</strong> ET First Threat Bull</td>
<td><strong>KPI 5</strong> POD Tsunami Waves</td>
</tr>
<tr>
<td>Target: 20 mins</td>
<td>Target: 100%</td>
</tr>
<tr>
<td><strong>KPI 5</strong> POD Tsunami Waves</td>
<td><strong>KPI 6</strong> Tsunami Height Accuracy</td>
</tr>
<tr>
<td>Target: Factor of 2</td>
<td>Target: Factor of 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Meets Target</th>
<th>Near Target</th>
<th>Misses Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 mins 82%</td>
<td>0.18 28km 21km</td>
<td>19 mins n/a n/a</td>
</tr>
</tbody>
</table>
Comparison of Average IOTWS-TSP Earthquake Bulletin Issue Times, by Calendar Year

IOTWS-TSP Earthquake Bulletin Issue Time Averages
(elapsed minutes after earthquake)
KPI 1: Target <= 10 minutes

Calendar Year

TSP Australia
TSP India
TSP Indonesia
International Conference to Commemorate 10th Anniversary of the Indian Ocean Tsunami
24-25 November 2014, Jakarta, Indonesia

The Indian Ocean Tsunami Warning and Mitigation System 10 years after the Indian Ocean Tsunami: Achievements, Challenges, Remaining Gaps and Policy Perspectives

Summary Statement
How ready are we?

* We are certainly "safer" against the tsunami threat than we were in 2004
* Due to the nature of the tsunami threat, unfortunately we can never be completely "safe"
* However, we must always be "ready".
Sustaining the achievements
Enhancements to address gaps & further meet needs
More effort into community awareness & preparedness... request acknowledge 'M' in IOTWMS
Power and unpredictability of tsunamis