Outlines

1. Earthquake and Sea Level Monitoring Capability

2. Tsunami Warning Technologies

3. Products and Dissemination

4. Public Awareness and Preparedness

5. International Activities
1. Earthquake and Sea Level Monitoring Capability
Real-time, broadband seismic waveform data from:
- SOA(25)
- CEA(54)
- IRIS + GEOFON DMC (~530)

Global Seismic Station

Global and Regional Seismic Monitoring

- Antelope
- SeisComp3
- CEA EQIM
- PTWC, USGS earthquake info.: via GTS, FAX and Email

Regional Seismic Networks
Earthquake Analysis and Alerting System

SeisComp3

Antelope *update*
Operational Focal Mechanism Inversion

- Automatic focal mechanism inversion system is operationally running in NTWC
- CEA's CMT solutions serve as backup

Focal mechanism of earthquake on Feb. 16 2018, Guerrero, Mexico

W-phase Moment Tensor (CENC/CEA)

Redundant Design

JMA-CMT
W-phase Moment Tensor (USGS)
GCMT
Real-time Sea Level Monitoring

- GTS sea level stations
- 120 tidal gauges along the Chinese coasts via dedicated cable and VSAT
- The SCS tsunami buoy
2. Tsunami Warning Technologies
Tsunami Scenario Database

NW Pacific Scenario Database

Whole Pacific Unit Source Database

Source Coverage:
37 partitions, 1671 sources
Resolution: 0.5° × 0.5°
Totally: 60,156 tsunami scenarios

Source Coverage:
Length: 100 km
Width: 50 km
Totally: 1391 unit sources
Real-time Tsunami Forecast Model

Parallelization Methods: OpenMP ➔ GPU

<table>
<thead>
<tr>
<th>Forecast region</th>
<th>Space resolution</th>
<th>Forecast period (hours)</th>
<th>Consuming time (seconds)</th>
<th>Speed-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacific Ocean</td>
<td>5 arc-min</td>
<td>32</td>
<td>480</td>
<td>76</td>
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<tr>
<td>NW Pacific Ocean</td>
<td>4 arc-min</td>
<td>15</td>
<td>32</td>
<td>10</td>
</tr>
<tr>
<td>South China Sea</td>
<td>2 arc-min</td>
<td>15</td>
<td>31</td>
<td>10</td>
</tr>
</tbody>
</table>
Decision Support System
Decision Support System Optimization

Focal mechanism retrieval and issue

Tsunami unit-source database integrated to the system
3. Products and Dissemination
Tsunami Warning Procedure and Levels

Tsunami warnings are classified as three levels:

- **Red** (Max. tsunami wave amplitude $\geq 300$cm), corresponding to ‘especially severe disaster possibly causing a number of casualties and huge economical losses’
- **Orange** (Amp. max $\geq 100$cm), ‘possibility of severe damage’
- **Yellow** (Amp. max $\geq 30$cm), ‘watch out for potential danger near the coastline’
Products

✴ Warnings and Bulletins
  - Tsunami information
  - Tsunami warning

✴ Event Summary for Major Tsunamis

Summary of 8 Sept. 2017 Mexico Tsunami

Earthquake info.
Tsunami message
Tsunami impact
Focal mechanism
Rupture process
Tsunami modeling
Lessons learned
Dissemination

- Dissemination is automated as much as possible to facilitate the issuance of tsunami messages efficiently.

- Fax
- Broadcast and TV
- Website, Email
- SMS & Weibo (IM like Twitter, 600,000)
- Mobile network media, like Toutiao app in your phone
Earthquake and Tsunami in 2017

- Responded to 28 major Earthquakes with magnitude greater than 6.5
- 51 tsunami information bulletins issued to relevant agencies and stakeholders with average latency of 11 mins.

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Mw</th>
<th>Max. AMP.(cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Apr.</td>
<td>Central Chile</td>
<td>6.9</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>33.038°S 72.062°W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Sept.</td>
<td>Mexico</td>
<td>8.2</td>
<td>175</td>
</tr>
<tr>
<td></td>
<td>15.022°N 93.899°W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 Oct.</td>
<td>Loyalty Island</td>
<td>6.8</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>21.660°S 169.203°E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 Nov.</td>
<td>Loyalty Island</td>
<td>7.0</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>21.325°S 168.672°E</td>
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<td></td>
</tr>
</tbody>
</table>
Dissemination

UNESCO/IOC SCSTAC website  http://www.scstac.org

Limits:

- **Public User**
  - Text messages

- **NTWC**/

- **FPs**/

- **Other TSPs**
  - Text messages
  - Graphic products
  - Focal mechanism
  - Sea level data
On-duty Shift

Before 26 Jan. 2018
One watch-stander was on duty in 24 hours, which was just responsible for national tsunami warning.

From 26 Jan. 2018 to now
Since the trial operation of SCSTAC, two watch-standers are on duty all the time in one day with shift time of 12 hours.
4. Public Awareness and Preparedness
<table>
<thead>
<tr>
<th>问题</th>
<th>页码</th>
</tr>
</thead>
<tbody>
<tr>
<td>什么是海啸？</td>
<td>6</td>
</tr>
<tr>
<td>海啸是怎样产生的？</td>
<td>6</td>
</tr>
<tr>
<td>海啸有多危险？</td>
<td>7</td>
</tr>
<tr>
<td>海啸如何传播？</td>
<td>8</td>
</tr>
<tr>
<td>海啸有多大？</td>
<td>9</td>
</tr>
<tr>
<td>海啸有多快？</td>
<td>9</td>
</tr>
<tr>
<td>为什么在海上或空中看不到海啸？</td>
<td>9</td>
</tr>
<tr>
<td>海啸造成破坏的因素有哪些？</td>
<td>10</td>
</tr>
<tr>
<td>历史上有哪些大海啸事件？</td>
<td>10</td>
</tr>
<tr>
<td>所有大型海底地震都会产生海啸吗？</td>
<td>11</td>
</tr>
<tr>
<td>海啸的持续时间有多长？</td>
<td>11</td>
</tr>
<tr>
<td>海啸到达时间能够准确预测吗？</td>
<td>11</td>
</tr>
<tr>
<td>海啸与一般海浪有何不同？</td>
<td>11</td>
</tr>
<tr>
<td>海啸能够预测吗？</td>
<td>12</td>
</tr>
<tr>
<td>海啸一般发生在哪里？</td>
<td>12</td>
</tr>
<tr>
<td>所有大洋都有海啸发生吗？</td>
<td>12</td>
</tr>
<tr>
<td>我国历史海啸</td>
<td>12</td>
</tr>
</tbody>
</table>

二、海啸来源

（一）海啸源
18. 海啸成因是什么？ | 17 |
19. 全球海啸是如何分布的？ | 17 |

（二）海啸
20. 地震是如何产生海啸的？ | 18 |
21. 飓风是如何产生海啸的？ | 19 |
22. 洪水是怎么产生的？ | 19 |
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24. 什么类型的地震容易引发海啸？ | 20 |
25. 地震有哪些分类？ | 20 |
26. 地震是怎样定义的？ | 20 |
27. 地震强度如何测定？ | 20 |
28. 地震波有哪些类型？ | 21 |
29. 地震台站的作用是什么？ | 22 |
30. 地震波由哪些部分组成？ | 22 |
31. 什么是地震震中？ | 22 |
32. 什么是地震震幅？ | 23 |

三、海啸监测

（一）海啸监测参数
33. 海啸波浪多深？ | 23 |
34. 平均海平面如何测定？ | 23 |
Publicity & Education

Tsunami publicity drawings

- Sent via microblog on the mobile phone to the public
Publicity & Education

Marine Disaster Prevention and Mitigation Day of China, 12 May
• Tsunami outreach activities in Haikou middle school of Hainan province
Tsunami Evacuation Drill, 12 May

2018年5月12日8时0分（北京时间），菲律宾以西海域（19.00° N, 120.00° E）发生9.8级地震，震源深度为30.0千米。国家海洋局海啸预警中心根据初步地震参数判断，地震可能会引发大规模海啸，预计对我国东南沿海造成灾害性影响。
World Tsunami Awareness Day, 2 November 2017

Tsunami publicity in the Huaihai Institute of Technology, Lianyungang City
Publicity & Education

• Tsunami education in the community, Haidian District, Beijing
5. International Activities
The 6th Meeting of the ICG/PTWS Regional Working Group on Tsunami Warning and Mitigation System in the South China Sea Region, 1-3 March 2017, Shanghai, China
Bangladesh-China Marine Disaster Forecasting Workshop, 18-19 September 2017, Dacca, Bangladesh
The 9th South China Sea Tsunami Workshop, 23-24 Oct. 2017, Qingdao, China
Thank You!