Recent experience and practice for strong motion observation in china

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Outlines

- Advance in strong motion observation in China
- Experience of NSMONS in recent earthquakes
- Current practice and future plan
Advance in strong motion observation in China

- In 1956, initiated
- In 1962, first recording
- In 1966, first accelerograph
- In 1973, first array
- In 2007, digital network

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Advance in strong motion observation in China

- Initiated by Pro. Liu Huixian
- Written in the “Outline of the national program for long- and medium-term scientific and technological development”
- Research group was founded
Advance in strong motion observation in China

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- In 1966, first accelerograph
- In 1973, first array
- In 2007, digital network
Advance in strong motion observation in China

The first strong-motion measurement was carried out and the first recordings was obtained.
Advance in strong motion observation in China

In 1956, initiated
In 1962, first recording
In 1966, first accelerograph
In 1973, first array
In 2007, digital network
Advance in strong motion observation in China

- The first accelerograph in China was produced by IEM, CEA
- Mobile observation was carried out in Xingtai Earthquake firstly

RDZ1-12-66 galvanometric accelerograph

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Advance in strong motion observation in China

 зат The first strong-motion observation array was installed
 зат China-US joint research on strong-motion observation began

Nanjing Yangtze River Bridge in Jiangsu Province

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Advance in strong motion observation in China

Fig. 1. Strong-motion accelerograph experimental array in Tangshan region and distribution of epicenters (1982.7–1983.3)
- TS-01: Zhangzhuhang seismological station;
- TS-02: Beijidian refractory material factory;
- TS-03: Leizhuhang army office;
- TS-04: Office of oil depot at Tuozitou;
- TS-05: Business agency of oil depot at Tuozitou;
- TS-06: Luanxian school of Communist Party at Tuozitou;
- TS-07: Luanxian nurses' school at Tuozitou;
- TS-08: Xiangjiang seismological station;
- TS-09: Luanxian seismological office;
- TS-10: Shimen town office;
- TS-11: Lulong seismological office;
- TS-12: Lulong goods bureau.

Tangshan experimental array

West Yunnan Earthquake Field Array
Advance in strong motion observation in China

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Advance in strong motion observation in China

In 2007, the digital National Strong Motion Observation Networks System (NSMONS) began trial operation in early 2007.
Advance in strong motion observation in China

- Instrument type of free-field stations

![Bar chart showing instrument type numbers for MR2002, ETNA, K2, GDQJ, and GSMA]
## Advance in strong motion observation in China

<table>
<thead>
<tr>
<th>Special observation arrays</th>
<th>Array number</th>
<th>Number of stations (observation points)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near-fault ground motion</td>
<td>1</td>
<td>30</td>
<td>Yunnan province</td>
</tr>
<tr>
<td>Ground motion attenuation</td>
<td>2</td>
<td>2×50</td>
<td>Gansu province and the Capital Region</td>
</tr>
<tr>
<td>Site effect</td>
<td>2</td>
<td>(2×8)</td>
<td>Yunnan province and Hebei province</td>
</tr>
<tr>
<td>Topographical effect</td>
<td>1</td>
<td>8</td>
<td>Sichuan province</td>
</tr>
<tr>
<td>Super- high-rise building</td>
<td>1</td>
<td>46</td>
<td>Shanghai city</td>
</tr>
<tr>
<td>Multi-story building</td>
<td>1</td>
<td>23</td>
<td>Beijing city</td>
</tr>
<tr>
<td>Long-span structure</td>
<td>1</td>
<td>46</td>
<td>Beijing city</td>
</tr>
<tr>
<td>Base-isolated building</td>
<td>1</td>
<td>14</td>
<td>Hebei province</td>
</tr>
<tr>
<td>Large bridge</td>
<td>1</td>
<td>23</td>
<td>Guangdong province</td>
</tr>
<tr>
<td>Large dam</td>
<td>1</td>
<td>21</td>
<td>Sichuan province</td>
</tr>
</tbody>
</table>

*Note:* In all arrays for structure response observation, there are tri-axial records for each observation point.

12 special arrays of NSMONS

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Advances in strong motion observation in China

- NSMONS management

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Advance in strong motion observation in China

- National Center responsibility

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Advance in strong motion observation in China

- NSMONS instrument calibration laboratory
Advance in strong motion observation in China

- National center have 80 sets of backup instruments

Instruments in Storage
Advance in strong motion observation in China

Special array of National Center

Differential motion array in Liangcheng Town

Differential motion array in my institute

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Outlines

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Experience of NSMONS in recent earthquakes

- Wenchuan Earthquake

Stations which obtained the strong motion recordings in the main shock

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Experience of NSMONS in recent earthquakes

- The mobile and temporal strong motion observation for Wenchuan Earthquake
Experience of NSMONS in recent earthquakes

- The mobile and temporal strong motion observation for Wenchuan Earthquake

- 92 sites had been measured
- 600 aftershocks in which we obtained recordings

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Experience of NSMONS in recent earthquakes

Typical acceleration time-histories in Huangping Town (No.L0027) obtained in Wenchuan aftershock
(PGA in EW, NS, UD component is -966.5Gal, 734.3Gal, 658.9Gal, respectively)
Experience of NSMONS in recent earthquakes

Others—Yushu Earthquake

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Experience of NSMons in recent earthquakes

- Others—Yingjiang, Yaoan and Panzhihua Earthquake
Outlines

- Advance in strong motion observation in China
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Current practice and future plan

Current practice

- Standard and Code for strong motion observation
  - Construction of strong motion station
  - Calibration of strong motion instrument
  - Management and Maintenance of strong motion networks
  - Processing, Management and Release of strong motion recording
  - Engineering quota of strong motion station
Current practice and future plan

Current practice—Shakemaps

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Current practice and future plan

Current practice—Earthquake Early Warning System

Two demo Earthquake Early Warning Systems are now setting up in Lanzhou and Beijing Capital regions.
Current practice and future plan

Future plan

Rapid Seismic Intensity Release System (RSIRS) and Earthquake Early Warning System (EEWS) in China

12th-Five-Years plan

Estimated Budget: RMB 3,000,000,000
Current practice and future plan

RSIRS and EEWS

- Monitoring & Observation sub-system
- Communication Network sub-system
- Data Processing sub-system
- Information Release sub-system
- Technical Support sub-system

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Thank you