

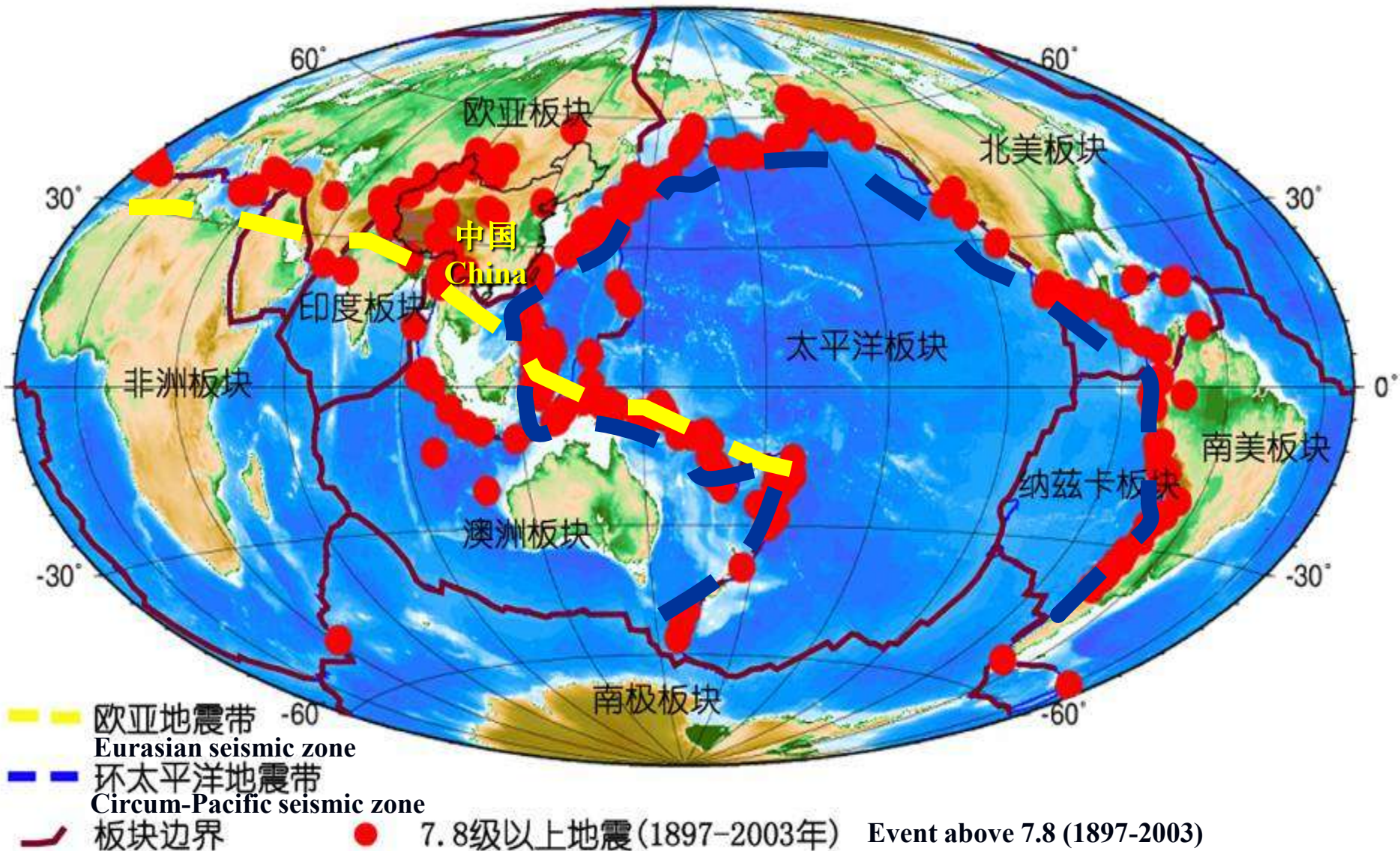
Earthquake Disaster Resilience in China

Yongxian Zhang (yxzhseis@sina.com)
China Earthquake Networks Center

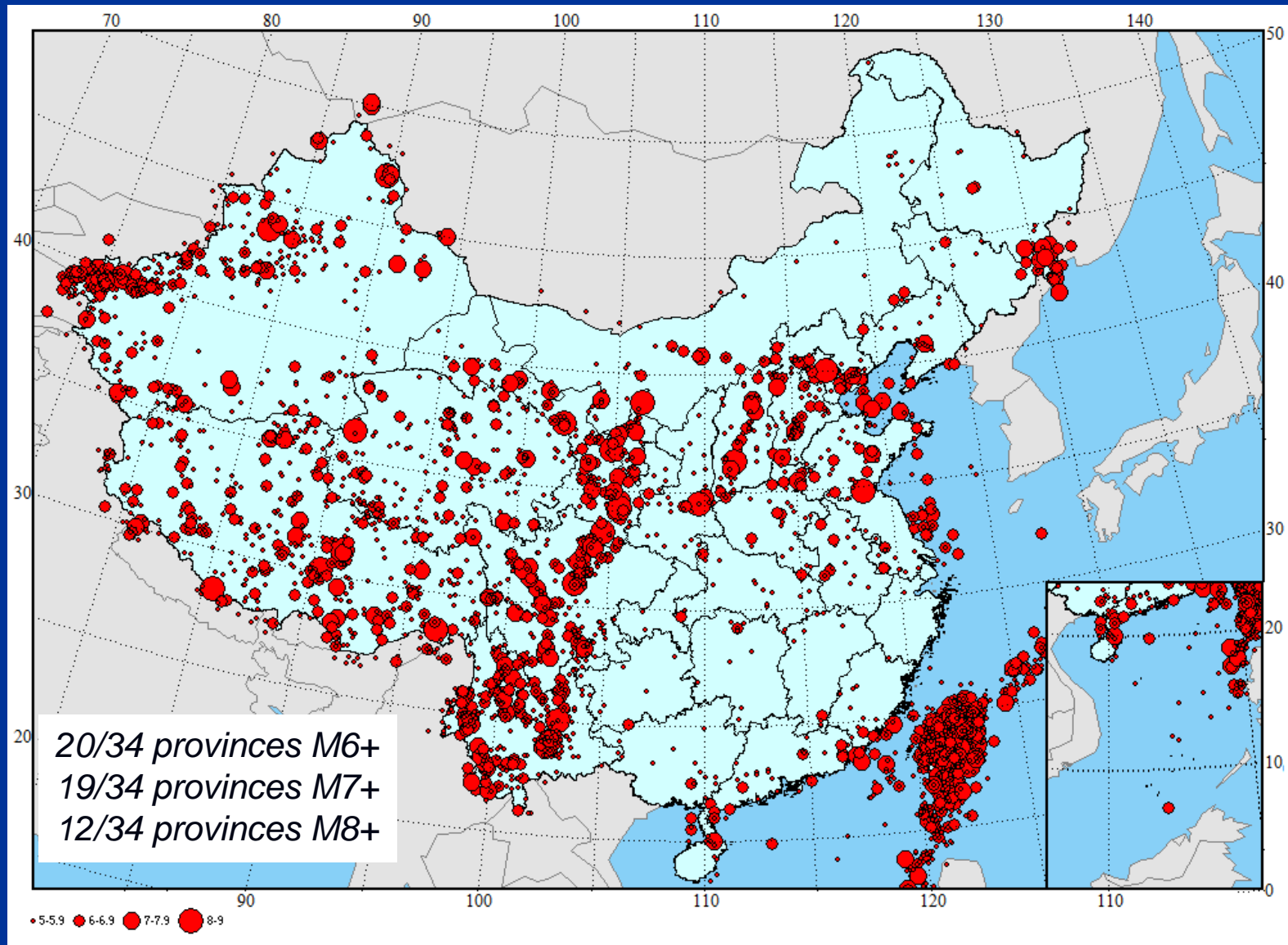
OUTLINES

- **Earthquake Disaster in China**
- **Laws Supporting Earthquake
Disaster Resilience in China**
- **Infrastructure of Earthquake
Disaster Resilience in China**

Earthquake above M7.8 in the World

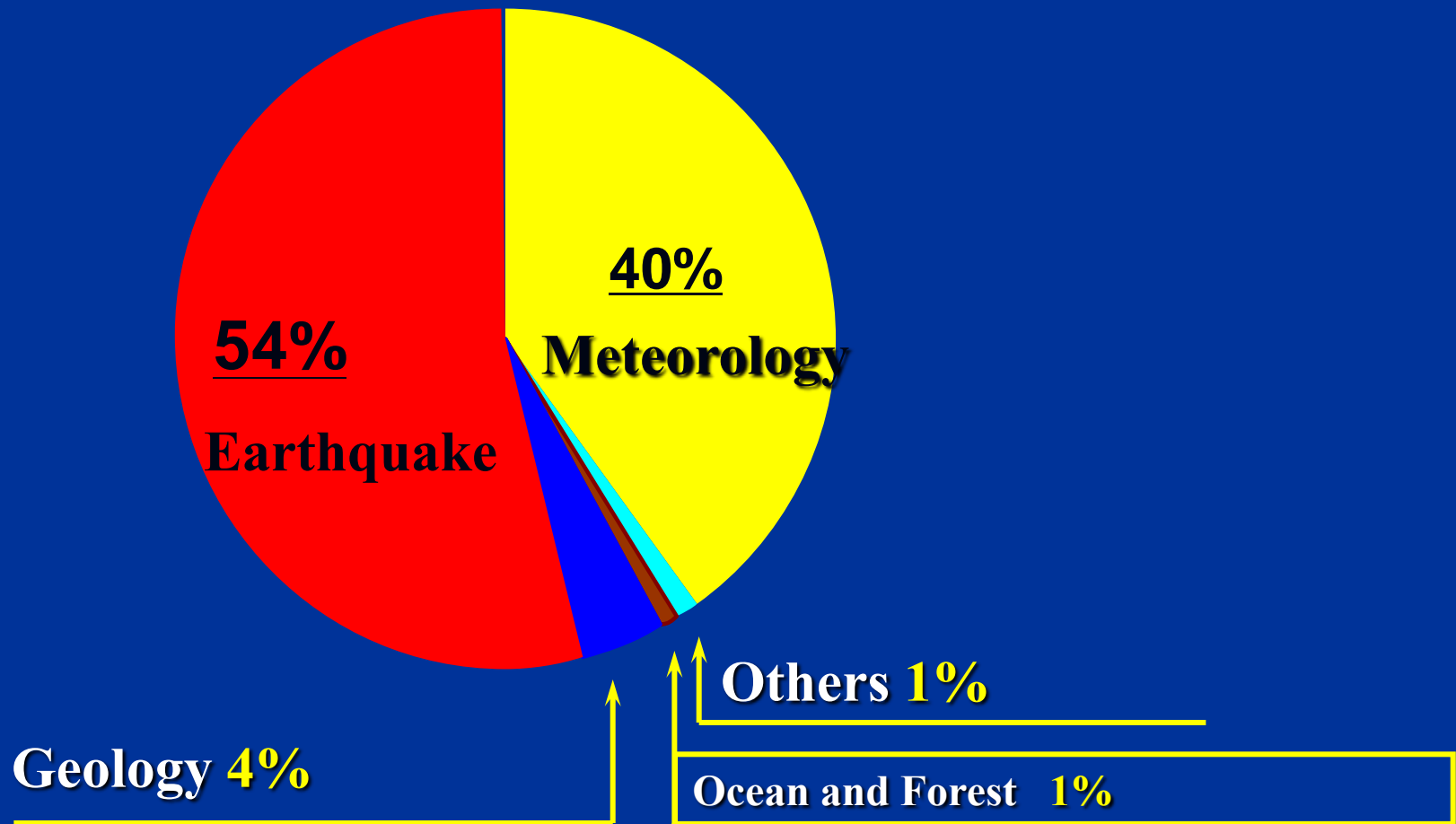


Earthquake above $M5.0$ in China



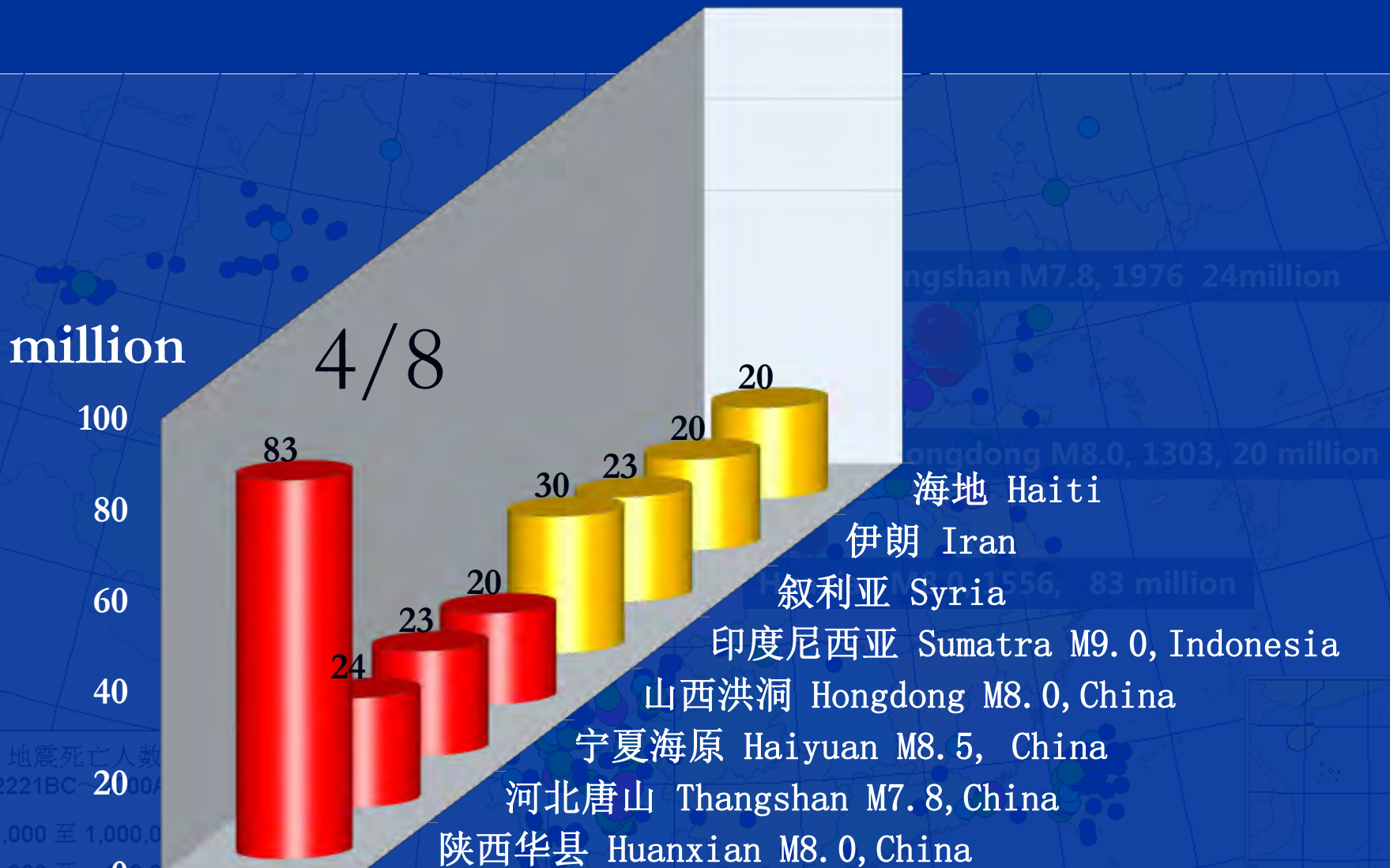
Proportion of Death Toll Caused by National Disaster in China

(since 1949)



Most Fatal Earthquakes Recorded in the world

(Death Toll exceeding 20 millions)



地震死亡人数

(-2221BC~2000A)

100,000 至 1,000,000

10,000 至 100,000

1,000 至 10,000

Milestone of Earthquake Disaster Prevention in China---Xingtai M7.2 Earthquake in 1966



Tangshan M7.8 Earthquake in 1976



Death Tolls
Above **242,000**,
Damaged Area
300,000 KM²

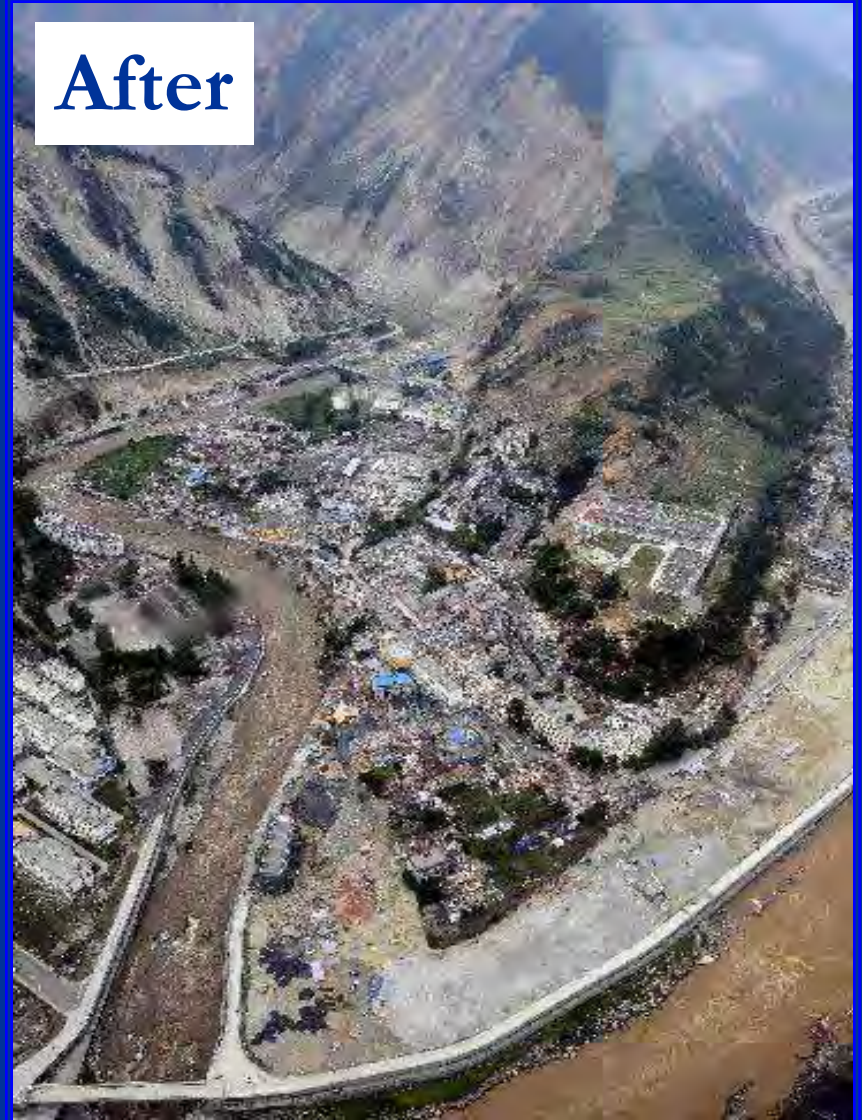
Wenchuan M8.0 Earthquake in 2008

Yinxiu County before and after the quake

Before



After



Wenchuan M8.0 Earthquake in 2008



Wenchuan M8.0 Earthquake in 2008

Earthquake Rescue



OUTLINES

- **Earthquake Disaster in China**
- **Laws Supporting Earthquake Disaster Resilience in China**
- **Infrastructure of Earthquake Disaster Resilience in China**

The System of Laws on Earthquake Prevention and Disaster Mitigation in China



**Law of Earthquake
Prevention and Disaster
Reduction, P.R.C**



**Law on Emergency
Responses, P.R.C**



**Regulations on
Emergency Response to
Destructive
Earthquakes**

Law of Earthquake Prevention and Disaster Reduction, P.R.C

Endorsed Dec.29, 1997, Amended Dec.27, 2008



中华人民共和国
防震减灾法

Chapter 1 General Rules

**Chapter 2 Blueprint for Earthquake Prevention
and Disaster Mitigation**

Chapter 3 Earthquake Monitoring and Prediction

Chapter 4 Earthquake Disaster Prevention

Chapter 5 Earthquake Emergency Responses

**Chapter 6 Post-earthquake transitional resettlement
and rehabilitation and reconstruction**

Chapter 7 Supervision and Administration

Chapter 8 Legal Liability

Chapter 9 Supplementary Articles

Regulations on the Administration of Seismic Monitoring, P.R.C

1. General Rules

2. Planning and Construction of Seismic Monitoring
Network

Coordinating with Chapter 3

4. Protection of Seismic Monitoring facilities and
Seismic observation Environment

5. Legal Liability

6. Supplementary Articles

Endorsed June 4, 2004, Enforced since Sept.1, 2004

Regulations on the Administration of Earthquake Prediction, P.R.C.

1. General Rules
2. Creation of Earthquake Prediction Report

Coordinating with Chapter 3

4. Issuing of Earthquake Prediction
5. Legal Liability
6. Supplementary Articles

Enforced since Dec.27, 1998

Regulations on the Administration of Seismic Safety Evaluation

1. General Rules
2. Qualification of Seismic Safety Evaluation Unit
3. General Technical Requirements of Seismic Safety Evaluation

Coordinating with Chapter 4

4. Approval of Seismic Safety Assessment Report
5. Supervision and Administration
6. Penalty Provisions
7. Supplementary Articles

Enforced since Jan.1, 2002

Regulations on Emergency Response to Destructive Earthquakes, P.R.C.

1. General Rules
2. Emergency Action Agency
3. Emergency Action Plan
4. Impending Earthquake Emergency

5. Coordinating with Chapter 5

Response

6. Reward and Punishment

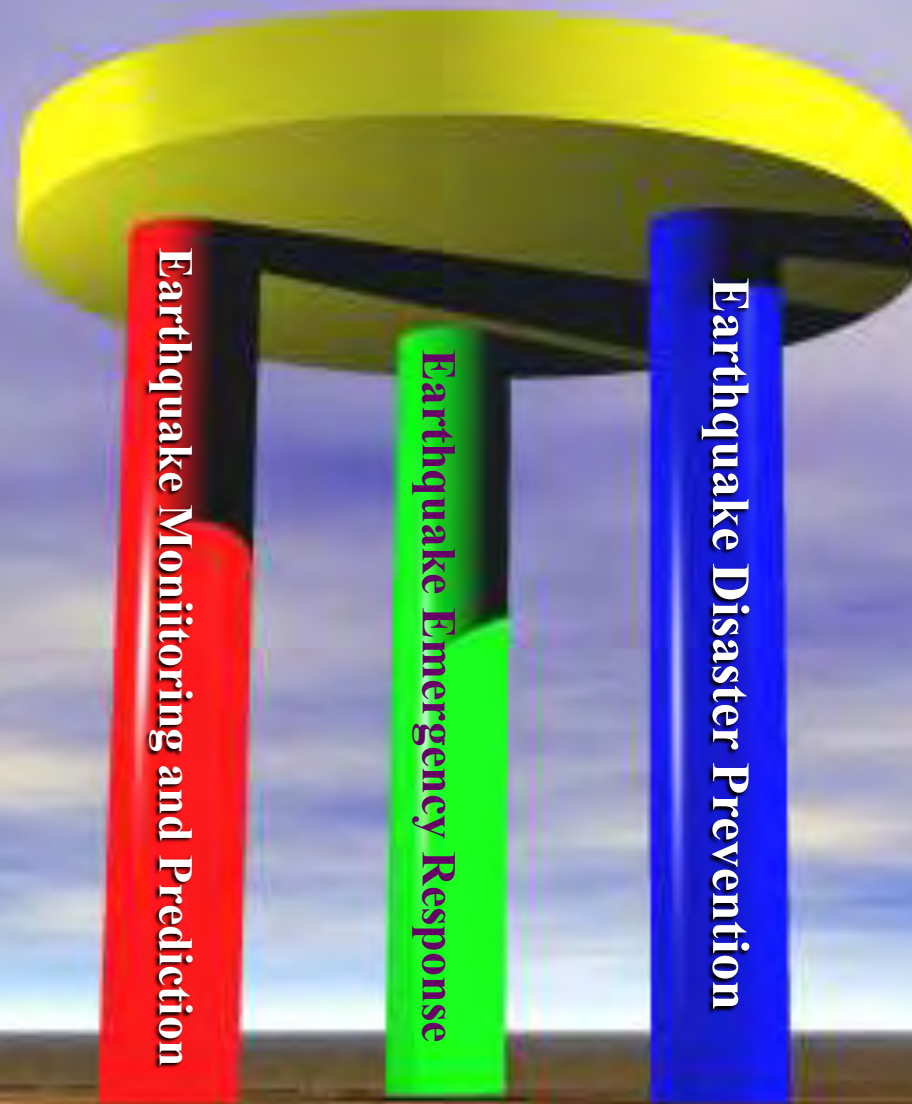


Enforced since April 1, 1995

OUTLINES

- **Earthquake Disaster in China**
- **Laws Supporting Earthquakes
Disaster Resilience in China**
- **Infrastructure of Earthquake
Disaster Resilience in China**

Earthquake Disaster Resilience

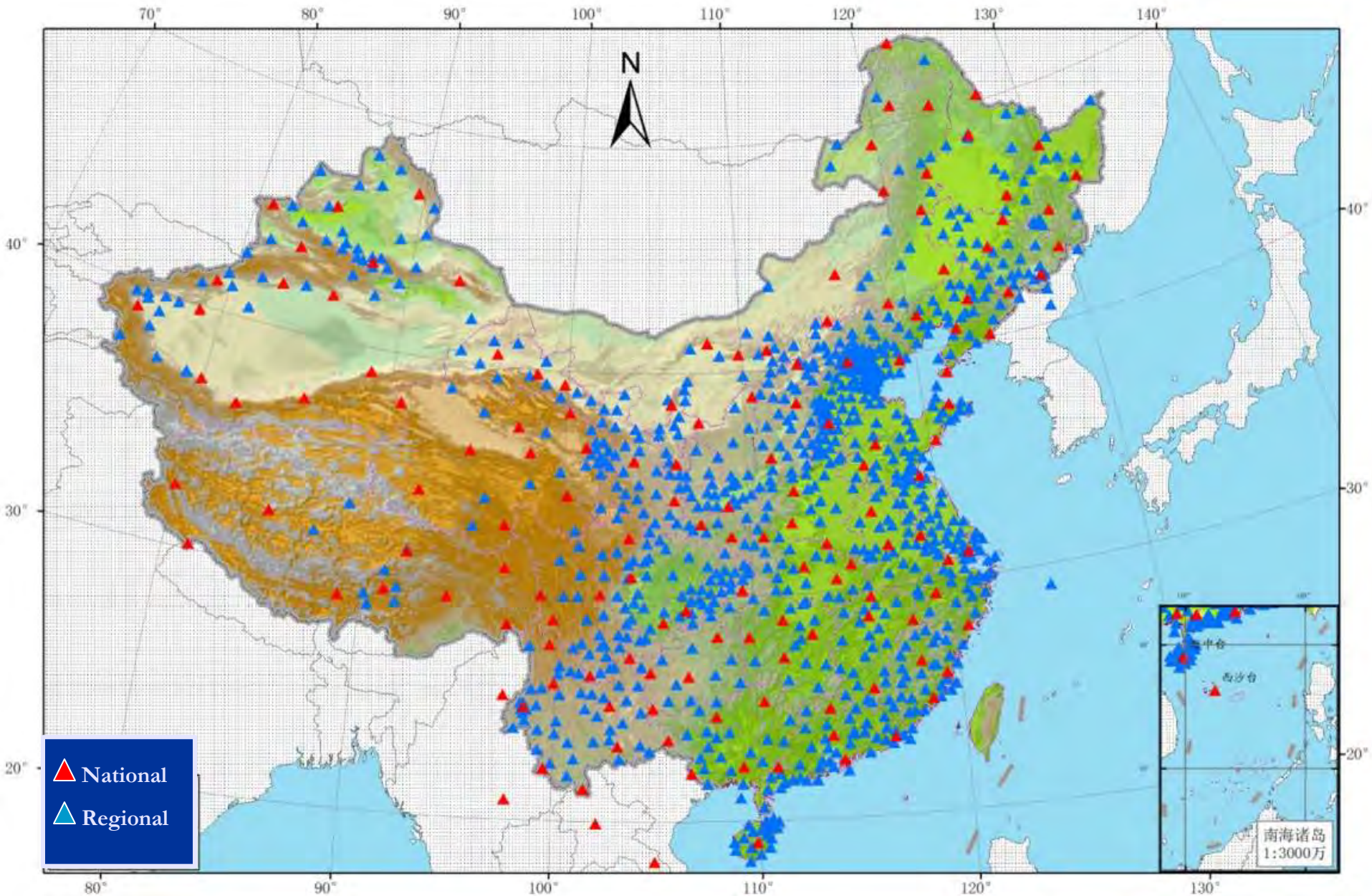


Pillar 1: Earthquake Monitoring and Prediction

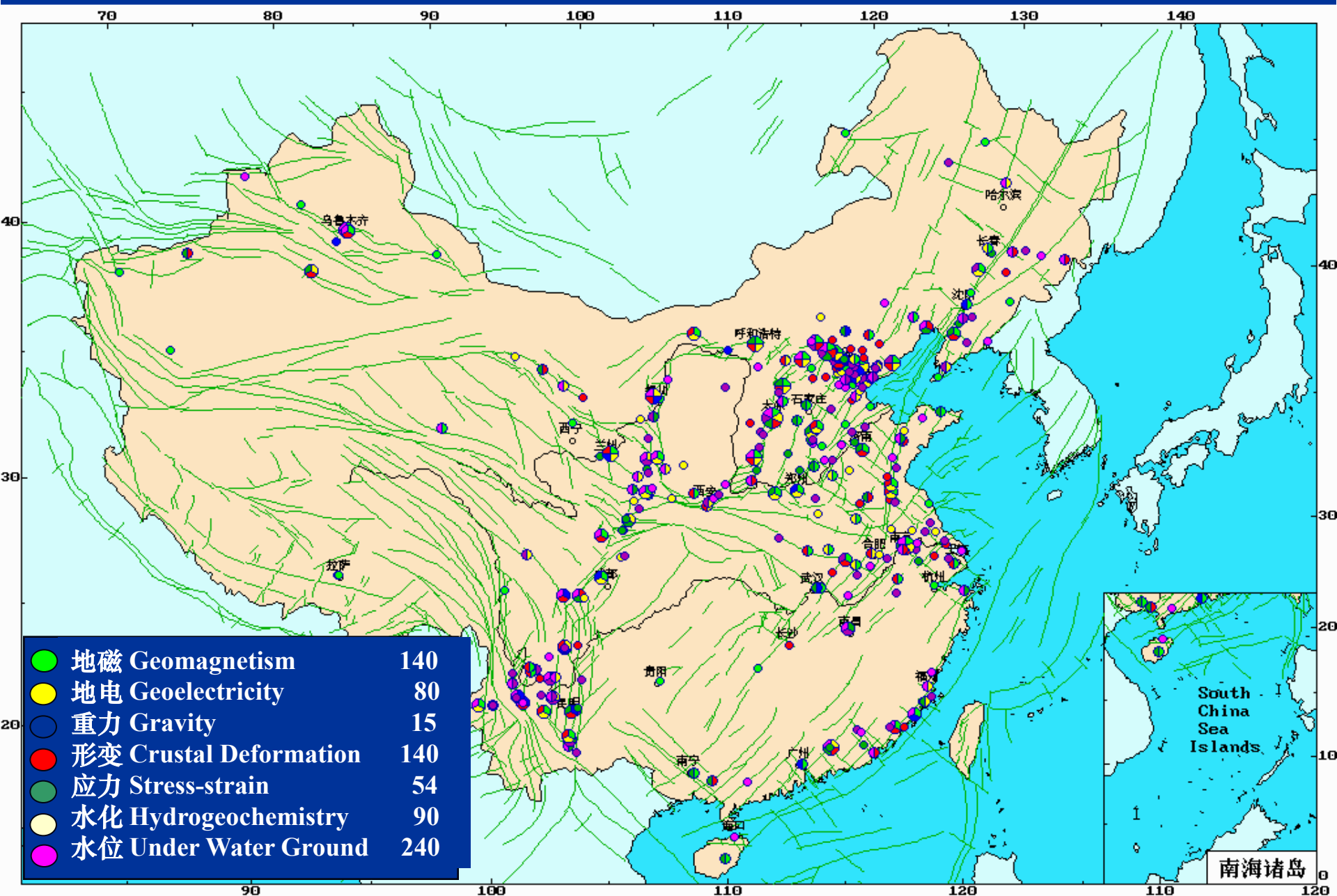
- **Digital Seismic Network**
- **Pre-Earthquake Anomaly Monitoring Network**
- **GPS Network**
- **Earthquake Prediction Practice**



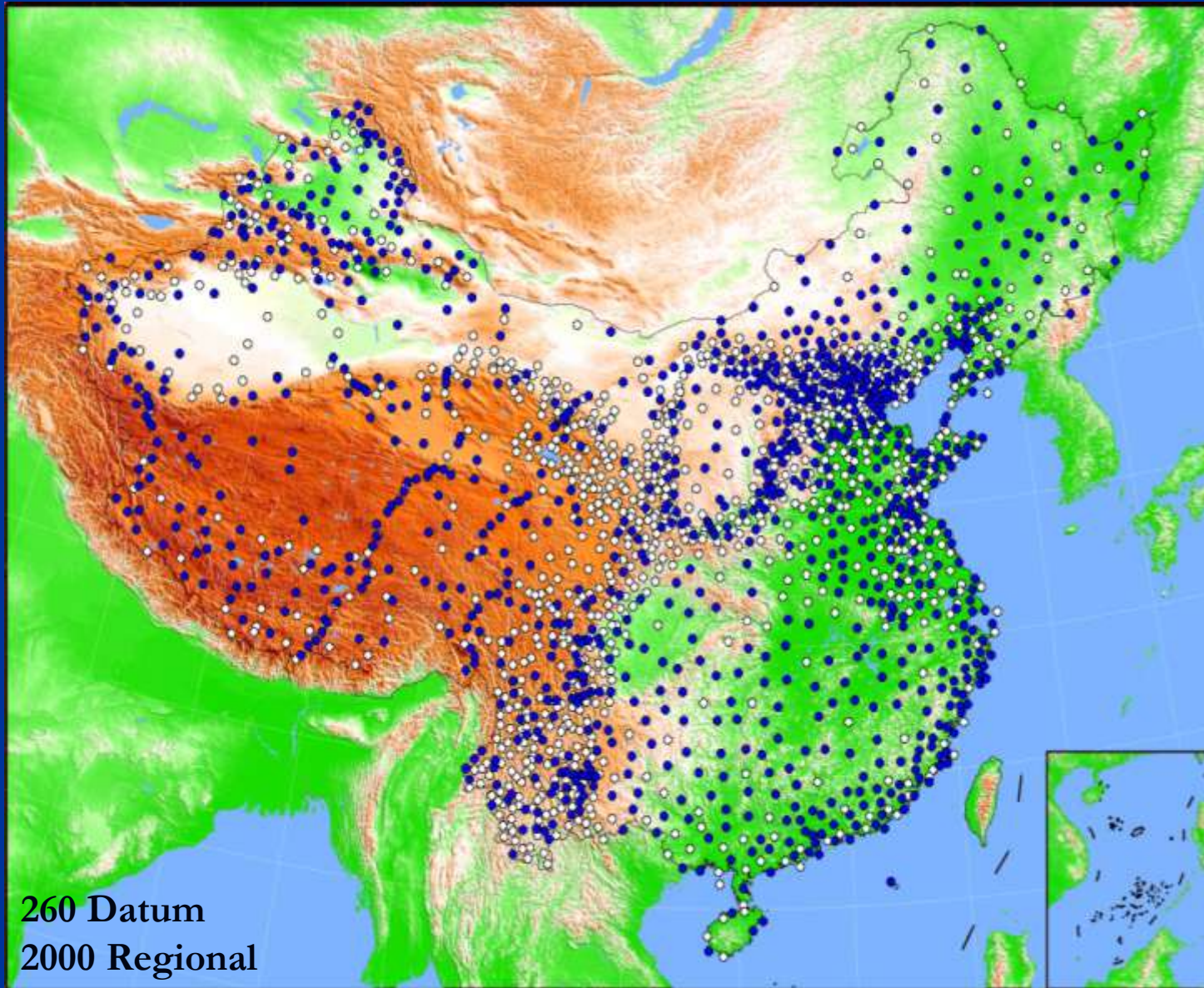
Seismic Network in China Mainland



Pre-Earthquake Anomaly Monitoring Network in China Mainland



GPS Network



Seismic Network of Indonesia

(Built with Aids by China Earthquake Networks Center)



地震预报

Earthquake Prediction

```
graph TD; A[地震预报  
Earthquake Prediction] --> B[长期预报  
(几年到十年)  
Long-term Prediction  
(several years to ten years)]; A --> C[中期预报  
(一年到几年)  
Medium-term Prediction  
(one year to several years)]; A --> D[短期预报  
(通常几个月)  
Short-term Prediction  
(usually several months)]; A --> E[临震预报  
(几天到十天)  
Imminent Prediction  
(several days to ten days)];
```

长期预报
(几年到十年)

Long-term
Prediction
(several
years to
ten years)

中期预报
(一年到几年)

Medium-term
Prediction
(one year to
several
years)

短期预报
(通常几个月)

Short-term
Prediction
(usually
several
months)

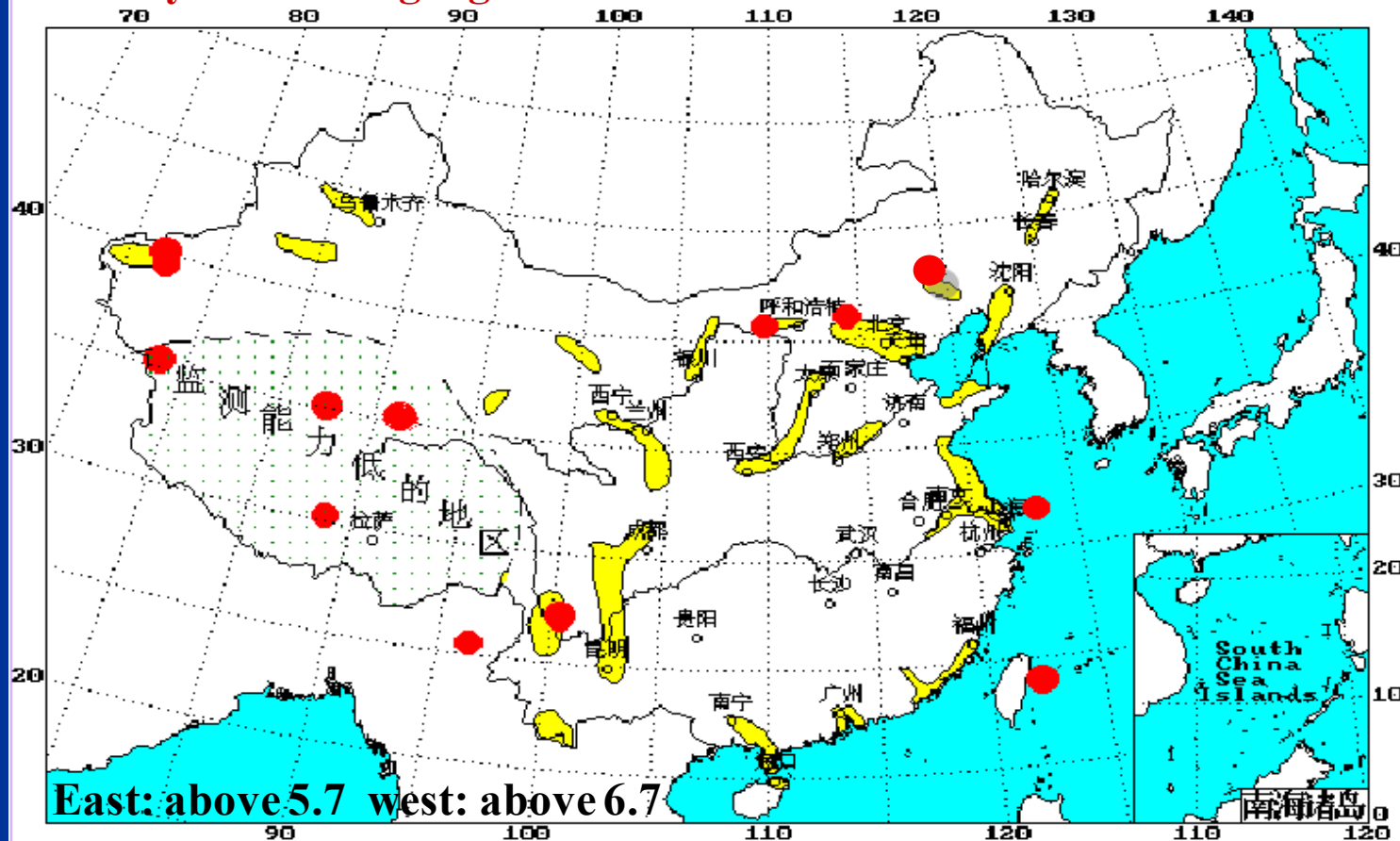
临震预报
(几天到十天)

Imminent
Prediction
(several days
to ten days)

Long Term: 10 years

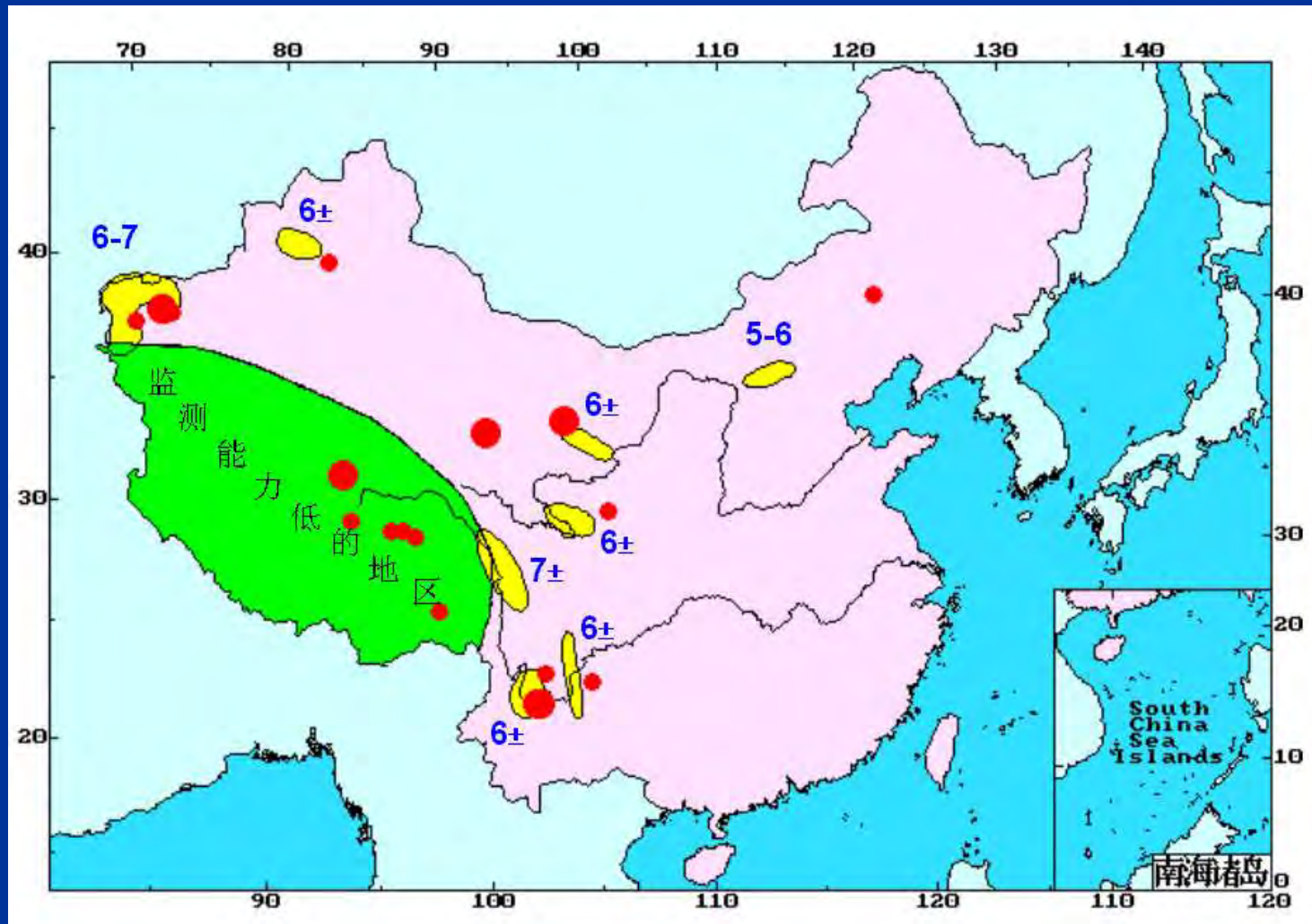
Prediction Map for 1996-2005
and Earthquakes above M6.7 in western region
and Earthquakes above 5.7 in Eastern Region
1996-2005年中国地震重点监视防御区分布
和震中分布图 (东部 $M \geq 5.7$, 西部 $M \geq 6.7$)

The key monitoring regions from 1996 to 2005



Medium Term: 1 year

Prediction Map for 2003 and Earthquakes above M5.0 in 2003



Successful Short and Imminent Earthquake Prediction in Human's History

**Haicheng M7.4
earthquake,
Feb.4, 1975**

啓事
按上级通知
近期可能发生
地震,电影改在
露天广场放映

新华影剧院

Public Notice

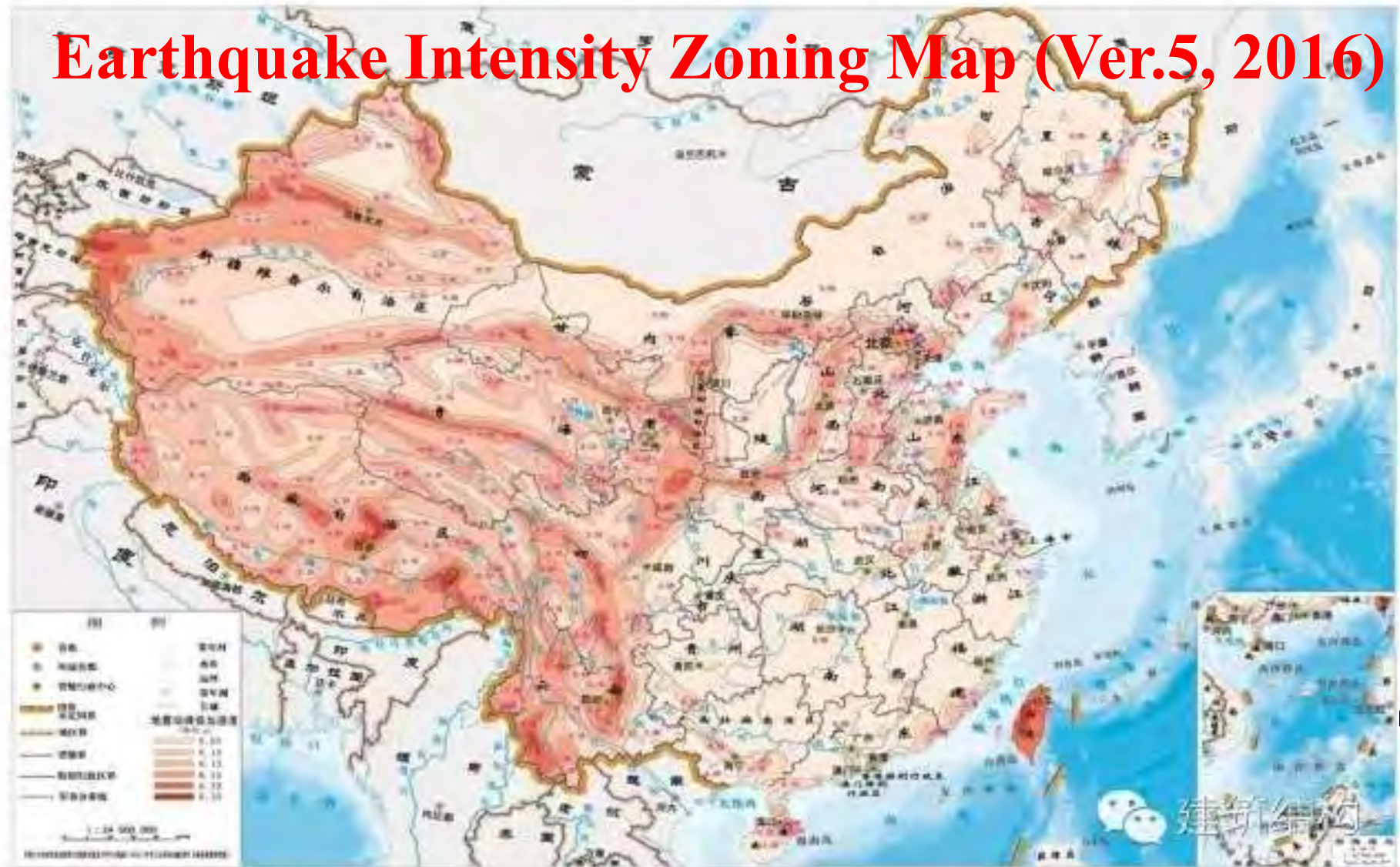
There will be an earthquake very soon, the film will be shown in the open air instead of in the cinema.

Xinhua Cinema

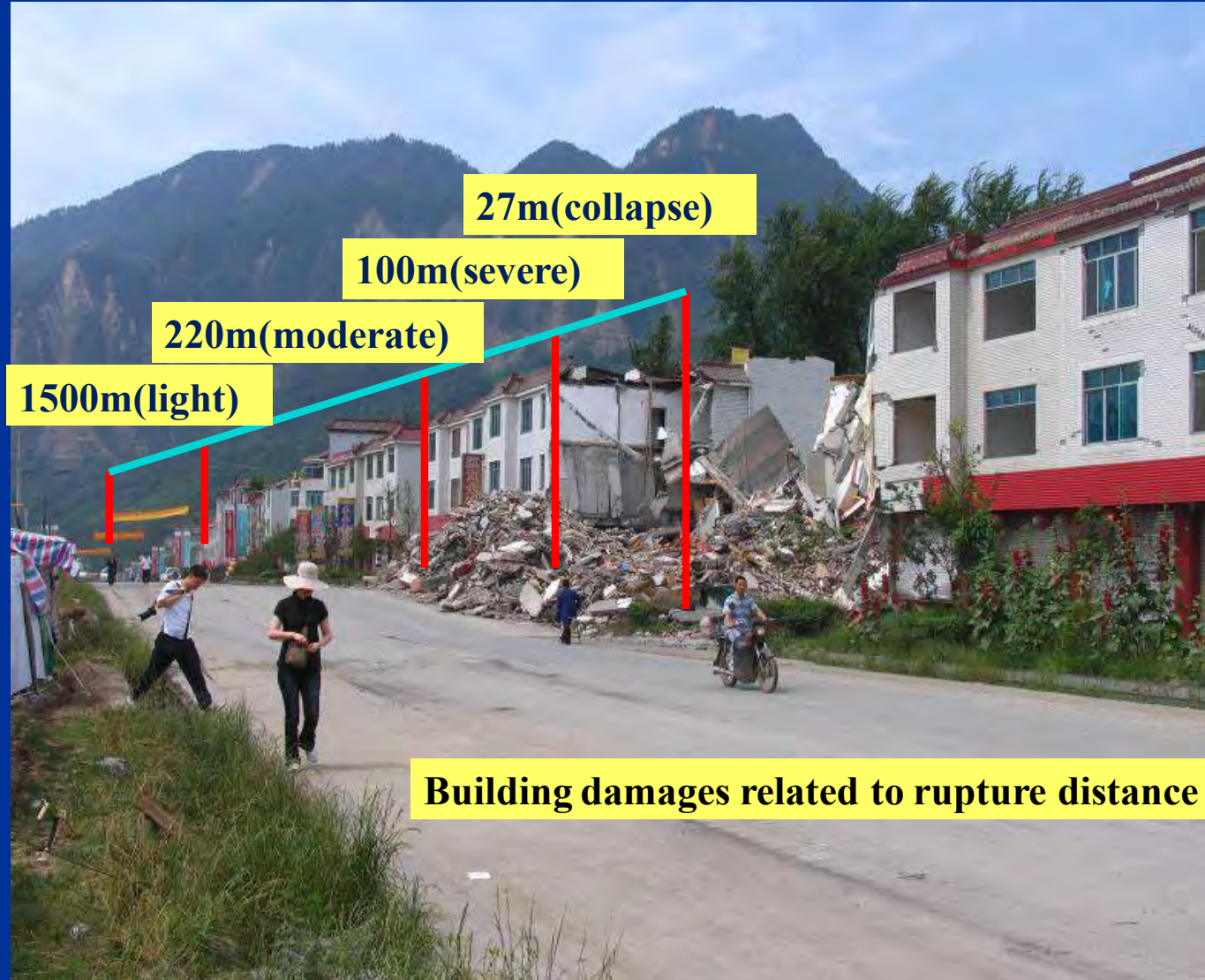
Pillar 2: Earthquake Disaster Prevention

- **Earthquake Resistant Building Design**
- **Safety Evaluation for Important Engineering**
- **Earthquake Disaster Loss Assessment**
- **Raising Public Awareness of Earthquake Mitigation**
- **Improving Legal System**
- **Urban Active Fault Detection**

Earthquake Intensity Zoning Map (Ver.5, 2016)



Urban Active Fault Detection



Building Reinforcement

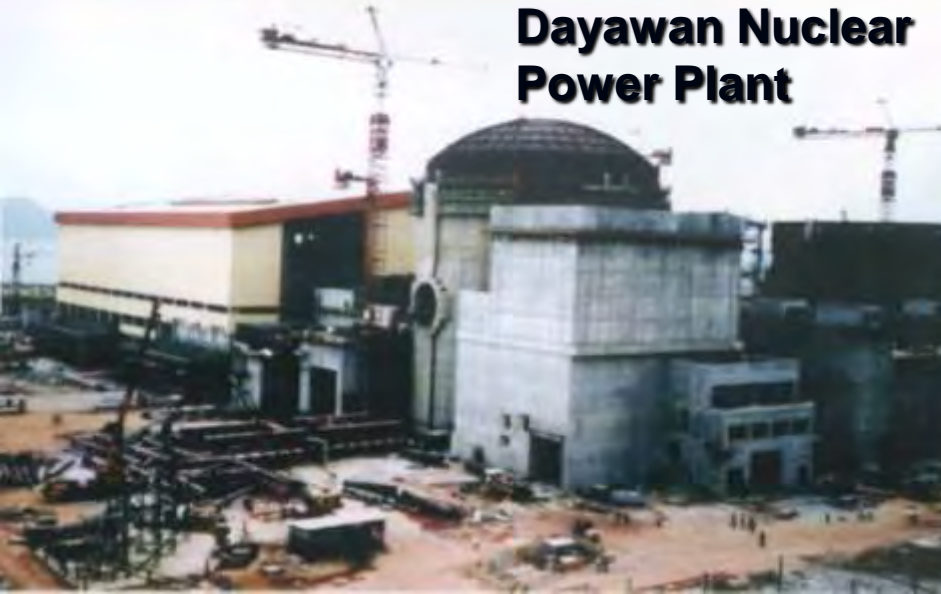


Safety Evaluation for Important Engineering

Three Gorges Project



Dayawan Nuclear Power Plant



The Qinghai -Tibetan Railway under Construction

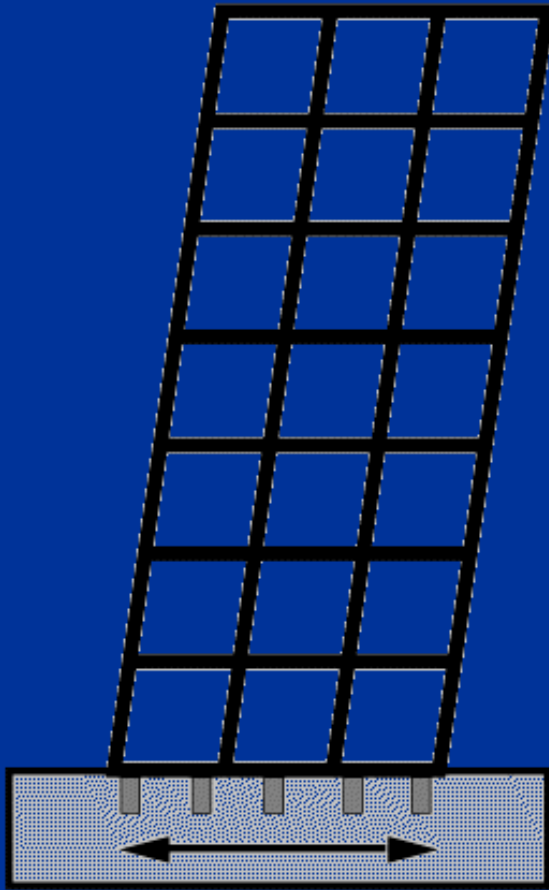




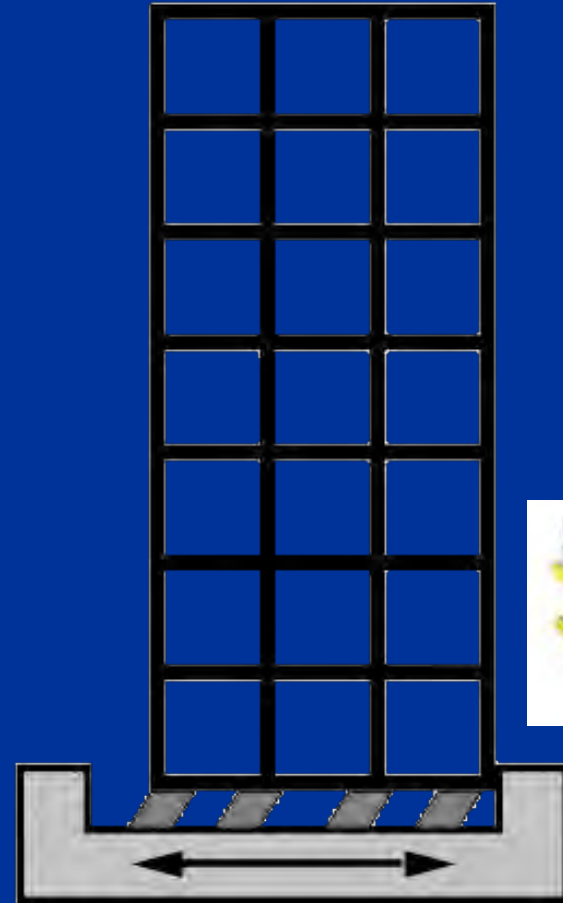
Emergency Shelter Site



New Technology Applied to Earthquake Resistance

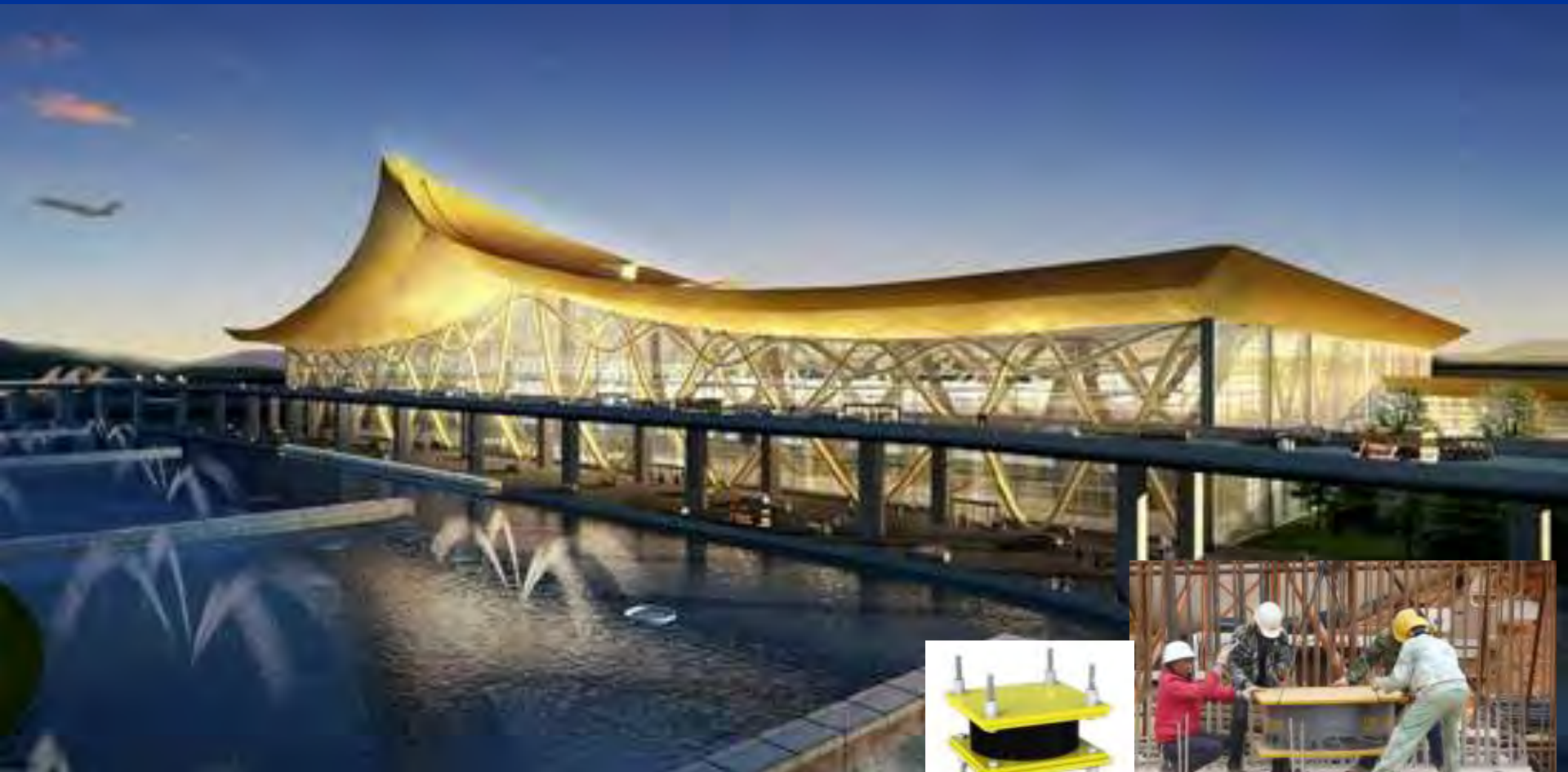


Non Earthquake Resistant Structure



Earthquake Resistant Structure

The Largest Single Building with Earthquake Resistance Technology (Kunming International Airport, 2012)



Pillar 3: Earthquake Emergency Response

- Emergency Action Plan
- 促进能力建设
 - 中国国家救援队管理
 - 引导地方救援队建设和志愿者
 - 鼓励救援（队）相关研究
 - 起草救援（队）标准
 - 支持救援（队）基础设施建设—指挥系统

Pillar 3: Earthquake Emergency Response



第二章 应急机构

第六条 国务院防震减灾工作主管部门指导和监督全国地震应急工作。国务院有关部门按照各自的职责，具体负责本部门的地震应急工作。

第七条 造成特大损失的严重破坏性地震发生后，国务院设立抗震救灾指挥部；国务院防震减灾工作主管部门为其办事机构；国务院有关部门设立本部门的地震应急机构。

第八条 县级以上地方人民政府防震减灾工作主管部门指导和监督本行政区域内的地震应急工作。

Emergency Response Act is according to the law.

On Article VII, Chapter II

Earthquake emergency rescue system should be established by National Departments in short time.

Hierarchy of Earthquake Emergency Response System

Commander

Official from the State Council

Vice Commander

Head Of
Earthquake
Administration

General
Secretary
of the State
Council

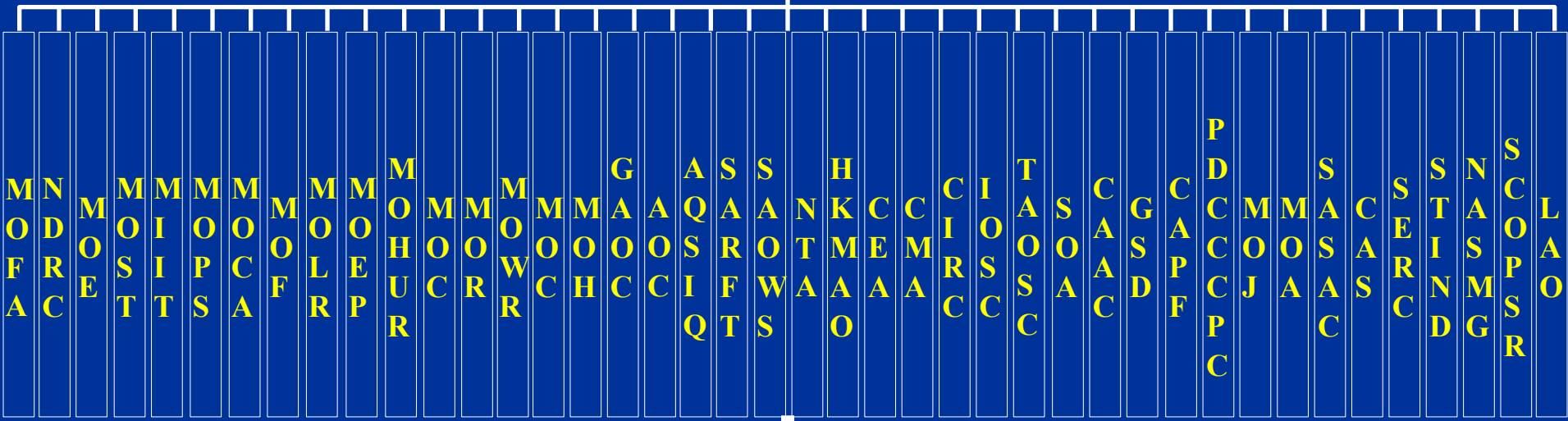
Chief
staff
officer

National
Development
and Reform
Commission

Ministry of
Civil Affairs

Ministry of
Public Security

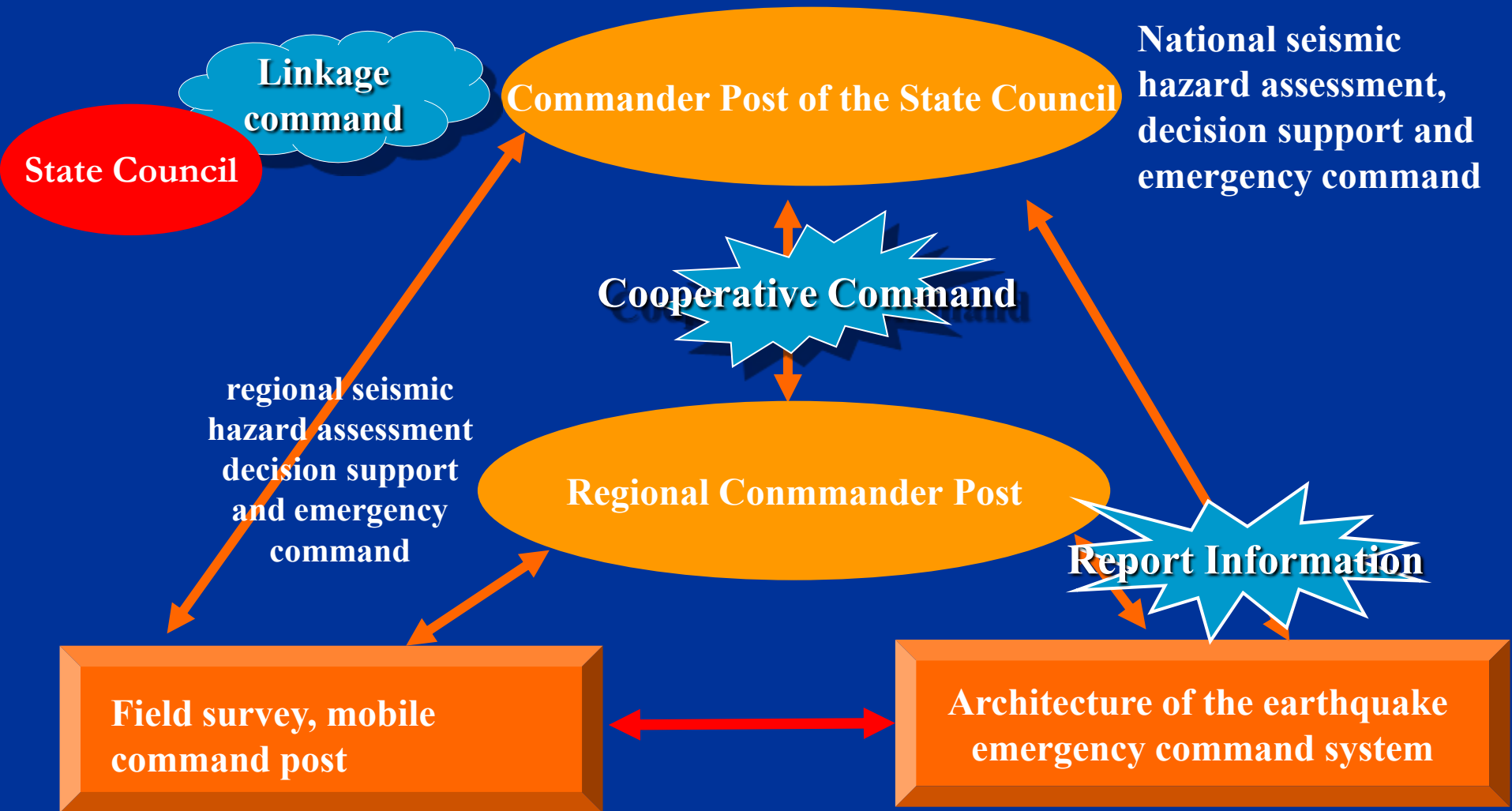
Command Post Member



Commander Office

(China Earthquake Administration)

Technology Supporting System



Commander Post



Commander Post



China International Search & Rescue Team(CISAR)



CISAR was established on April 27, 2001. Former Premier Wen granted the team flag.

Emergency Response of CISAR team



CISAR team



CISAR in Pakistan in 2005



Ten million of People's Liberation Army in Wenchuan, 2008



Volunteers



News Press



China has made great efforts great achievements on EDR. However, pillars support EDR still remain very weak. Science and Technology Innovation is necessary to improve EDR.

Earthquake Disaster Resilience (EDR)





谢谢

Thanks