The development of EEWS in China since the Wenchuan earthquake

--Initiated by the 2008 Wenchuan earthquake and tested by over 1500 quakes

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Background

Avoid this tragedy !

- 2008 WenChuan
- Near 70,000 people died

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Earthquake Early Warning System !

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EEWs has already been used in Japan Successfully

- In 2011 March 11th quake, all trains on Shenganxen were stopped timely
- Warning messages were delivered to Public, gaining warning with up to tens of seconds in advance

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It has been estimated that if there were EEWs in Wenchuan……

- 20,000~30,000 or more people can live

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So, the leaders and civilians of China have been aggressively calling for EEWS since then

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The EEW on the “4.20” LuShan earthquake

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The response of EEWS for the LuShan earthquake on April 20

- Gave 28 seconds of warning time for Chengdu “quake is occuring in Lushan”
- Gave 21 seconds of warning time to Chengdu “estimated seismic intensity 4.5”
- When the countdown is finished, the Chengdu is strongly shaked
- Gave 5 seconds of warning time for Ya’An

The mitigation by the EEWS

- Students and teachers evacuated according to prescribed rules
- Cell phone users evacuated as well
- People in Wenchuan received warning from TV

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EEW for 6 destructive quakes

- Feb.19, QiaoJia of YunNan province, Magnitude 4.9
- April 17, Dali of YunNan province, Magnitude 5.0
- April 20, Lushan of SiChuan province, Magnitude 7.0
- April 25, YiBin of Sichuan province, Magnitude 4.8
- Nov. 16, Dongchuan of Yunnan province, Magnitude 4.5
- Nov. 28, Dali of Yunnan province, Magnitude 4.6

(The above are all the destructive quakes in the covered area by ICL EEWS)

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ICL EEWS has been publically tested by over 3000 quakes

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The area covered by EEW sensors

- Over 570,000 square kilometers covered
- 1700 sensor (marked by green do)

The EEWS by ICL

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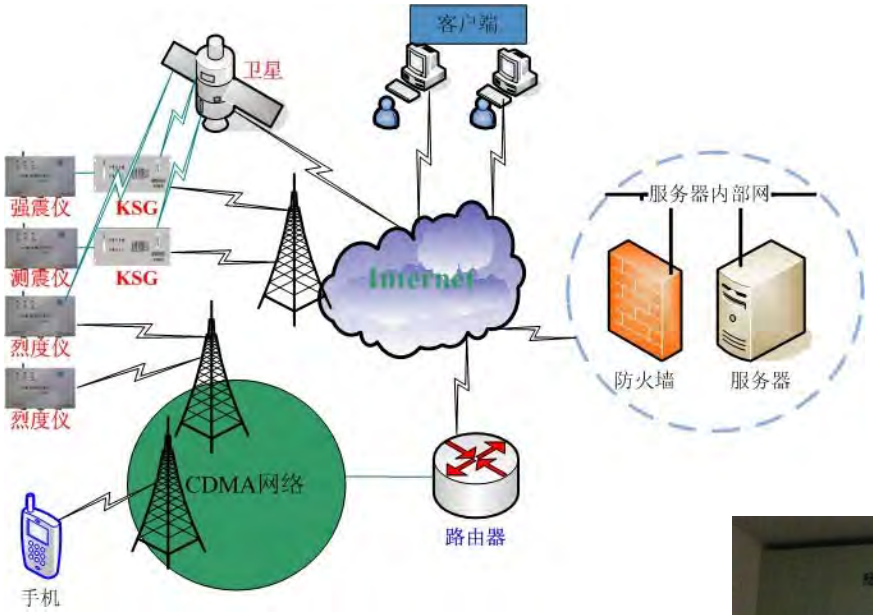
The Schematic of the ICL EEWs



- It covers all EEW steps (from sensing to application of EEW messages)
- Developed creative algorithm to suppress false alarm, to reduce blind zone, to get more accurate parameters…

- Single station data processed on-site !

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Note on the principle of EEW

- During a lightning, we get the flash first, then the sound.
- This is because of the speed difference between the light and the sound
- Similarly, the speed difference between the seismic wave and the network gives the EEW time for EEWS

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- EEW time: for 50 Km, EEW time 10 Second; for 100 Km, EEW time 22 Second

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Many ways to send warnings

- Computers
- Cell phones
- Television
- Radio
- Special receivers

Computers and cell phones are used for the public to receive EEW messages

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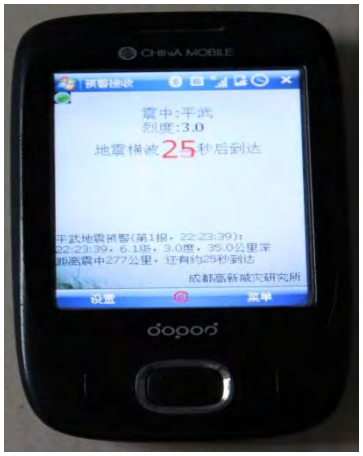

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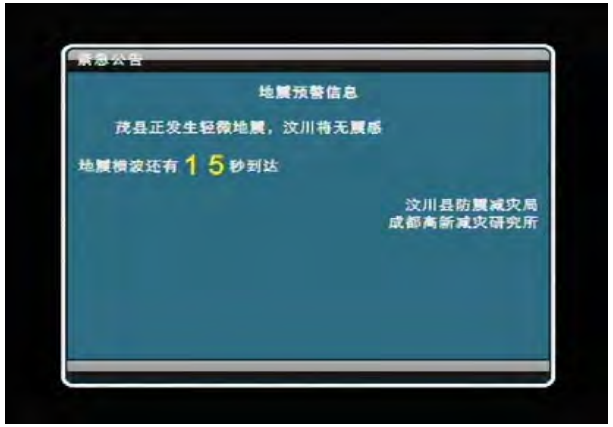

Television EEW is used in Wenchuan county

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Many ways to send warnings

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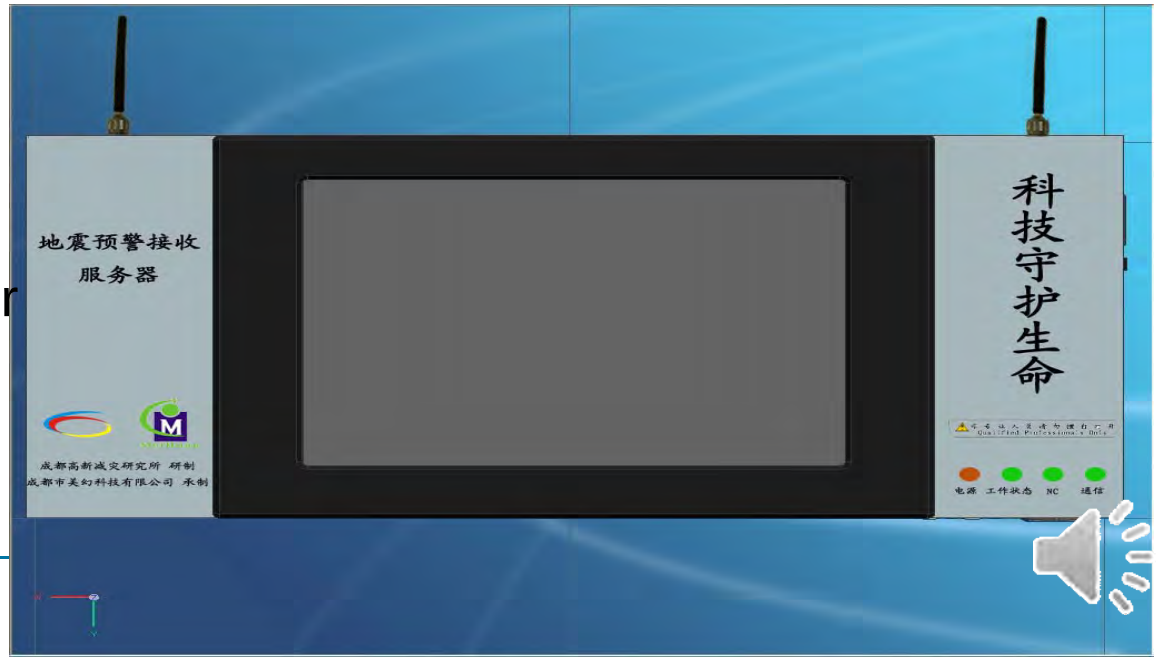
Special receivers for schools (and other places with dense population)

- 1. When quake, turn on the power of a broadcasting system, broadcast the EEW messages
- 2. Earthquake Drills (Educate how to respond)
- Photo of a Special Receiver



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Earthquake Drills（7 seven schools over 10,000 students from three provinces at one time)

Ex: A middle school from JiangYou, Sichuan

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It started an real evacuation for a real quake

The school in JiangYou on 2011/12/6, one month after the drill

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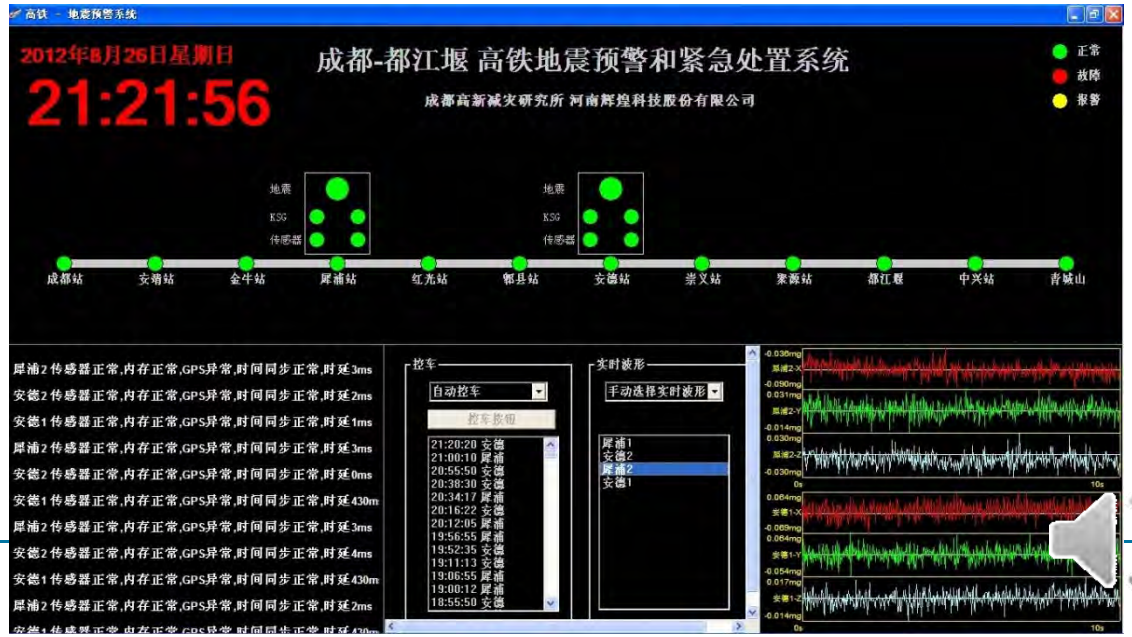
Developing EEW for high speed trains

- Provide the quake emergent control system for Harbin-Dalian high speed railway
- Provide the quake emergent control system for HeFei-Bongbu high speed railway
- …



EEW on gas-lines（with YunNan institute of disaster-prevention）

- With an electrical valve, a gas line in YunNan earthquake administration is controlled by EEW.

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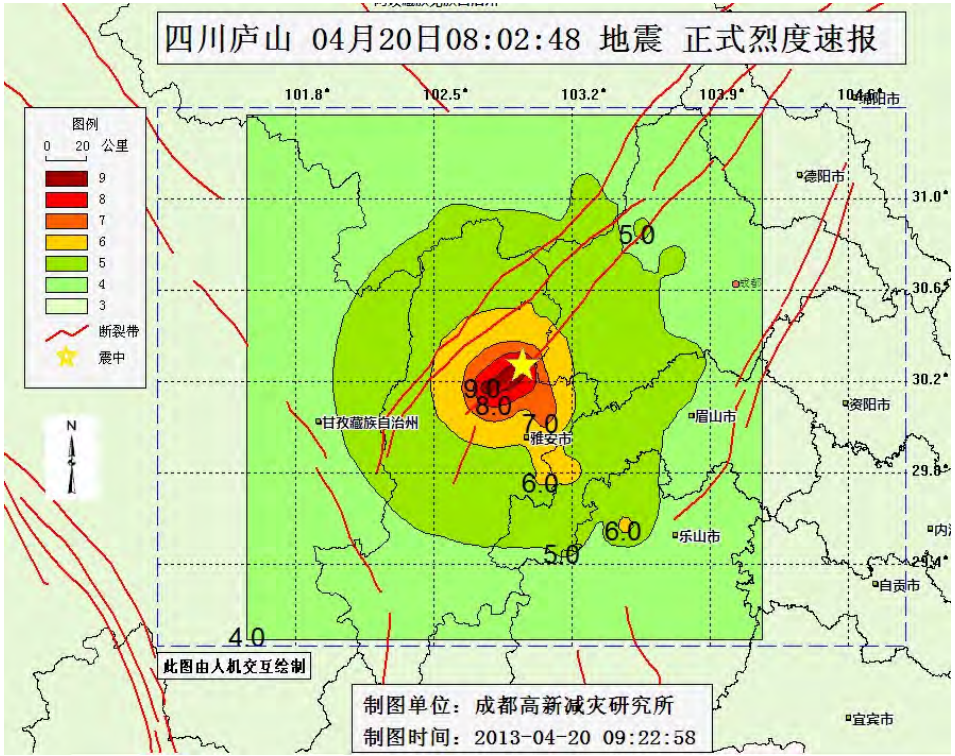
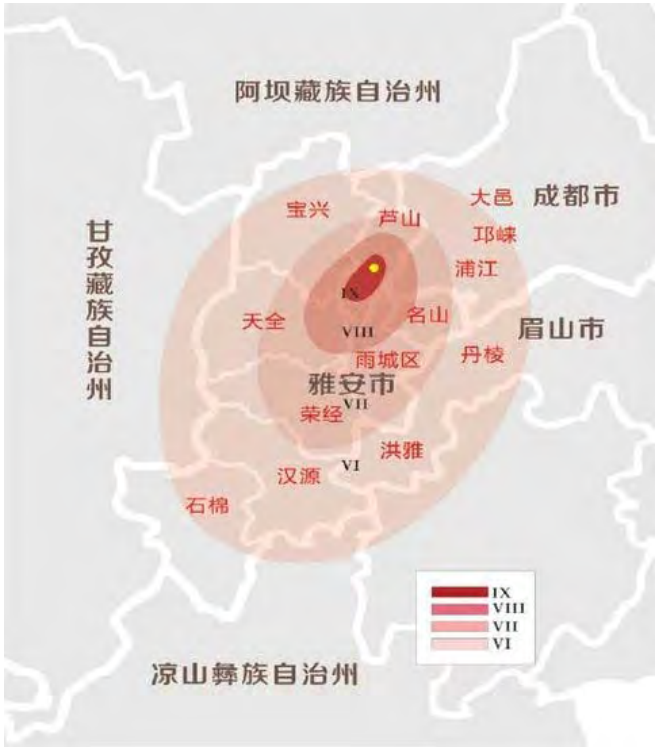
ShakeMap: for seismic Intensity fast evaluation





Shakemap after 1.2 hours of the Lushan quake by the EEW system

Shakemap after 6 days of the Lushan quake by expert investigation

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Summary of key parameters

- 1）No false triggers，No miss alarm for quakes of magnitude over 2.7
- 2）EEW messages have already been sent via computers, cell phones, television, special receivers

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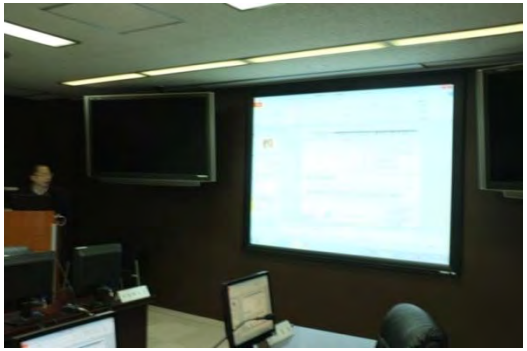
International exchange of ideas



Dr. Wang in JMA, Japan (2011)

Dr. Wang in CalTech. (2012)

Dr. Wang in MIT (2012)

Dr. Wang is the first one from PRC to give EEW presentation in any one of the above institute.

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News reports……

我国公众将首次体验地震预警

http://www.stdaily.com 2011年09月22日 来源： 科技日报 作者： 盛利

我国首次利用地震预警技术举行跨区域预警演习

《 中国青年报 》（ 2011年11月03日 12

四川江油3.8级地震触动警报 千余师生提前36秒逃生

2011年12月09日 10:16 来源：中国新闻网 参与互动(0) 【字体：↑大 ↓小】

News reports (cont.)

新浪新闻中心 | 新闻中心 > 国内新闻 > 正文

中国新闻网 WWW.CHINANEWS.COM

成都研制出最新地震预警系统 震后4秒发出预警

http://www.sina.com.cn 2011年04月25日16:24 中国新闻网

首页 > 科技日报 > 三版 [大][中][小][打印][收藏]

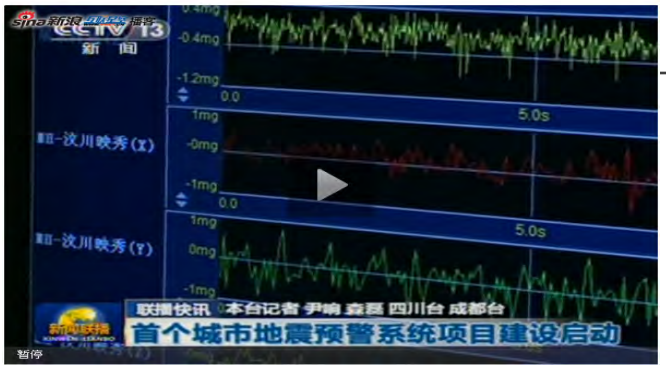
汶川：首次实现电视即时播报地震预警信息

http://www.stdaily.com 2012年05月16日 来源： 科技日报 作者： 盛利

新浪视频 > 正文

《新闻联播》 首个城市地震预警系统项目建设启动

上传时间：2012-07-12 20:04:48



以生命名义祝福成都地震预警试验成功

http://www.scol.com.cn 四川在线 (2011-4-26 14:06:38) 来源：四川在线－麻辣烫评论

首页 >> 新闻中心 转播到腾讯微博 字号：大 中 小

地震电视预警给生命更多呵护

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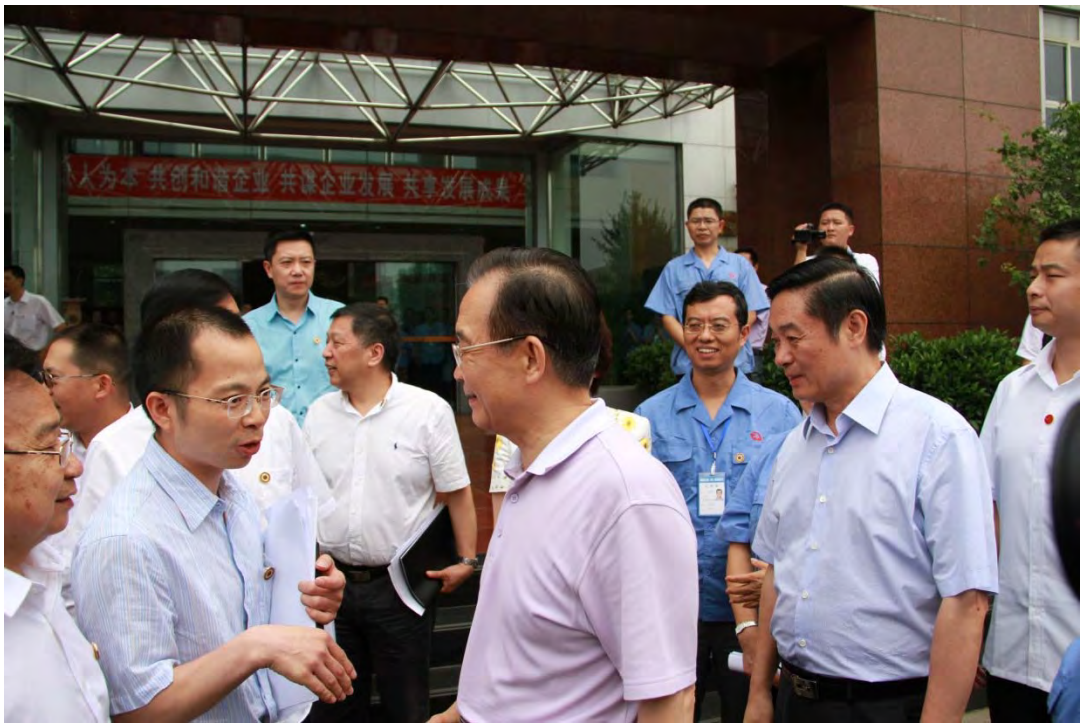
The progress on EEW catches the attention of Chinese Prime Minister



- Tun Wang reported the progresses of EEW to Wen Jiabao, the PM of China（2012/7/14 ChengDu）

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EEWS for more part of China

中国地震局：计划用五年时间建设国家地震预警系统

2013年02月20日07:25　　来源：新华网　　手机看新闻

Chinese government plans to construct EEWS in the next 5 years

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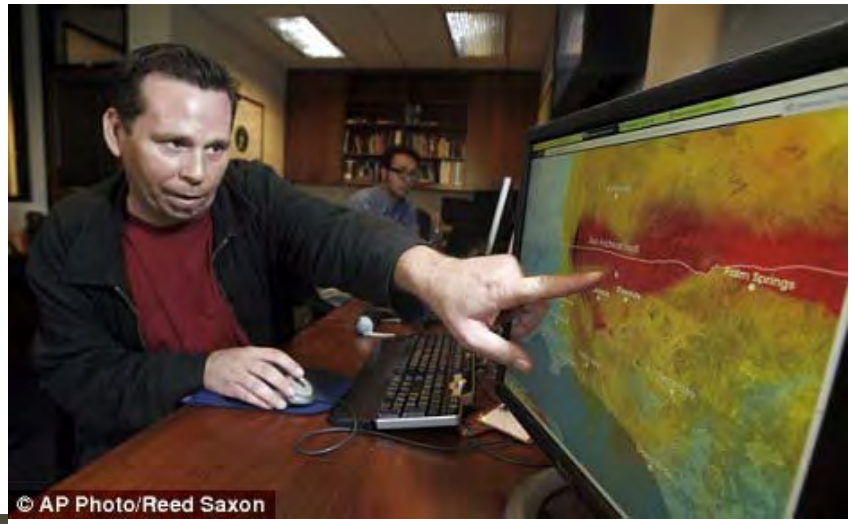
EEW in progress in Caltech as well

- On Sep. 27, 2011, A successful on-line test of EEWS in USA.
- Sep., 2013, proposal to build EEWS in California



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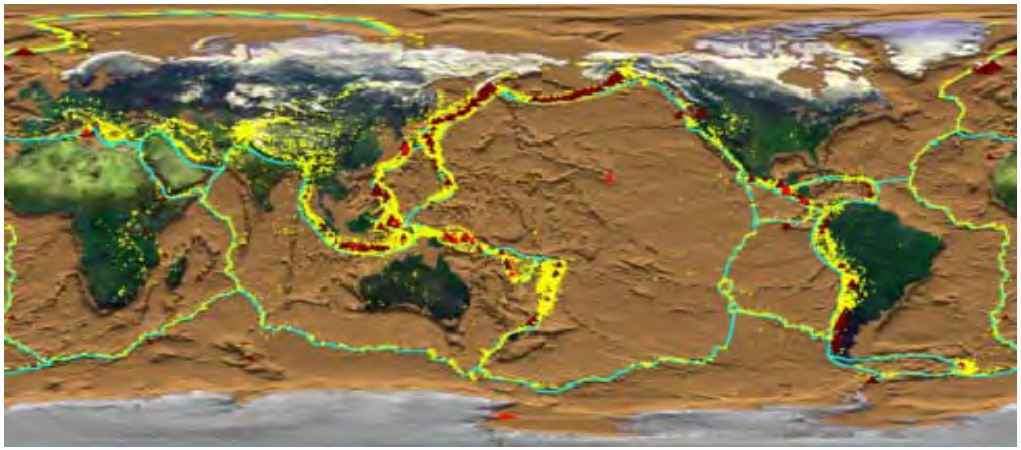
EEWS for more places?



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Conclusion and Outlook

- After 5 years of hard work:
- 1. Innovative solution on EEW, and already applied in 560,000 square km.
- 2. No false trigger, no miss alarm for 2.7 magnitude quakes inside EEW zone
- 3. Found a special way, i.e., through volunteers receiving EEW messages, for guiding the application of EEW to the Chinese public and government
- 4. Following Mexico and Japan, China becomes the 3rd country to have the technology capability of EEW for the public

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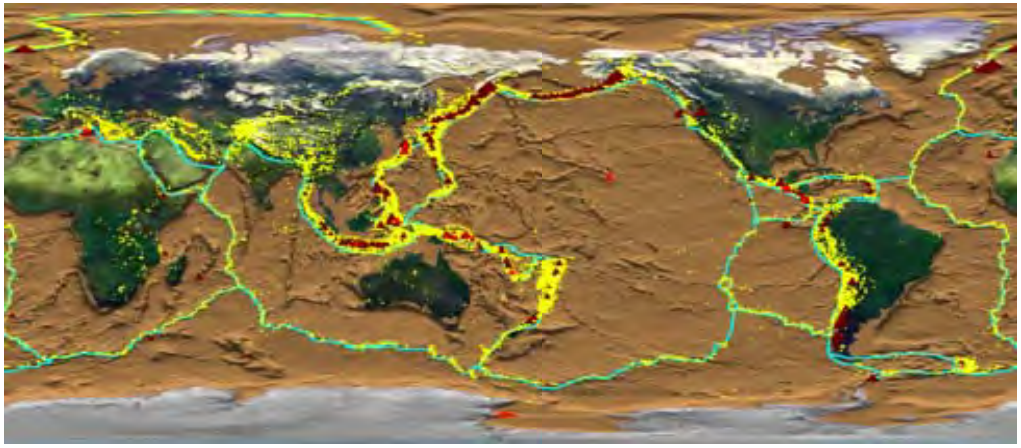
Cooperation expected

- More promotion of EEW in countries by both experts, Journalists, and governments (experience in Indonesia)
- More cooperation between different countries



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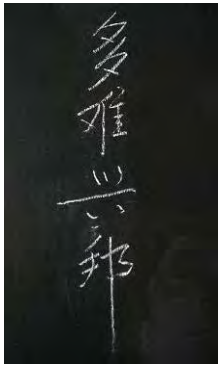
Thank you for your kind attention

For next big quake, the world has EEW !?

To memorize the dead



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