

The development of K-SEIS (Korea Speedy Earthquake Information System) including EEW (Earthquake Early Warning)

Jung-Ho Park, Heon-Cheol Chi, Iin-Seub Lim

2012. 10. 30

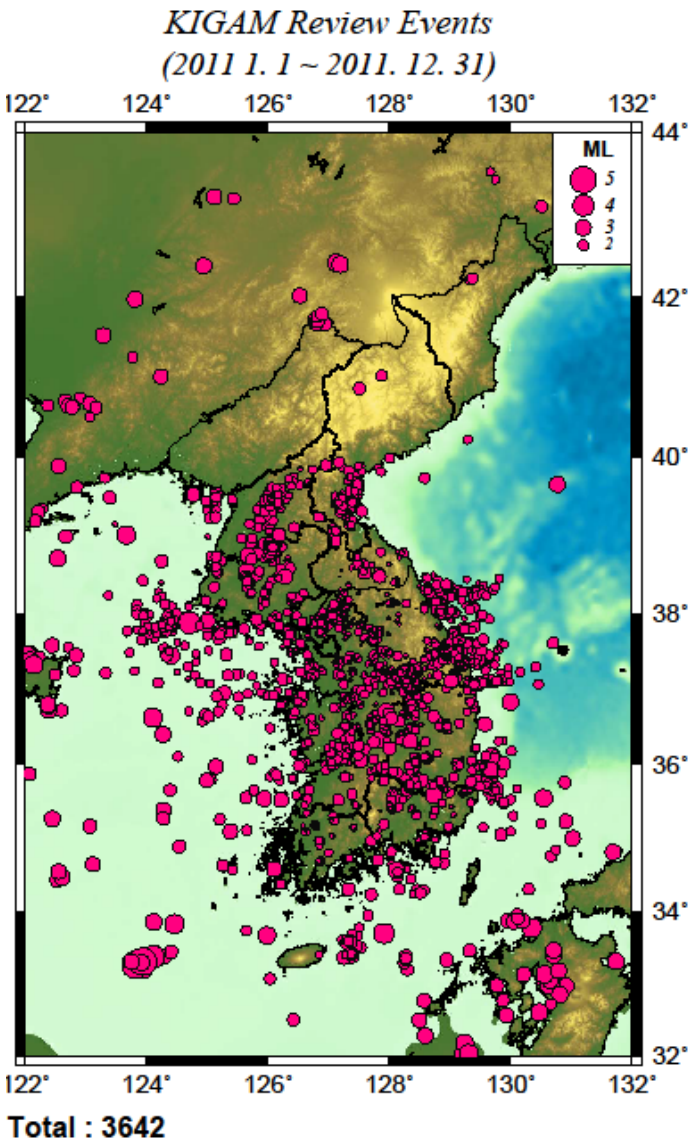
KIGAM

(Korea Institute of Geoscience & Mineral Resources)

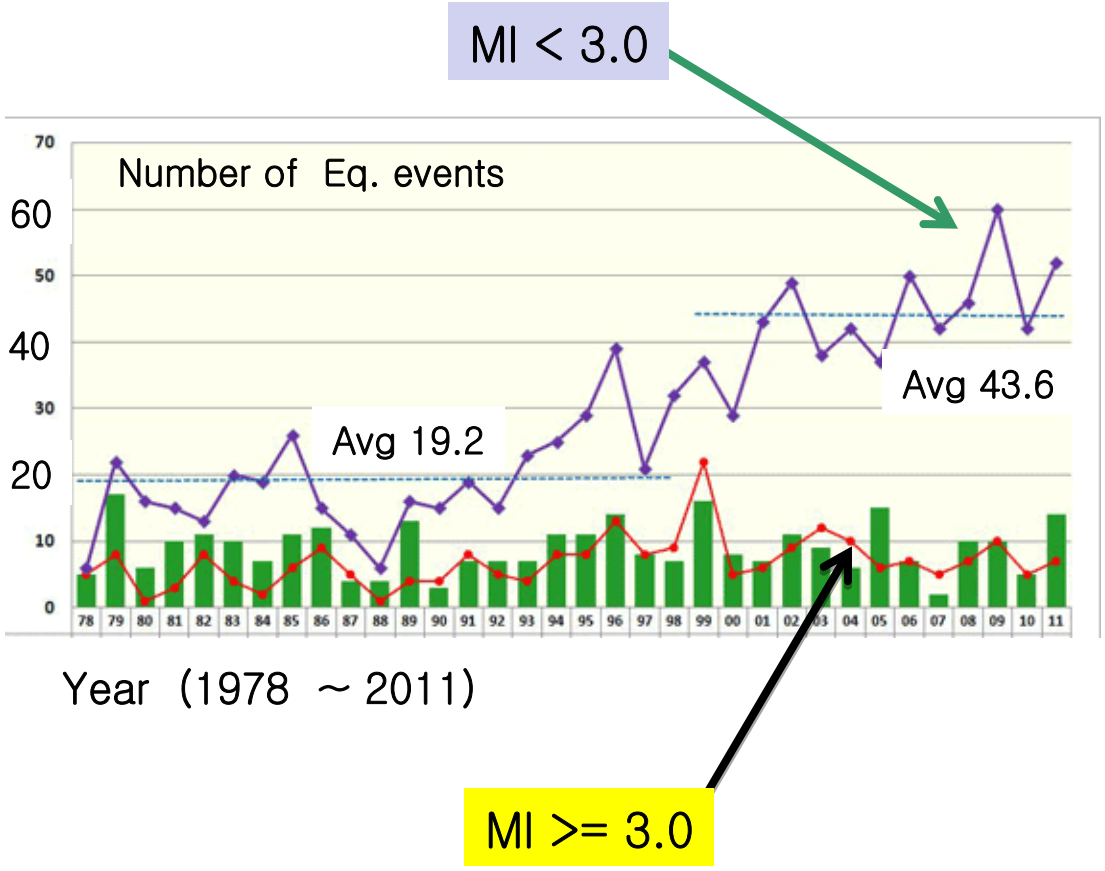
Out line

- ◆ Seismicity and monitoring network in Korea
- ◆ K-SEIS (Korea-Speedy Information System)
  - ▪ RTiCOM (Real Time Intensity Color Mapping)
  - ▪ EEW (Earthquake Early Warning)

KIGAM



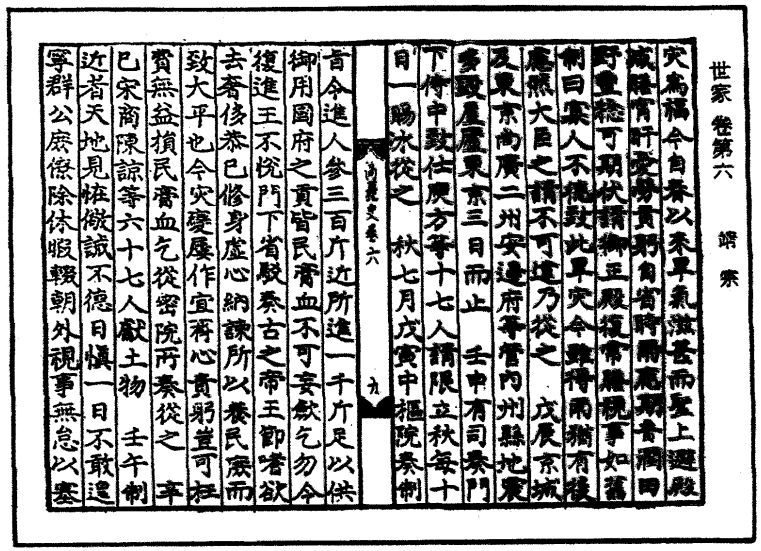
The seismicity is not so high nowadays in Korea.



(from http://kma.go.kr)

Historical Literatures recorded many destructive damages by earthquakes.

- Koryo Dynasty (高麗時代 : 936~1393)
  - Koryosa (高麗史)
  - Koryosajeolyo (高麗史 節要)
    : 193 earthquakes are reported

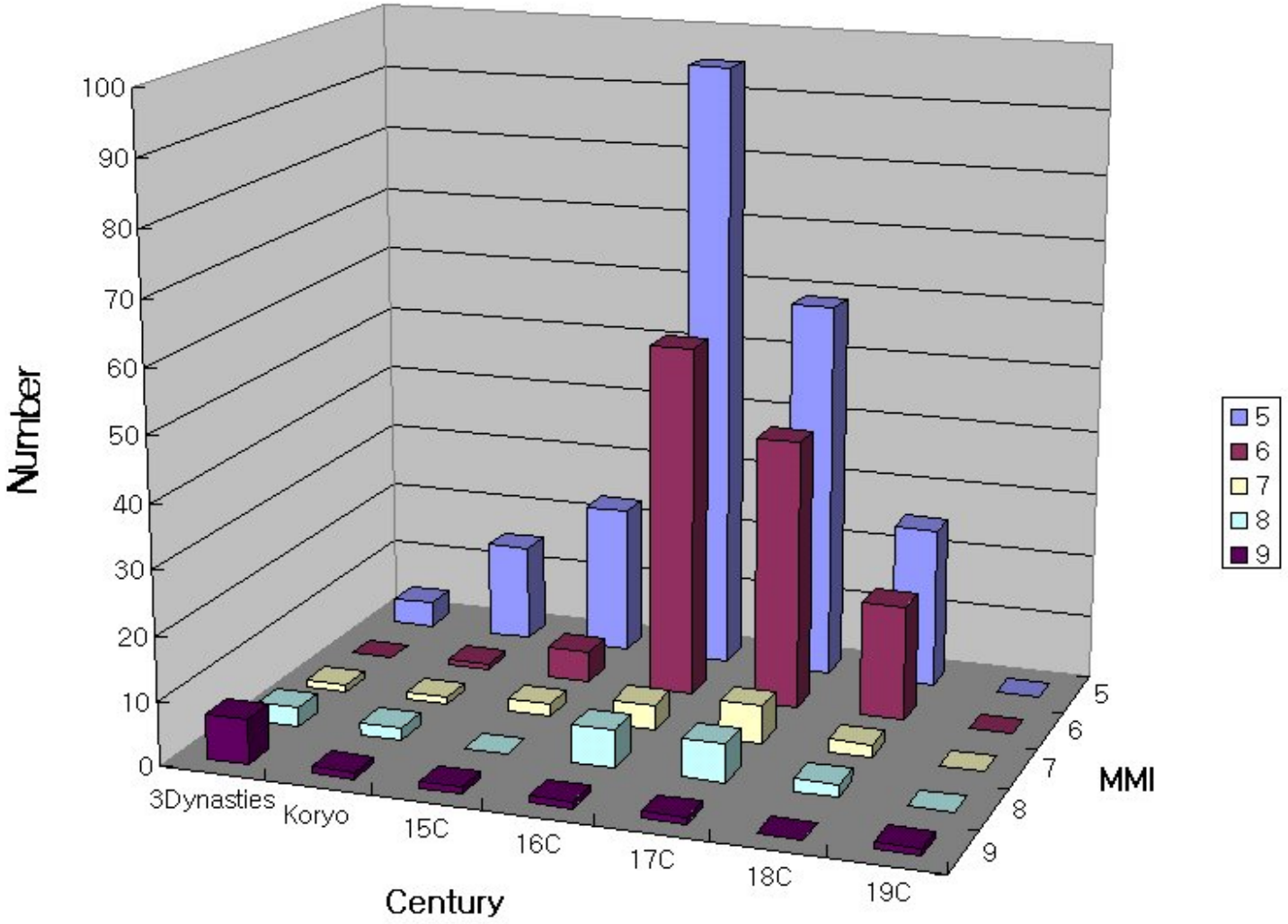


July, 23, 1036

The ground was shaken, which brought about collapse of traditional wooden house at Kasung, Kyeongju and so on.

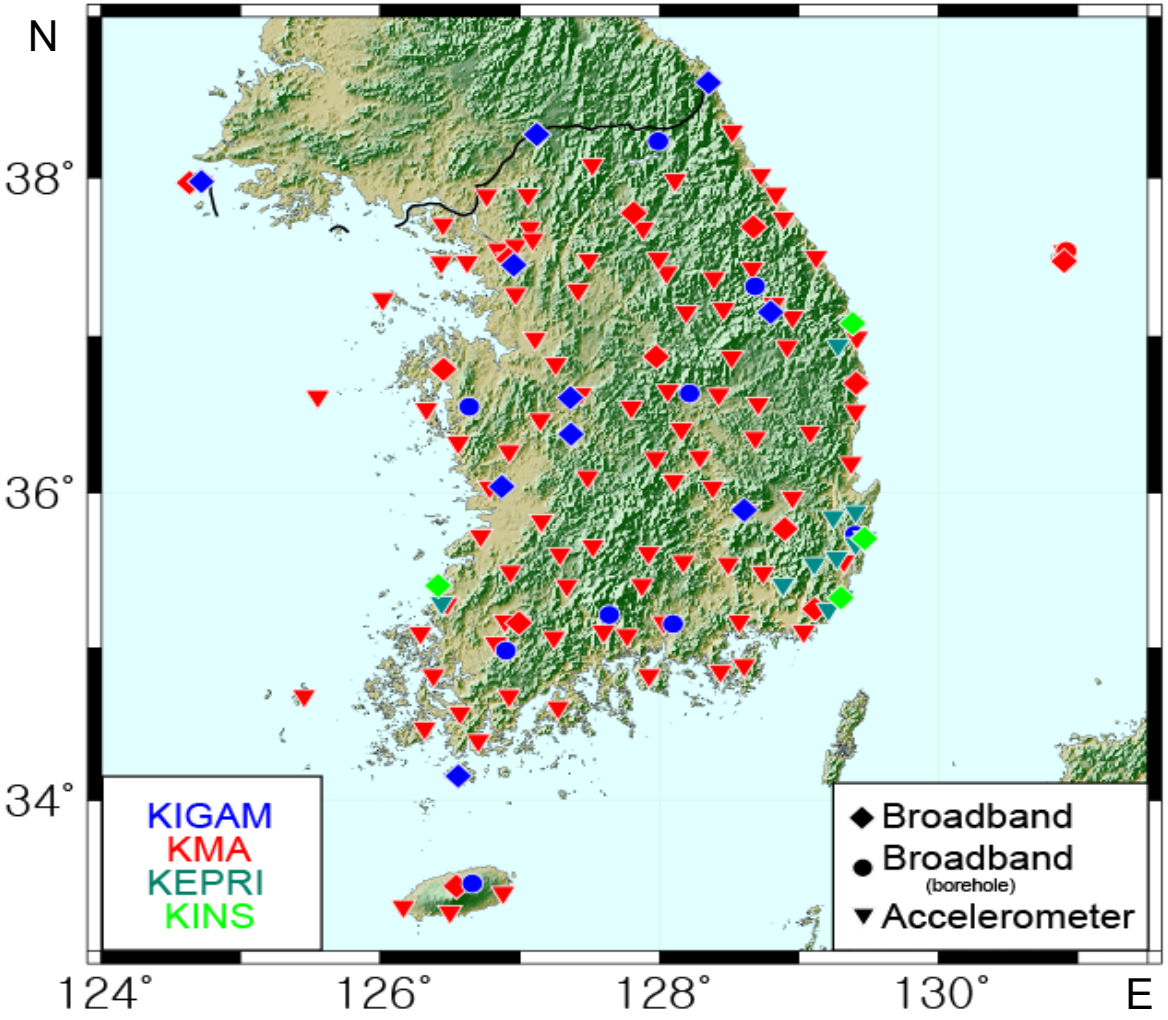
Shaking continued for three days at Kyeongju.

Historical Earthquakes



Seismicity was very active from 16 to 17 century (Baag, 2004).

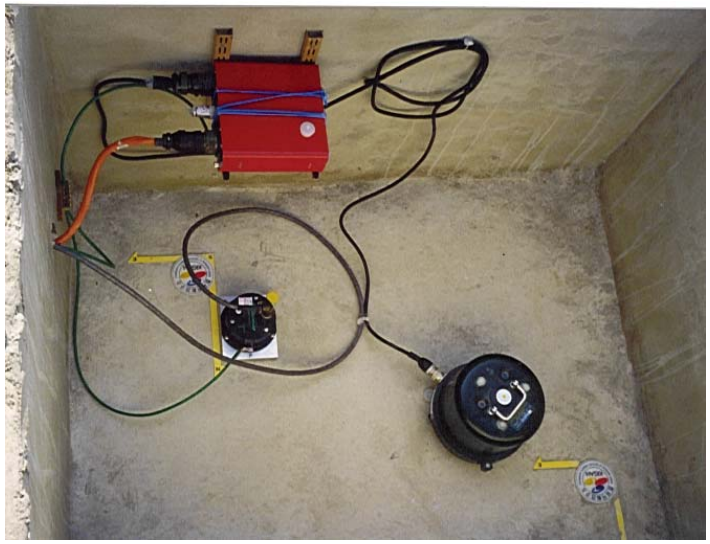
Seismic Networks belong to major Organizations



Modern digital seismic stations

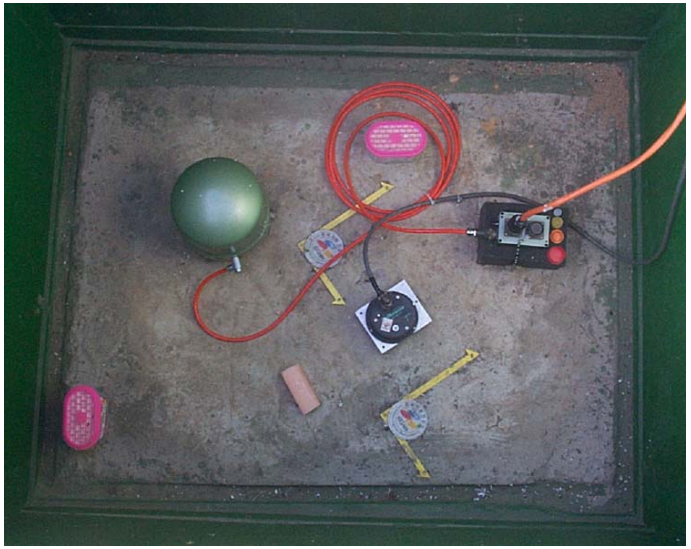
Short Period and Acc. Station



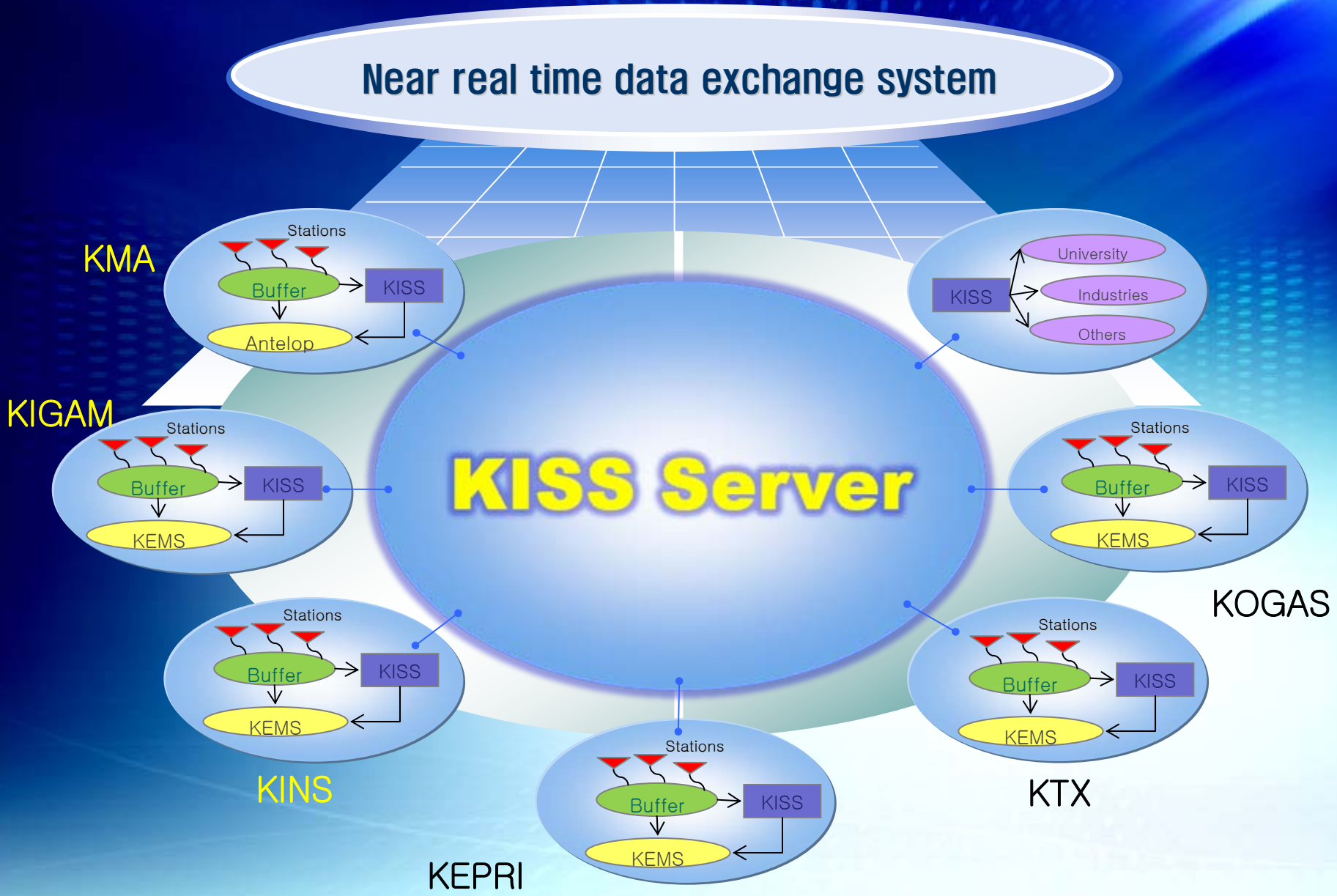


Broad Band and Acc. Station





Near real time data exchange system



Out line

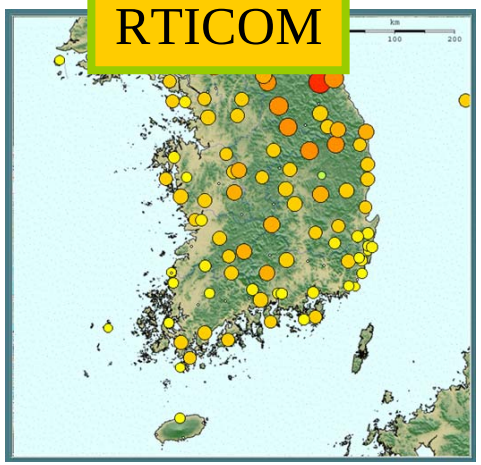
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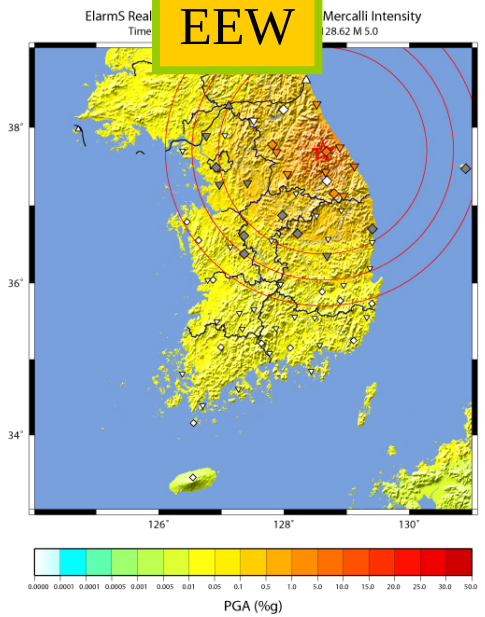
K-SEIS

RTICOM, EEW, & ShakeMap

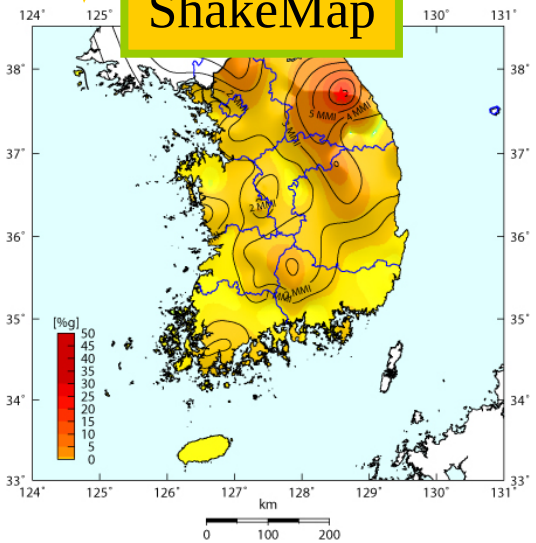
RTICOM



EEW

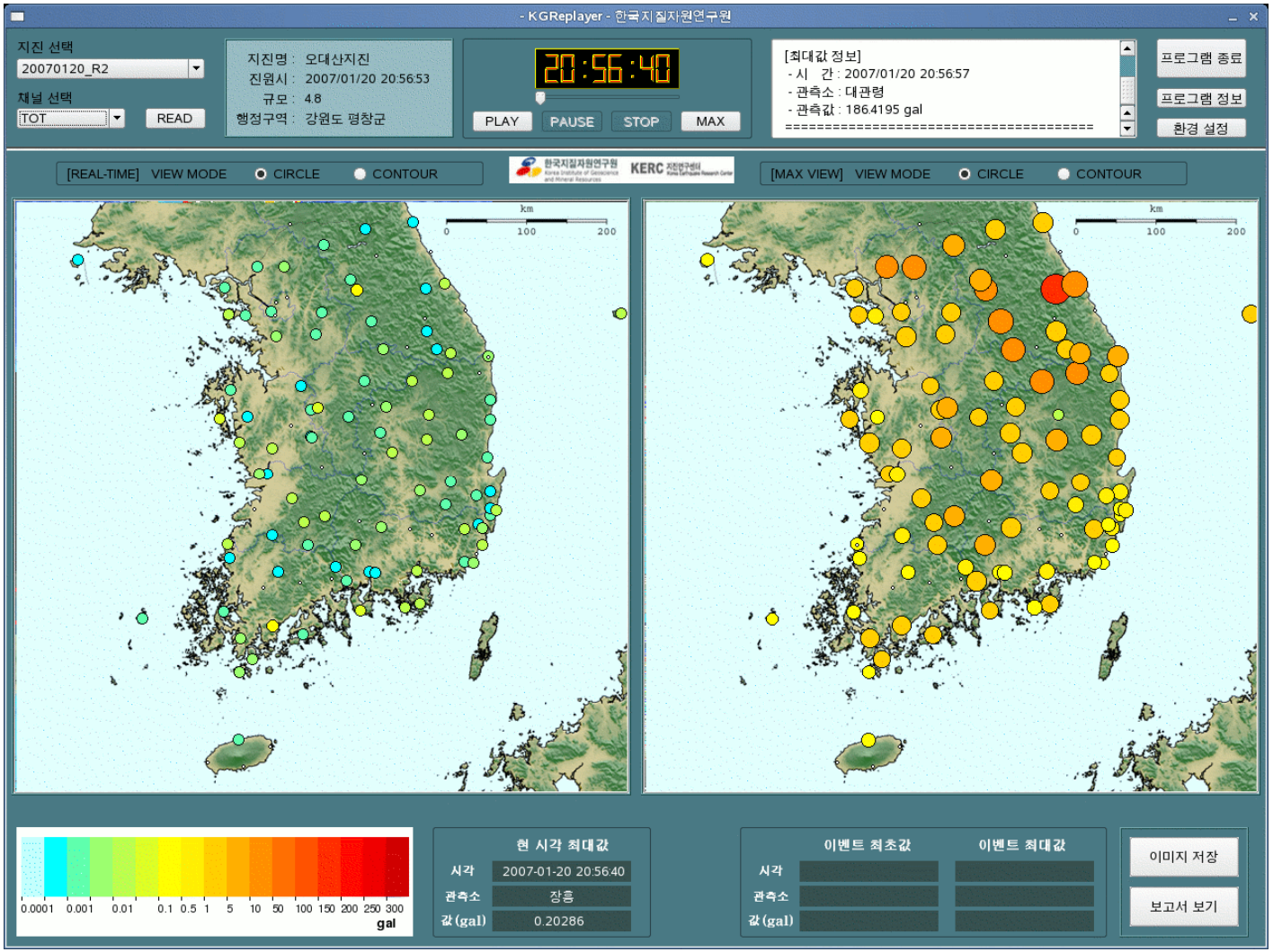


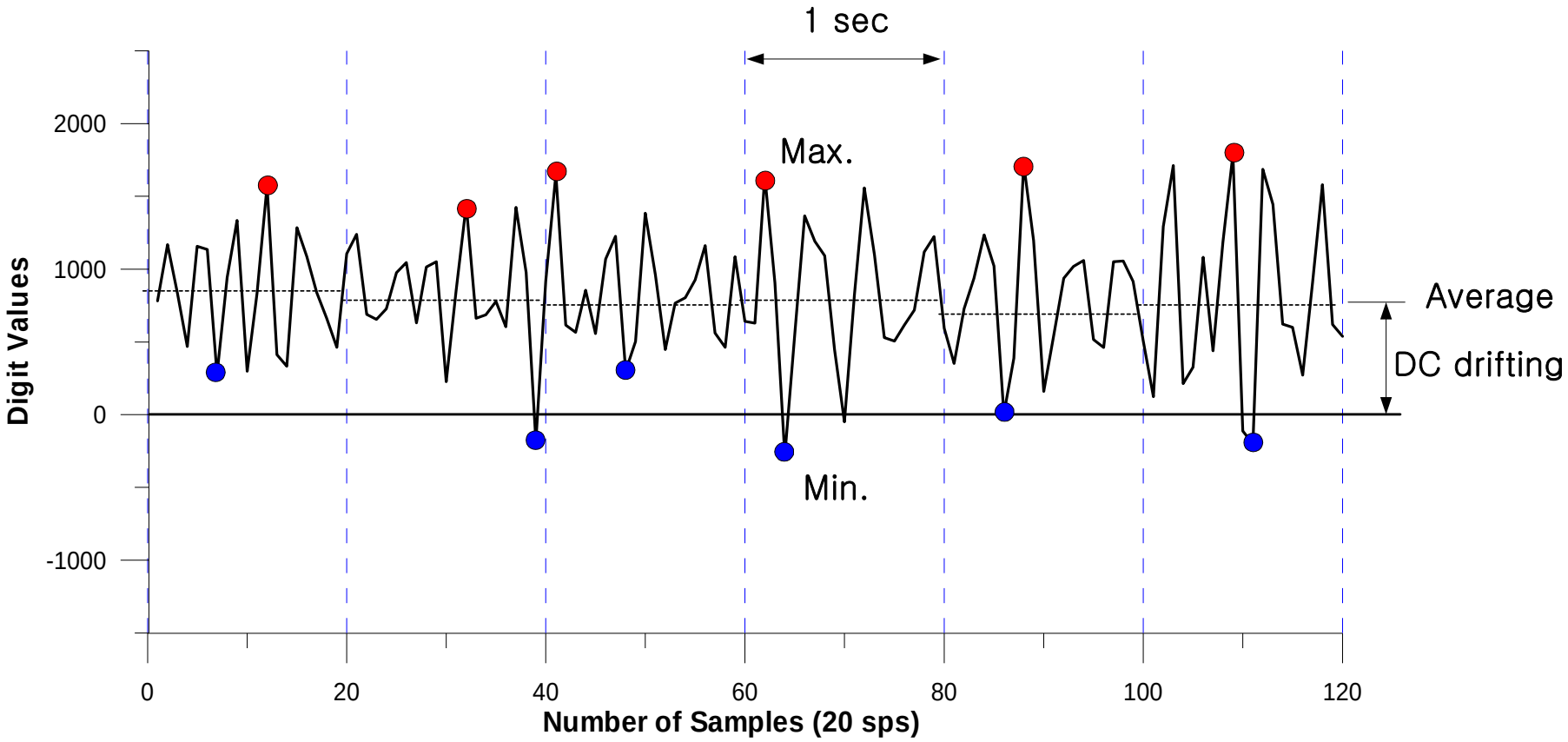
ShakeMap



Real Time Intensity Color Mapping(RTICOM) : Odesan Eq. 2007.1.20 MI4.9

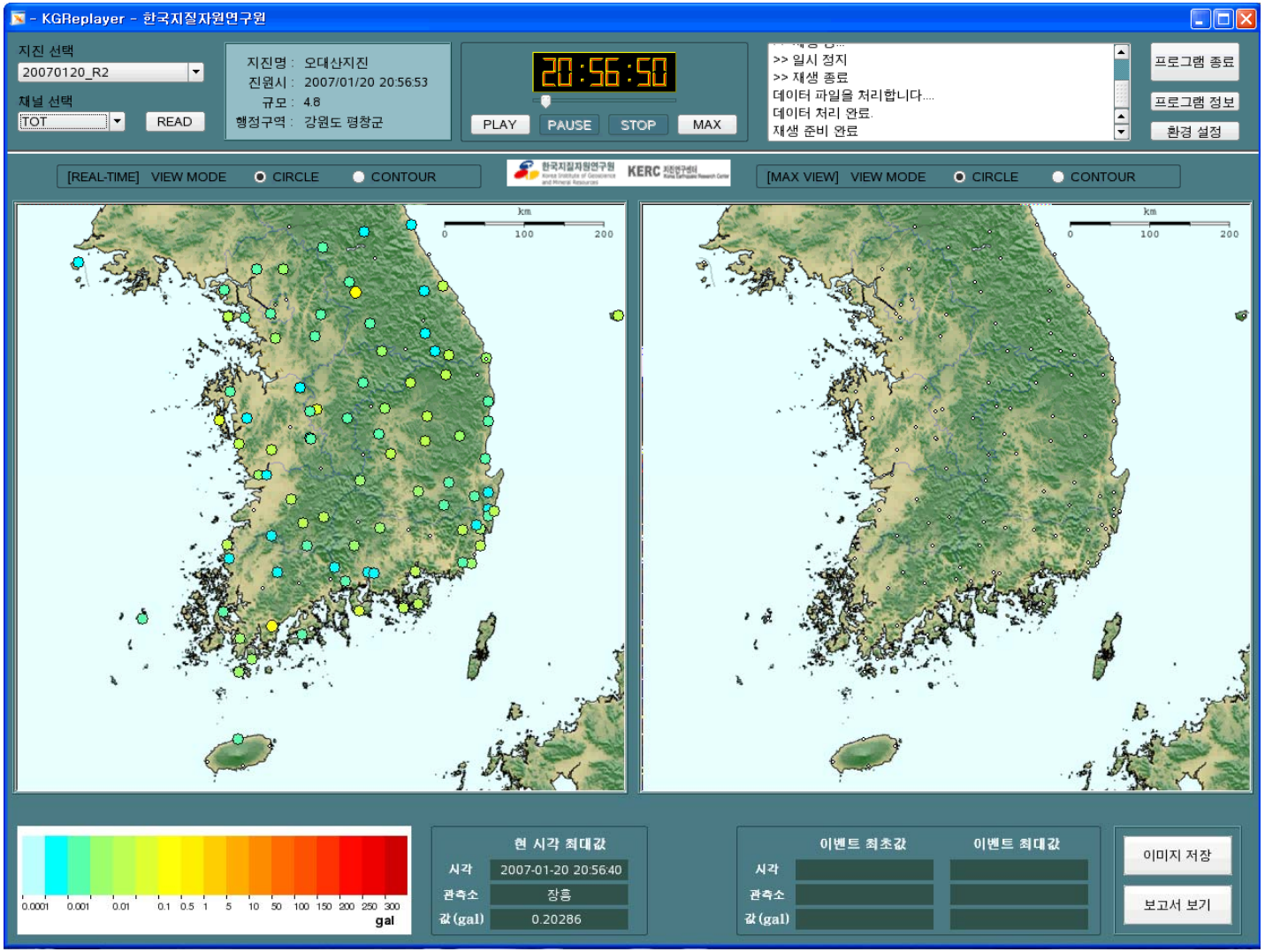
- PGA Monitoring in every second





Schematic display of Min., Max. and DC drifting in acceleration data (Chi *et al.*, 2004)

Real Time Intensity Color Mapping(RTICOM) : Odesan Eq. 2007.1.20 MI4.9

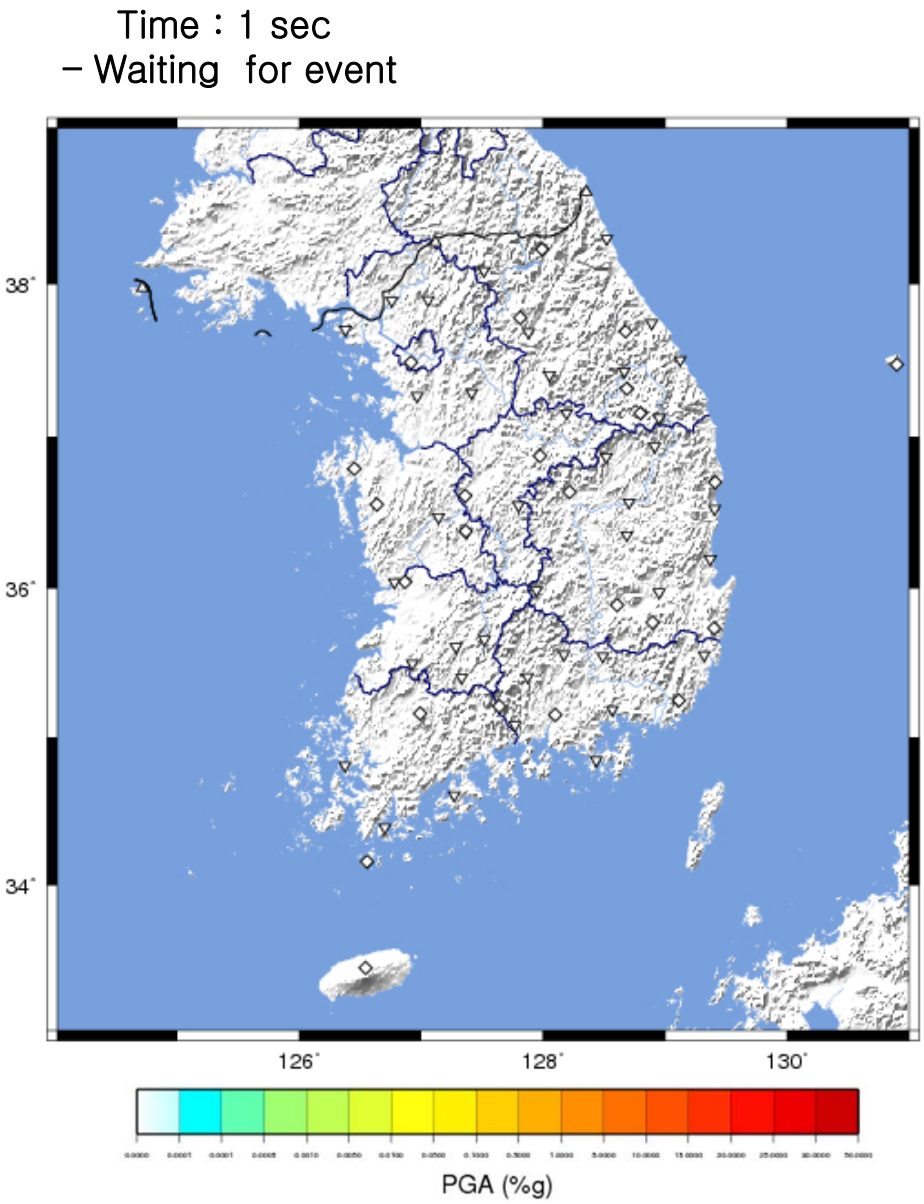


RTICOM (Real Time Intensity Color Mapping)

EEW Simulation

Odesan Eq.

2007. 1. 20
Magnitude 4.9

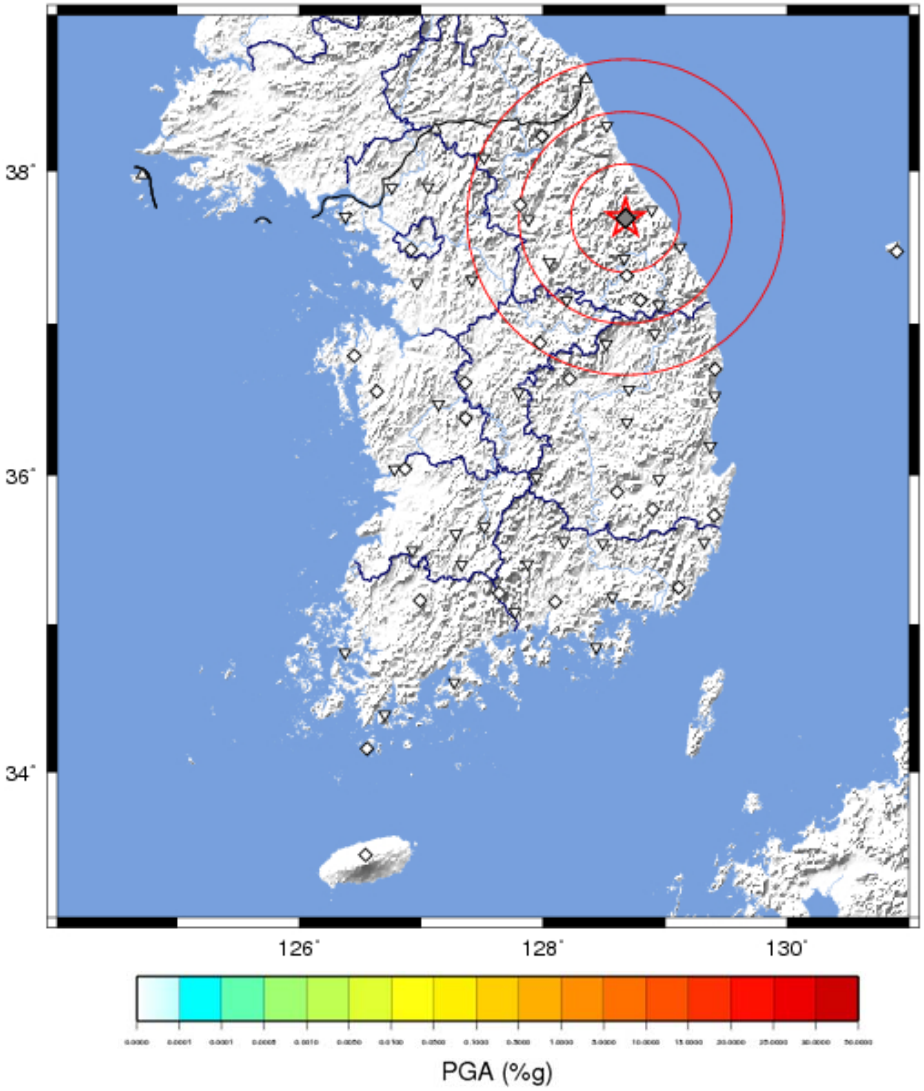


EEW Simulation

Odesan Eq.

2007. 1. 20
Magnitude 4.9

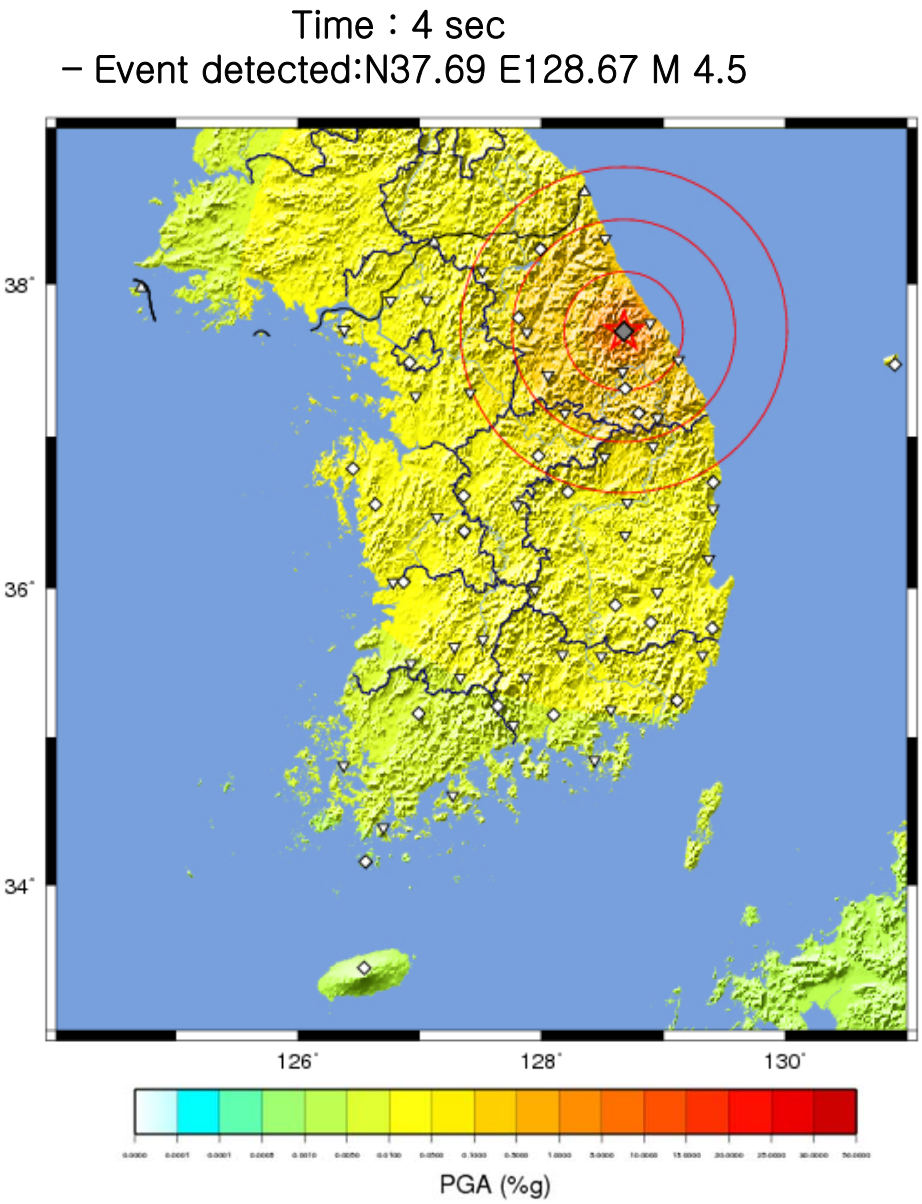
Time : 3 sec
- Event detected:N37.69 E128.67 Magnitude unknown



EEW Simulation

Odesan Eq.

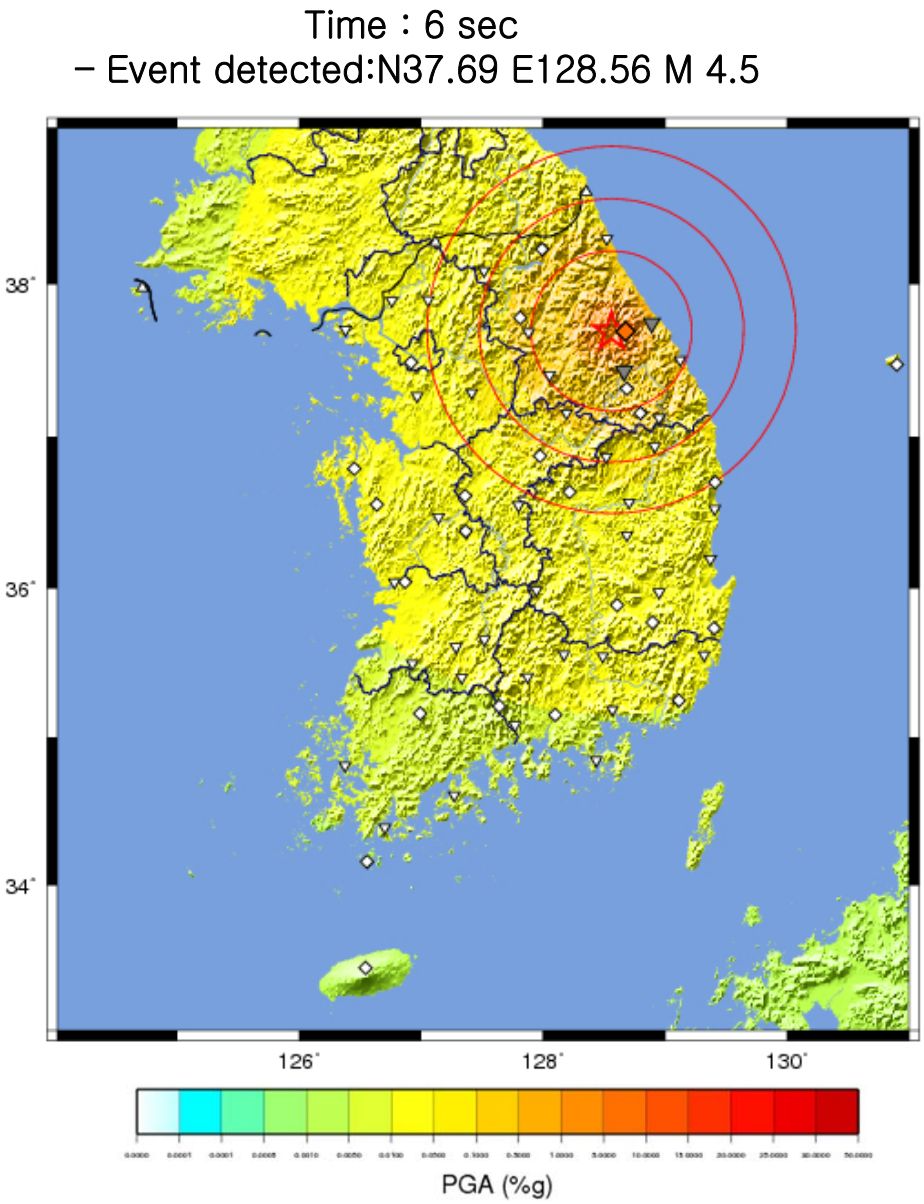
2007. 1. 20
Magnitude 4.9



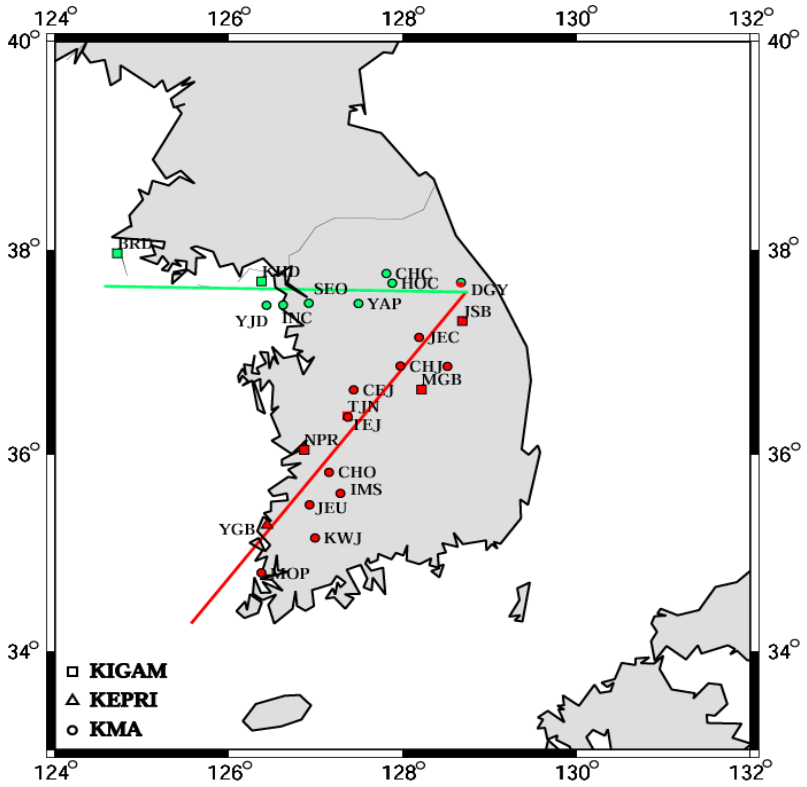
EEW Simulation

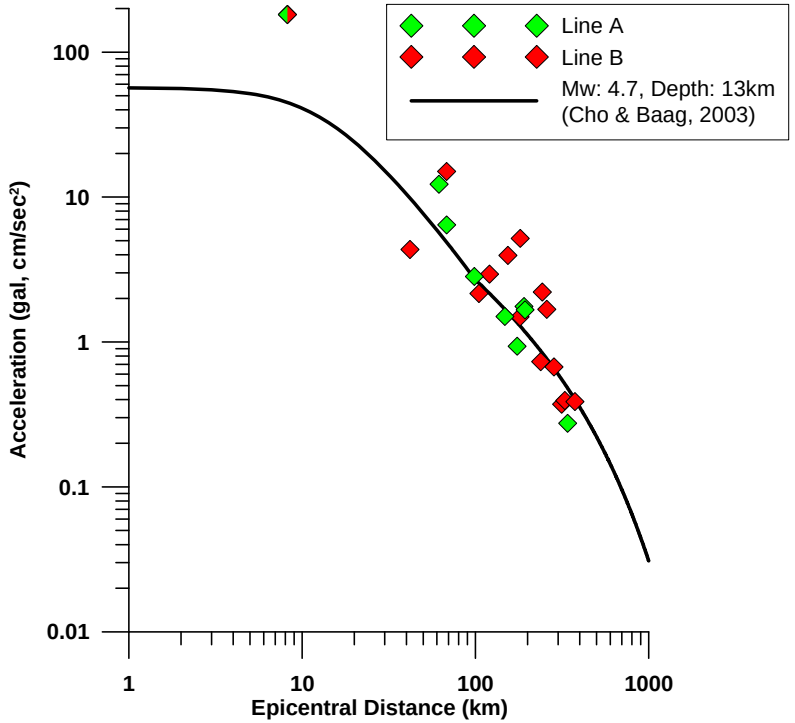
Odesan Eq.

2007. 1. 20
Magnitude 4.9

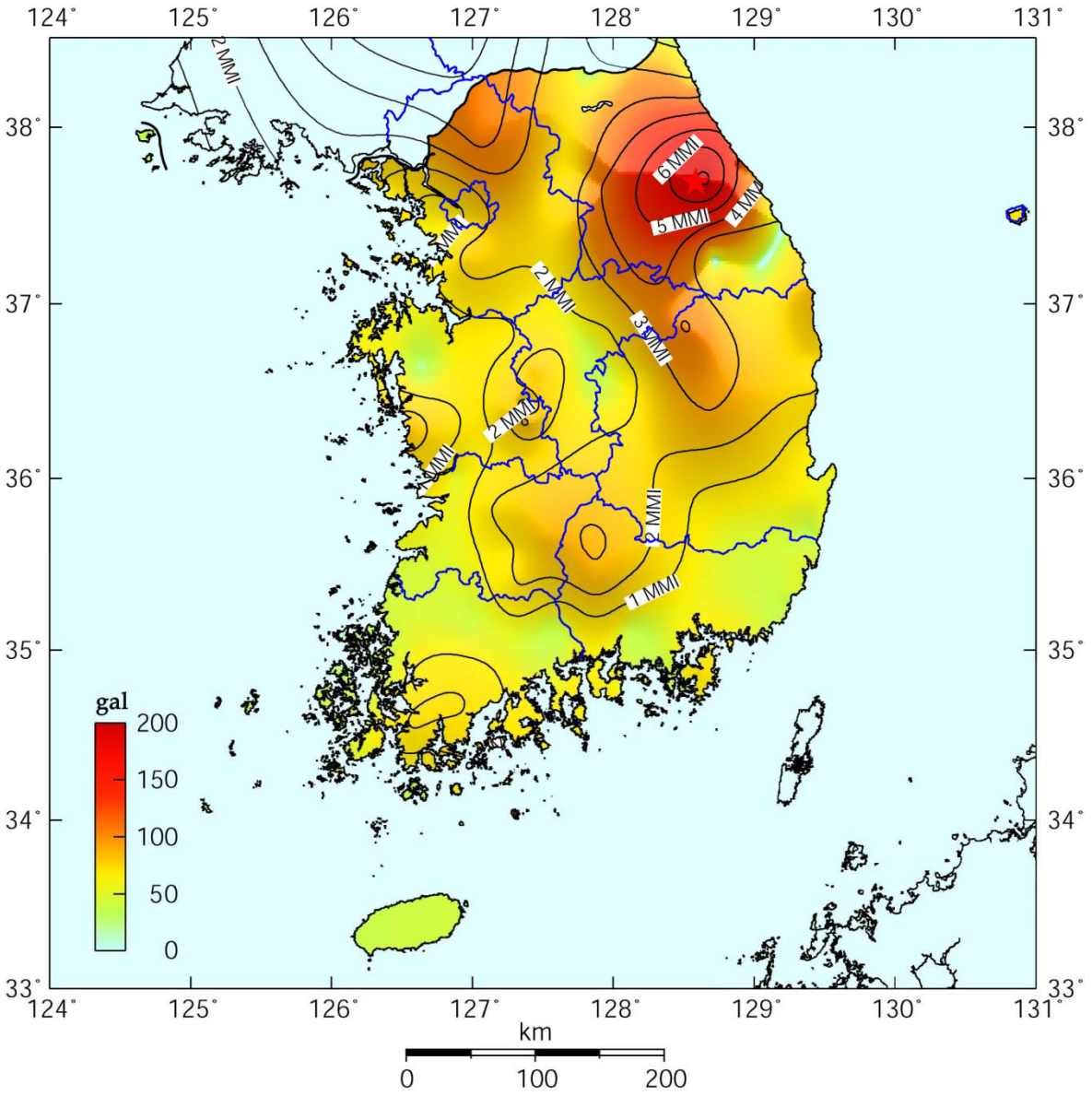


Odeasan Eq.(2007.1.20) attenuation

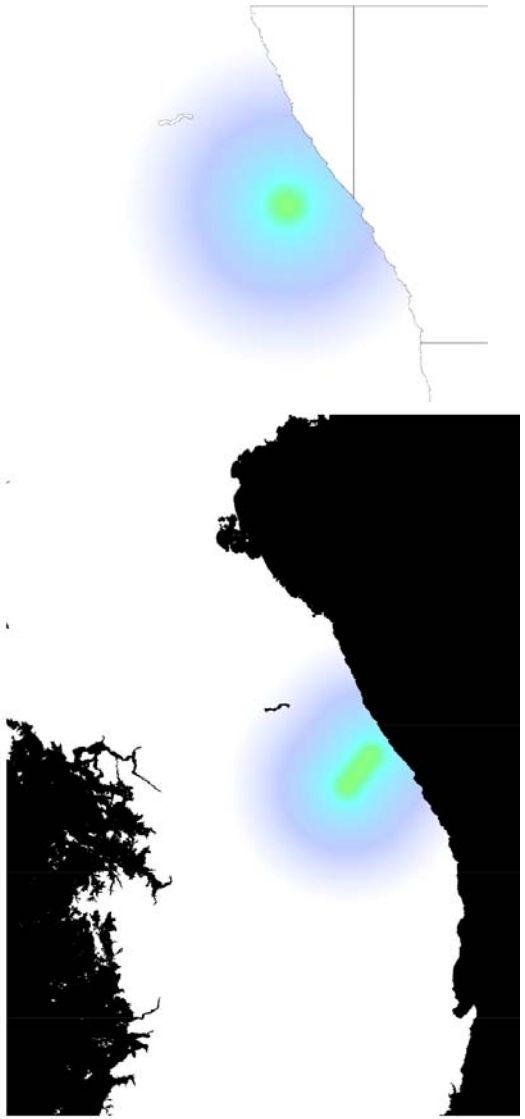


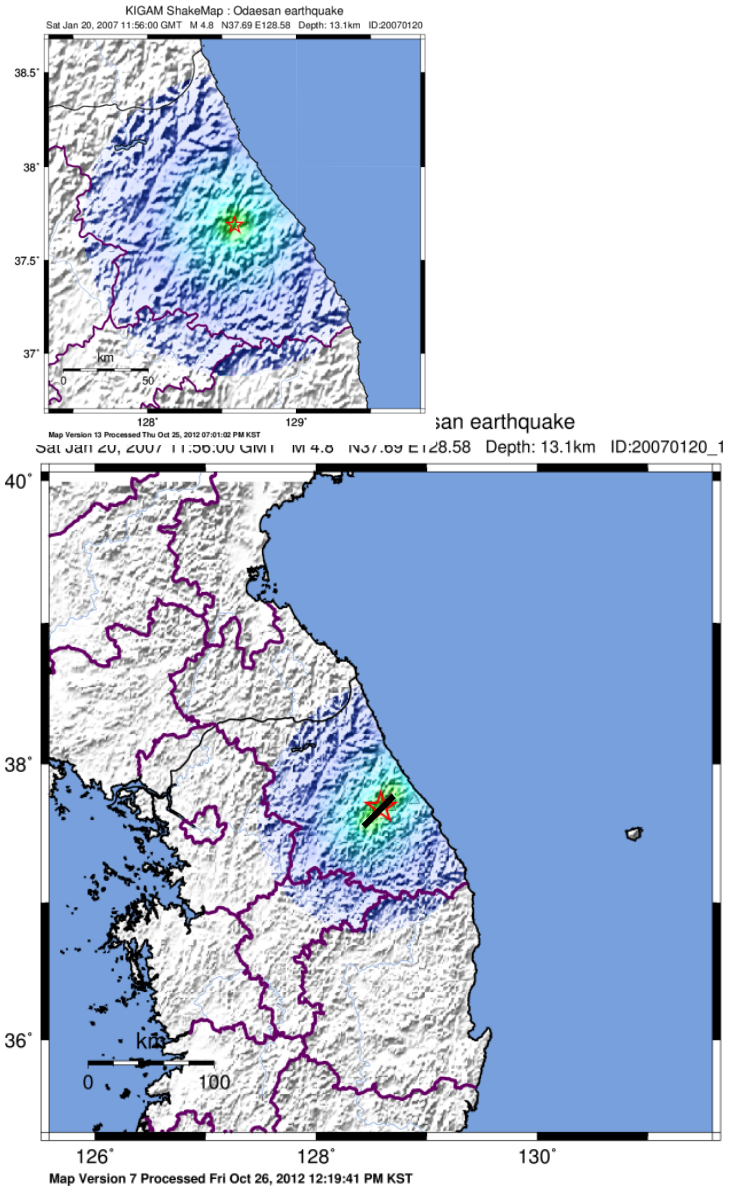


Instrumental PGA Map Odeasan Eq. M4.9



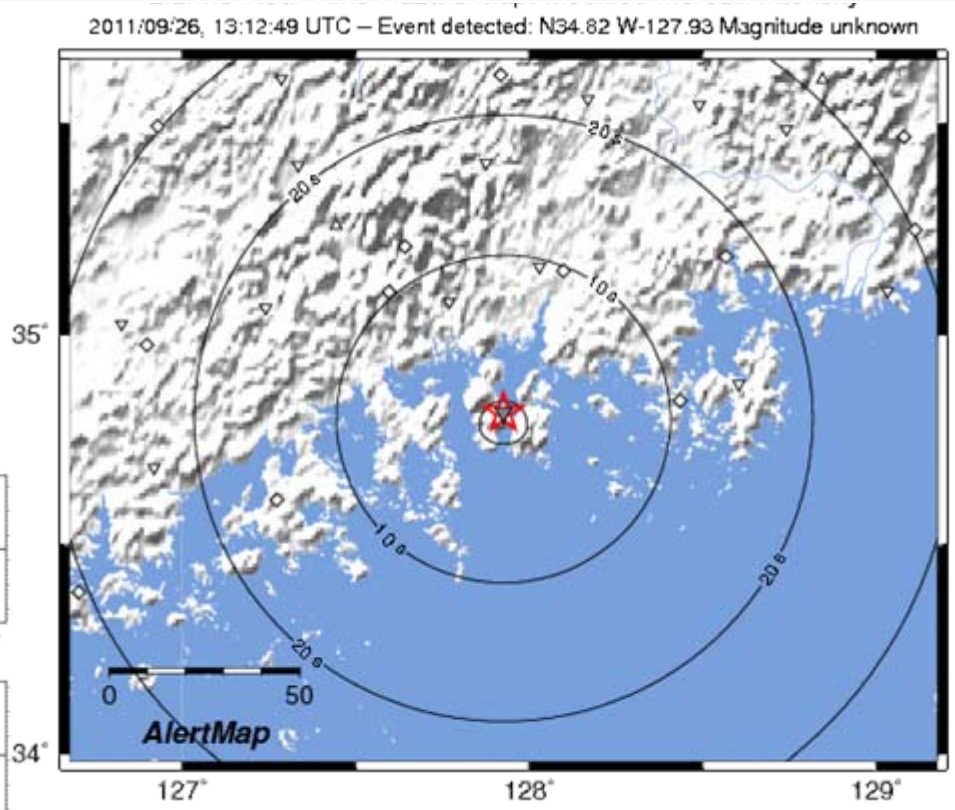
ShakeMap simulation for point and line source

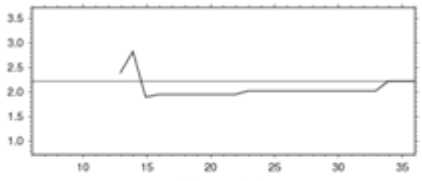


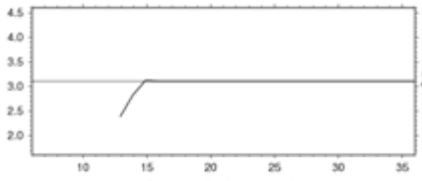


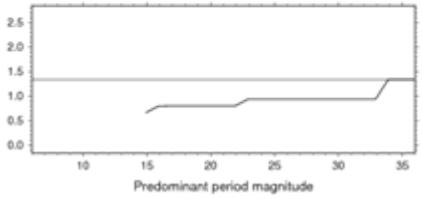
Real time K-SEIS® TEST : 경남 남해군 남동쪽 35Km 해역, M 3.3, 2011/09/26

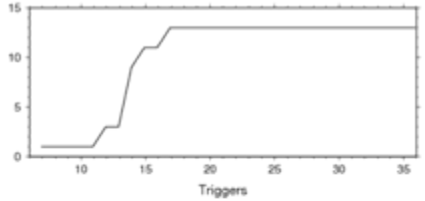
	시간(local time)	위도(lat.)	경도 (long.)	규모(Magnitude)
KMA	22:12:19	34.58	128.12	3.3
K-SEIS®	22:12:19	34.54	128.13	**2.2(MPd 3.10, Mtaup 1.33)**

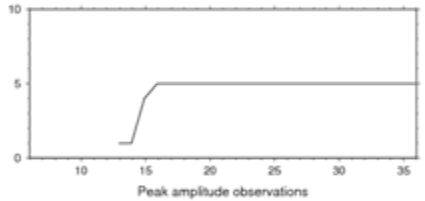


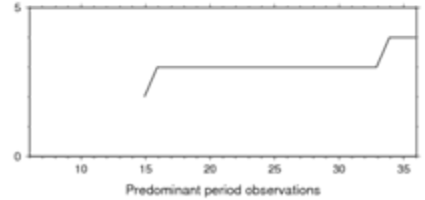








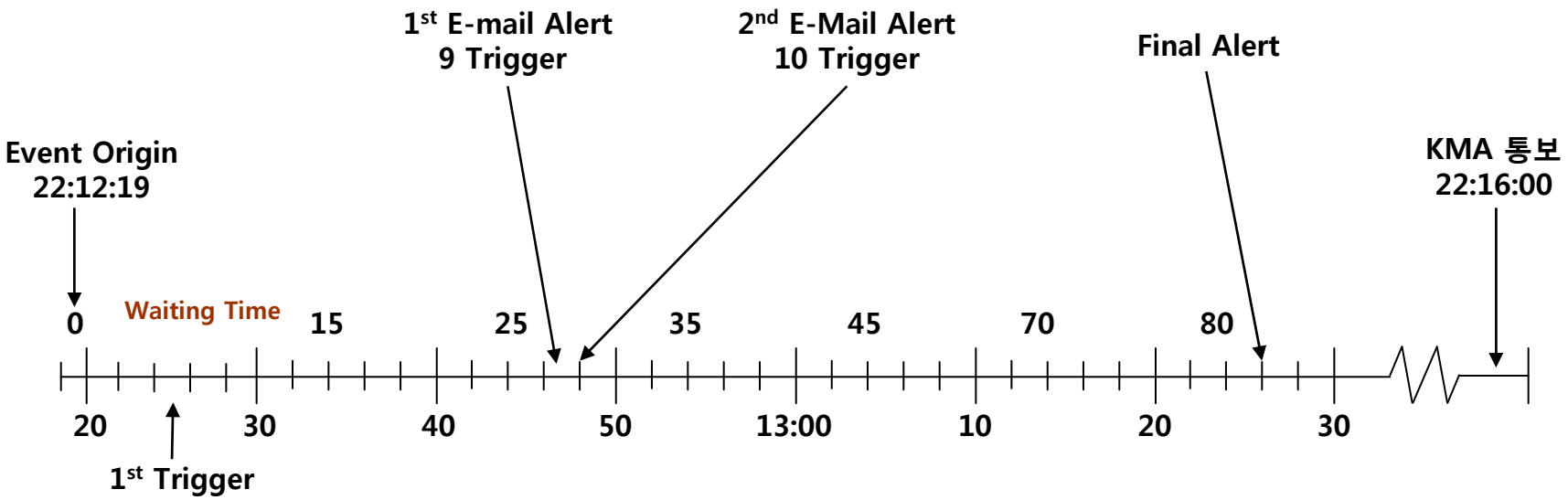




PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Real time K-SEIS® TEST : 경남 남해군 남동쪽 35Km 해역, M 3.3, 2011/09/26

	시간(local time)	위도(lat.)	경도 (long.)	규모(Magnitude)
KMA	22:12:19	34.58	128.12	3.3
K-SEIS®	22:12:19	34.54	128.13	**2.2(MPd 3.10, Mtaup 1.33)**



Messages from EEW

Ordinary Eq. Inform. from KMA

Local Time 2012. 9. 27. 10:25 PM *5 min faster >* 2012. 9. 27. 10:30 PM

Origin Time : 09:27 13:24:47 GMT



Pd M : 3.1

Pd M : 3.4

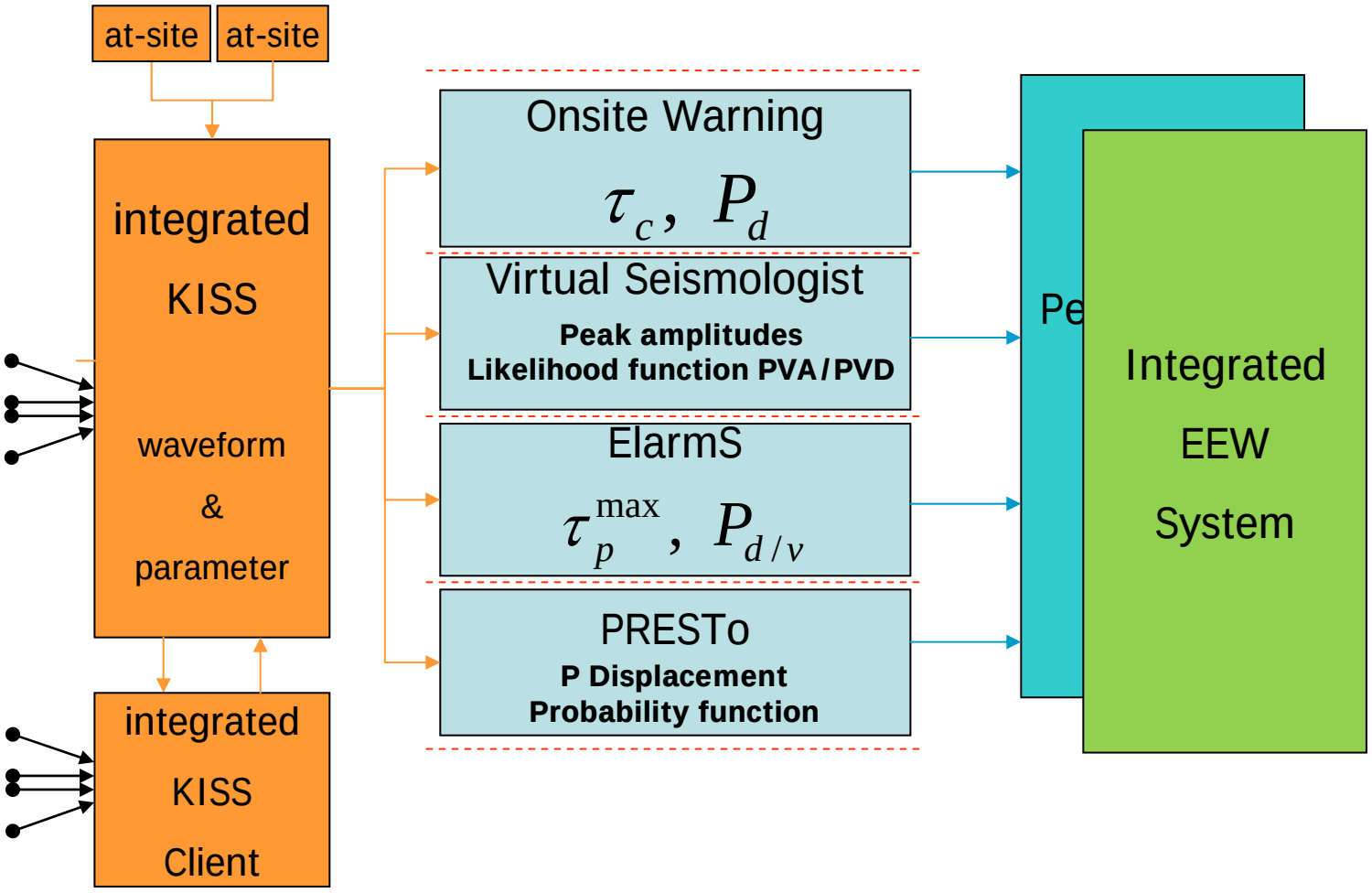


Ml : 2.7



Goal: evaluation of existing early warning methodologies in real-time

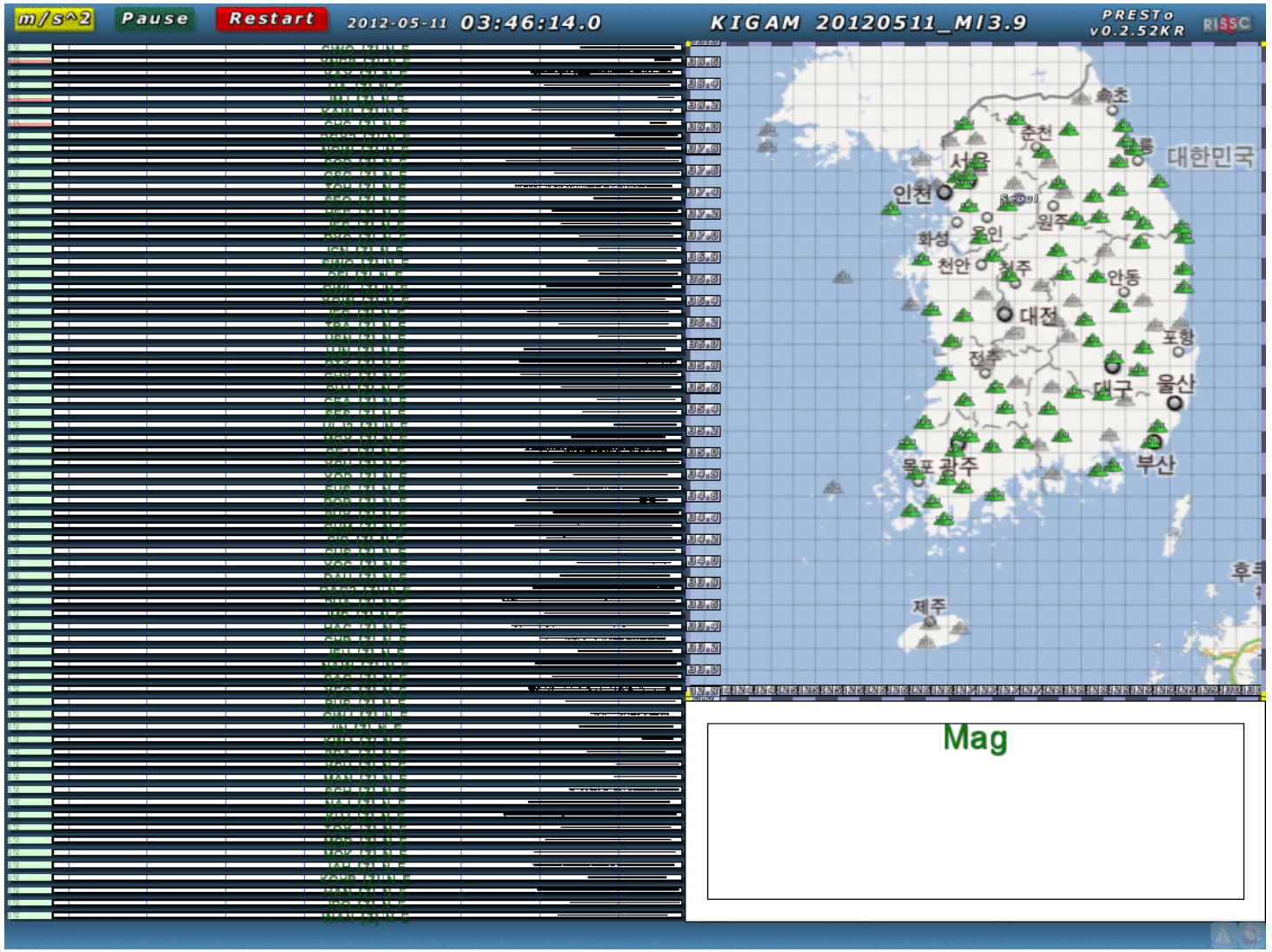
➔ specifications for integrating methodology



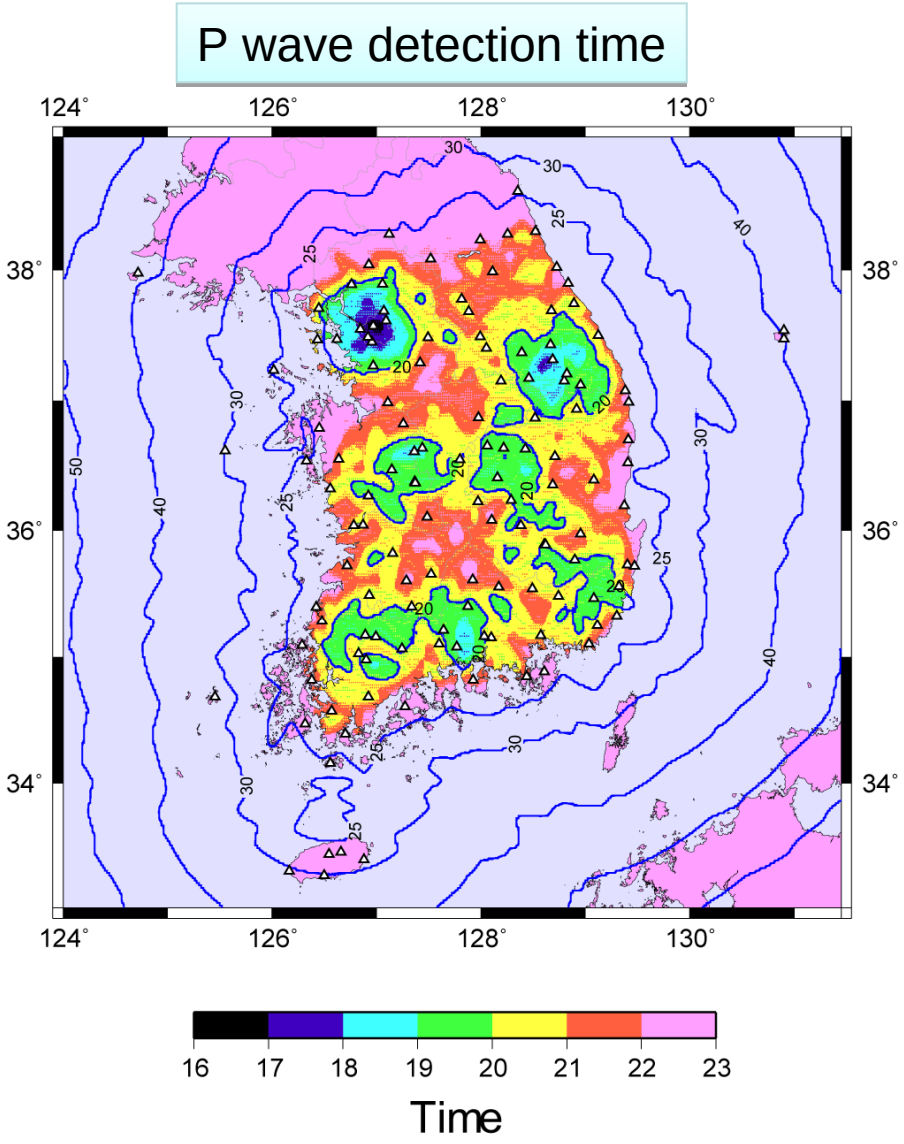
Test of PRESTo

2012/05/11 Ml 3.9 Muju Eq.Off-line simulation

- PRESTo (Probabilistic and evolutionaRy Early warning SysTem) by Zollo *et al.*



Evaluate density of seismic stations



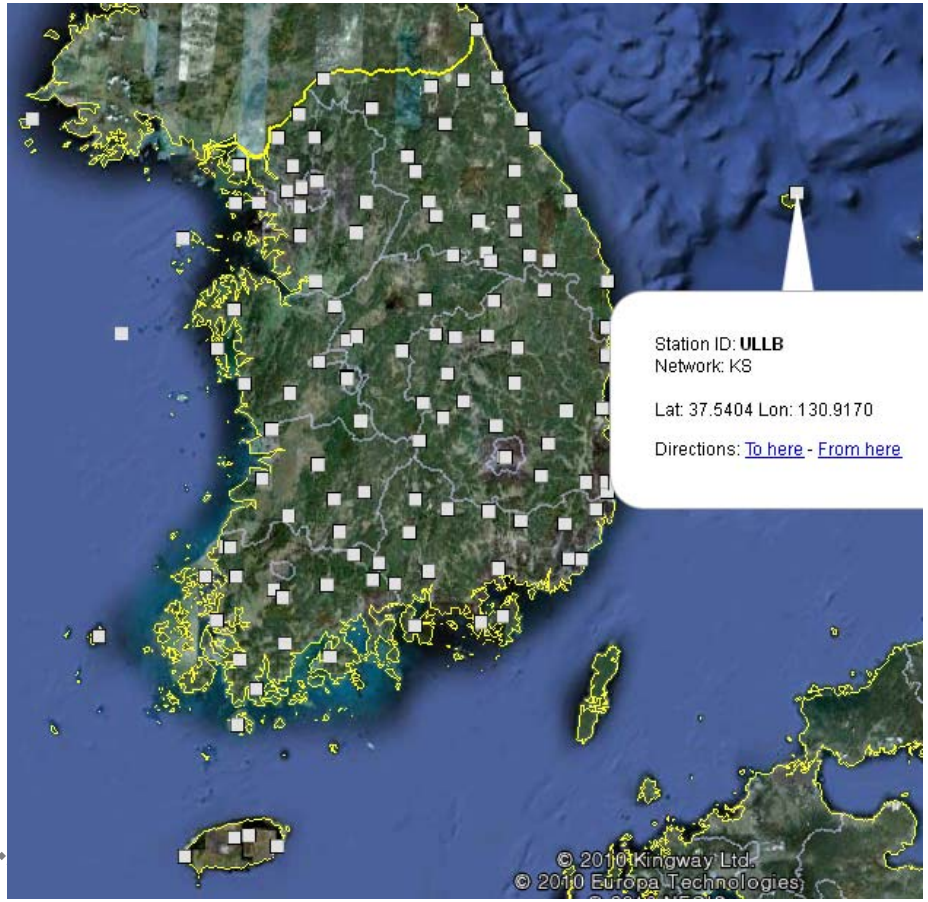
- P wave velocity: 6 km/s
- Focal depth: 8 km
- Telemetry: 8 sec
- Processing time: 5 sec

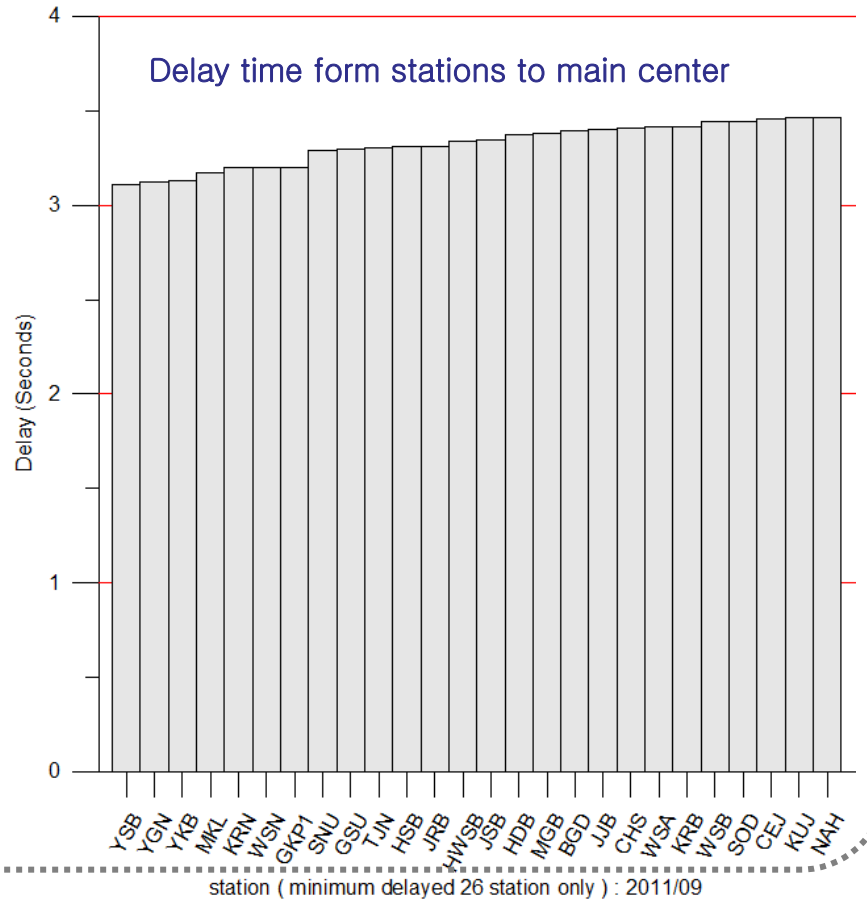
- Grid size: 0.05 degree
- Detection threshold: 6 stations
- 132 stations considered

➢ **Need more qualified stations**

Delay time in real time data retrieve

- Using KISS network
- Need to shorten data delay time.





2010/11/04 Status of stations

Summary

Seismicity and Seismic stations :

- Historical earthquakes can occur in the future in Korea.
- KISS(Korea Integrated Seismic System) supports near real time data exchanging service between different networks.

K-SEIS(Korea-Speedy Earthquake Information Service) includes

- Real time intensity mapping using PGA/sec from 20 sps.
- EEW(Earthquake Early Warning) need to more test and adjustment
- Near field fault effect or site amplification are considered in future

EEW(Earthquake Early Warning) :

- works well about inland small earthquakes.
- PRESTo will be combined as a parallel SW to ElarmS

KIGAM


Thank you