Utilization of Antelope for effective Earthquakes disaster prevention in Korea

Gilbert, Woo
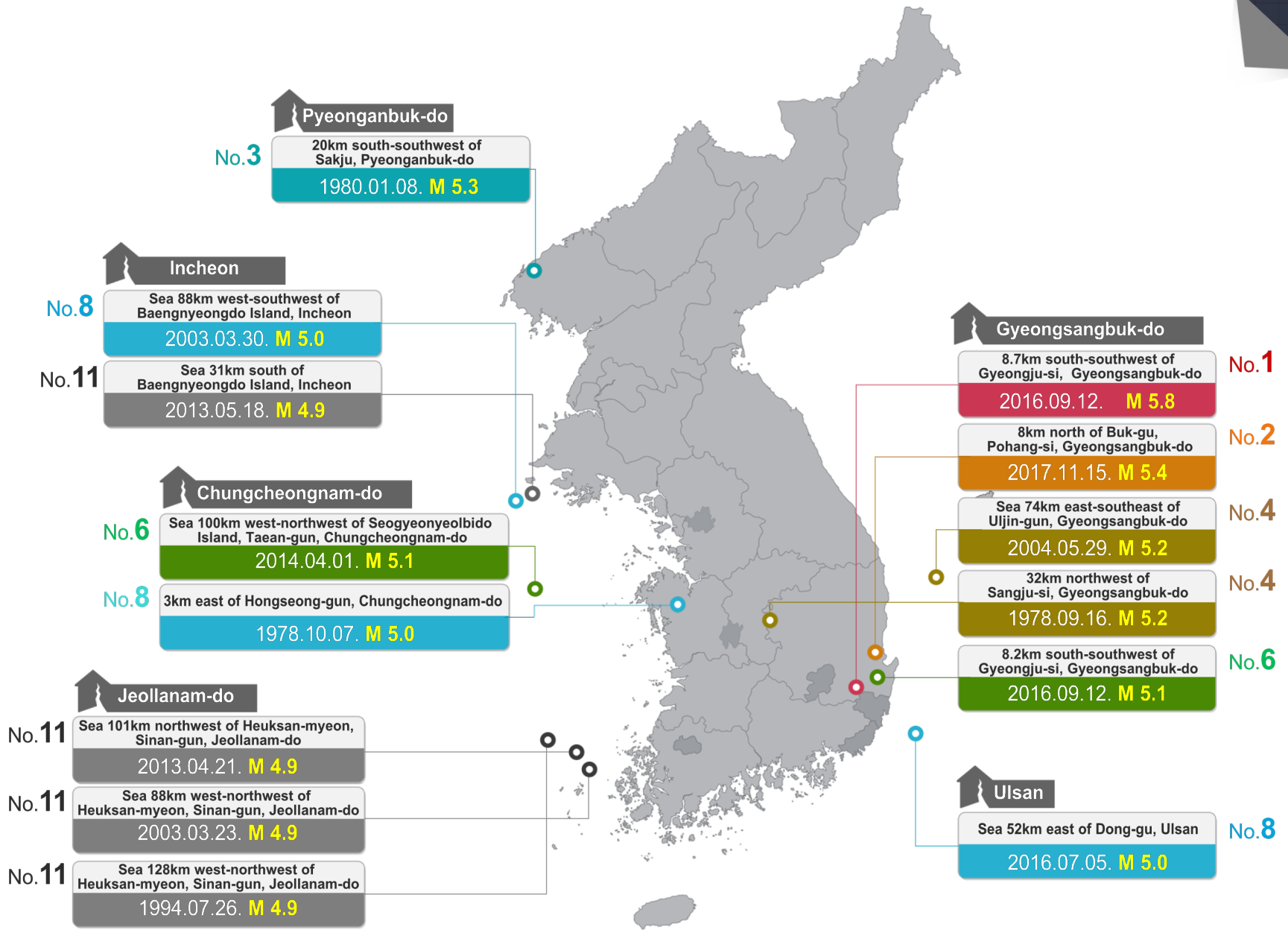
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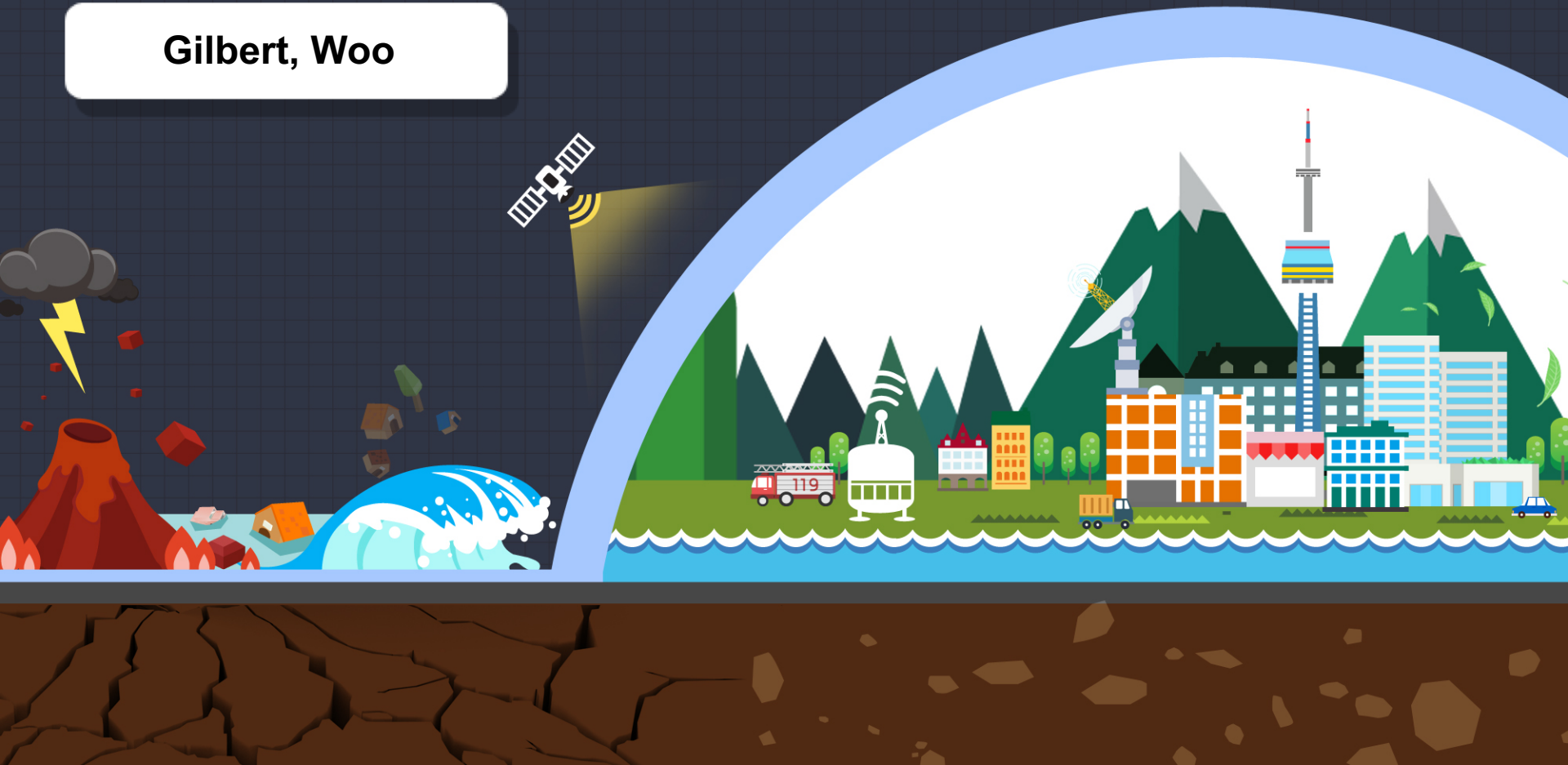
Statistics on Earthquake Occurrence in Korea

Legend:
- M 3.0 or more
- Felt earthquake
- Total

'78~'98
Average **19.2** incidents

'99~'17
Average **67.6** incidents
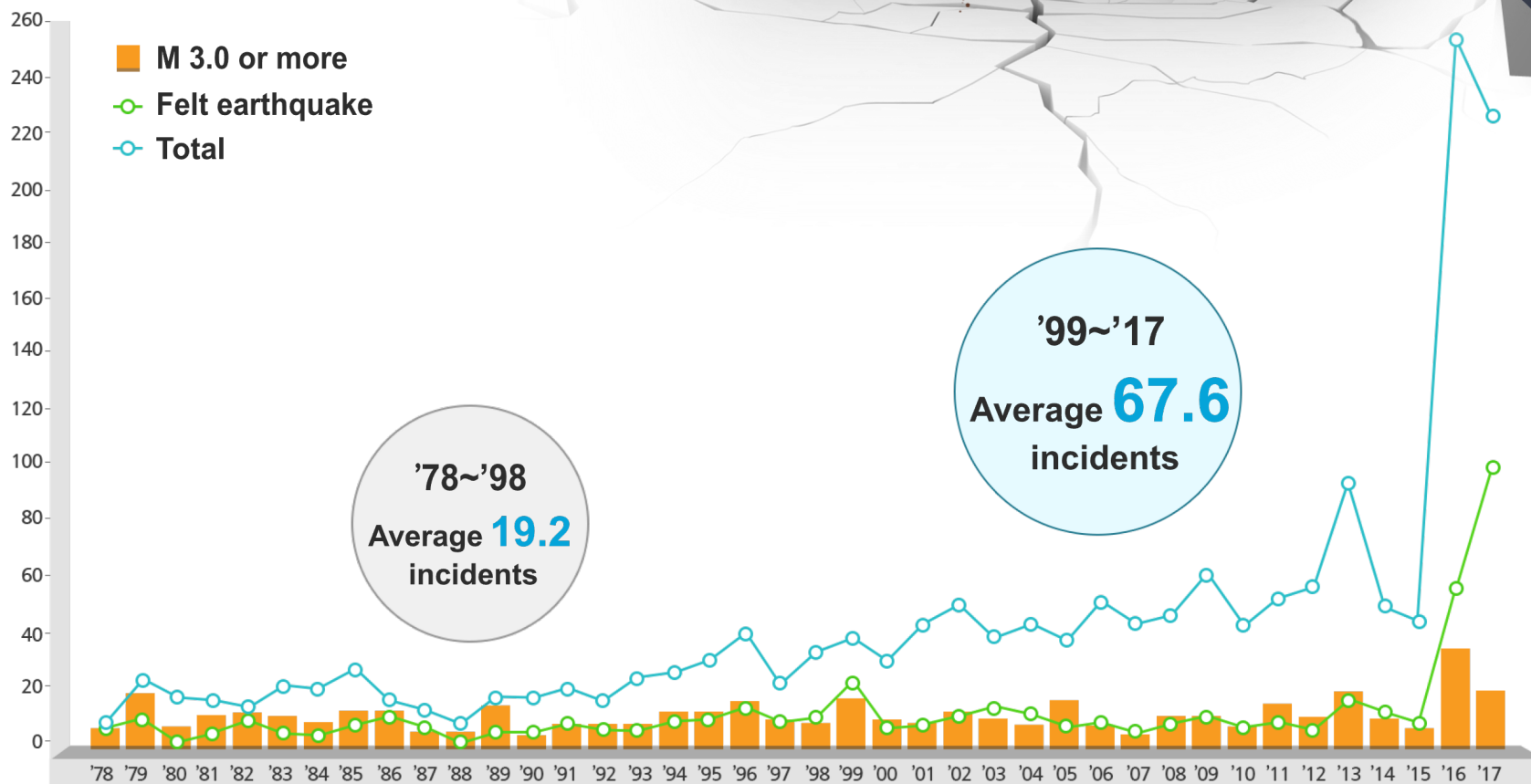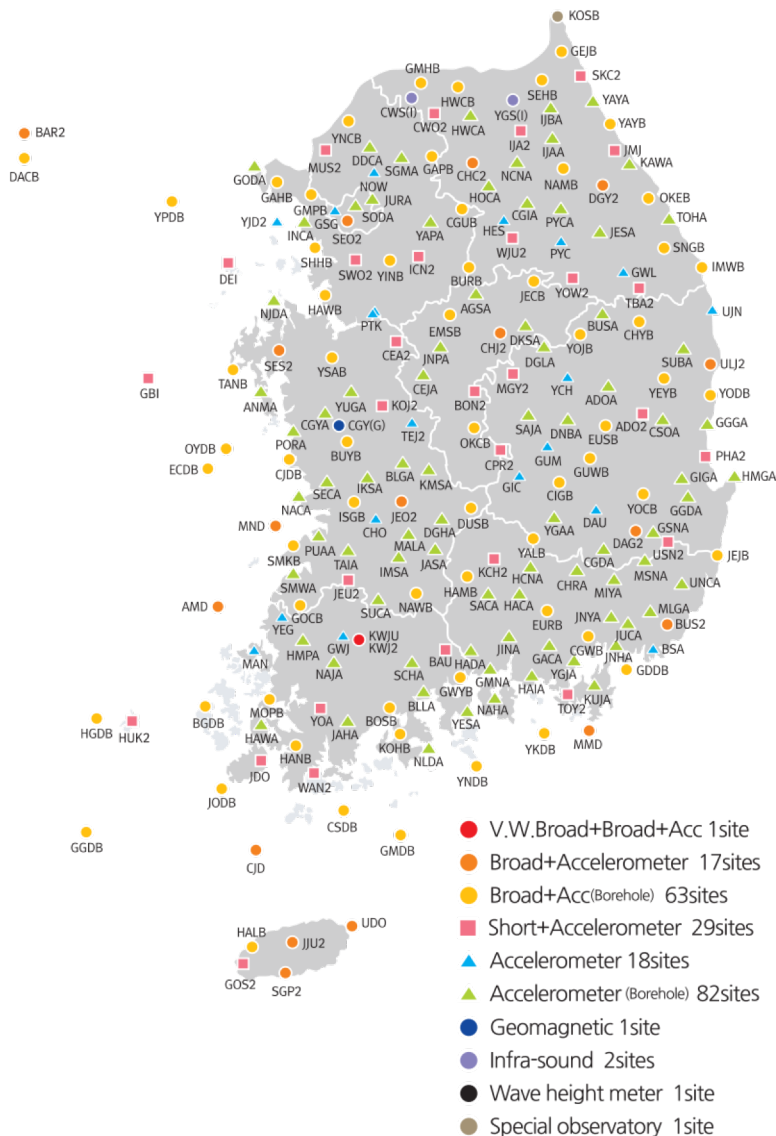
* Annual earthquake trend in Korea (1978~2017)

Classification	Annual average number of earthquakes		
	1978~2017	1978~1998(analogue observation)	1999~2017(digital observation)
M 2.0 or more	42.2	19.2	67.6
M 3.0 or more	10.0	8.8	11.2
Felt earthquake	10.6	5.9	15.8

Major Earthquakes in Korea

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Pyeonganbuk-do

No.3
20km south-southwest of Sakju, Pyeonganbuk-do
1980.01.08. M 5.3

Incheon

No.8
Sea 88km west-southwest of Baengnyeongdo Island, Incheon
2003.03.30. M 5.0

No.11
Sea 31km south of Baengnyeongdo Island, Incheon
2013.05.18. M 4.9

Chungcheongnam-do

No.6
Sea 100km west-northwest of Seogyeonyeolbido Island, Taean-gun, Chungcheongnam-do
2014.04.01. M 5.1

No.8
3km east of Hongseong-gun, Chungcheongnam-do
1978.10.07. M 5.0

Jeollanam-do

No.11
Sea 101km northwest of Heuksan-myeon, Sinan-gun, Jeollanam-do
2013.04.21. M 4.9

No.11
Sea 88km west-northwest of Heuksan-myeon, Sinan-gun, Jeollanam-do
2003.03.23. M 4.9

No.11
Sea 128km west-northwest of Heuksan-myeon, Sinan-gun, Jeollanam-do
1994.07.26. M 4.9

Gyeongsangbuk-do

No.1
8.7km south-southwest of Gyeongju-si, Gyeongsangbuk-do
2016.09.12. M 5.8

No.2
8km north of Buk-gu, Pohang-si, Gyeongsangbuk-do
2017.11.15. M 5.4

No.4
Sea 74km east-southeast of Uljin-gun, Gyeongsangbuk-do
2004.05.29. M 5.2

No.4
32km northwest of Sangju-si, Gyeongsangbuk-do
1978.09.16. M 5.2

No.6
8.2km south-southwest of Gyeongju-si, Gyeongsangbuk-do
2016.09.12. M 5.1

Ulsan

No.8
Sea 52km east of Dong-gu, Ulsan
2016.07.05. M 5.0

National Seismograph Network in Korea

Korea Meteorological Administration

Seismic Stations

Korea Meteorological Administration	**210**
Korea Institute of Geoscience and Mineral Resources	**36**
KEPCO Research Institute	**10**
KINS	**4**

2 Infrasound wave Stations
(Cheolwon, Yanggu)

1 Geomagnetic Station
(Cheongyang)

2018
Expanding up to 314 seismic stations

Including 50 sts of domestic related institutions

Map legend:
- ● V.W.Broad+Broad+Acc 1site
- ● Broad+Accelerometer 17sites
- ● Broad+Acc(Borehole) 63sites
- ■ Short+Accelerometer 29sites
- ▲ Accelerometer 18sites
- ▲ Accelerometer (Borehole) 82sites
- ● Geomagnetic 1site
- ● Infra-sound 2sites
- ● Wave height meter 1site
- ● Special observatory 1site

Type of seismometer	Seismometer				Accelerometer		Total
	Ultra Broadband	Broadband		Short period	Surface type	Borehole type	
		Surface type	Borehole type				
KMA	1	17	63	29	18	82	210

Automatic analysis & Manual analysis

	Automatic analysis			Manual analysis		
Classification	**Prompt information** Earthquake Early Warning system (automatic)			**Detailed information** Analysis system(manual)	**Abroad earthquake information**	
	Earthquake Early Warning		**Earthquake early information**	**Earthquake information**		
					Within area	Outside area
Announcement Standard	**Domestic & Abroad Earthquake**	**M 5.0 or more**	**Domestic Earthquake**	**In land** M 3.5 or more & less than 5.0 **Seas** M 4.0 or more & less than 5.0	**M 2.0 or more**	**M 5.0 or more** **In land** **M 5.5 or more** **Seas**	**M 6.0 or more** **M 7.0 or more**
Contents	**Origin time, Estimated epicenter, Estimated magnitude, Estimated intensity**				**Origin time, Epicenter, Magnitude, Instrumental intensity, Focal Depth**	**Origin time, Epicenter, Magnitude, Focal Depth**	
Announcement time (after initial observation)	**7~25 secs**		**60~100 secs**		**Initially within 5 min, Afterwards when needed**	**-**	**-**

Earthquake and Tsunami Momitoring & Early Warning Area

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Earthquake and tsunami monitoring area

Latitude of 21°N~45°N, Longitude of 110°E~145°E
※ The yellow line is domestic earthquake monitoring area and the number indicates the standard magnitude of earthquake alert

Domestic earthquake monitoring area(2.0 or more)

5.5

5.0

Earthquake Early Warning area

5.0

Abroad Earthquake Early Warning area

5.5

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Three basic conditions

- The results of dbloc2 can be **easily and quickly** converted into the Earthquake Alarm System.

- It is determined that the **best result** among the repeated analysis results **is transmitted**.

- Deliver only **minimal information** about the earthquake.
  ➔ Origin Time, Location, Depth, Magnitude, Intensity

dbloc2

is a collection of several programs which run together under the control of a perl script(from man page)

- dbloc2 runs with several TCL scripts

- These TCL scripts are reponsible for what is shown in GUI when the dbloc2 is run.

- The original is consists of 32 scripts.

- That scripts are located in…
  - /opt/antelope/5.7/data/tcl/library/dbloc

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Add New Script

- Name   : sendforwarn.tcl
- Location : same with dbloc tcl scripts folder
- Function : send analysis results to the alarm system
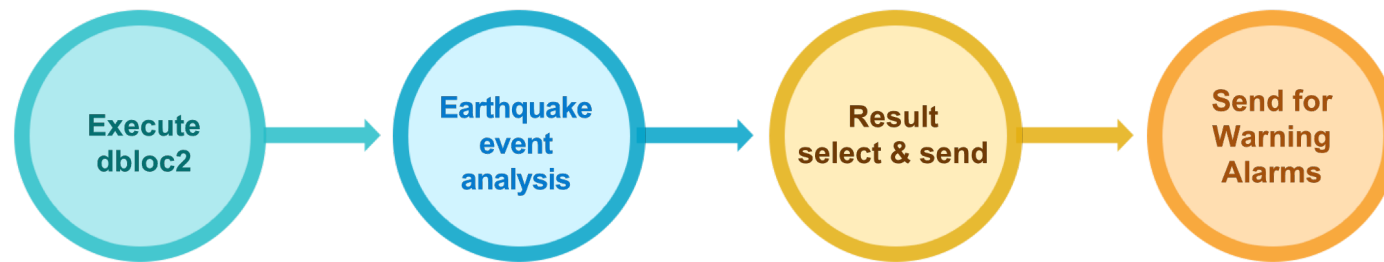
Add New Parameter in dbloc2.pf

```
…
Ebs &Arr{
#server_ip     port     index     header :          1: 1000,   3: 1200
172.20.136.xx  5000      3      DM_ANTL_01  # for New EBS Server VIP
172.20.136.xx  5000      3      DM_ANTL_01  # for New Intensity Server VIP
}
…
```
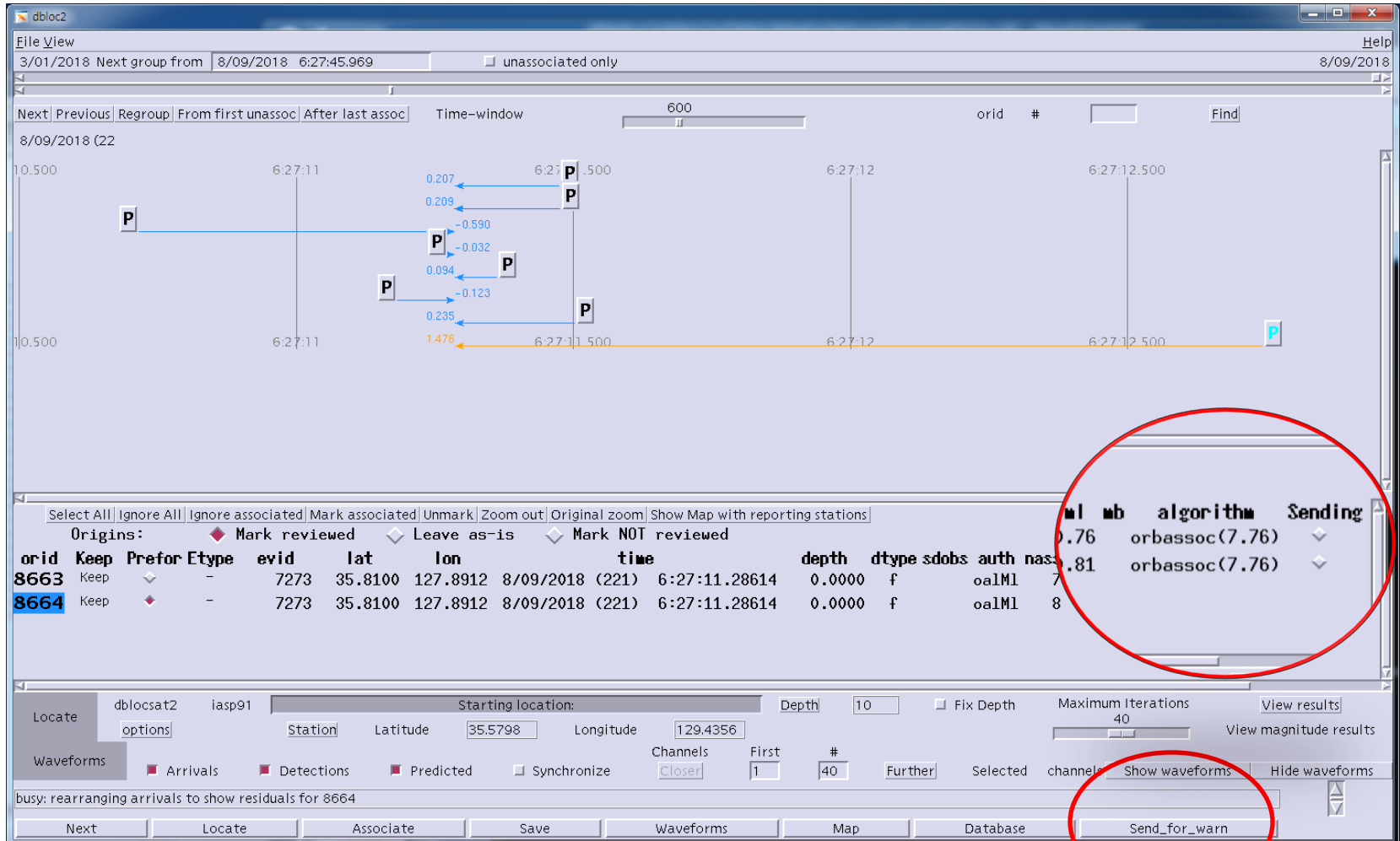
Modify for dbloc2

Modified Script

- tclIndex, ArrivalDisplay.tcl, buttonbar.tcl, dblocsat2.tcl, locate.tcl, OriginDisplay.tcl(7 files)

Original dbloc2

Modify for dbloc2

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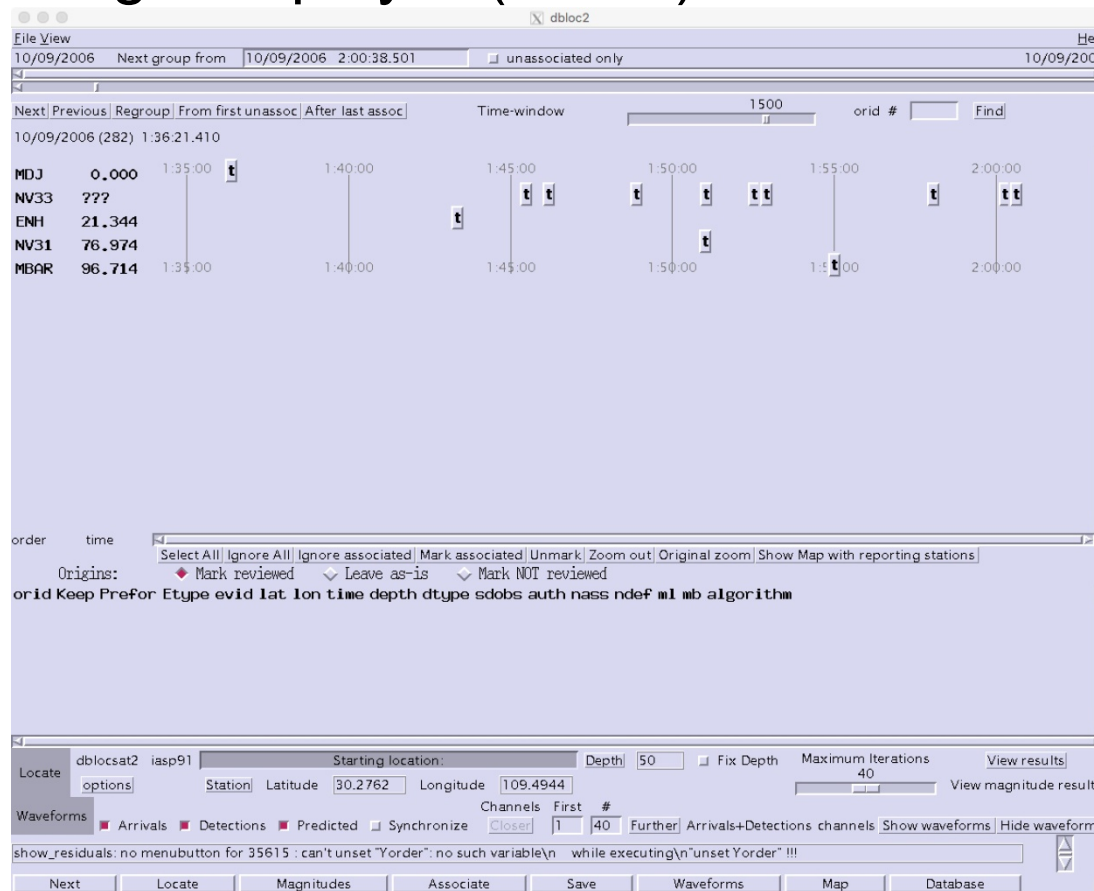
Modified dbloc2

Earthquakes Alert System

Earthquake Information Disseminsation System

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Earthquake monitoring & analysis

Disaster Task Manager
- PC Client
- FAX
- E-mail
- SMS/MMS

Public
- SNS
- WEB
- 131ARS

Earthquake alert system

System connection

Cell Broadcasting Service System

Earthquake disaster message

Ministry of Science and ICT

Disaster Broadcasting online system

- KBS
- Yonhap news
- LINE
- Naver
- Daum
- Korea Railway Corporation
- Korea Water Resources Corporation
- Korea Rural Community Corporation
- Ministry of Oceans and Fisheries Port Earthquake Dissemination System

10 Main broadcasting companies

Automatic Subtitle Transmission system

TV subtitle

Korea Meteorological Administration – Directly connected to local government disaster dissemination system

BUSAN METROPOLITAN CITY
- Education institution (elementary, middle, high)
- website, fax, SMS, mobile, Local broadcasting companies. BIS,etc.

Global Inspiration GyeongGi-Do
- Safety map APP, Fire station within Gyeonggi-do

SEOUL
- Disaster safety portal APP

disaster broadcasting system, smart disaster information dissemination system

ULSAN METROPOLITAN CITY
- website, fax, SMS, mobile, Local broadcasting companies. BIS,etc.
- Earthquake disaster guide system (5 elementary schools)

Active Yangsan
- Bus information system (BIS) Disaster guide broadcasting system

pohang 포항시
- Disaster Warning Integrated System
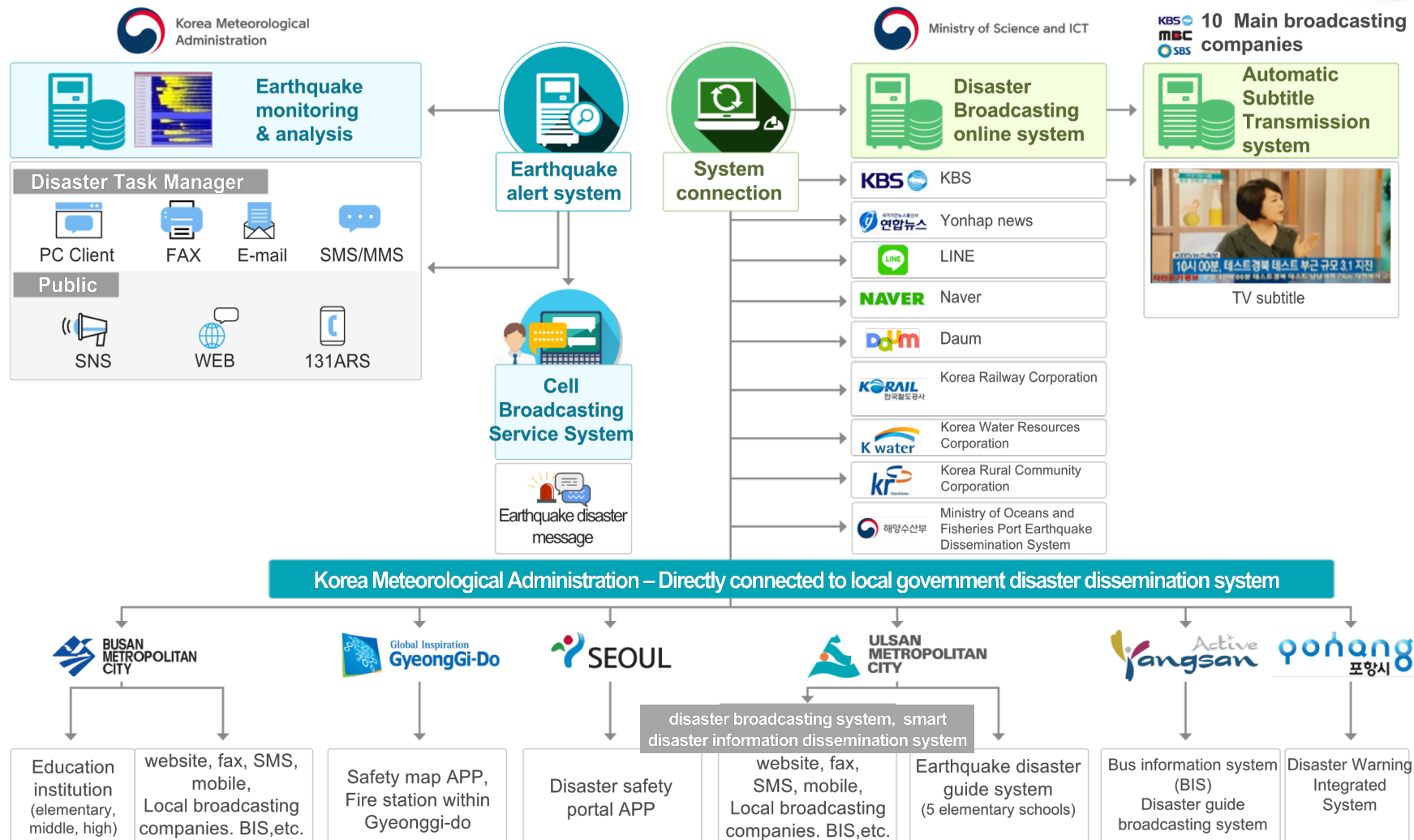
"Observe, analyze and report earthquake information"

Thank you

Korea Meteorological
Administration