

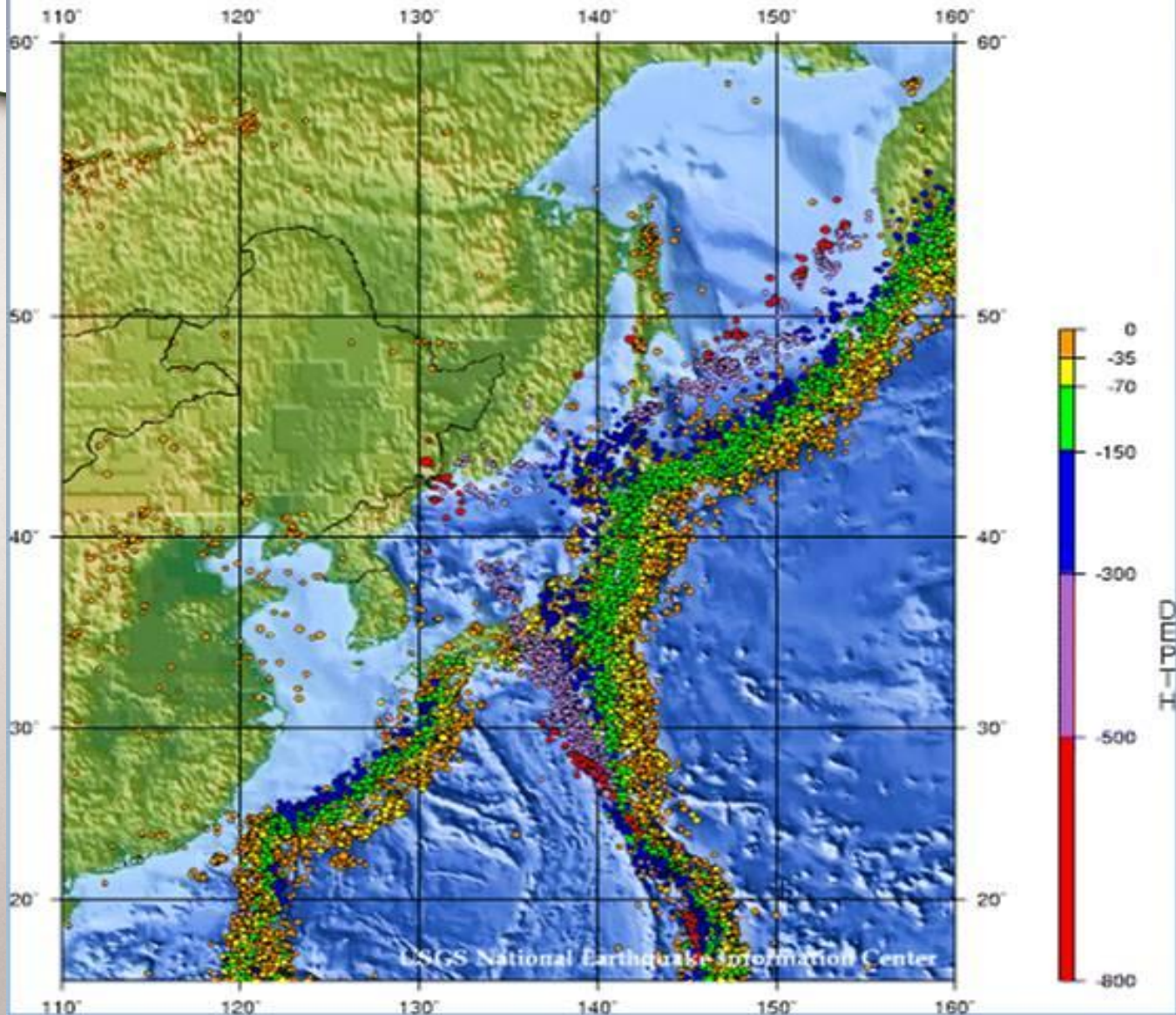
# **Earthquake Data used for the Seismic Hazard Map in Korea**

**Myung-Soon Jun**

*Korea Institute of Geoscience and Mineral  
Resources*



# Seismicity of Japan and Kuril Islands: 1990 - 2000



# Earthquake Data in Korea

<b>Historical Data</b>	<b>Instrumental Data</b>		
<b>Before 1900</b>	<b>1905 - 1943</b>	<b>1943 - 1977</b>	<b>After 1978</b>
<b>Historical Documents</b>	<b>Jun and Jeon (2001)</b>	<b>ISS, DPRK</b>	<b>KMA data</b>

# 歷史地震 目錄 作成을 위한 D/B

## 既存 歷史地震 資料 蒐集 및 D/B

- 韓半島의 地震危險度(動力資源研究所, 1983),
- 韓半島 地震災害圖 作成을 위한 歷史被害地震의 評價 및 綜合整理(國立防災研究所, 1999),
- 歷史地震 評價 및 目錄作成(韓國原子力安全技術院, 2000),
- Historical seismicity of Korea (Lee&Yang, 2006),
- 韓半島의 地震活動 研究(경제복, 2008)

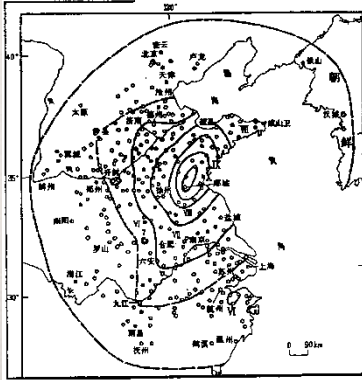
# 國會圖書館, 忠南大學校 등 圖書館 D/B를 利用한 歷史文獻 地震記錄

- 한글翻譯本 CD 를 利用하여 既存 原文 補完
- 增補文獻備考(303회),
- 高麗史節要(93회),
- 梅泉野錄(4회),
- 國朝寶鑑(3회),
- 眉巖日記(4회), 이재고난(9회),
- 大東韻府群(11회),
- 高純宗實錄(11회)

# 隣接國 歴史地震 目錄 分析

1668. 7. 25.

地震日期 公历 农历	震中位置 (北纬) (东经) 精度	烈度 (震级)	地震情况
1668.7.25 清康熙七年六 月十七日戌时	山东郯城 (34.8°) (118.5°) 2	> XI (8½)	鲁、苏、浙、皖、赣、鄂、豫、冀、晋、辽、陕、闽浙省及朝鲜同时地震，山东郯城、沂州、莒州破坏最重。50多万平方公里范围内的150多个州县遭受不同程度的破坏，有感半径800多公里。震区内城廓、公廨、官民庐舍、庙宇等一时尽毁。野城倒塌如平地，莒州百里无存屋。并伴有大规模的山崩地裂、地陷、涌水喷沙等现象。震时如升旗，如枯棒上下，屋为瓦，梁为渊，沙涌并逐，地侧倒覆，百谷颠仆。共压毙5万余人，死尸遍野，不能殓葬者甚多。凡值村疇之处，靡美之气达于四处，暴雨烈日，瘟疫随作。人民流散。免山东沂州等40州。县卫年稻多寡不等。银227300余两。并遣官賑济。朝鲜半岛双城、铁山等。震前，1664年(三年)郯城地震有声。1668年5月(四月)山东冷雨，民多冻死。五月重蝗见。越三月乃疫：太白经天，彗月不退。震前天雨50余日。7月18日(六月十日)大水暴涨，淹死者无数，输物高者仅露其梢，淮安地软如陷而空，艘船凡有俱暴沉。海水通舍30里。山东苏、丹诸河水泛滥。河南济河而上，伊、洛之间蛟龙突起，黄河壅口水壅沙生。



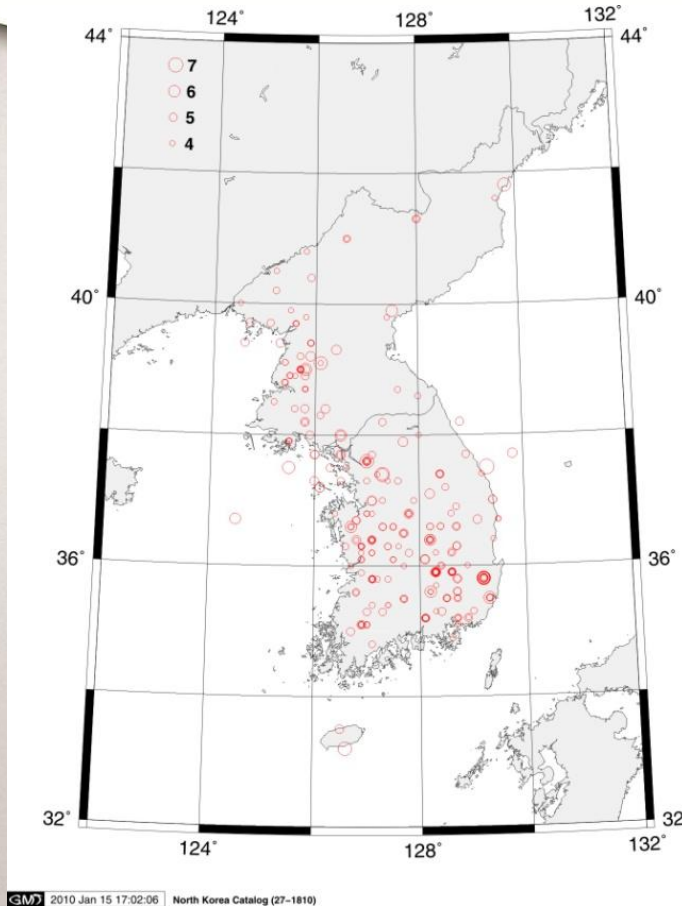
地震이 發生. 평안도(平安道) 평양(平壤), 철산(鐵山), 황해도(黃海道) 해주(海州), 안악(安岳), 연안(宴安), 재령(載寧), 장연(長淵), 백천, 봉산(鳳山), 강원도(江原道) 창원(昌原), 웅천(熊川), 충청도(忠淸道) 홍산(鴻山), 전라도(全羅道) 김제(金堤), 당진(唐津)에서 感震. 鐵山地域에 海溢(朝鮮王朝實錄)

번호	일시	진앙지		지진 규모 (M)
		위도 / 경도	지역	
1	1548. 9. 13	38.0 / 121.0	발해	7
2	1597. 10. 6.	38.5 / 120.0	"	7
3	1668. 7. 25.	35.3 / 118.6	산동반도	8.5
4	1679. 9. 2.	40.0 / 117.0	하북	8
5	1846. 8. 4.	32.5 / 123.0	동대양	7
6	1852. 12. 16.	33.5 / 122.0	"	7
7	1853. 4. 14.	33.0 / 122.5	"	7
8	1888. 6. 13	38.5 / 119.0	발해	7.5

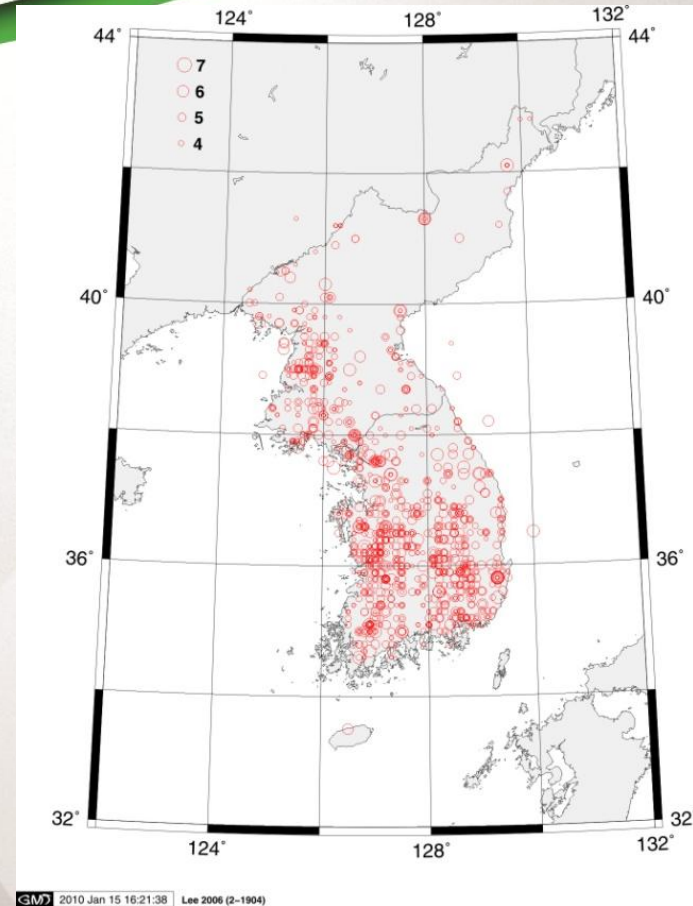
# 隣接國 地震目錄 중 韓半島 地域 資料 分析

- 中國近代地震目錄(1999,中國地震國),
- 黃海 및 그 周邊의 歷史지진(1995, 吳伐主),
- 國外地震科技情報(1987,中朝地震活動性연구소조)
- 日本被害地震總覽(1996, 東京大學校),
- 地震活動總說(1999, 東京大學校)

# Previous Studies



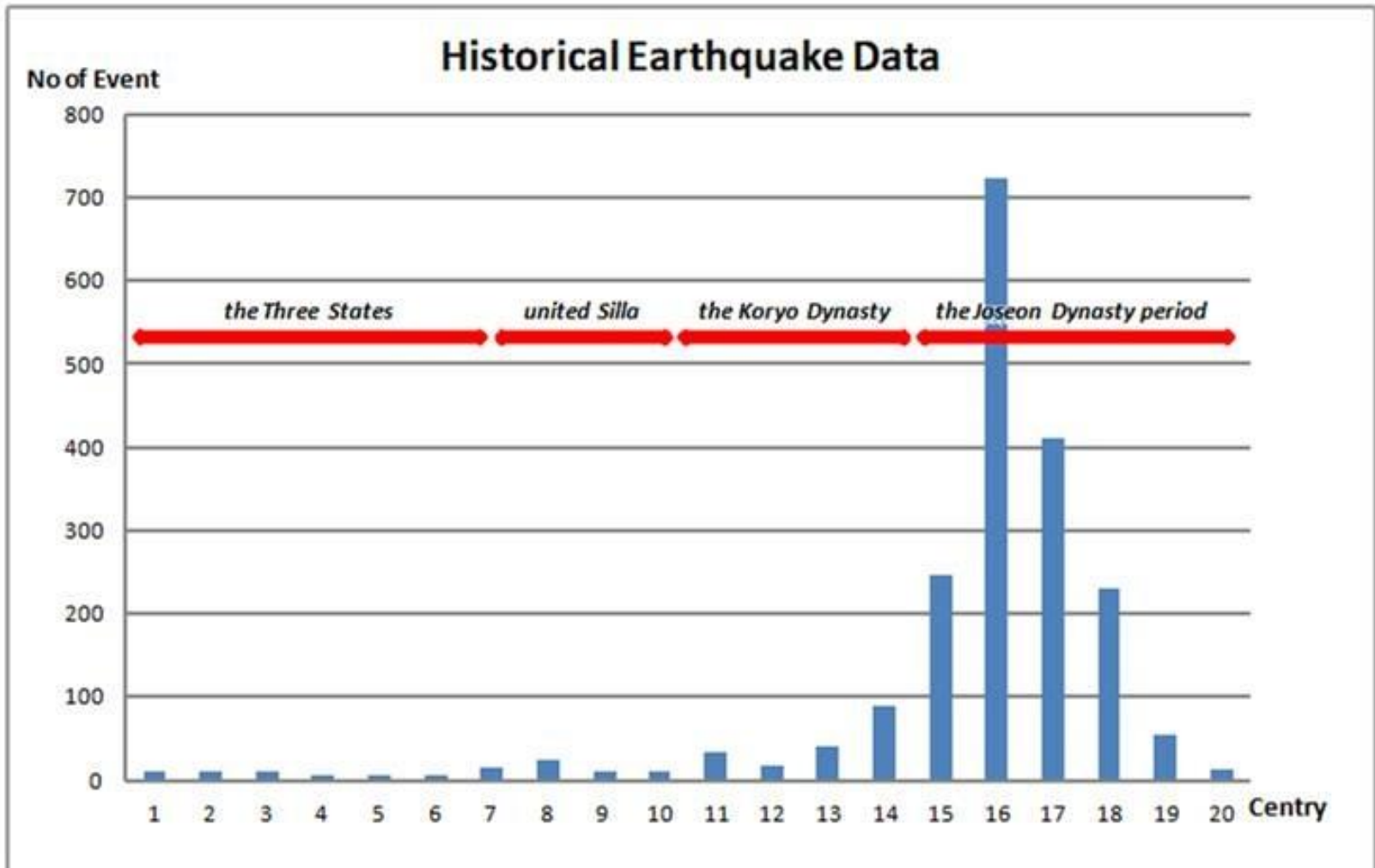
292 earthquakes (ML > 4.0)  
between 2 -1898  
(Seismological Institute of North  
Korea, 1987)



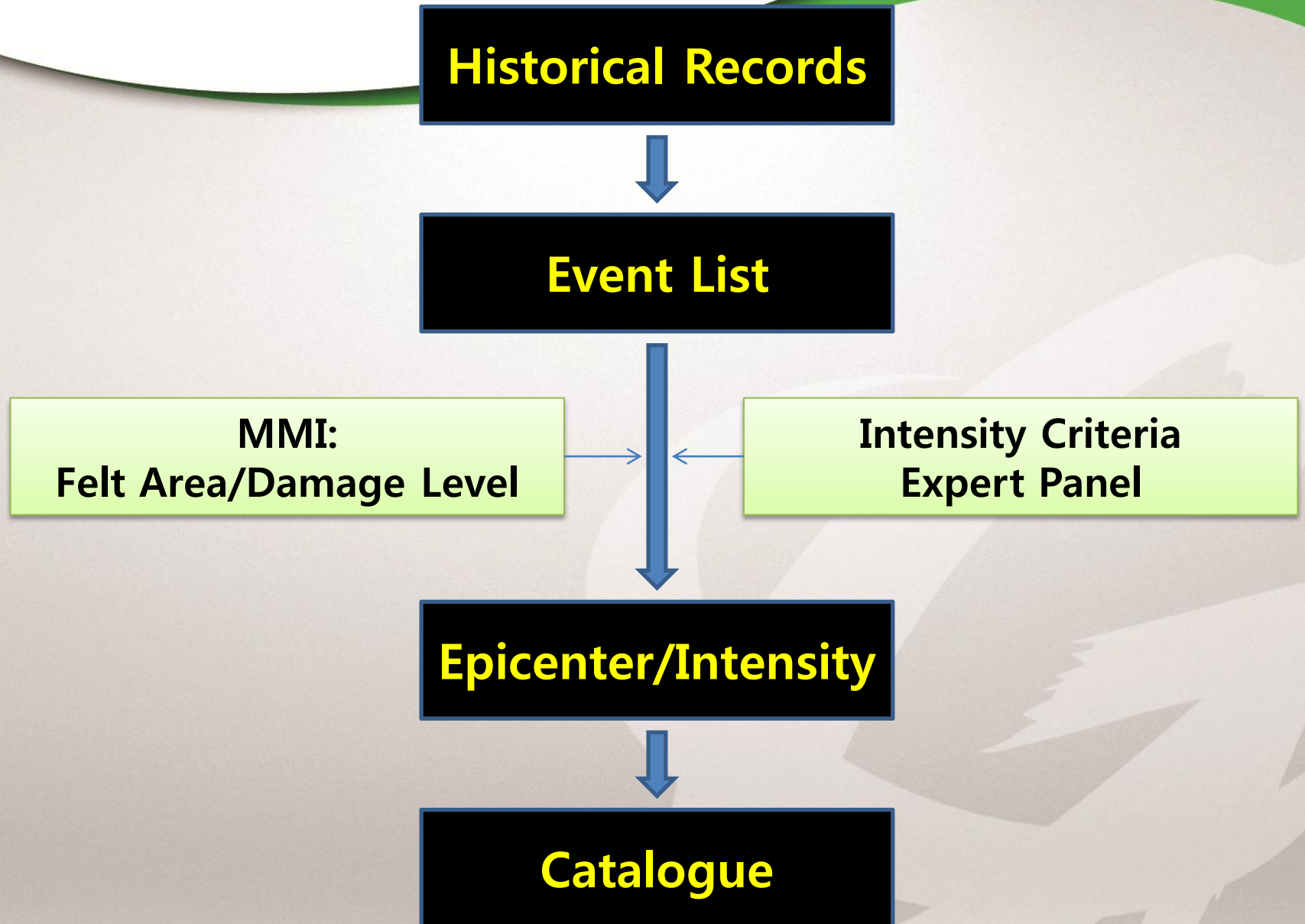
2,185 earthquakes between 2 -1904  
(Lee & Yang, 2006)



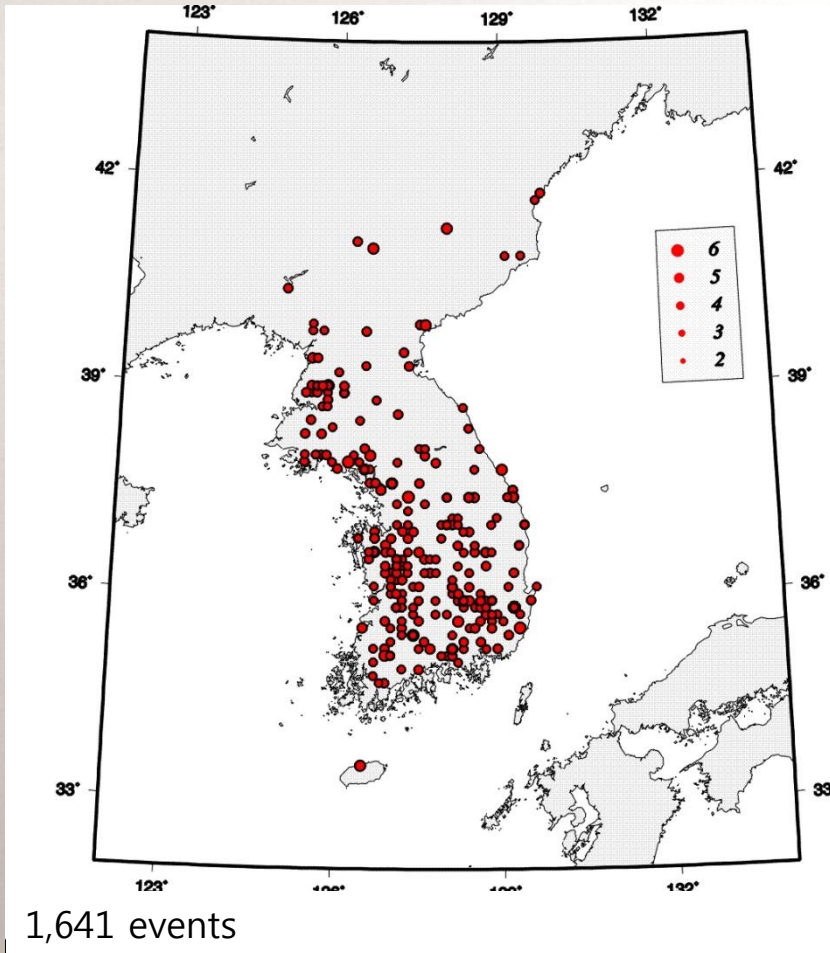
# Occurrence of Historical EQ



# Flow Chart for Historical Catalogue



# Historical Earthquakes used in Seismic Hazard

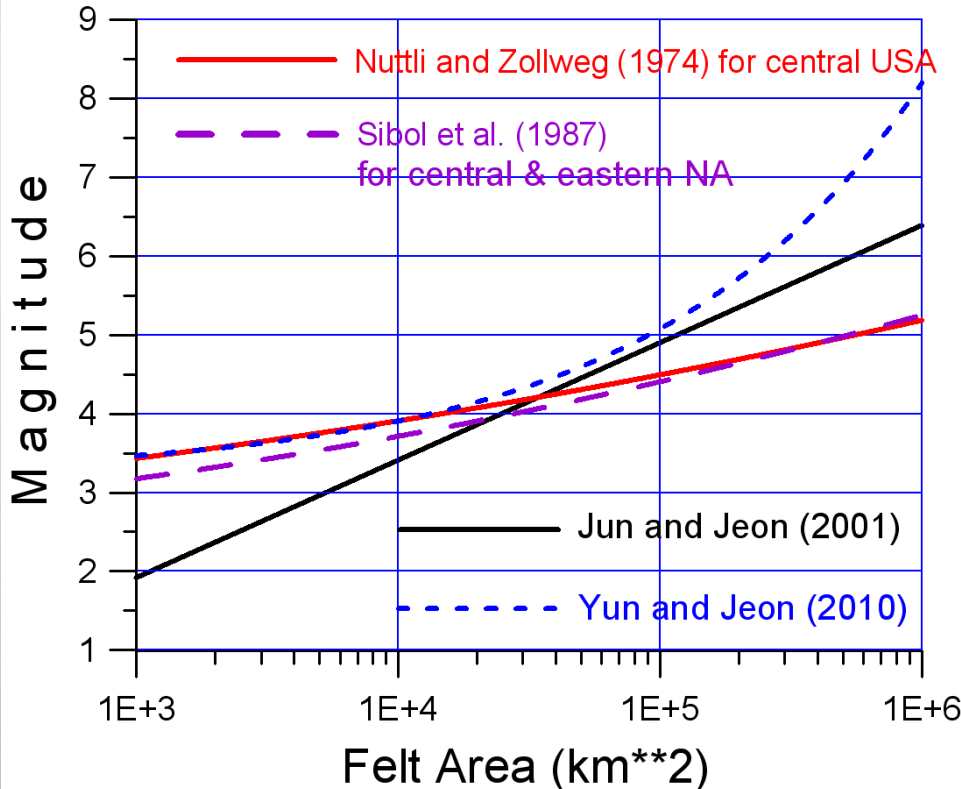


## Source Parameter Estimation

- Lunar Calendar -> Solar Calendar (After Korea Dynasty, 10<sup>th</sup> Century)
- Damage Distribution and Damage Level -> Epicenter and Intensity
- Intensity -> Magnitude

# Intensity only felt area information (I)

## Felt Area(NO. of provincial reports)-Magnitude Relationship



- NO. of provinces  $\leq 2$  : ML 4.0 ~ 4.5
- NO. of provinces = 3 : ML 4.5~4.8
- Half to Whole Korea: ML 5.0 ~ 5.5

\*Earthquakes reported by each provincial government

# Intensity only felt area information (II)

## Intensity Attenuation Relationship

- Estimation of Radius of Felt Area
- Radius of Felt Area → Intensity

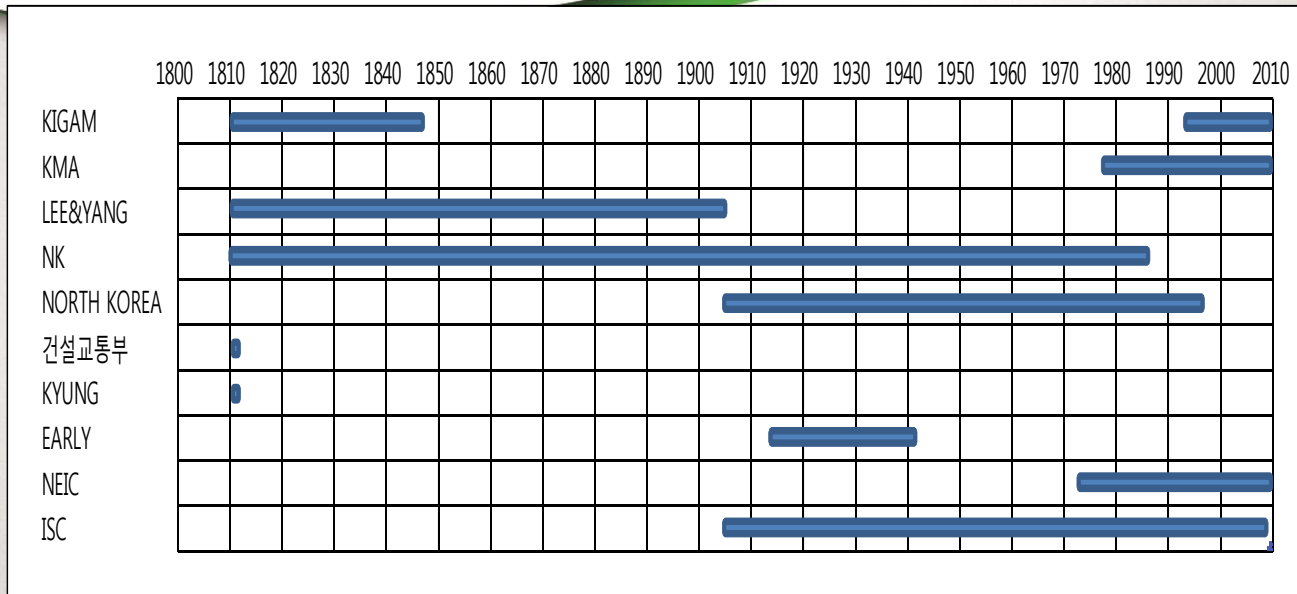
$$I_s = I_0 + 0.191 - 0.834 \ln R - 0.00680R \quad (\text{Lee, 1984})$$

$$I_s = I_0 + 1.89 - 0.89 \ln R - 0.0078R \quad (\text{김성균, 1986})$$

$I_s$ : Site Intensity,  $I$ : Intensity,  $R$ : Radius

No. of Provinces(Area)	Radius(km)	Intensity
1	80	5.6
2	115	6.2
3	140	6.6
Half of Korea	160	6.9
Whole Korea	225	7.7

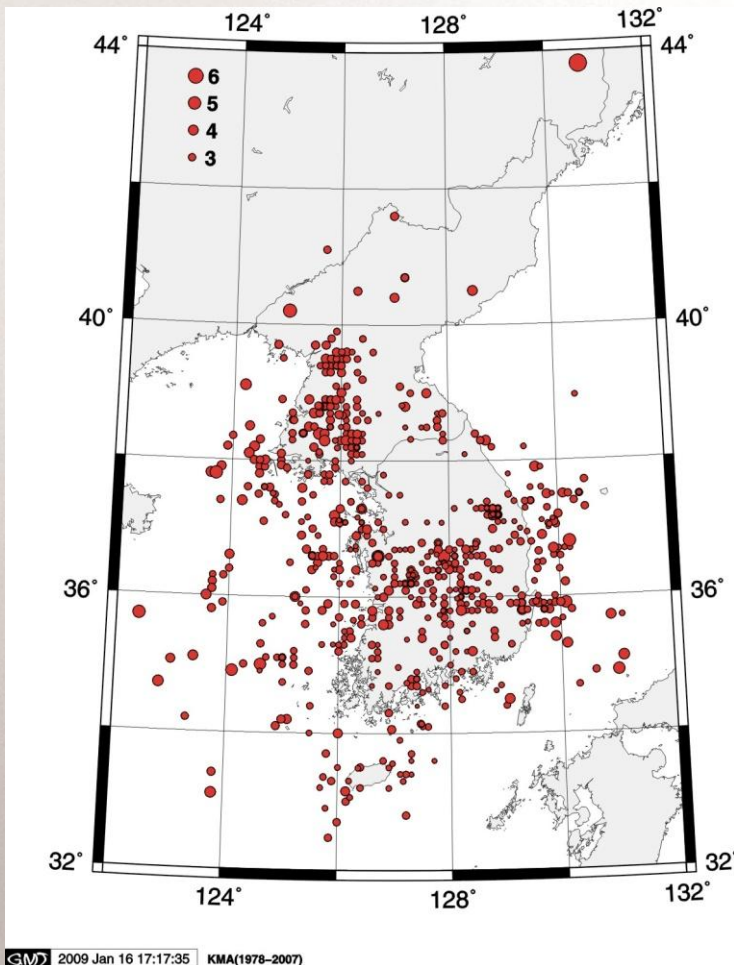
# EQ. Data Distribution



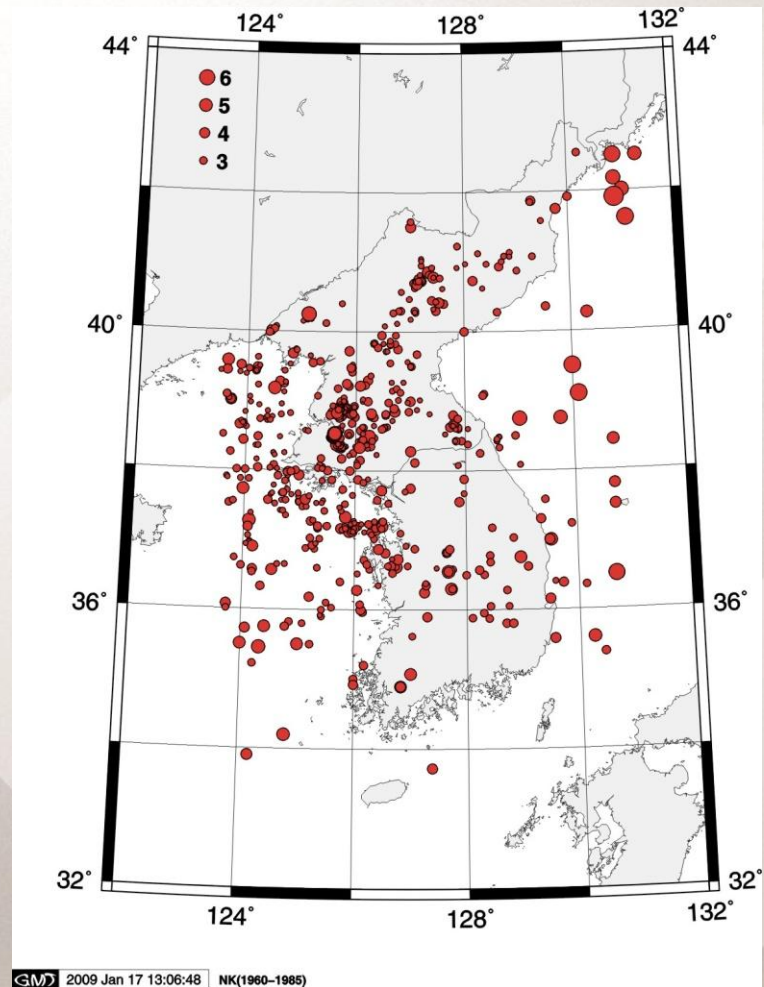
ORGANIZATION	TIME PERIOD			NO. of DATA
KIGAM	02-08	~	2010-11-28	2437
KMA	1978-08-30	~	2010-12-20	918
LEE&YANG	02-08	~	1904-03-23	1928
NK	27-10	~	1985-12-23	1057
NORTH KOREA	1905-08-25	~	1996-11-17	445
건설교통부	27-00	~	1810-01-20	389
KYUNG	27-00	~	1810-02-19	449
EARLY	1913-05-12	~	1941-12-15	91
NEIC	1973-09-10	~	2009-08-10	207
ISC	1905-08-25	~	2009-05-01	849

# Instrumental Data

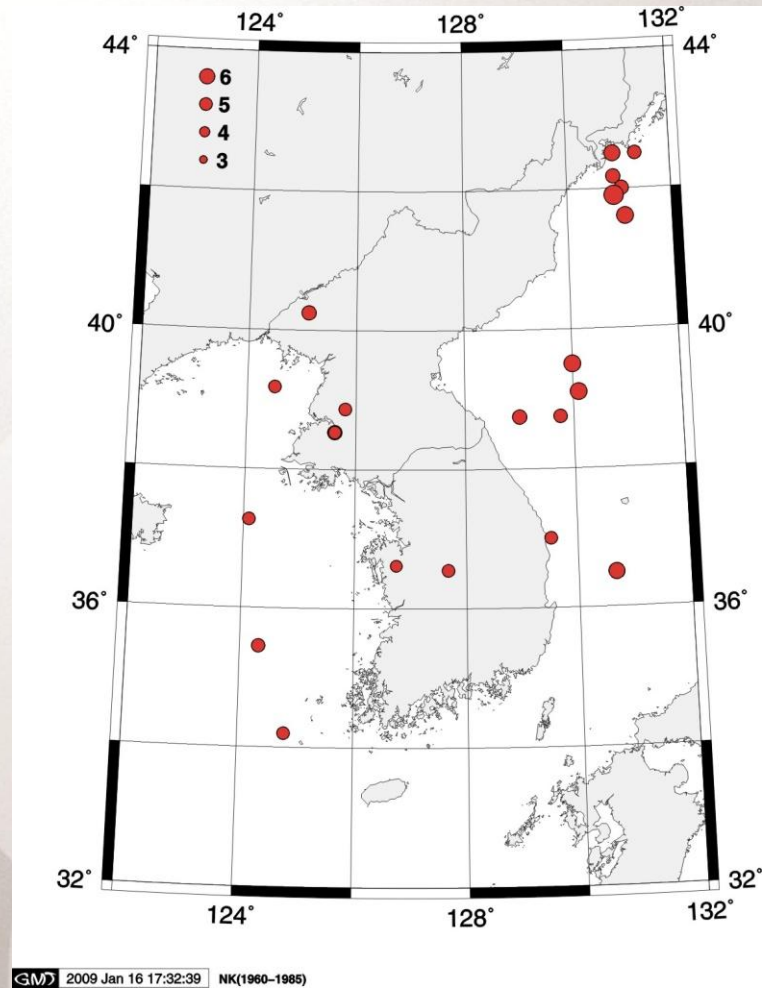
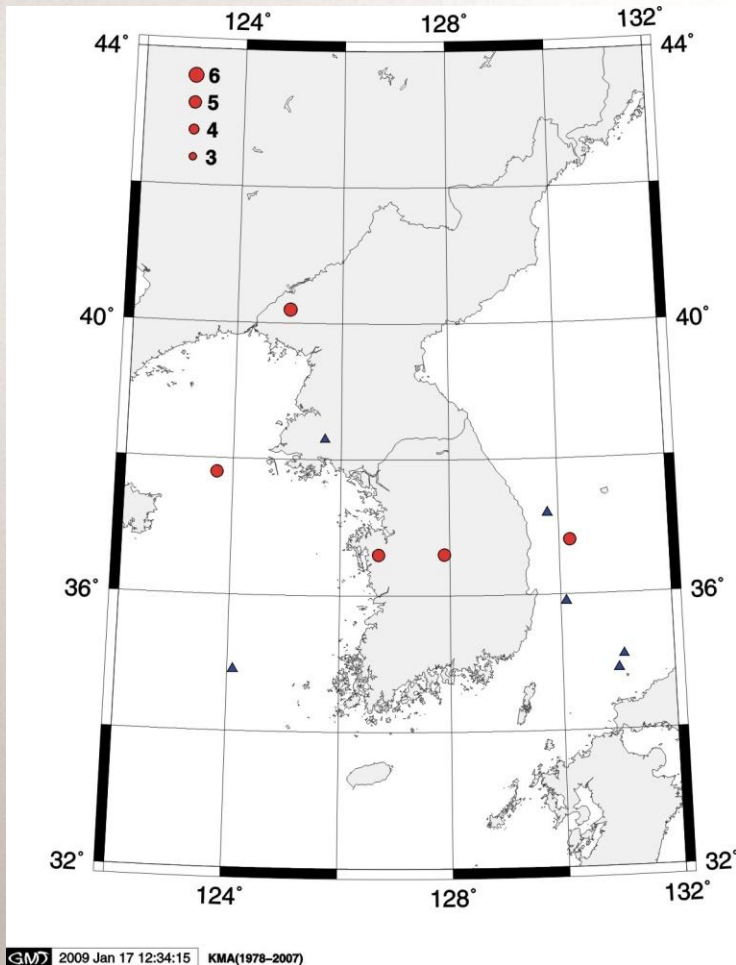
KMA(1978 ~ 2010)



North Korea(1960 ~ 1985)



# Instrumental Data (M > 5)



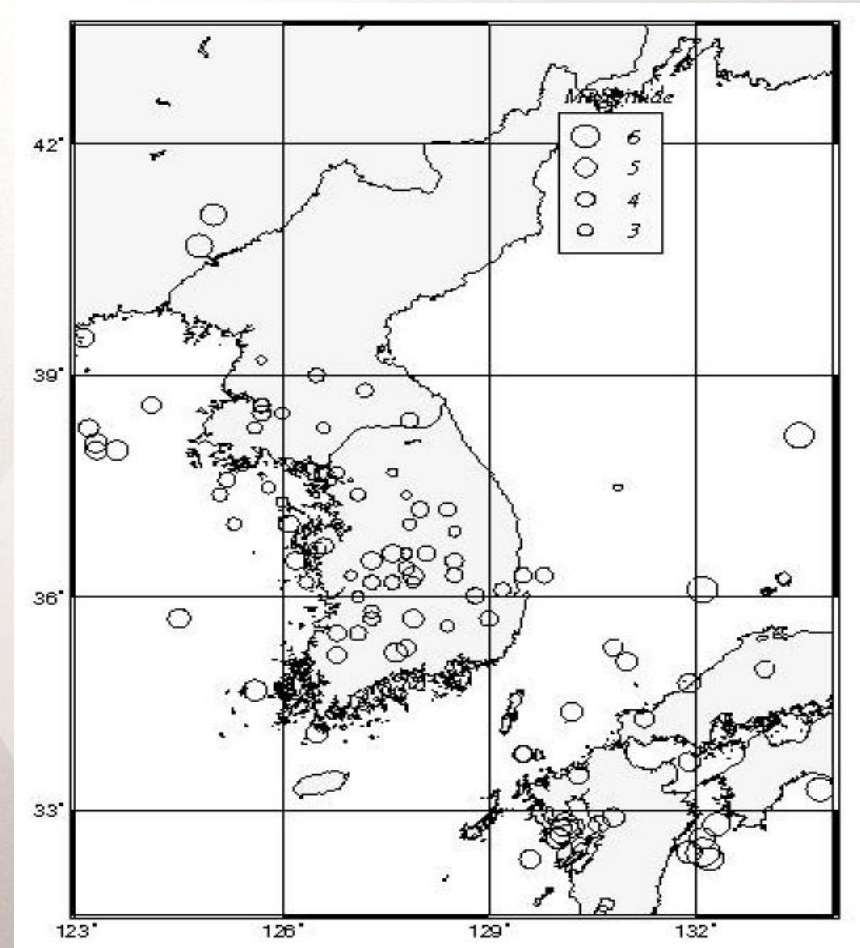
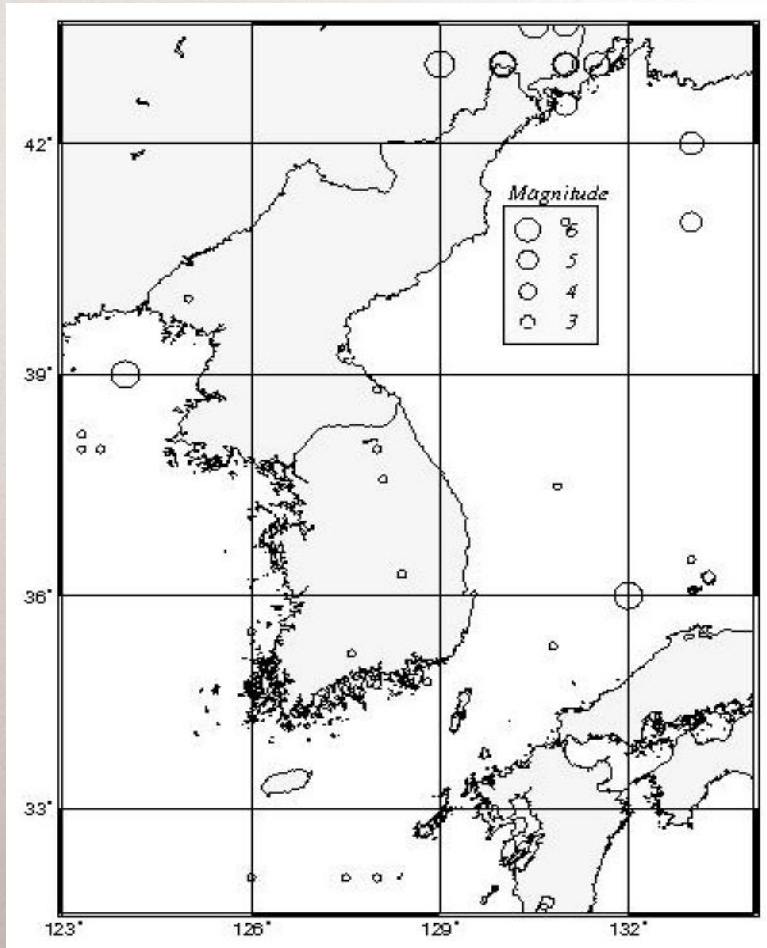


# EQ Data (1905 – 1943)

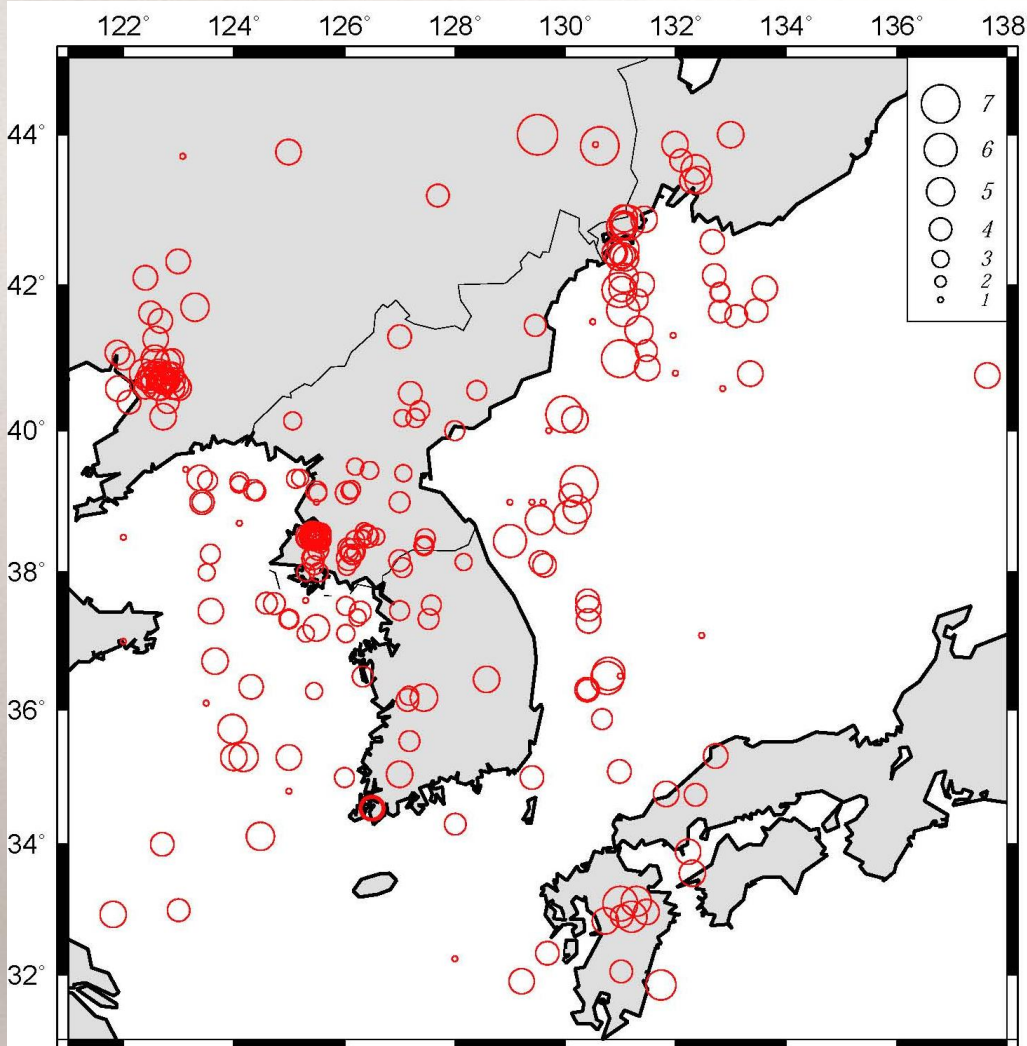
– Jun and Jeon(2001)

- **朝鮮地震報告**(1905-1912)
- **朝鮮氣象30年報**(1934)
- **地震年報**(1933-1938)
- Annual Report of the Weather Bureau of Tyosen(1935-1939)
- **朝鮮總督府氣象臺 地震年報**(1940)
- **朝鮮氣象要報**(1940-1942)
- The seismological Bulletin of the Central Meteorological Observatory, Japan(1952)
- ISS Bulletins

# ISS and Jun & Jeon (1905-1943)



# Instrumental Data (1945 ~ 1977)



- **Between 1945-1963**
- **WWSSN Seoul Station (1963)**
- **KSRS data from late 1960'**
- **Data from North Korea**
- **Data from ISS & ISC & USGS**

# Earthquake Observation in Korea

- Until 1974 **No Magnitude Information, JMA Intensity information only**
- Since 1975 **Magnitude Information**

# Instrumental Earthquakes used in Seismic Hazard

