Role of the Egyptian National Seismological Network in improving seismic hazard studies

By
Dr. Mahmoud Elhadidy
National Research Institute of Astronomy and Geophysics (NRIAG)

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outlines

- ✓ History of seismic monitoring in Egypt.
- ✓ ENSN (Seismic Network and accelographs Network).
- ✓ Inputs of probabilistic seismic hazard.
- ✓ seismic hazard studies in Egypt before 2003.
- ✓ Recent seismic hazard studies in Egypt.
- ✓ Developing ENSN for earthquake risk reduction.
- ✓ Conclusion.

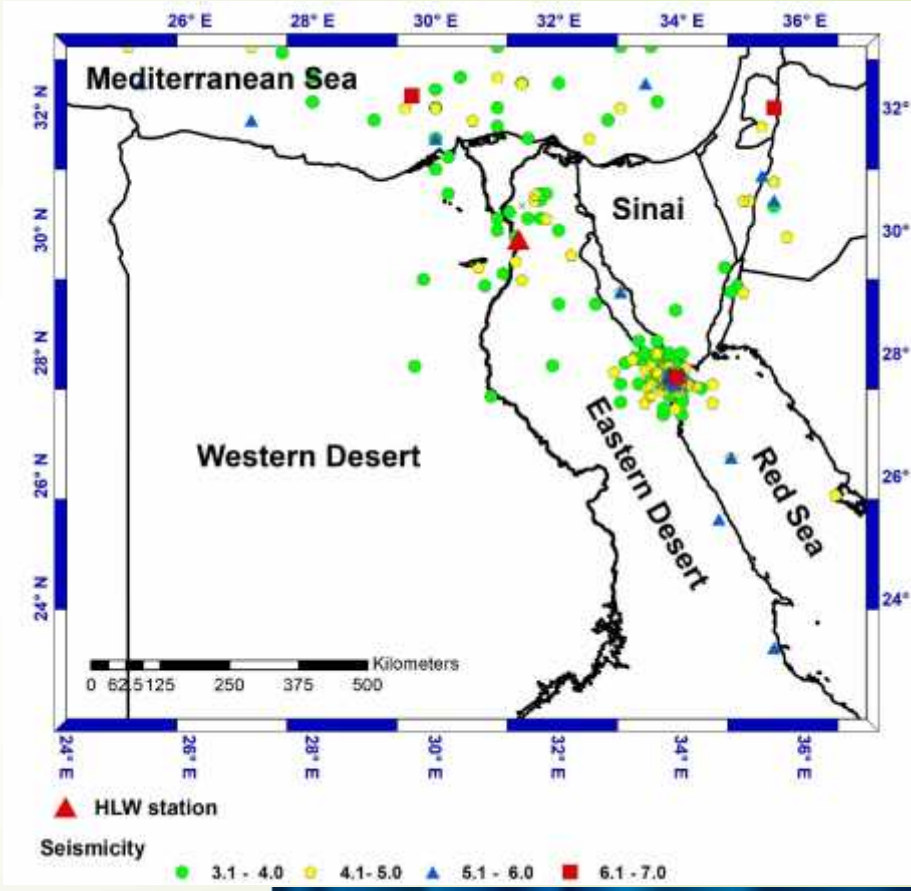
History of seismic monitoring in Egypt

- Phase 1 : Single Analogue station
- Time period : 1889-1975 AD
- Complete : M > 5.0 from 1900- 1963
  M > 4.5 from 1964- 1975

Significant events:

1955, Alexandria earthquake

1969, Shedwan earthquake

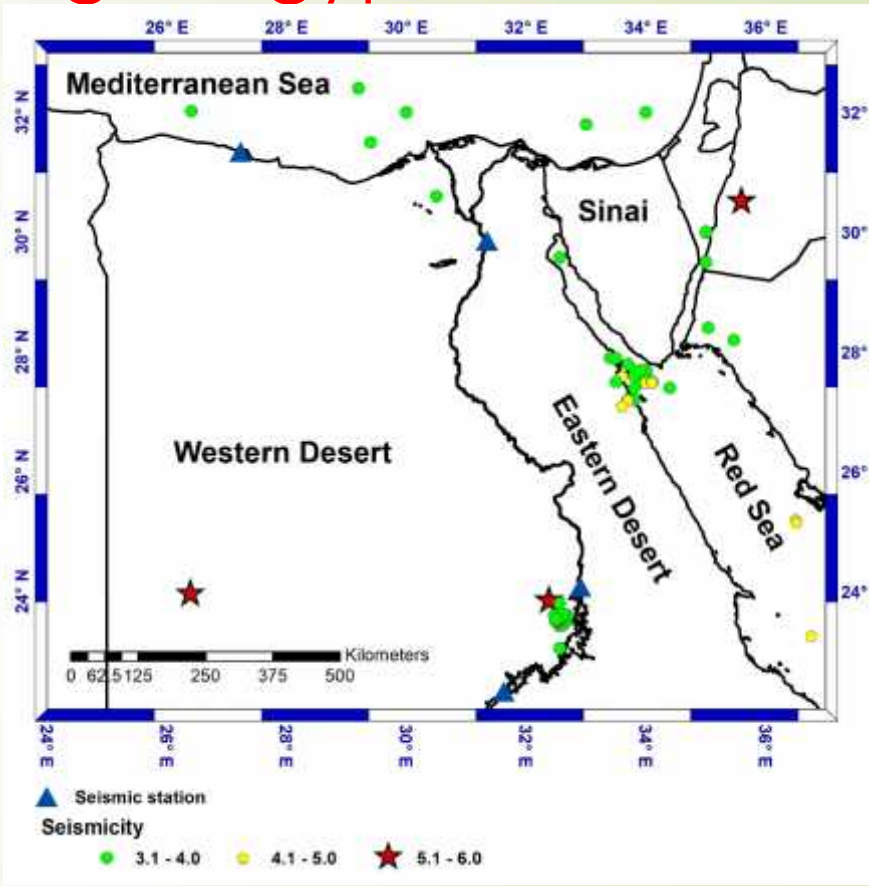


History of seismic monitoring in Egypt

- Phase 2 : Multi Analogue stations
- Time period : 1976-1981 AD
- Complete : M > 3.5
- Significant events:

  1978, El-Gilf Elkeber earthquake

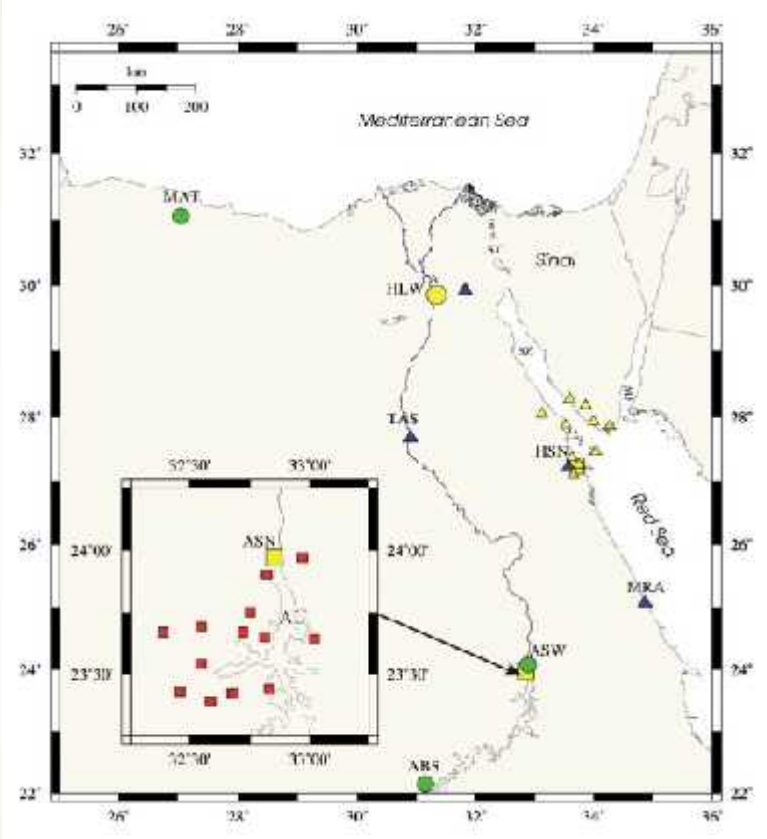
  1981, Kalabsha earthquake



History of seismic monitoring in Egypt

- Phase 3 : Multi Analogue stations and digital local networks
- Time period : 1982 -1997 AD
- Instreumentation : Aswan Local Network and Hurghada Local Network,

  MAT, ASN, TAS, KOT, MRS, and HLW stations



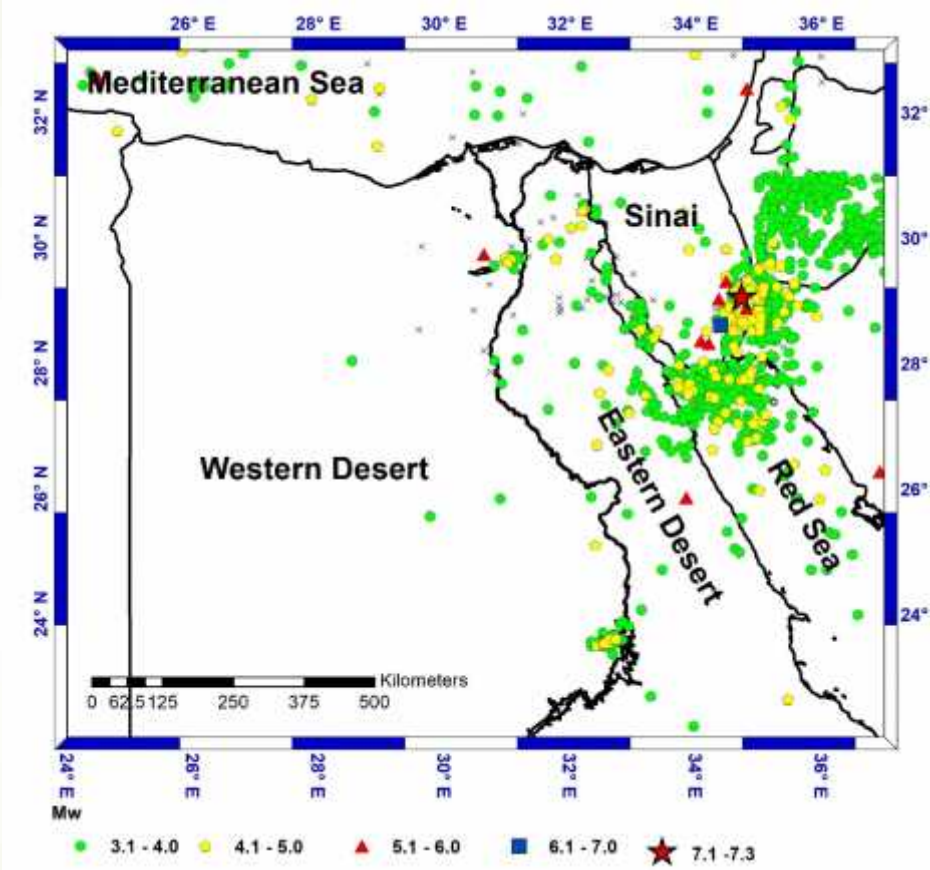
(After Hussien et al., 2008)

History of seismic monitoring in Egypt

- Cont. phase 3 : Multi Analogue stations and digital local networks
- Number of events: 1711
- Complete : M > 3.0
- Significant events:

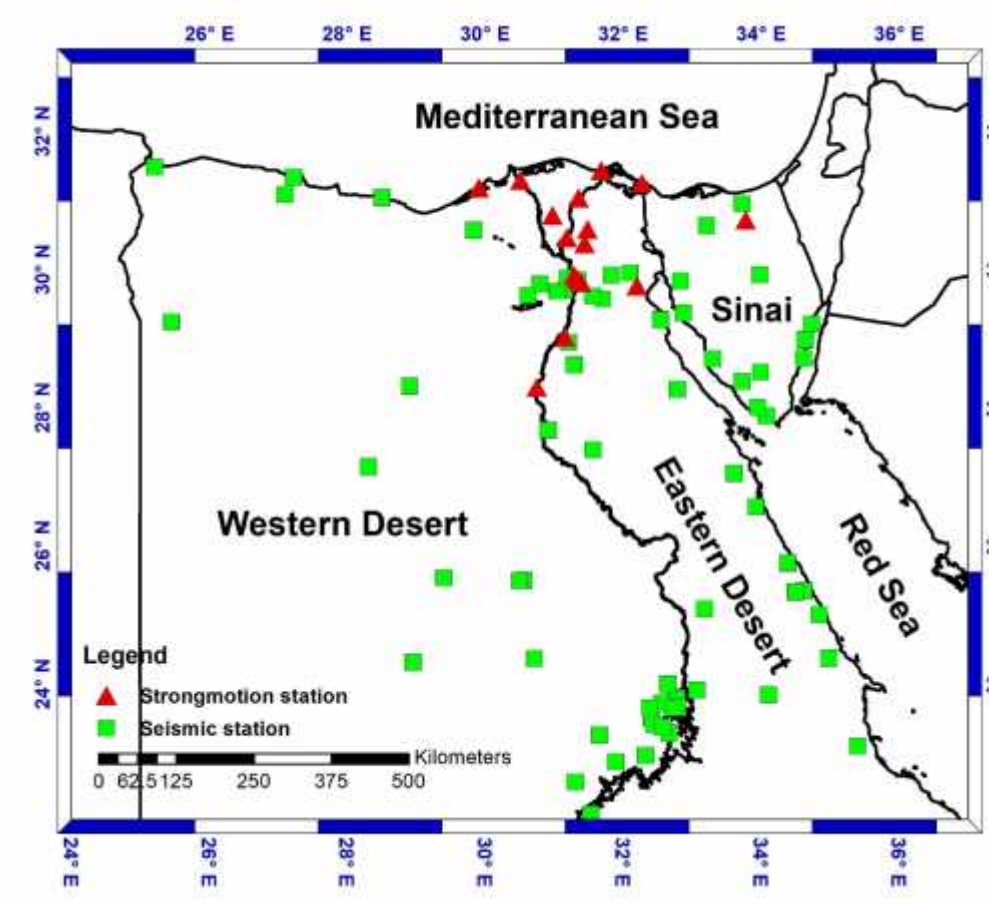
  1992, Cairo earthquake

  1995, Aqaba earthquake



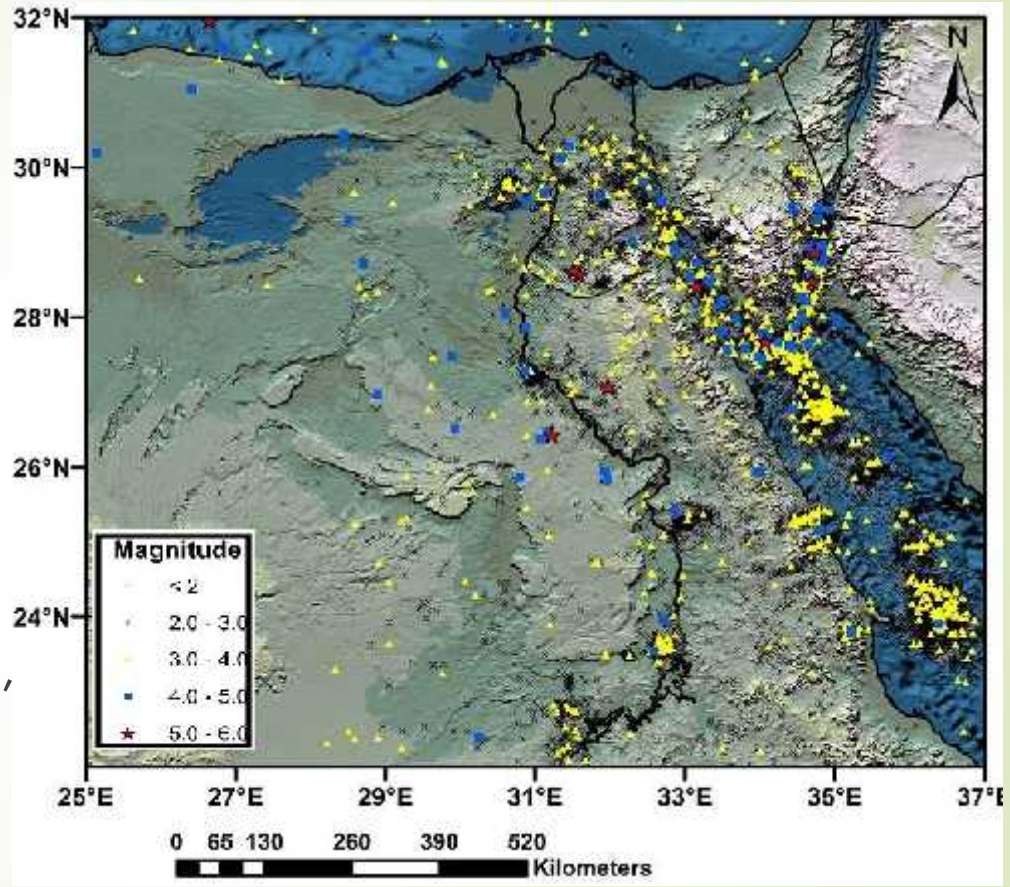
History of seismic monitoring in Egypt

- Phase 4 : Egyptian National Seismological Network
- Time period : 1998 -2017 AD
- Instrumentation : 74 online seismic stations and 25 accelerometers

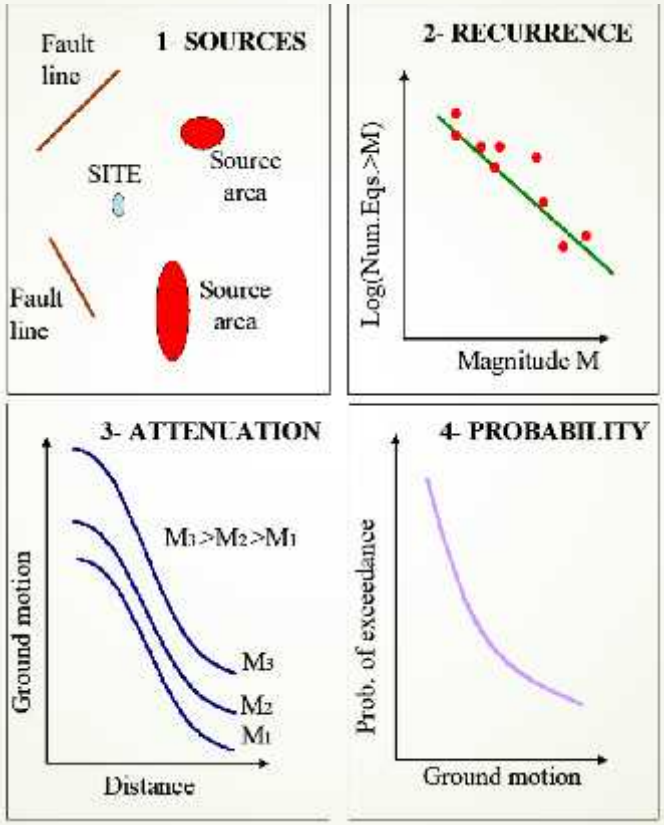


History of seismic monitoring in Egypt

- Phase 4 : Egyptian National Seismological Network
- Number of events: 34744
- Complete : M > 1.6
- Significant sources: Gulf of Aqaba, Gulf of Suez, Northern Red Sea, Aswan, Beni Seuf, Cairo Suez District , Continental margin, Abu Dabbab, East Sohag, South Alamein, Abu hamad and Abu Zabal.



Inputs of probabilistic seismic hazard



Seismic hazard studies in Egypt before 2003

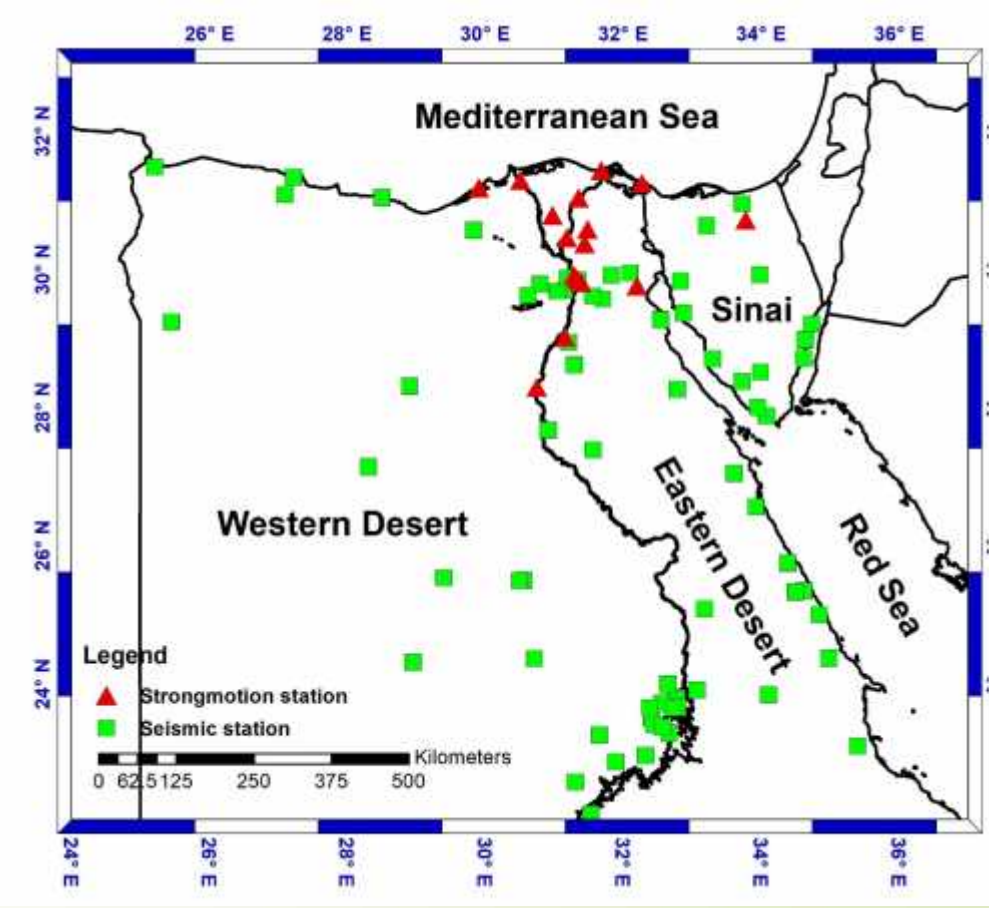
Item	Deif, 1998	El-Sayed et al., 2001
Methodology	PSHA	DSHA
Earthquake Catalogue	Local Sources and ISC	Poirier&Taher (1980), Mammoun et al., 1984, Amberaseys, (1994) EMSC, ISC, NEIC
Seismic sources	6 sources Along the Gulf of Aqaba Dead Sea, Northern Red Sea, Southern Gulf of Suez, Cairo-Suez-District and Dahshour	10 sources (modified after Kebasey, 1990)
Attenuation model	1-Intensity based attenuation 2- Regional accelograms based attenuation	Synthetic time histories
Results	Cairo, 60-80 gal Alexandria, 60 gal Nuwbie, 220 gal	Cairo, 150- 300 gal Alexandria, 40 - 150 gal Nuwbie, 300- 338 gal

Modern seismic hazard studies in Egypt

Item	Farghaly et al., 2017	Hassan et al., 2017
Methodology	PSHA	NDSHA
Earthquake Catalogue	1900-1997 Publications + local sources + data from international centres 1998 – 2015 ENSN catalogue + data from international centres	Persan et al., 2009 Mourabit et al., 2014
Seismic sources	1- EL- Sayed et al., 2001 2- Abu Elenean, 2010 3- EL-hadidy, 2012	1- Mourabit et al., (2014) 2- Hassan et al., (2017)
GEMPs	4 Next Generation GMPEs representing the Shallow active crust seismic sources	Synthetic green function using Makris et al., 1979; Marzouk, 1988; El-Hady et al., 2004 crustal models
Results	Cairo, 0.11 g Alexandria, 0.09 g Nuwbie, 0.26 g	Cairo, 0.15-0.3 g Alexandria, 0.15 g Nuwbie, 0.3-0.6 g

Developing ENSN for Earthquake Risk Reduction

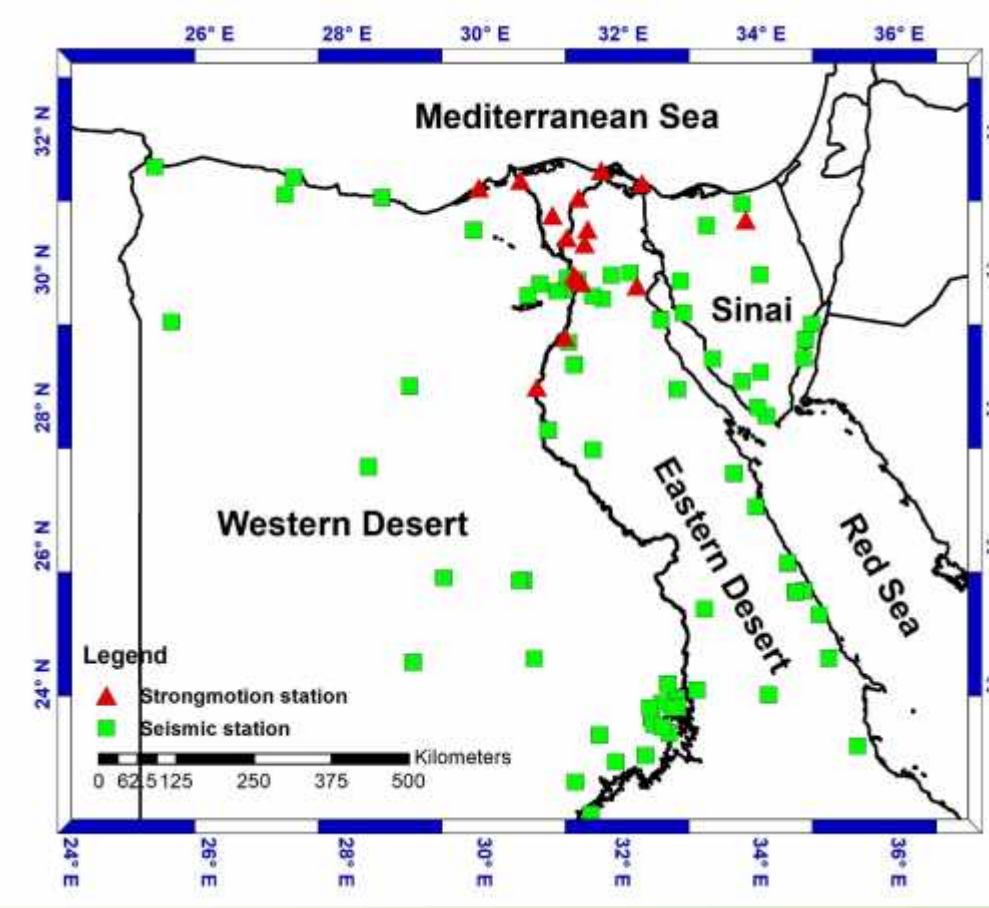
- **Instrumentation**:
  - Selecting new sites for the stations surrounded by the urban areas.
  - Adding new borehole stations in and around the Nile Delta and Nile Valley.
  - Increasing the stations density around the active seismic sources.
  - Supplying the seismic stations with GPS units and accelerometers.
  - Replacing the satellite communication system with direct lines or cell modems to reduce the latency.



African Union

Developing ENSN for Earthquake Risk Reduction

- **Research:**
  - Detectability analysis of ENSN.
  - Calculating proper STA\LTA for ENSN stations.
  - Construct and validate GMPEs for Egypt.
  - Developing relationships between empirical site effect and surface geology.
  - Generate shake maps for the significant earthquakes in Egypt.



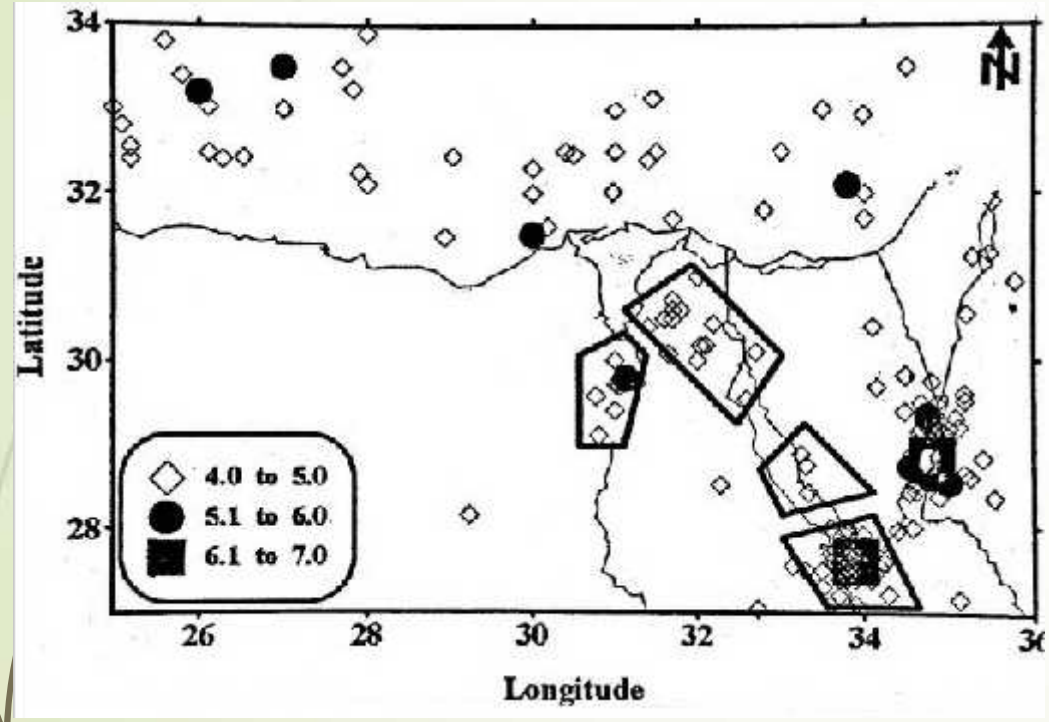
African Union

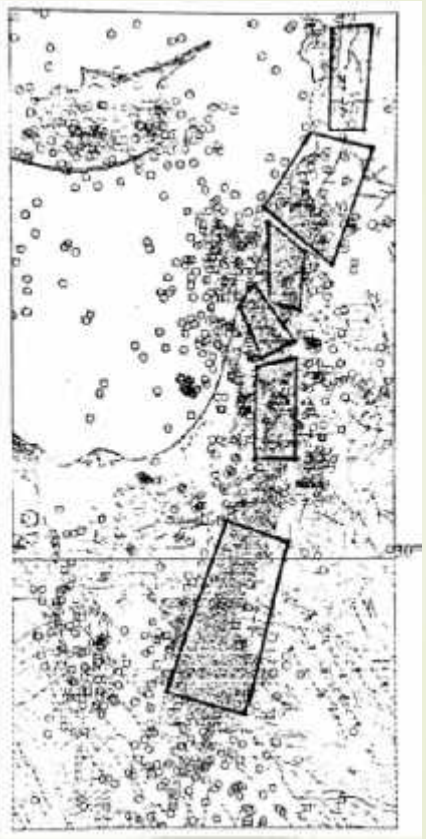
Conclusion

- Integrating waveforms form the neighbouring networks will improve the earthquake locations especially for the earthquake occurring along the plate boundaries.
- ENSN Developing will enlarge its role in earthquake risk reduction in Egypt.
- Creating database for the data and information acquired by ENSN and incorporating with different layers under GIS will improve the emergency response planning.
- Estimating of GMPE and studying the relation between the site effect and surface geology in Egypt has a great importance for both seismic hazard assessment and earthquake risk reduction.
- Providing the decision makers with the post-event data such as shake maps, loss estimation maps and emergency response planning is very important for the aftermaths assessment.

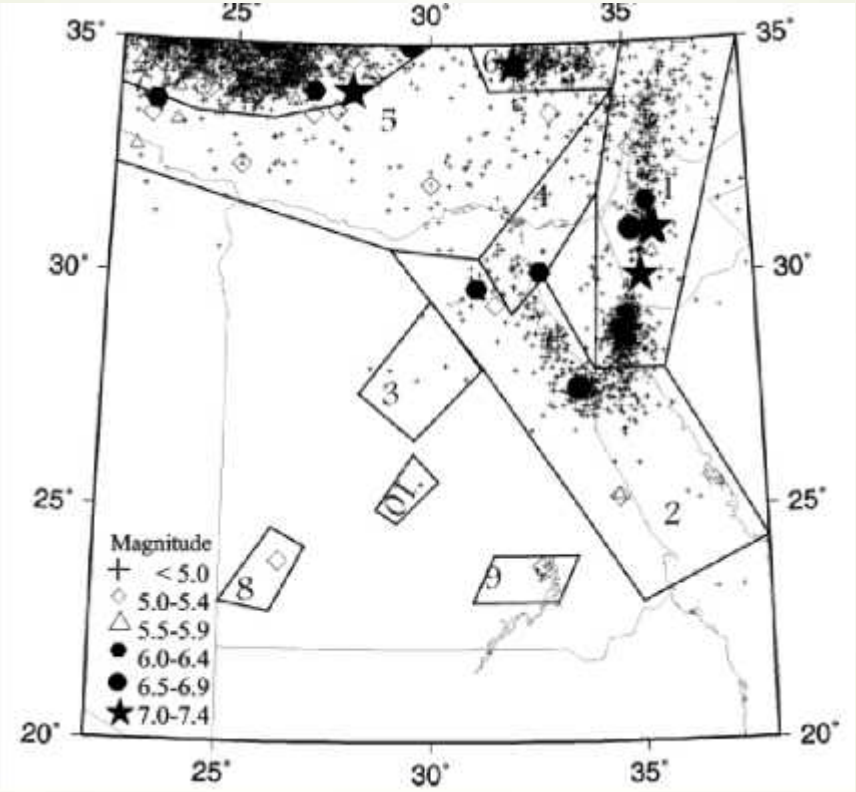
Thanks for your attention

Seismotectonic model used by Deif (1998)



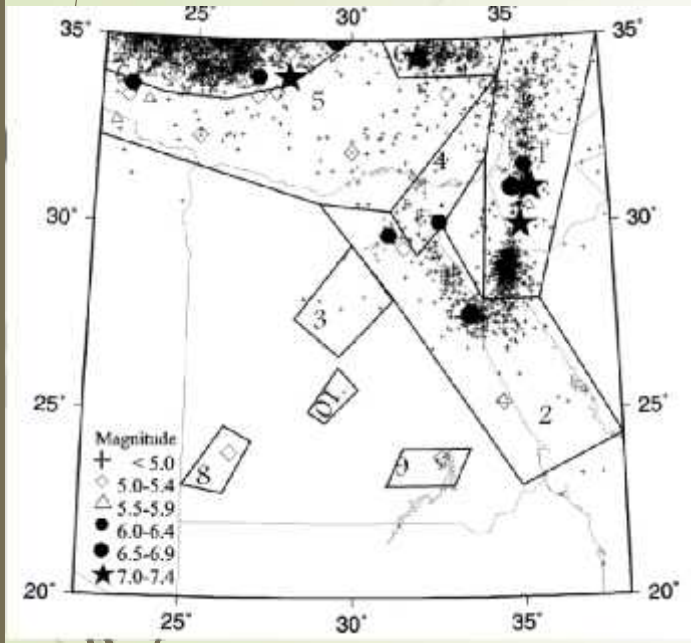


Seismotectonic model used by El-Sayed et al., (2001)

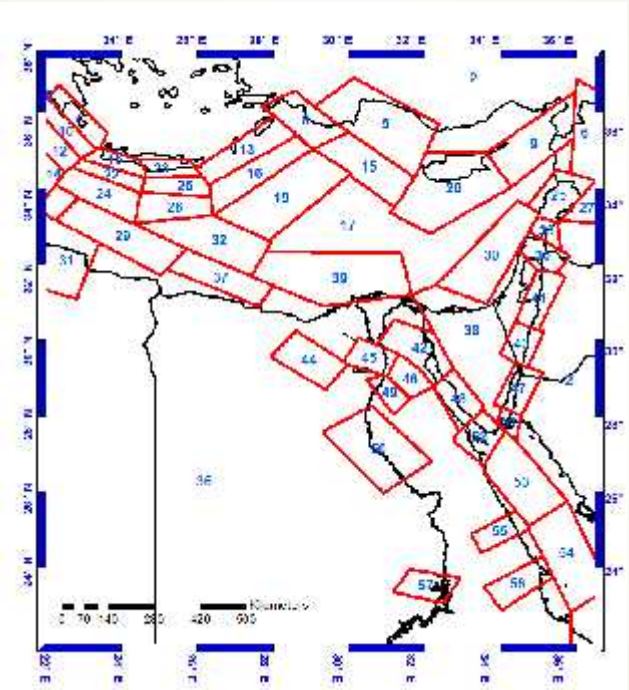


Modified after Kebeasy (1990)

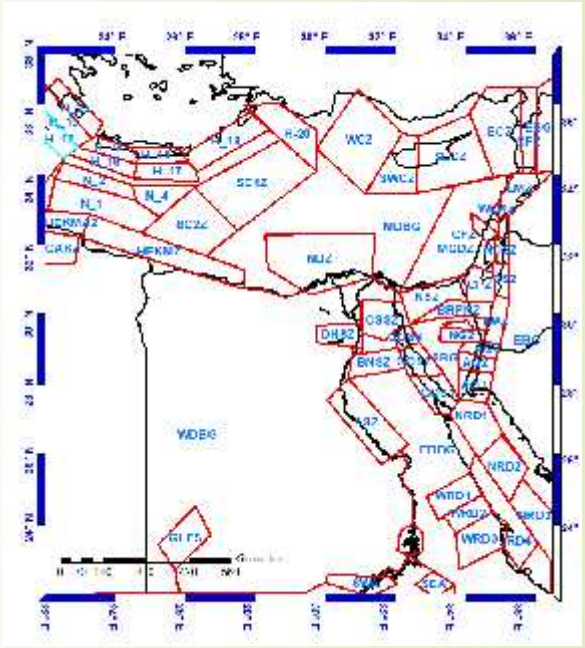
Seismotectonic models used by Farghaly et al., 2017



Elsayed et al., 2001

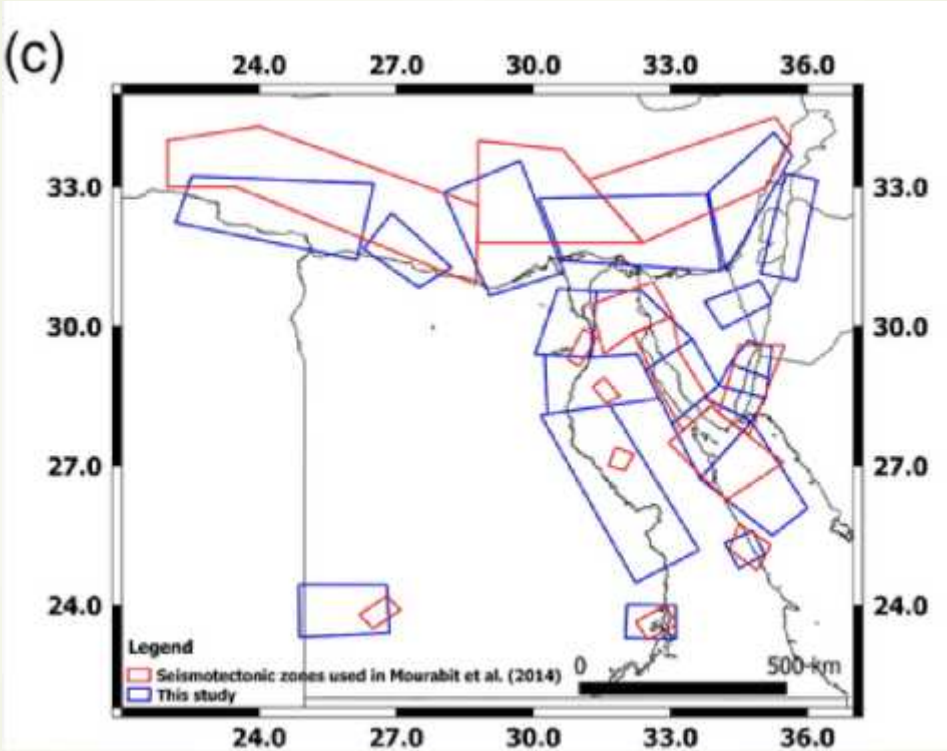


Abu Elenenan et al., 2010

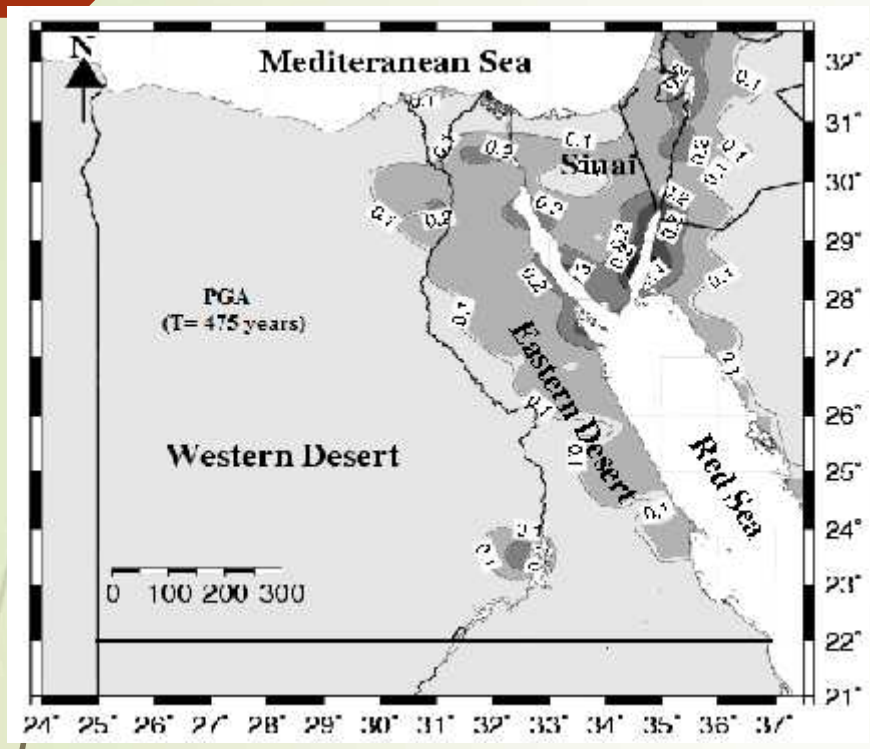


Elhadidy, 2012

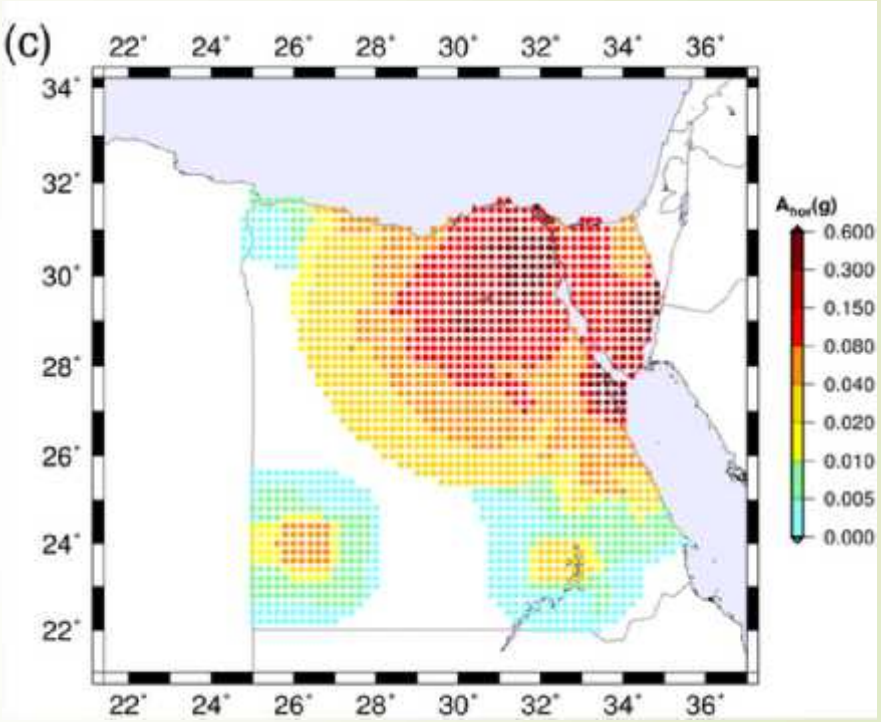
Seismotectonic models used by Hassan et al., (2017)



Results of the recent seismic hazard studies



Farghaly et al., 2017



Hassan et al., 2017