

# Earthquake Hazard in Sub-Saharan Africa in general and EARS in particular

---

Atalay Ayele (PhD)  
GEM sub-Saharan Africa Operation Manager

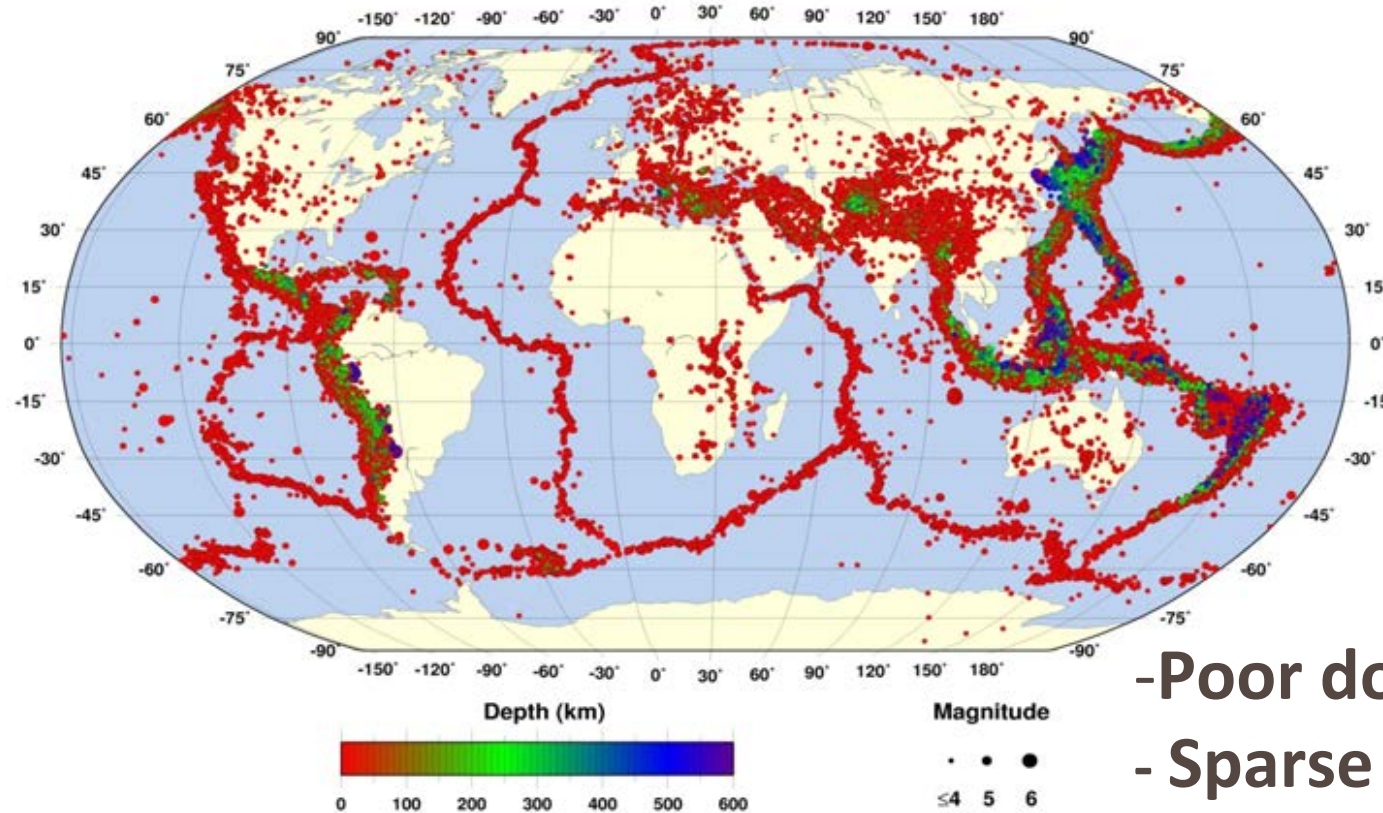
*Institute of Geophysics Space Science and Astronomy  
Addis Ababa University, Ethiopia*



# Background

IDC Reviewed Event Bulletin

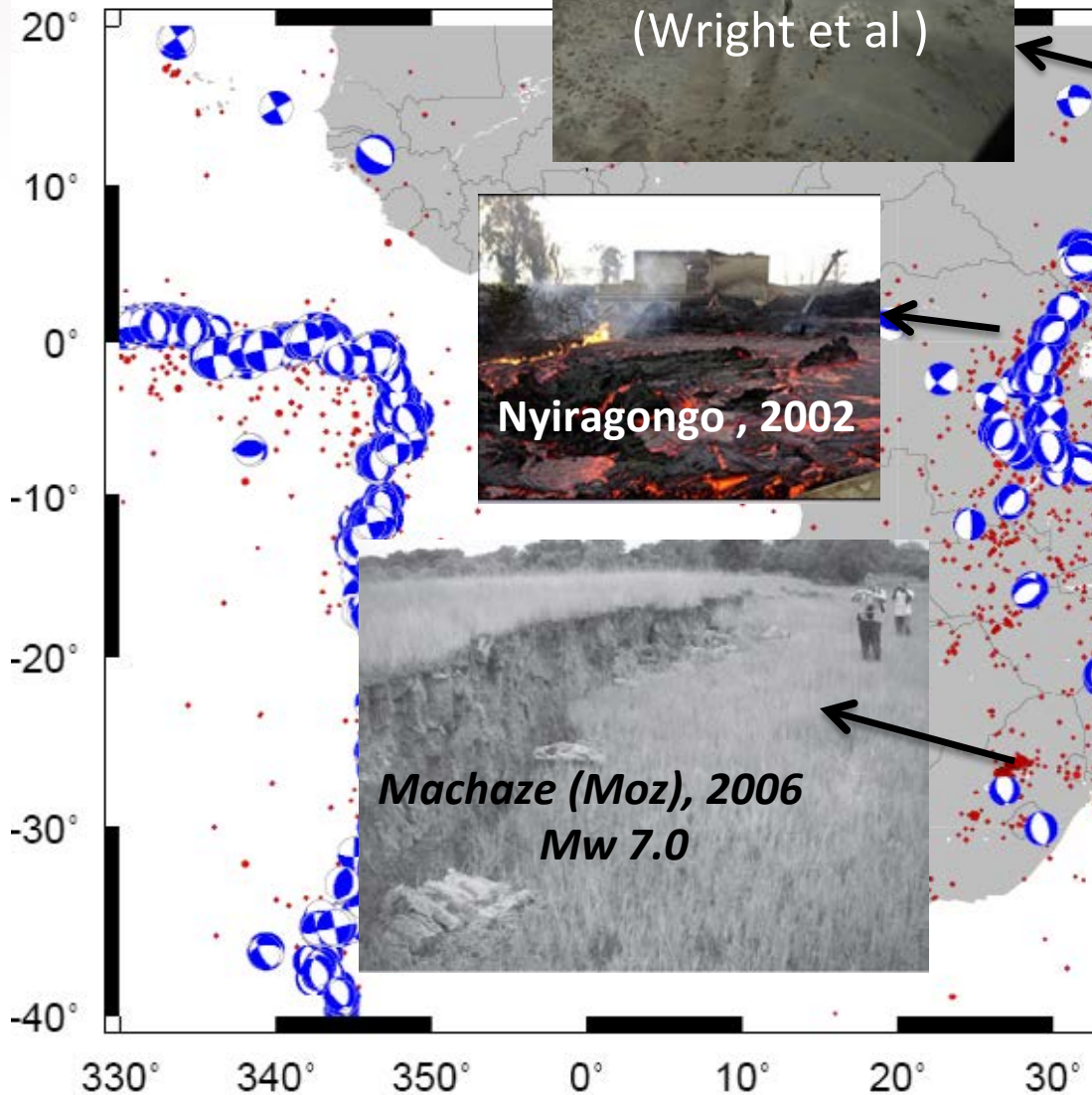
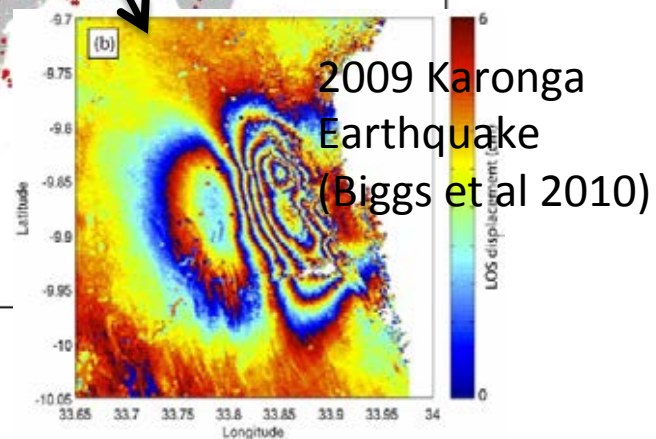
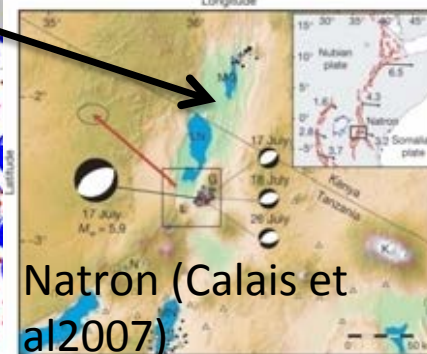
21 February 2000 - 30 September 2004: 104,178 Events



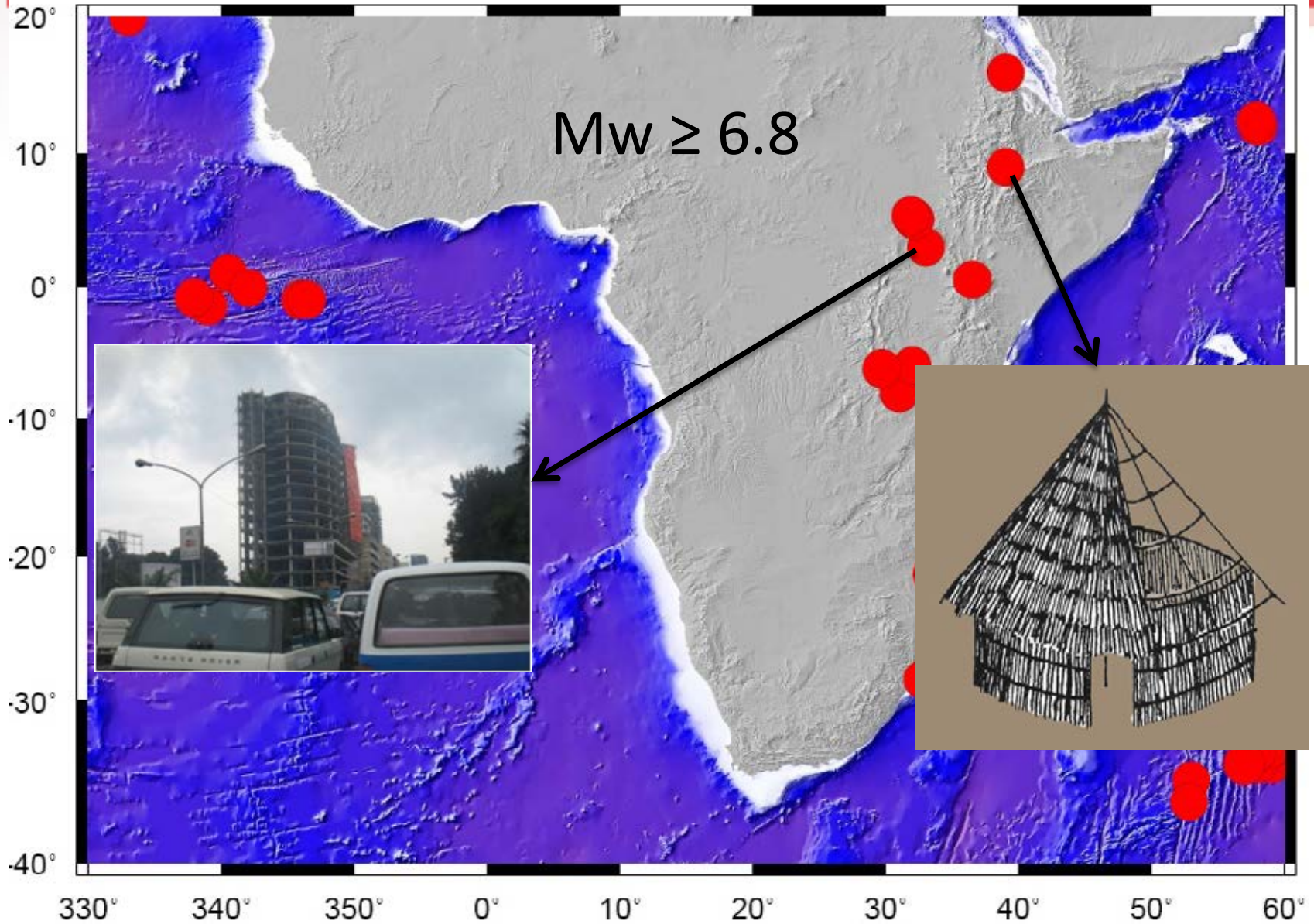
- Poor documentation
- Sparse station coverage
- Lack of capacity

*Is Africa that aseismic?*

# Background



# Vulnerability of SSA Africa for ER

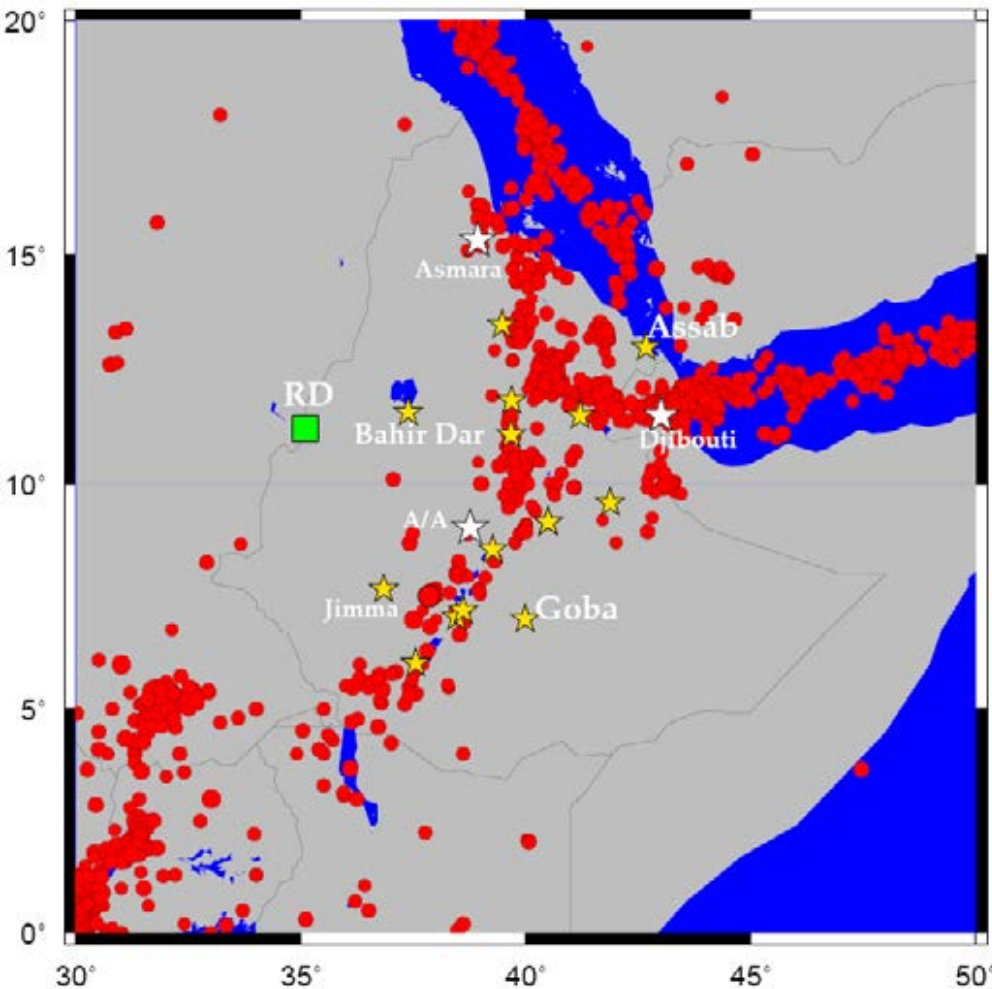


# Examples of Observed Damage & loss



The December 2009 Karonga (Malawi) earthquake crisis

# Earthquake risk in the Horn of Africa



- White stars are capital cities

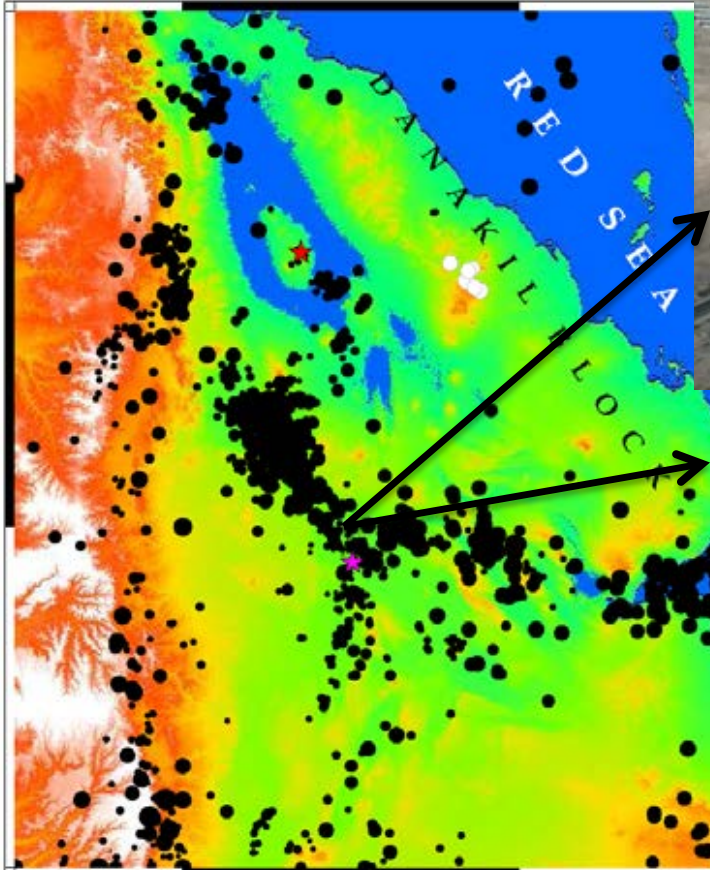
- yellow stars are major towns

- high population density & urbanization in the fertile rift valley

# Earthquake Risk Mitigation Challenges

- **Mega cities of rapid population and economic growth are emerging close to active rift margins in SSA with least awareness on eminent earthquake and volcanic hazard**
- **sub-Saharan Africa is unprepared to face earthquake threats and national development could be crippled by a large earthquake of say  $M_w > 7.0$  which is potentially possible.**
- **Leaders in SSA give priority to other issues (food security)**

# Earthquake Risk Mitigation Challenges



**Emerging town at a triple junction**



**Irrigation dam with over 100,000 people at risk (downstream)**

40°

42°

44°



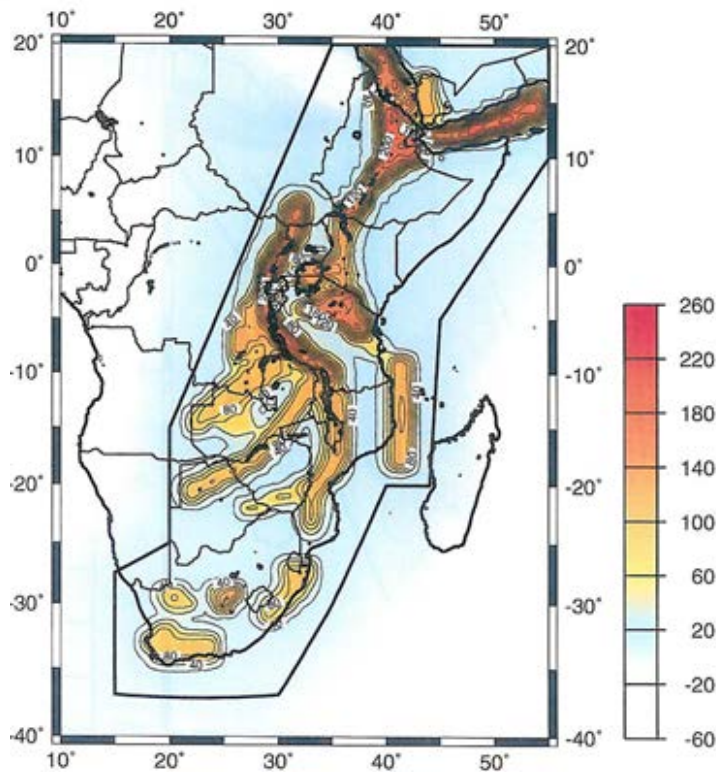
# Two Categories of the solutions

The GEM logo is located in the top right corner of the slide. It consists of the letters 'GEM' in a bold, sans-serif font, followed by a registered trademark symbol (®). To the right of the text are three concentric, semi-transparent circles that resemble a signal or ripple effect.

- Investigate the existing data to better map the hazard and mitigate the risk
- Build capacity to reliably monitor & archive the current and future earth activities (earthquakes and volcanoes) on real-time basis

# Investigate and model existing data

Updating seismic hazard map of SSA is long overdue

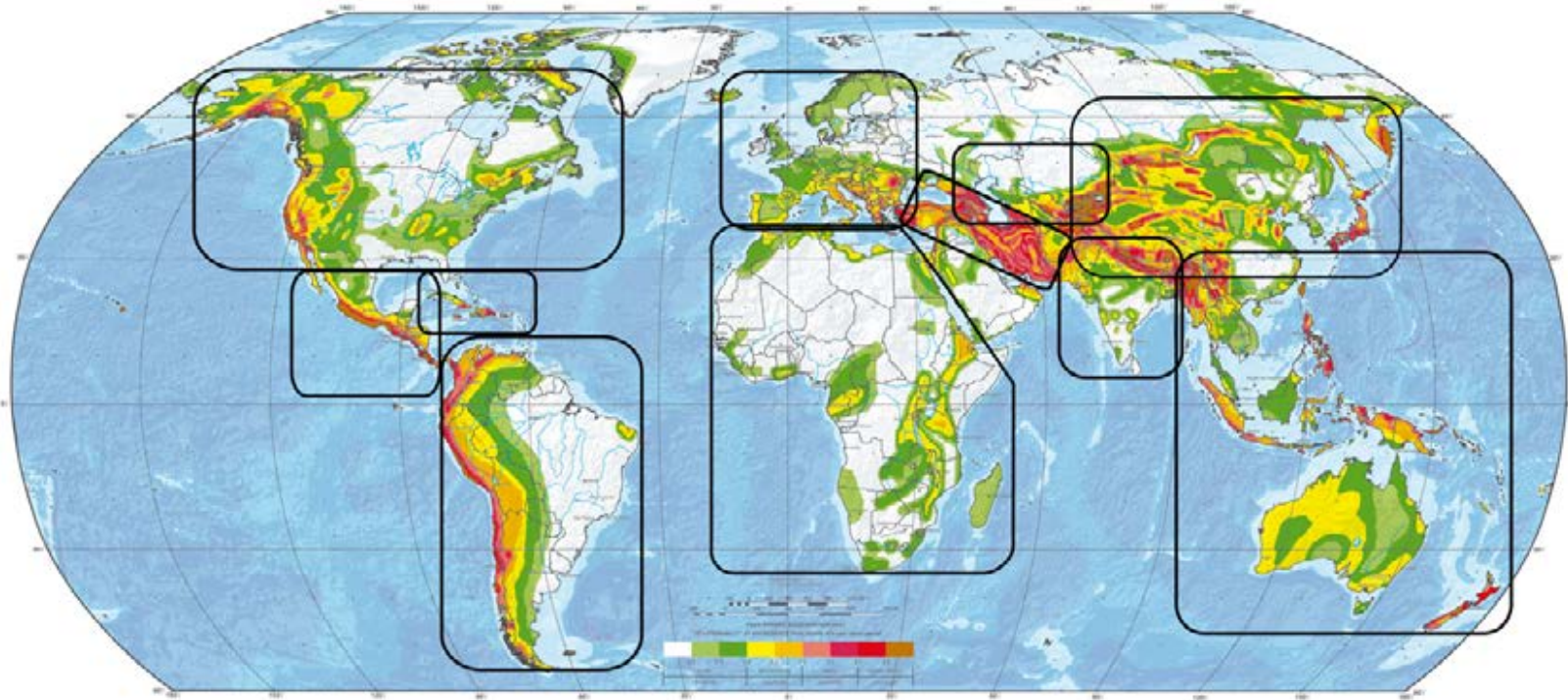


Mean PGA (gal) , 10% probability of exceedance in 50 years

GSHAP results underestimates the hazard and even that result is not applied for code revisions in many African countries

**GSHAP** → **GEM**

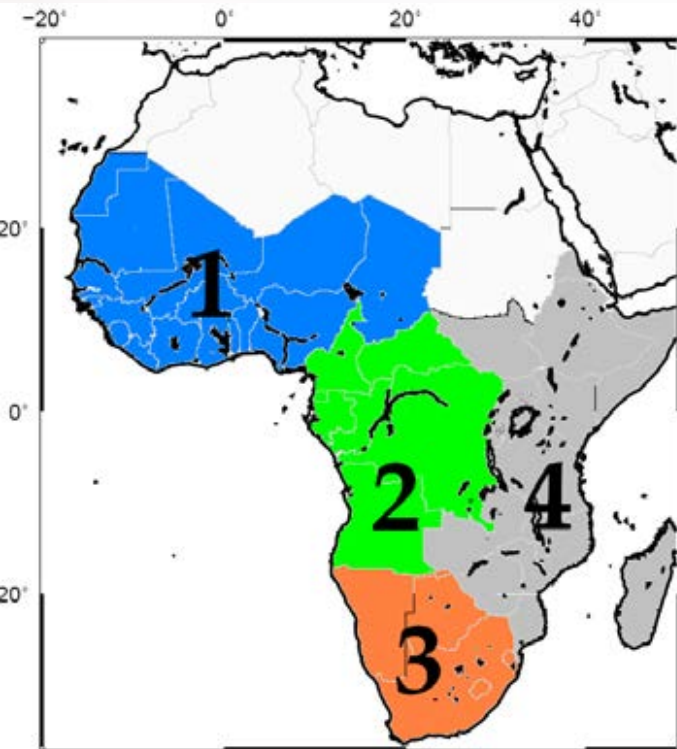
# GEM Regional Programs



A collaborative effort devised and launched by OECD's ([Organization for Economic Cooperation & Development](#)) Global Science Forum, aimed at **engaging the global community** in the design, development and deployment of uniform open standards and tools for earthquake risk assessment worldwide

# GEM sub-Saharan Africa

GEM



- Region 1: Mr. Ofonime Akpan (Nigeria)
- Region 2: Dr. Ateba Bekoa (Cameroon)
- Region 3: Dr. Vunganai Midzi (South Africa)
- Region 4: Mr. Kwangwari Marimira (Zimbabwe)

# GEM sub-Saharan Africa



Training on OpenQuake  
for SSA experts Cape  
Town, July (2012)

- 1. Earthquake catalogue**
- 2. Active fault and source database**
- 3. GMPEs**
- 4. Geodetic Strain rate model**

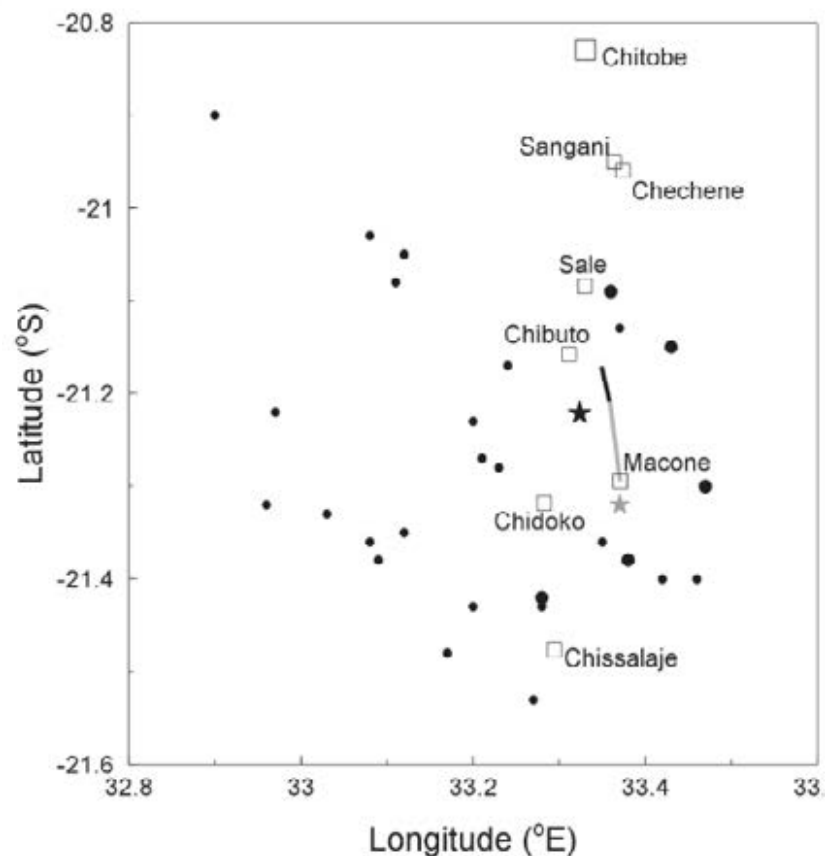
# Challenges on building the Hazard Model

---

- Earthquake Catalogue
  - Poor documentation on historical/instrumental catalogue
  - Inhomogeneous catalogue
  - No enough data available for regional regression relations and we are tending to use the global ones (Scordilis, 2006)
  - Short duration of observation to cover the repeat cycles of large earthquakes

# Challenges on building the Hazard Model

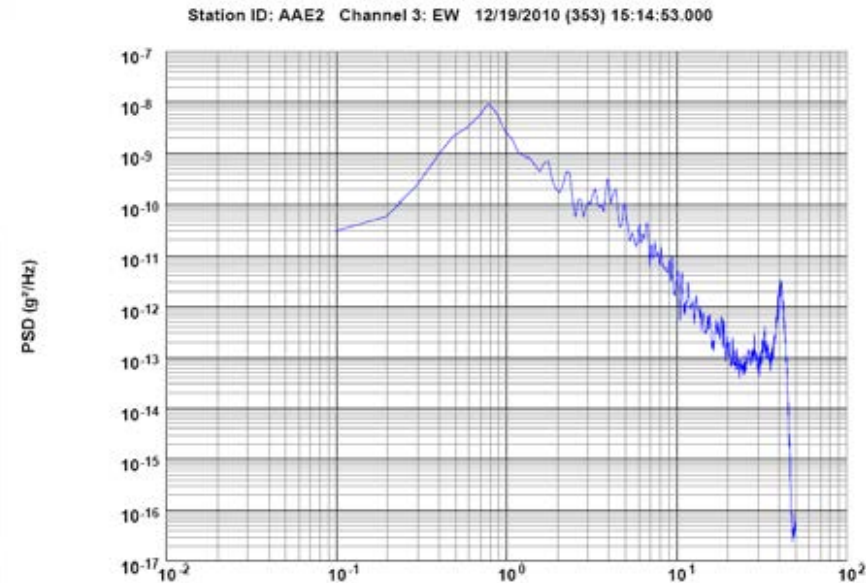
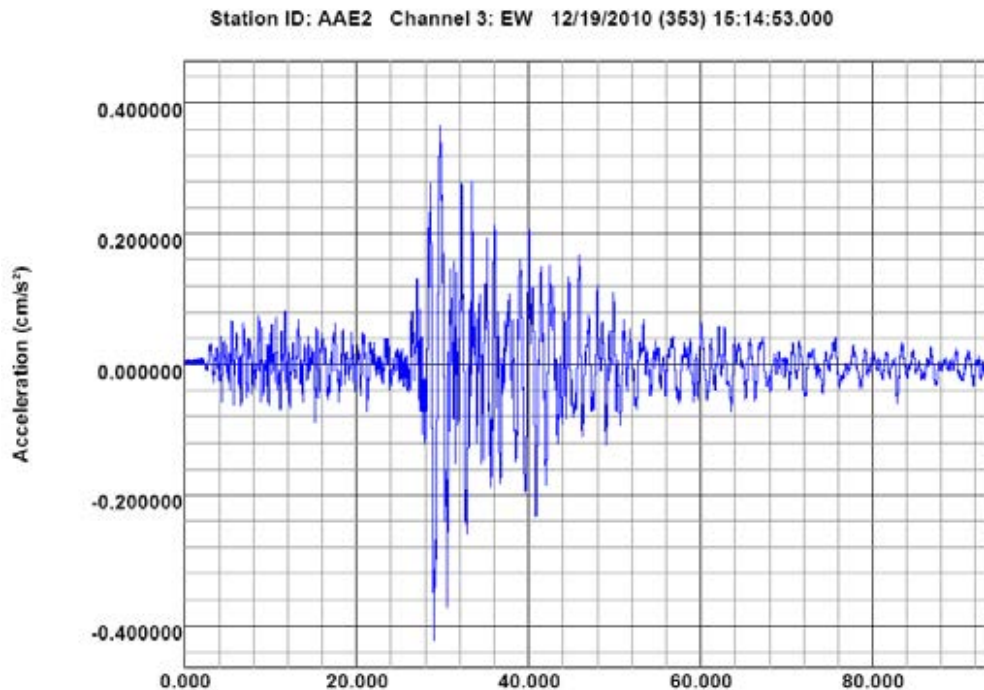
- Active Fault Database
  - Not many faults studied



Fenton and Bommer, 2006

# Challenges on building the Hazard Model

- GMPEs

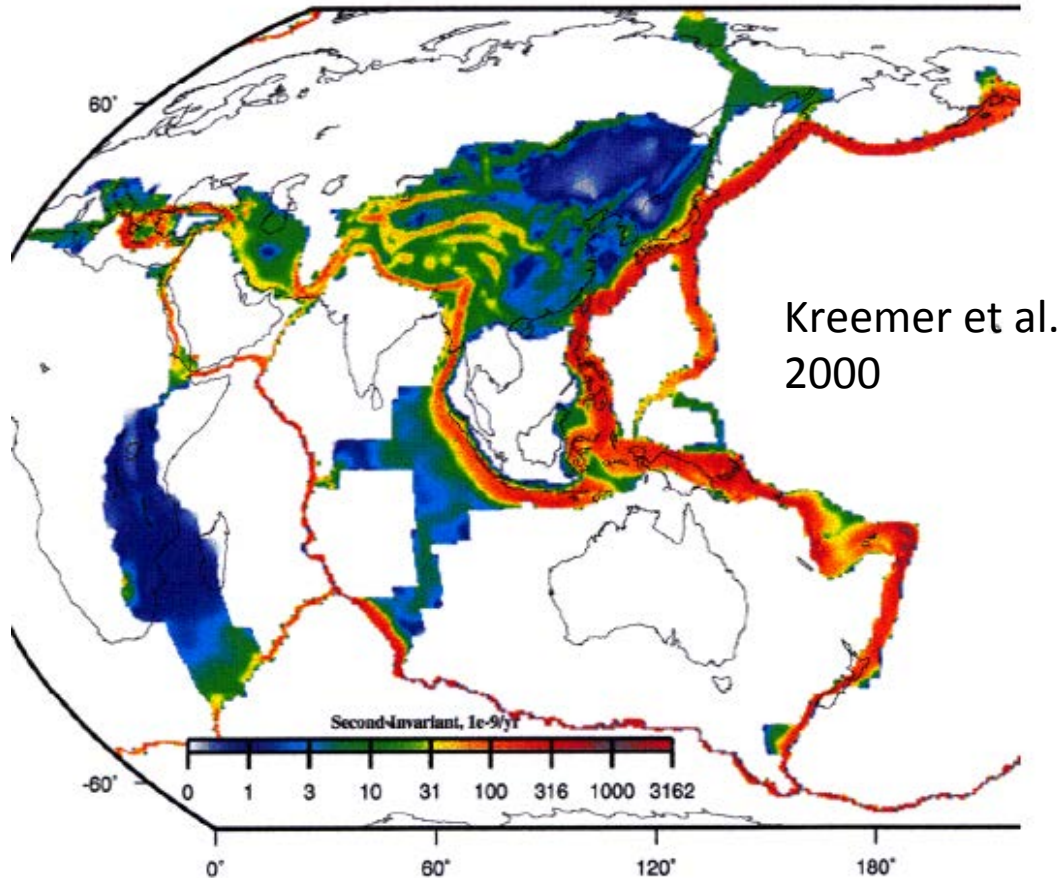


Almost no Strong  
motion records in SSA




# Challenges on building the Hazard Model

- Geodetic strain rate model



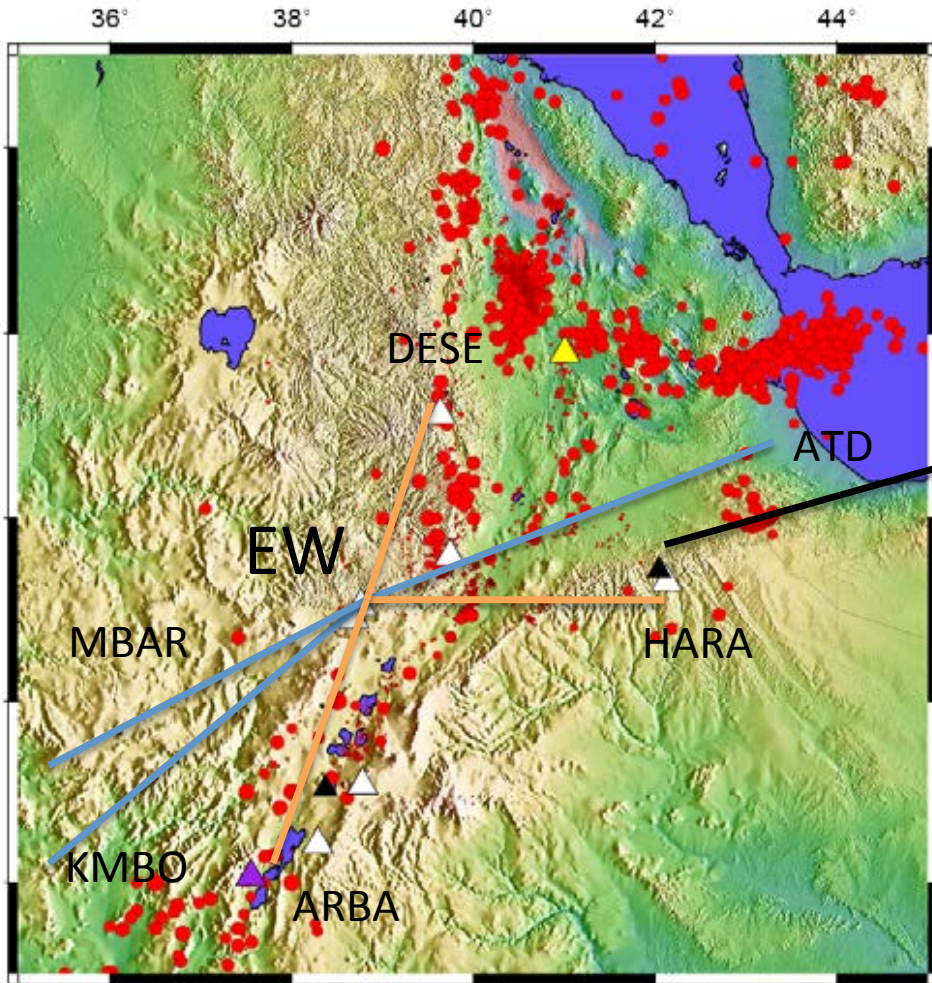
Poor GPS station coverage for Africa, fault plane solution will be a way out from modelled earthquakes

# Challenges for observing and analysing what is going on now

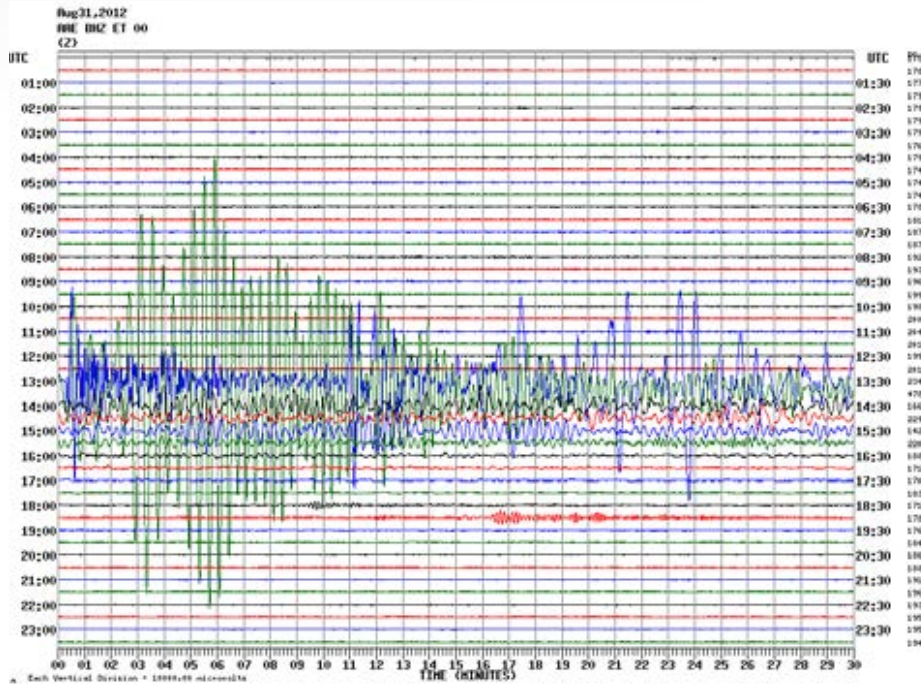
The logo for GEM (Global Earthquake Model) is located in the top right corner. It features the letters 'GEM' in a bold, white, sans-serif font, followed by a circular icon containing a stylized globe or wave pattern. The logo is set against a red, semi-transparent background that also serves as a decorative header element.

- No access for real-time data in many countries
- Hard to build and sustain capacity in SSA
  - Instrumentation
  - Manpower
- No exposure in international conferences and workshops
- There is lack of attention for creating awareness in the society

# Current status of the Ethiopian Seismic Station Network (ESSN)



# A glimpse of hope for real time data access



AAE helicorder  
for a recent  
telescismic  
earthquake

We have real-time data access to ATD, KMBO, MBAR

# Conclusions and Recommendations

The GEM logo is located in the top right corner of the slide. It consists of the letters 'GEM' in a bold, sans-serif font, with a stylized globe icon to its right. The globe is composed of several curved lines representing latitude and longitude. The entire logo is set against a light red background that matches the slide's header.

- The GEM train arrived to Africa the right time while revising the hazard map is long overdue
- Another proto-Haiti type experience is not tolerable in Africa which is potentially possible
- Supporting such activities is well within the capacity of African governments but are not convinced on the potential risk
- We still have funding problems to support training & data analysis workshops

# Conclusions and Recommendations

---

- ▶ We need more training on network connectivity, real-time data access, data management and archiving which are current problem in many African countries