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

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Background

IDC Reviewed Event Bulletin
21 February 2000 - 30 September 2004: 104,178 Events

Is Africa that aseismic?

- Poor documentation
- Sparse station coverage
- Lack of capacity
Background

- Nyiragongo, 2002 (Wright et al.)
- Dabbahu, 2005 (Wright et al.)
- Machaze (Moz), 2006
  - Mw 7.0
- Natron (Calais et al., 2007)
- Nabro 2011
- November, 2010
- 2009 Karonga Earthquake (Biggs et al., 2010)
<table>
<thead>
<tr>
<th>Date</th>
<th>Origin Time</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Depth</th>
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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 Mw > 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)
Two Categories of the solutions

• 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

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

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

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

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

- 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 teleseismic earthquake

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

• 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.