

Seismic Hazard in the East African Rift system (EARS): challenges in Disaster Risk Management

Atalay Ayele

Institute of Geophysics Space Science and Astronomy
Addis Ababa University

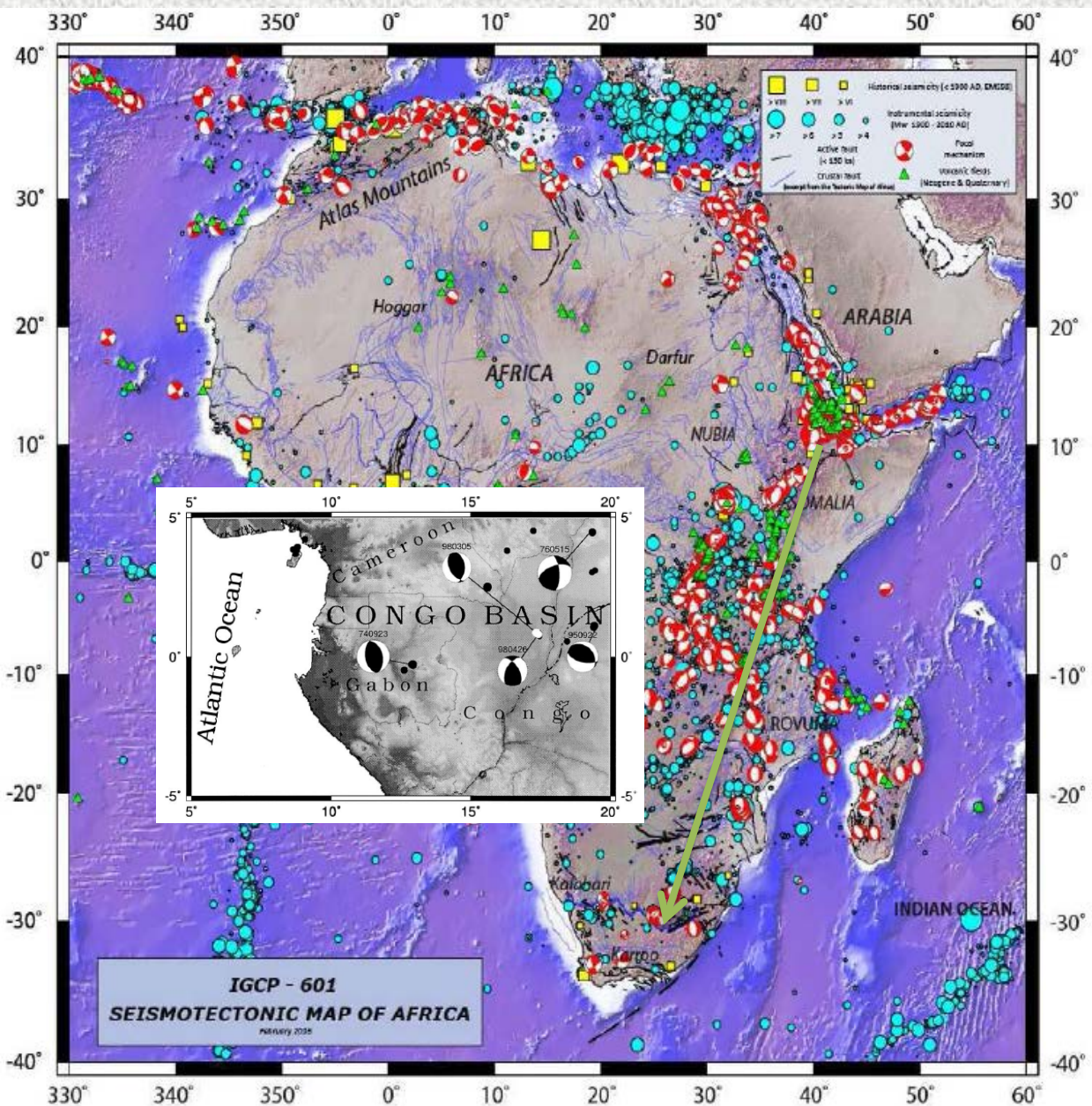


GeoPRISMS TEI RIE Initiative
Albuquerque, 2017



Content

- Seismicity of the East African Rift System (EARS)
- Recent activities
- Challenges in disaster risk management
 - Capacity in Equipment and Human resource
 - Level of understanding of the potential risk
- The way forward



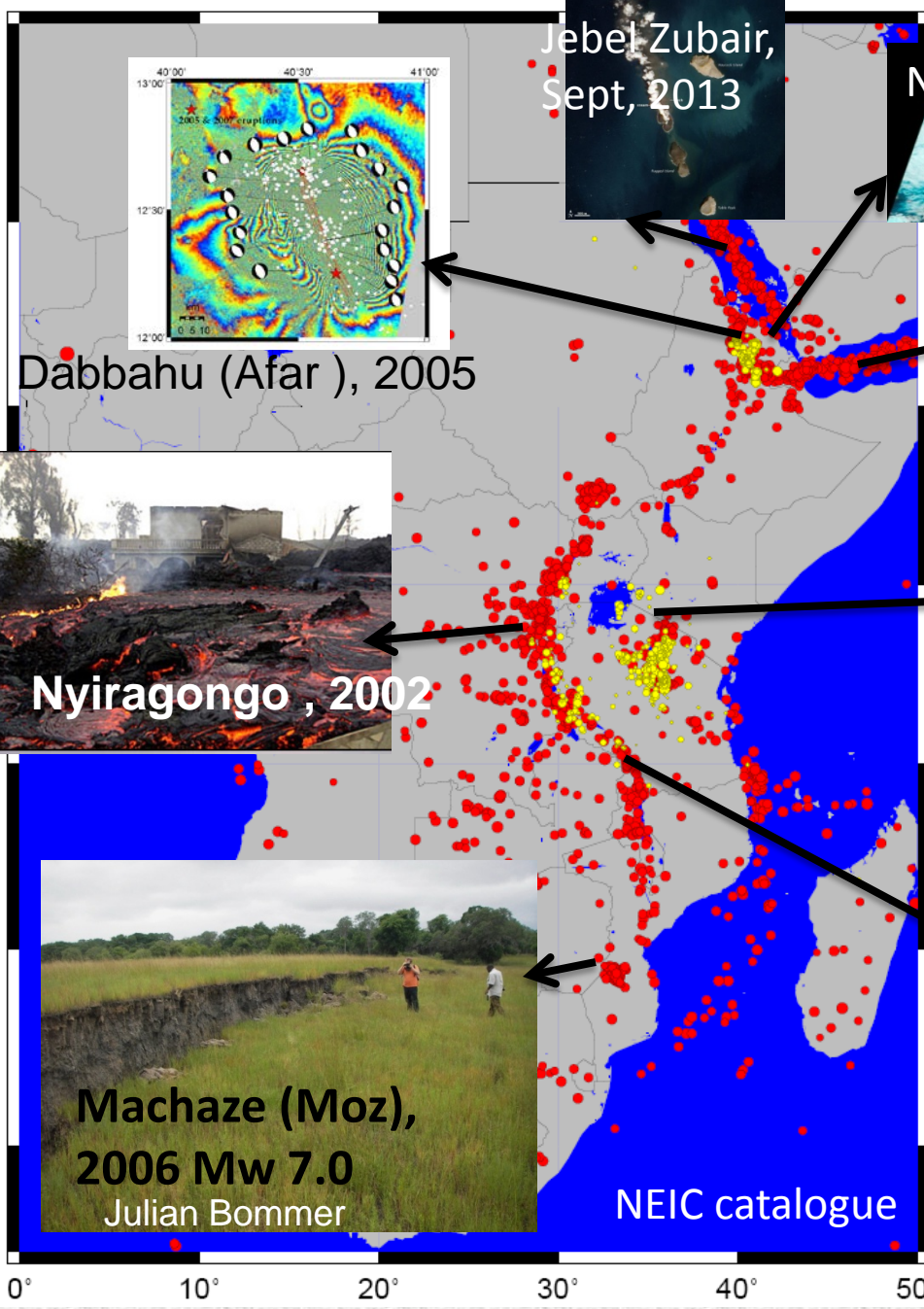
Earthquake magnitude & depth



Magmatism and spreading rate



e.g. Craig et al, *GJI*, 2011



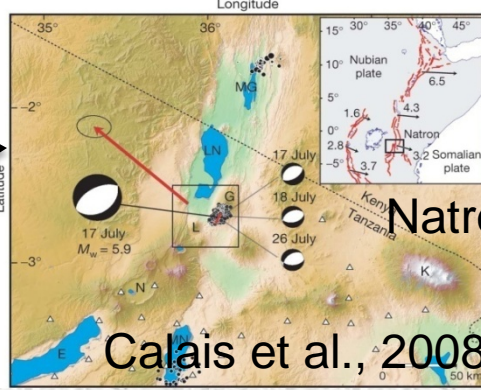
Jebel Zubair, Sept, 2013

Nabro, 2011

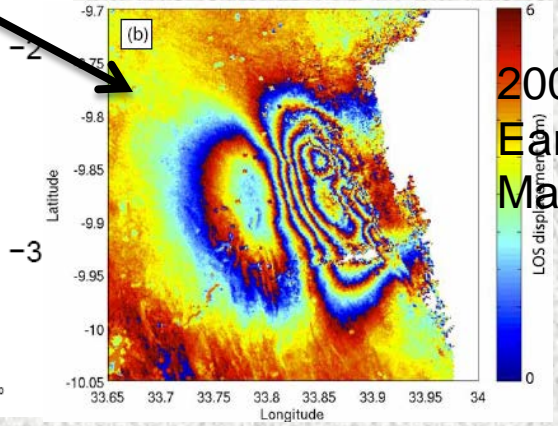
Gulf of Aden, 2010

Shuler and Nettles, 2012

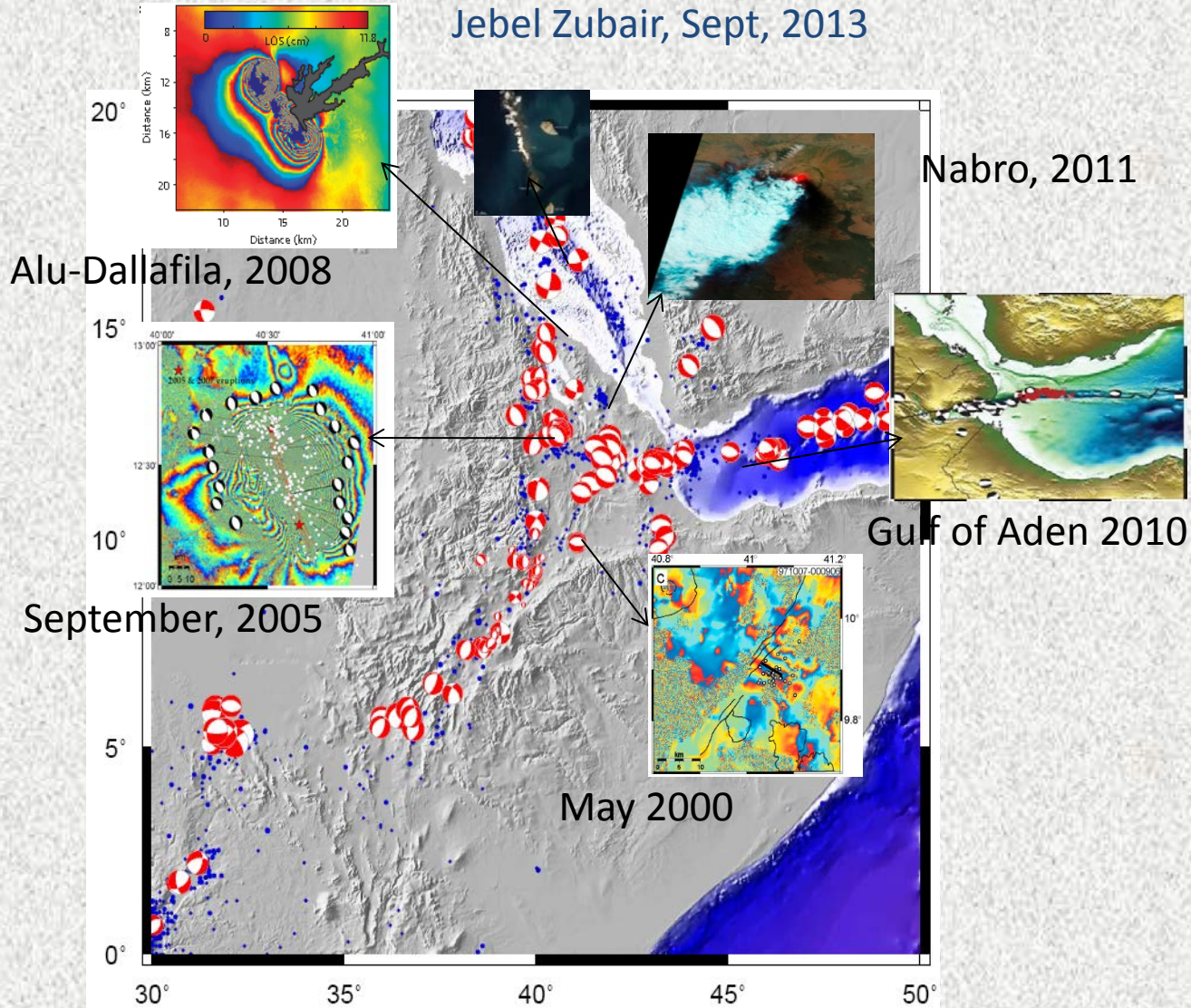
Dabbahu (Afar), 2005



Natron, 2007



Recent Eruptions in the Afar region



The September 10, 2016 Tanzania earthquake of Magnitude 5.9 recorded by FURI station



Search Results

14 of 17 earthquakes in map area.

5.2 25km SSW of Ziway, Ethiopia
2017-01-27 16:29:22 (UTC) 10.0 km

4.7 18km SE of Cyangugu, Rwanda
2016-10-24 23:30:00 (UTC) 10.0 km

4.8 24km SE of Cyangugu, Rwanda
2016-09-23 16:11:56 (UTC) 10.0 km

[M 5.9 - 27km ENE of Nsunga, Tanzania](#)

x

V

DYFI?

VII

ShakeMap

GREEN

PAGER

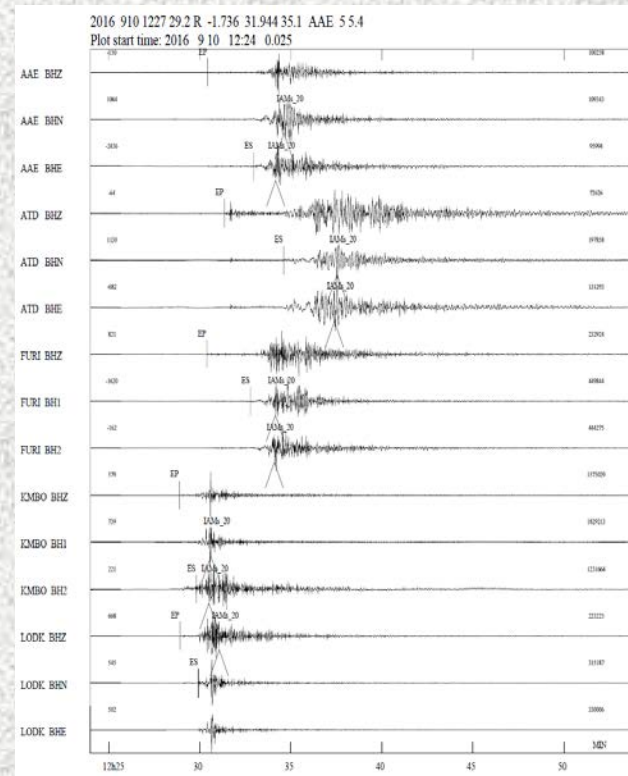
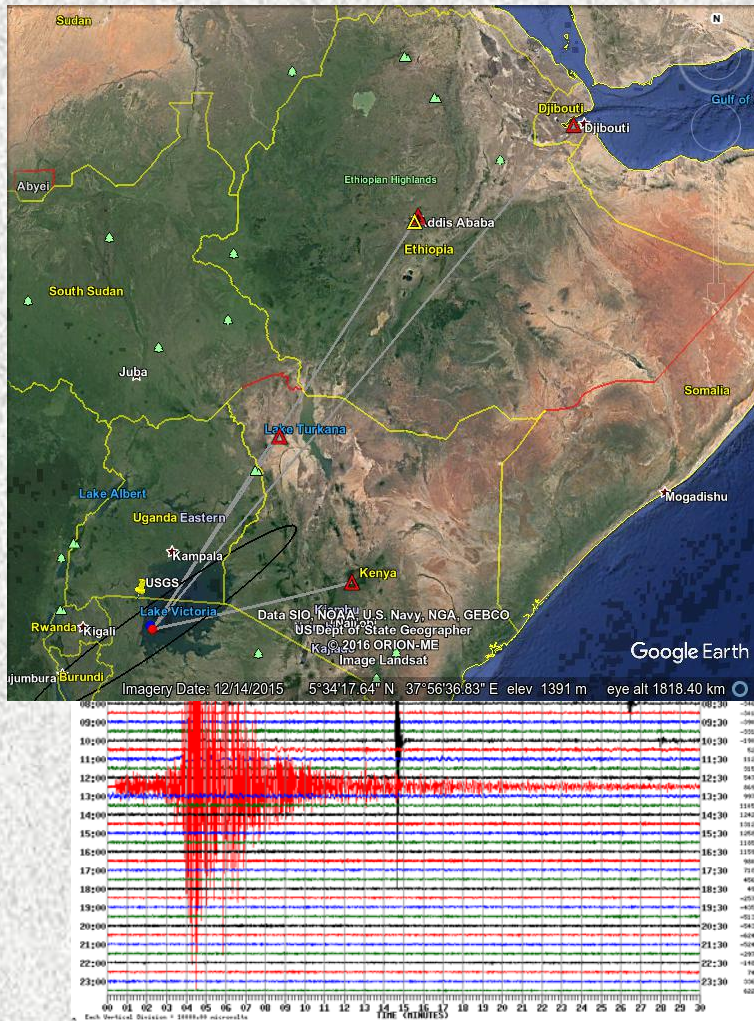
Time 2016-09-10 12:27:33 (UTC)

Location 1.036°S 31.618°E



16 people died and
253 were injured
(daily mail)

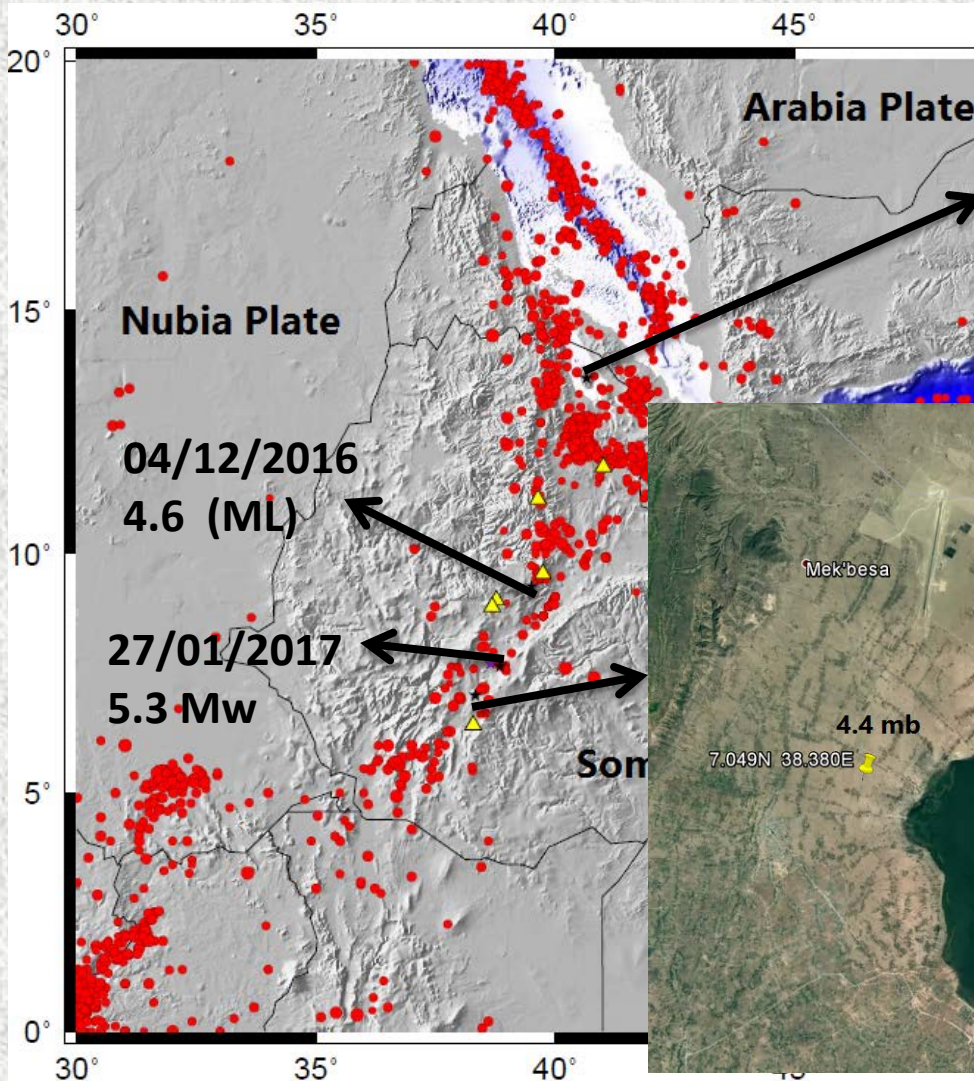
Regional effort for rapid response



3/2/2017

ISP/IPPS Grantt Application 2917-2019,
 Nairobi, Kenya

2016/2017 Activity in the Ethiopian case

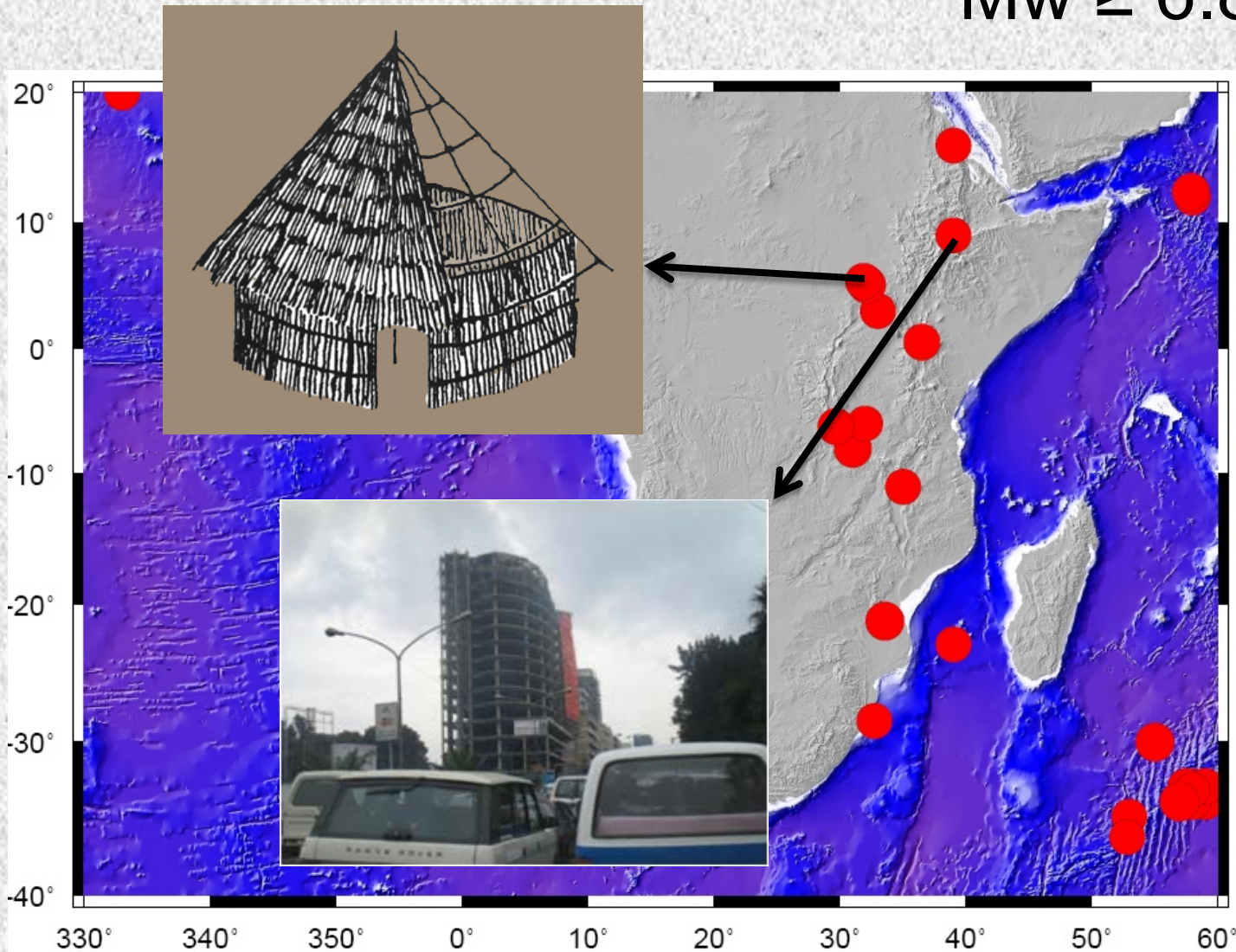


Large magnitude earthquakes

Vulnerability of SSA earthquake for risk

Date	Origin Time	Latitude	Longitude	Depth	Mw
1904/10/03	03:05:00	12.00	58.00	35?	7.0
1906/08/25	13:47:36	9.00	39.00	35?	6.8
1909/04/29	22:41:12	-35.00	53.00	35?	6.8
1910/12/13	11:37:24	-08.00	31.00	35?	7.3
1912/02/20	08:18:06	03.00	33.00	35?	6.8
1915/05/08	13:42:54	-23.00	39.00	35?	6.8
1915/09/23	08:14:48	16.00	39.00	35?	6.8
1916/04/07	09:26:12	-30.00	55.00	35?	7.4
1919/07/08	21:06:25	-06.00	32.00	35?	6.8
1925/04/11	10:42:02	-34.00	59.00	35?	7.0
1925/05/03	22:59:04	-34.00	58.00	35?	7.0
1925/05/19	05:23:45	-33.00	58.00	35?	6.8
1926/09/02	01:21:52	-33.00	59.00	35?	7.0
1928/01/06	19:31:58	00.50	36.50	35?	7.0
1929/02/02	00:00:19	-01.50	-21.00	35?	7.1
1932/12/31	06:30:53	-28.50	32.75	35?	6.8
1933/01/21	19:21:10	-33.00	57.50	35?	7.0
1940/04/27	10:33:13	01.00	-19.50	35?	6.8
1941/08/15	06:09:25	20.00	-27.00	35?	6.8
1942/10/09	15:46:14	-11.00	35.00	60?	6.8
1946/04/11	01:52:20	-01.00	-14.00	35?	7.2
1949/10/07	12:02:21	-33.25	58.00	35?	6.8
1951/12/08	04:14:12	-34.00	57.00	35?	7.7
1954/03/31	18:25:45	12.40	57.90	35?	7.2
1960/11/22	06:21:45	-36.31	52.81	35?	6.8
1971/08/05	01:58:53	-00.85	-22.07	23	7.0
1973/08/28	15:02:04	-00.15	-17.97	35?	6.8
1990/05/20	02:22:01	05.07	32.16	15	7.2
1990/05/24	20:00:08	05.36	31.87	16	7.0
1992/08/28	18:18:46	-00.99	-13.60	15	7.0
2005/12/05	12:19:53	-06.24	29.68	15	7.0
2006/02/22	22:19:09	-21.31	33.55	16	7.0

Mw ≥ 6.8



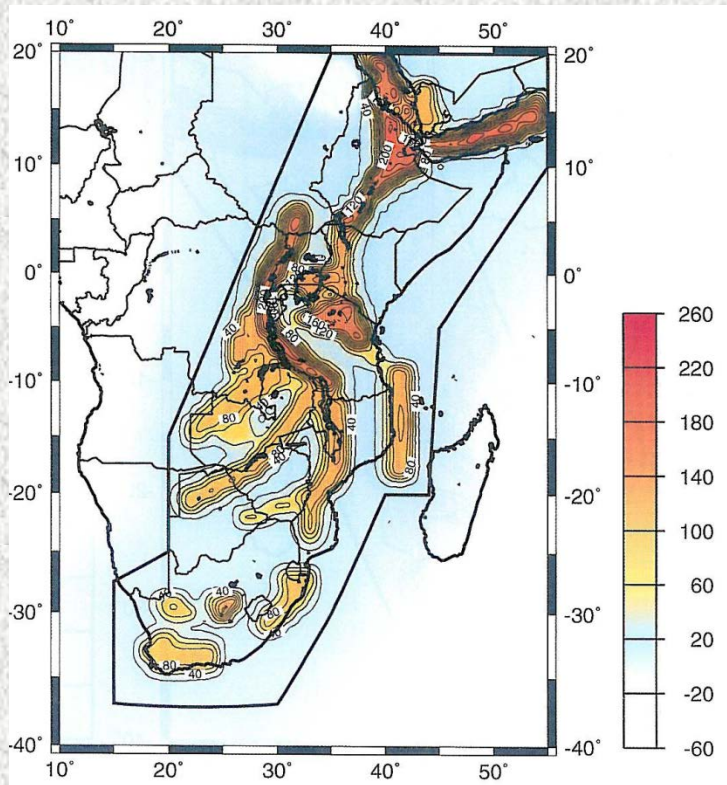
Earthquakes do not kill people, but buildings do!

The two classical approaches

- **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 Africa is long overdue

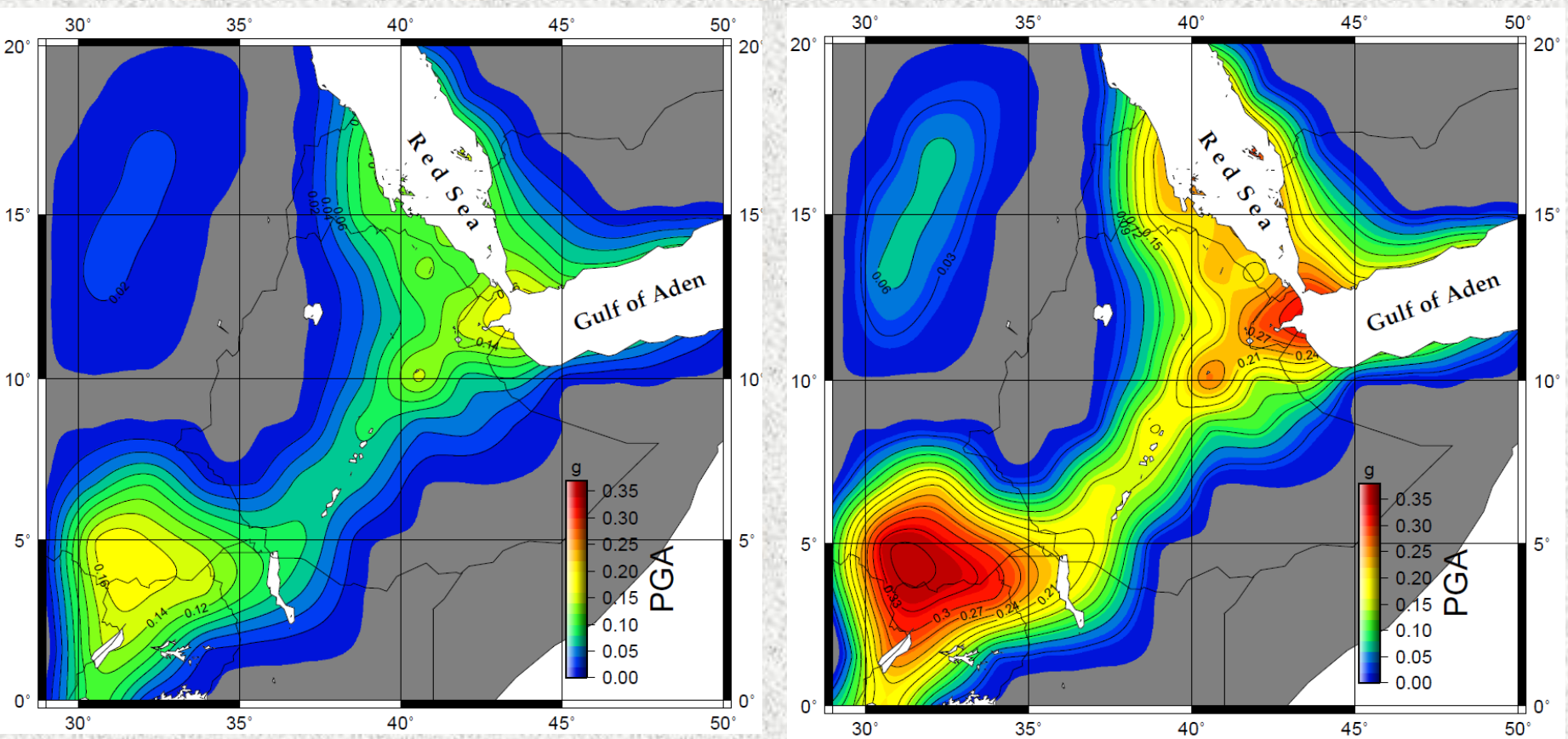


Mean PGA (gal) , 10% probability of exceedance in 50 years (Midzi et al., 1999)

GSHAP used only catalogue data only & even that result is not applied for code revisions in many African countries

How can we integrate all results from basic science research results to better model earthquake hazard and risk maps?

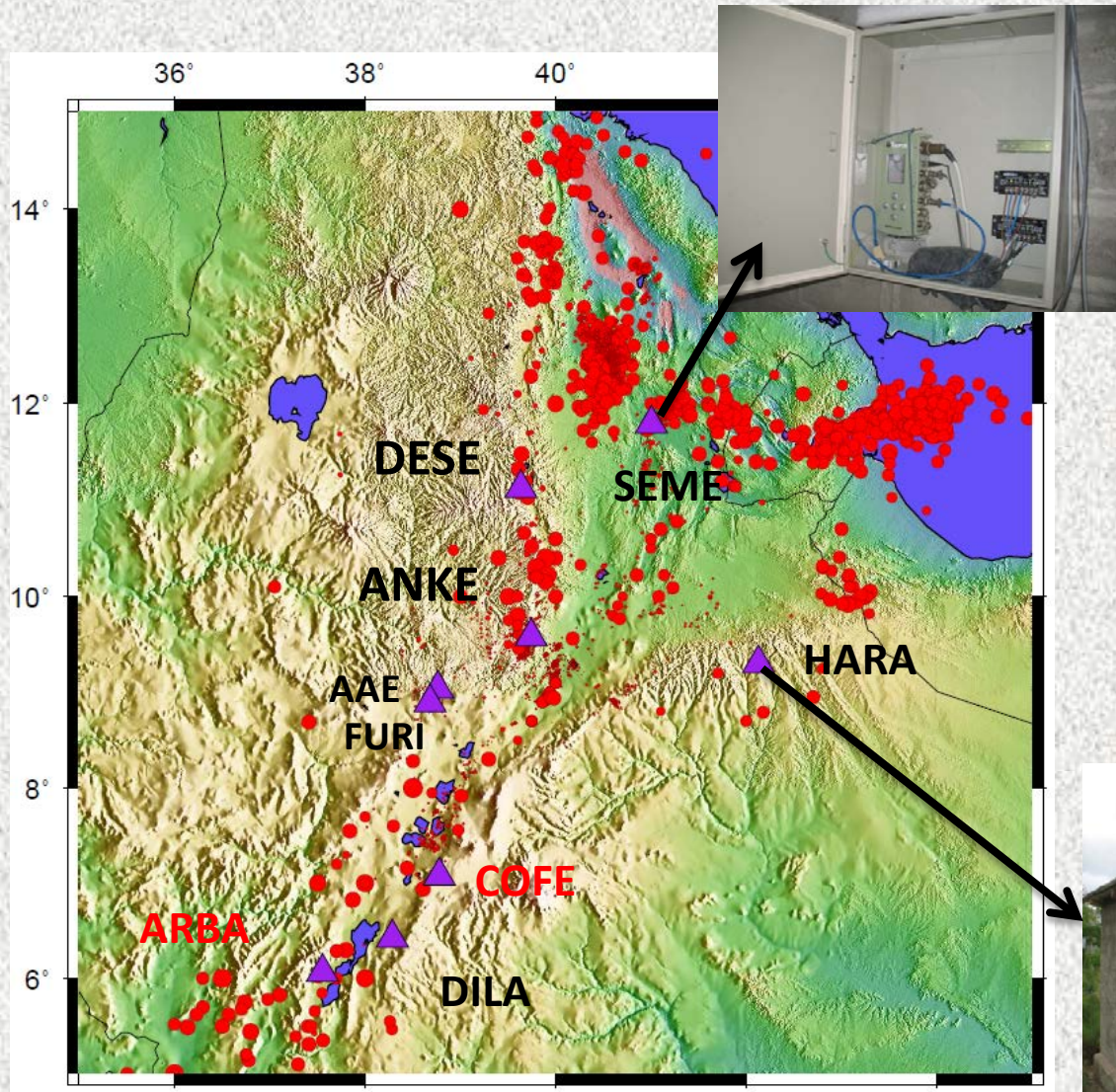
The latest generation of hazard map for the horn of Africa region



3/2/2017

ISP/IPPS Grant Application 2917-2019,
Nairobi, Kenya

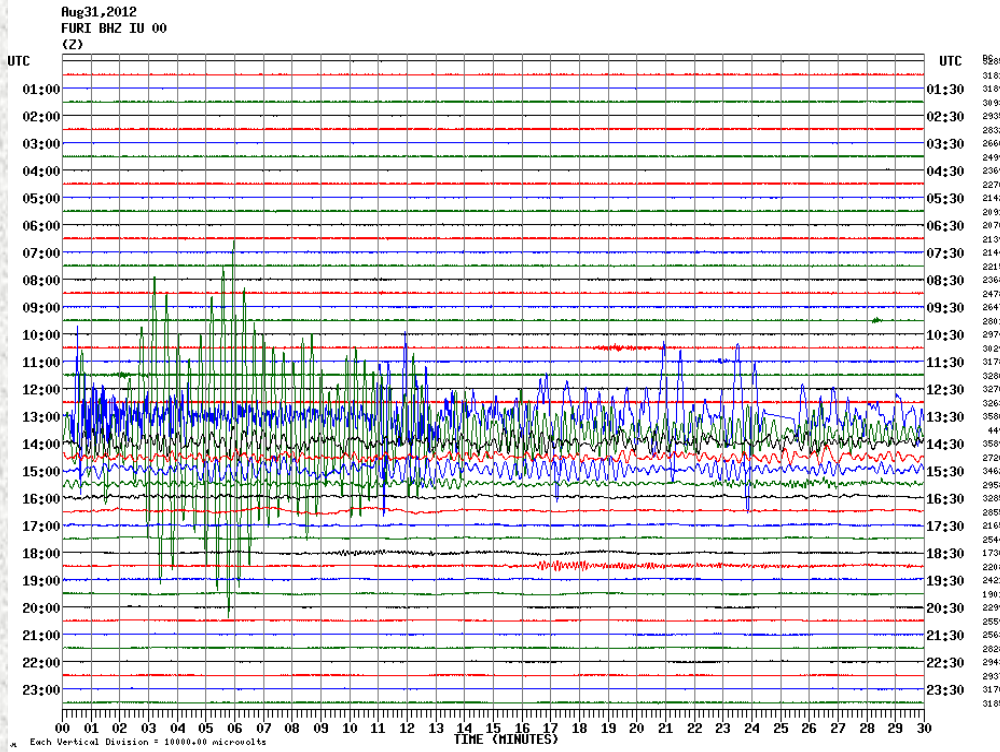
Ethiopian Seismic Station Network (ESSN)



The purple triangles are the locations of the nine seismic stations running in Ethiopia



Real-time data flow is the one to go for



FURI

AAE

DESE

HARA

MBAR

ATD

KMB

BEKO (RiftVolc)

National Workshop



A national workshop entitled “Natural Hazard Monitoring & Risk Management in Ethiopia” held in Addis Ababa University from November 6 to 7, 2014.



3/2/2017

ISP/IPPS Grant Application 2917-2019,
Nairobi, Kenya

Capacity Building Efforts



ESARSWG Bulletin workshop held at Instituto Geológico-Mineiro, Maputo Mozambique

May 11th - 16th 2015

Workshop sponsored by ISP of Uppsala University

Capacity Building Efforts



- Training on PDDC software
- instrument response and magnitude estimate
- data quality and validation

November 30 – December 5, 2015 held at IGSSA and sponsored by ISP and Addis Ababa University

1st General Assembly of the African Seismological Commission (AfSC) Nile River, Egypt, 2 – 5 April 2016



Figure 1



April, 2017 is the deadline for submitting bid document to host the 2nd GA in 2018

Summary

- Earthquake and volcanic risk is on the rise in EARS
- Communicating hazard to the community and decision makers is a challenge
- Internationally coordinated effort is required in all aspects
- How can we use all research results in the region to serve humanity?

Acknowledgements

International Science Program of Uppsala University for generous support of seismological activities in EARS region

Fruitful International Collaborations



Afar Consortium Meeting, Skye (2009)