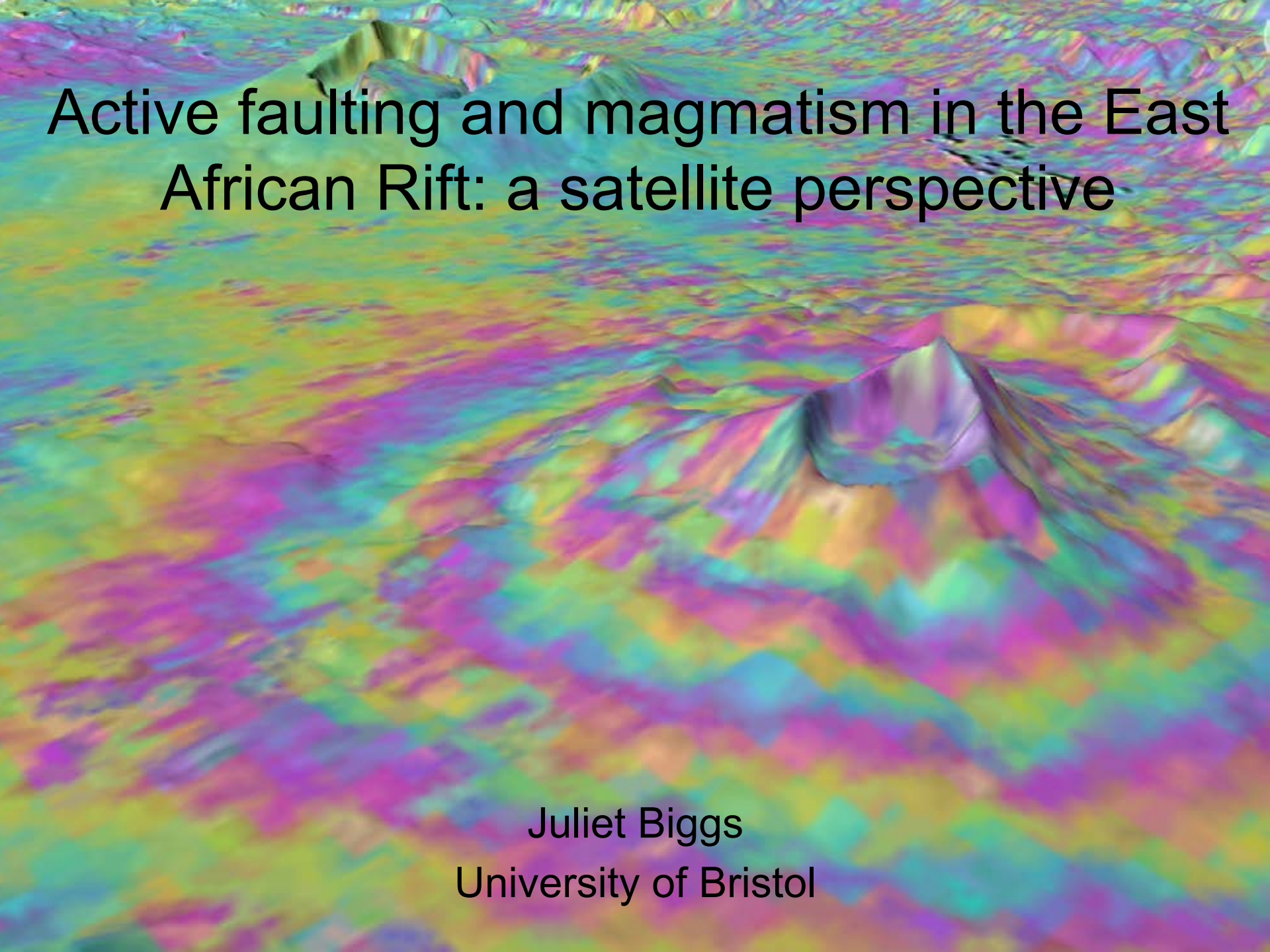
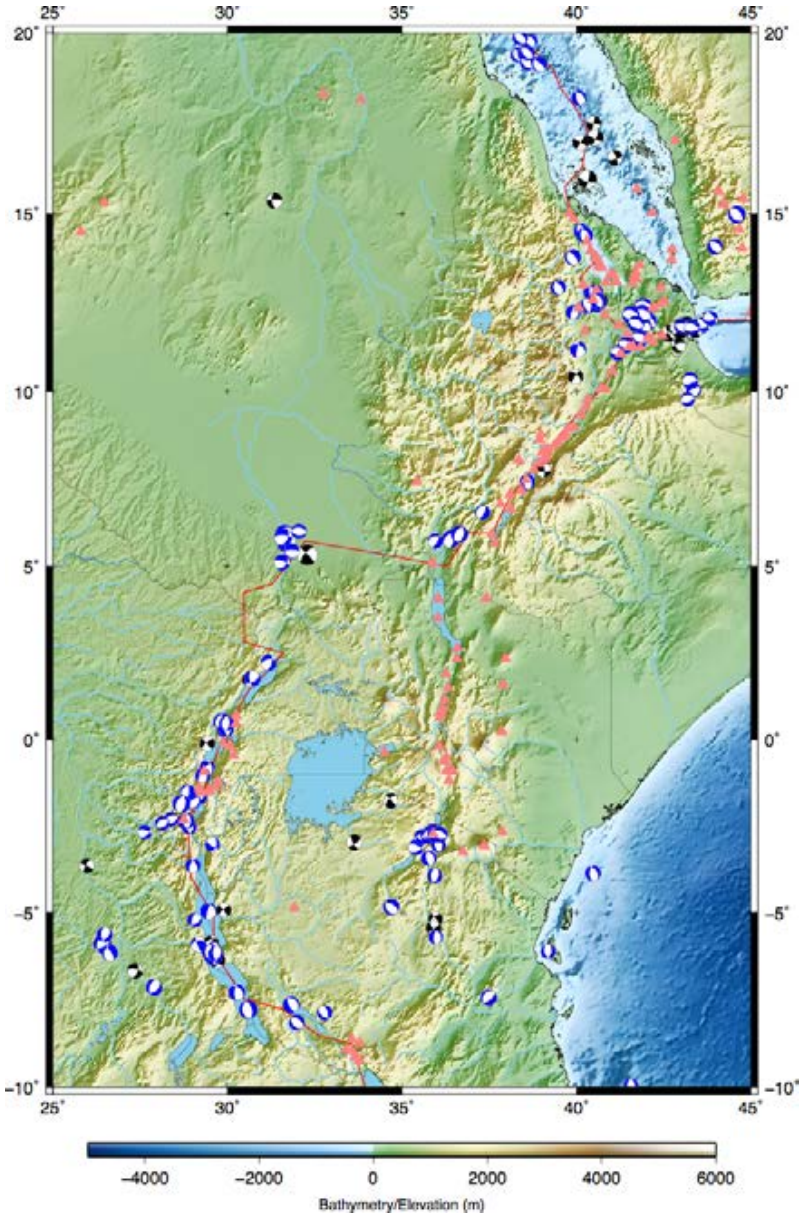
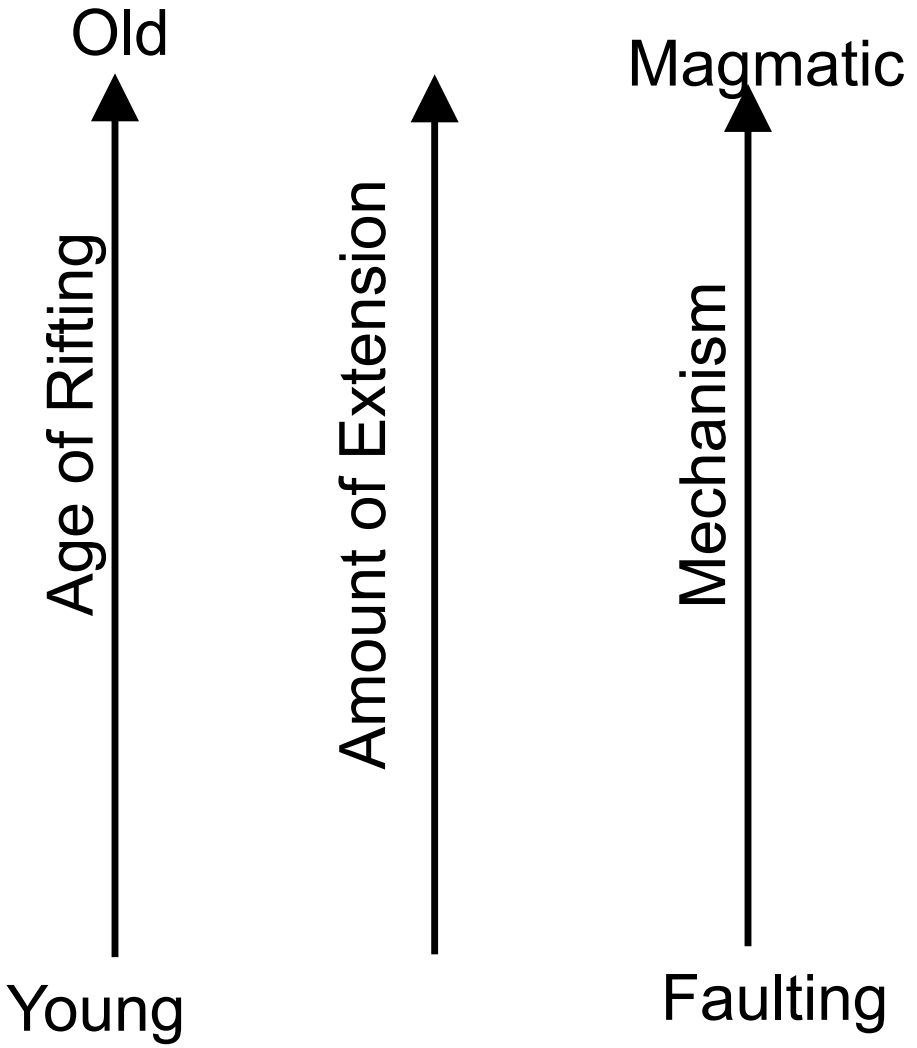


Active faulting and magmatism in the East African Rift: a satellite perspective

Juliet Biggs
University of Bristol

What are the controls on strain localization and migration?

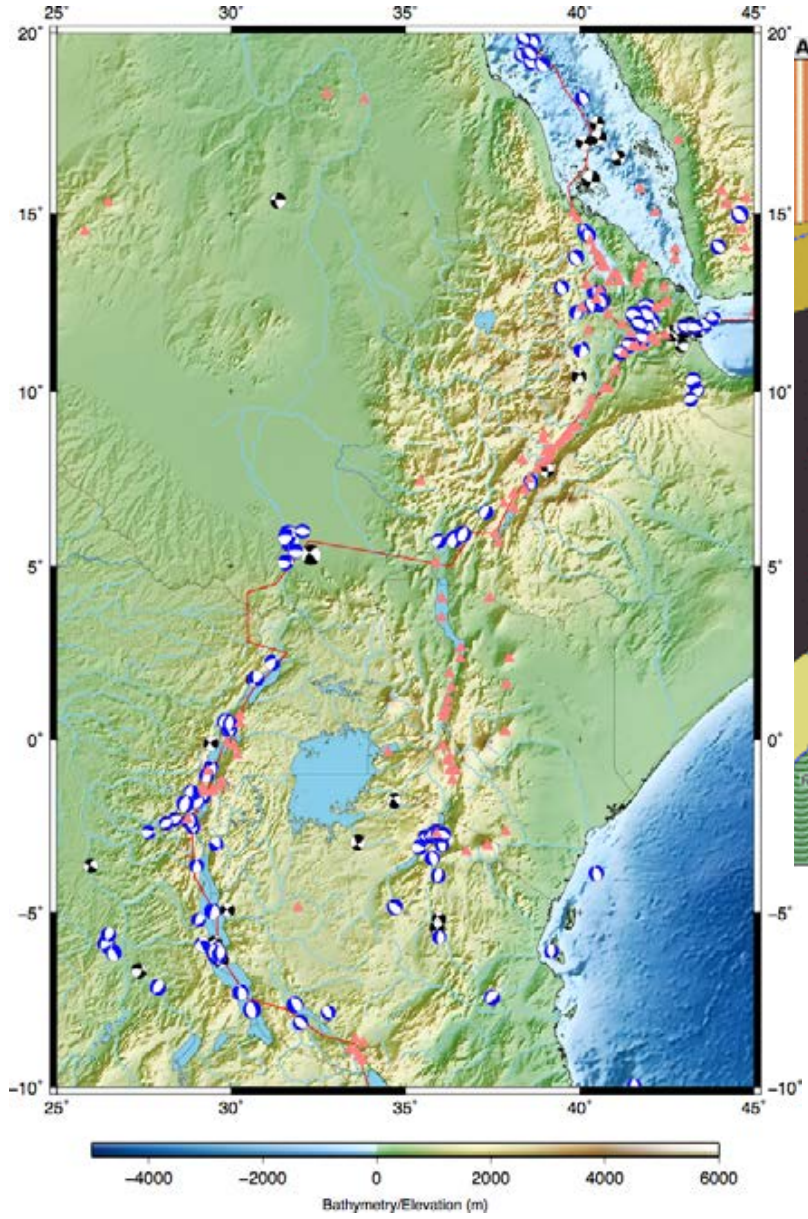


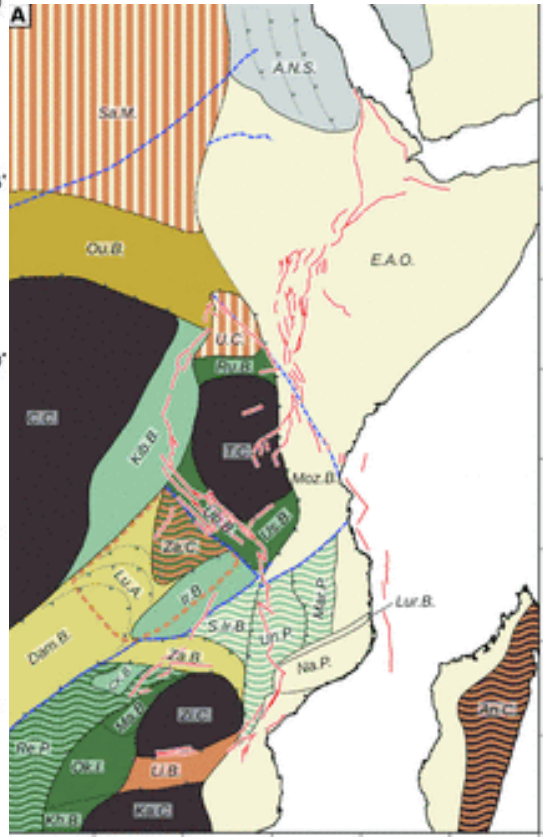


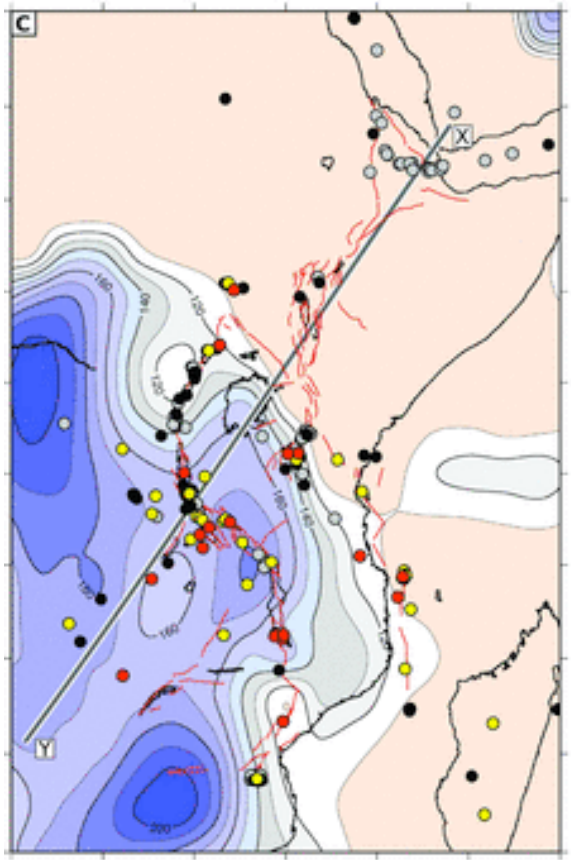
At what point does magma become important?

Ebinger et al,

What are the controls on strain localization and migration?



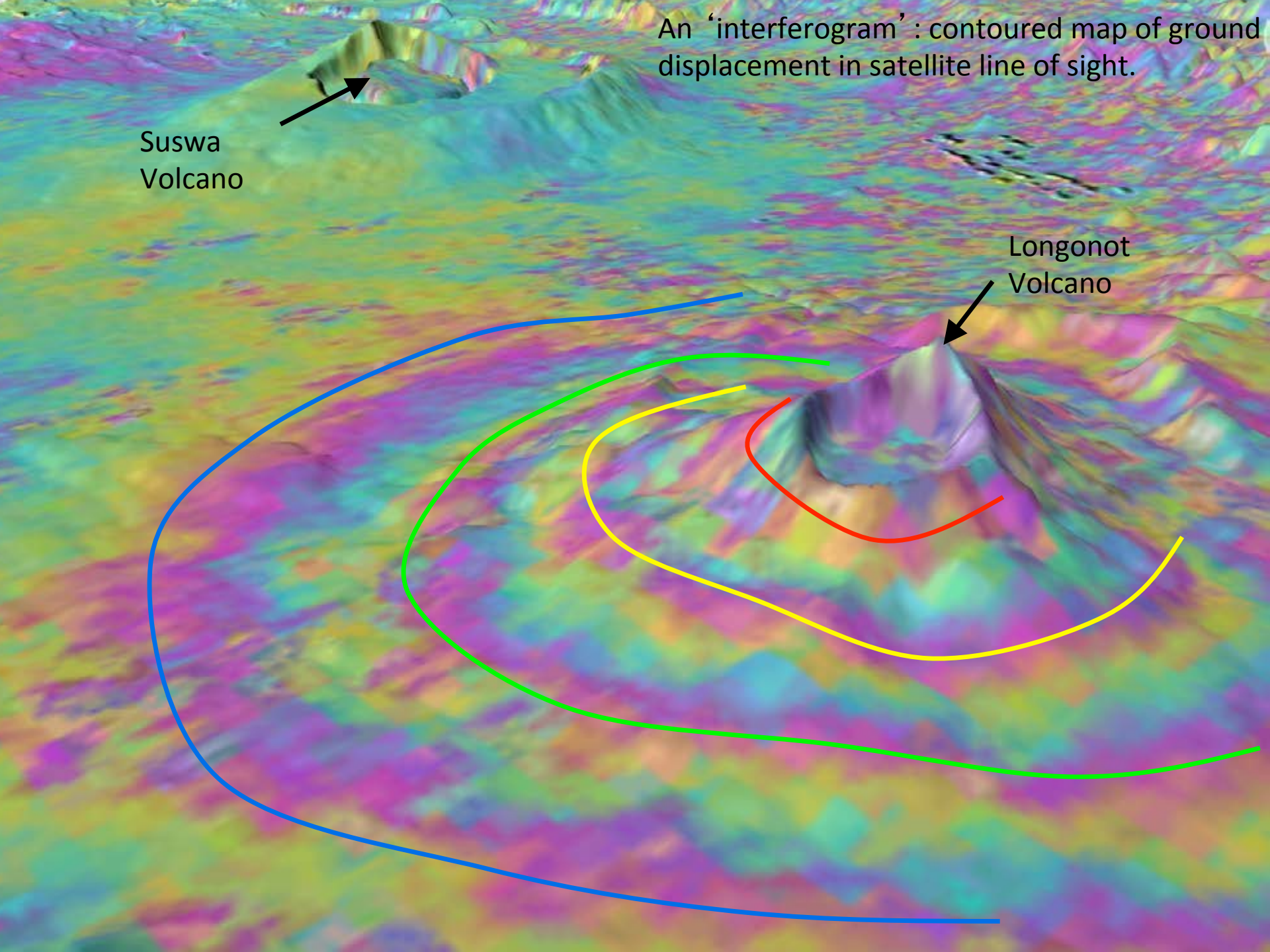




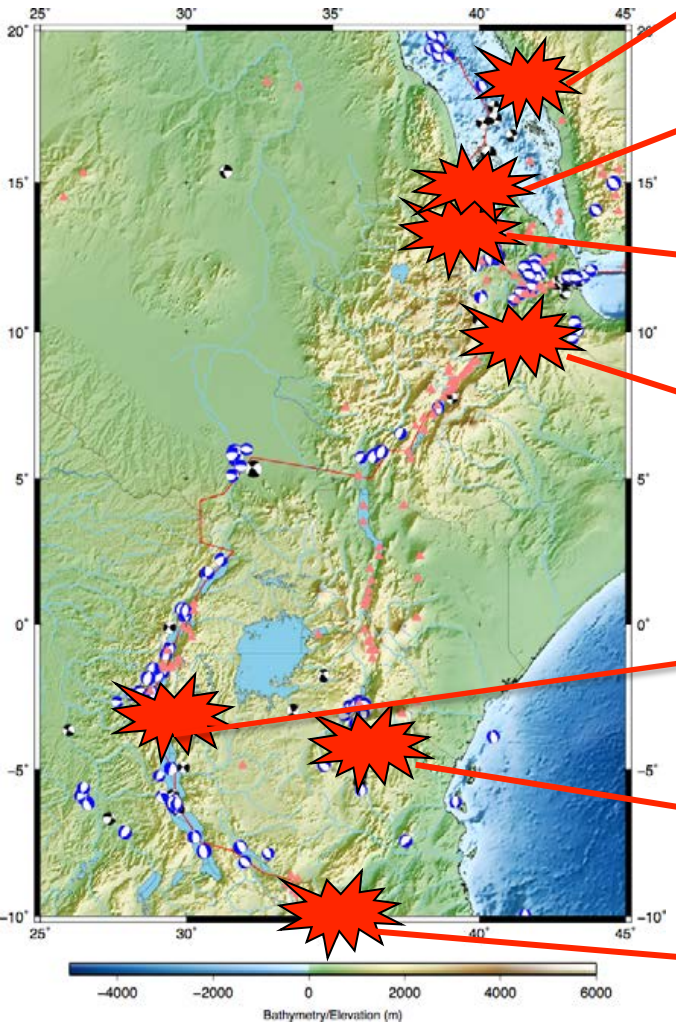
Geology

Lithospheric Thickness

Craig et al, 2010


An ‘interferogram’: contoured map of ground displacement in satellite line of sight.
Suswa Volcano
Longonot Volcano

How is strain accommodated and partitioned?



2009: Saudi Arabia Dyke

Jonsson et al,. 2010, Baer et al, 2010.

2004: Dallol Dyke

Nobile et al, 2012

2005- Afar Dyke sequence

e.g. Wright et al, 2006; and many, many more….

2008: Ayelew-Amoissa Dyke

e.g. Keir et al 2011

2008: Bukavu Earthquake

e.g. d'Oreye et al, 2010

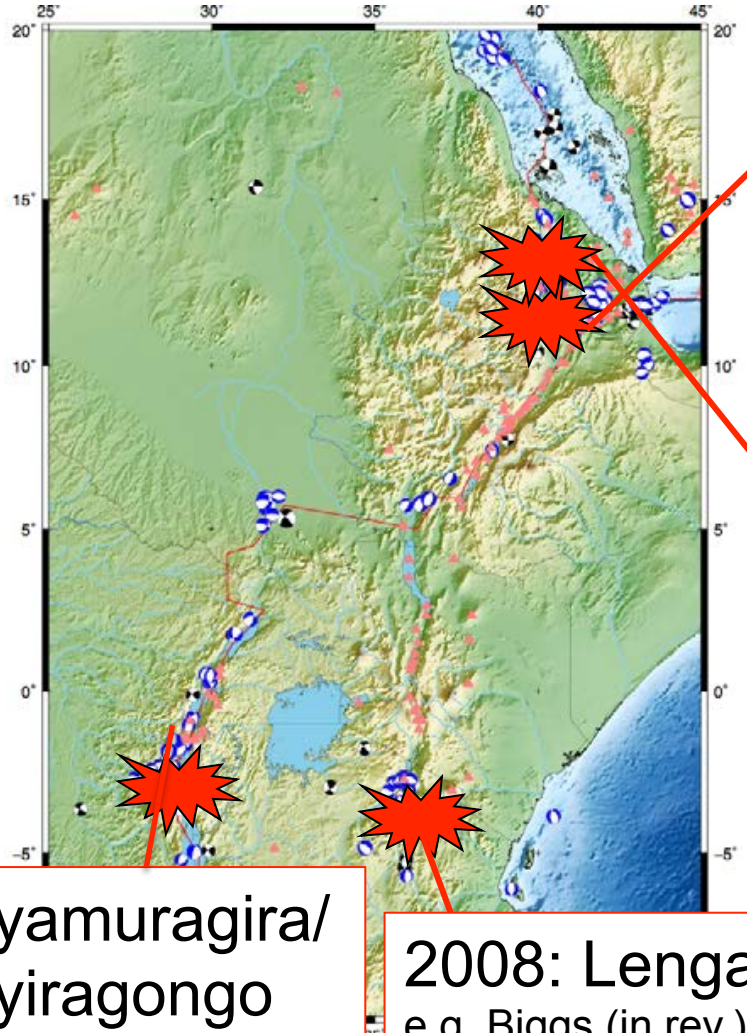
2007: Lake Natron Dyke

e.g. Calais 2009; Biggs et al, 2009; Baer, 2008.

2009: Karonga Earthquakes

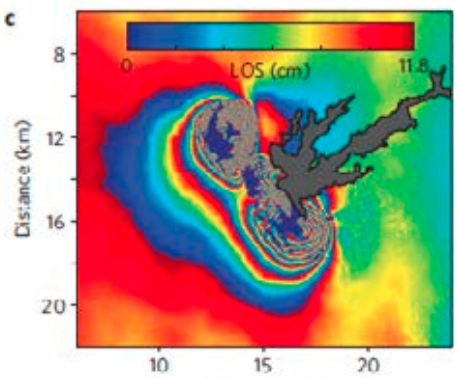
e.g. Biggs et al, 2010.

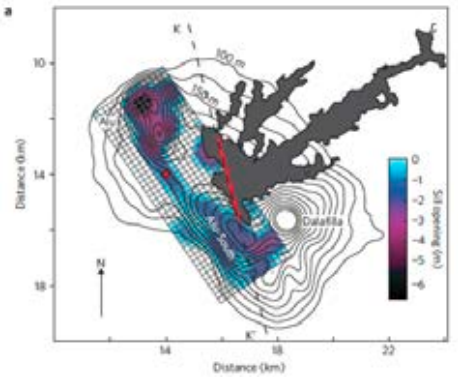
How is strain accommodated and partitioned?



2008: Erta Ale Range

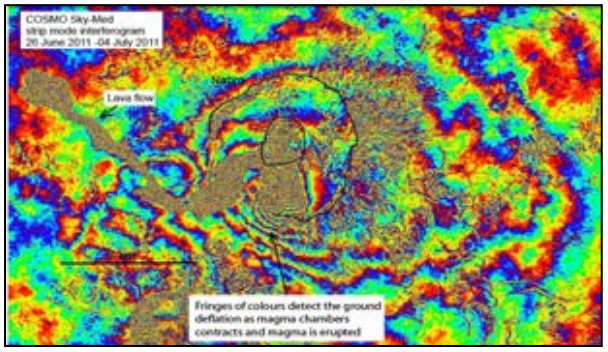
e.g. Pagli et al, 2012.





2011: Nabro

e.g. Pagli et al, in prep.

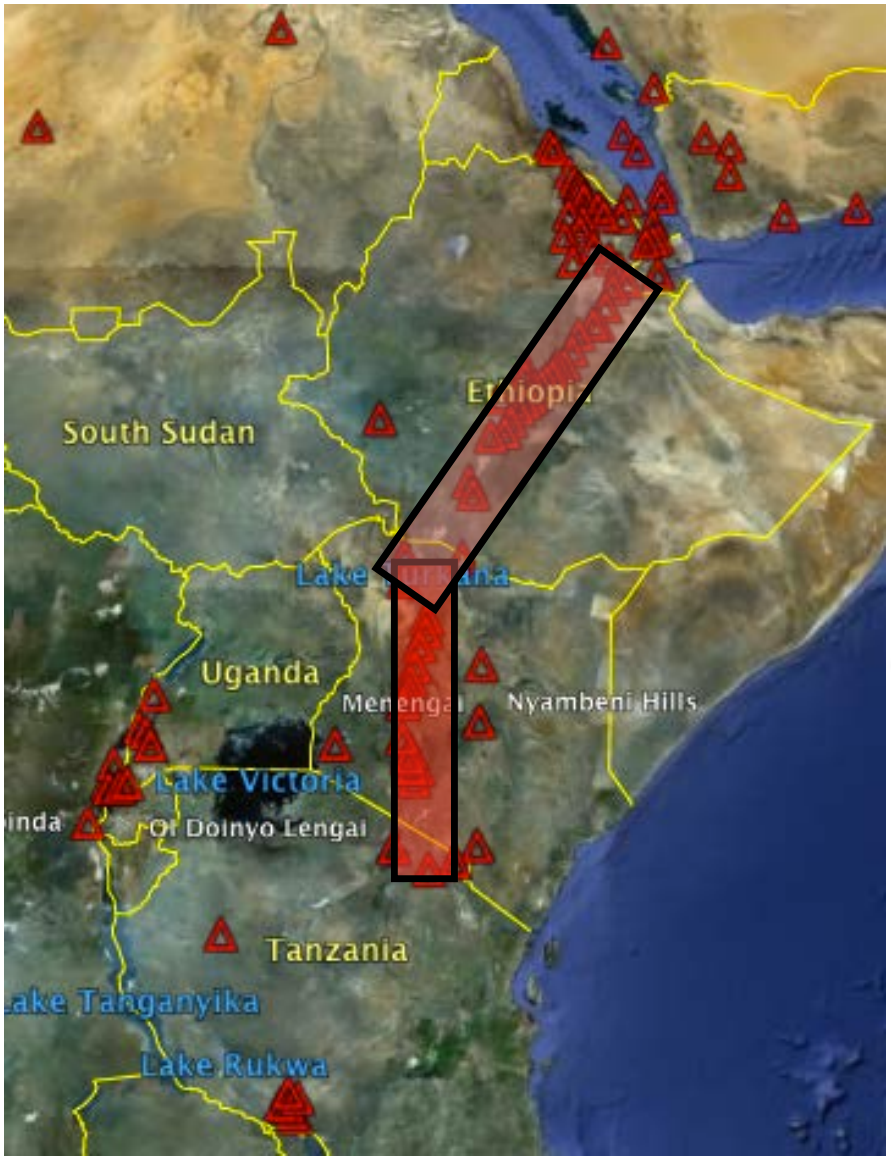


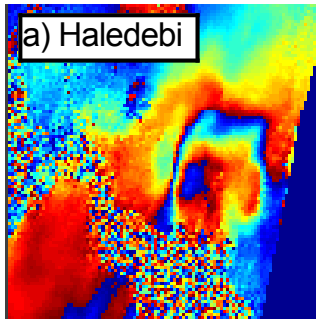
Nyamuragira/ Nyiragongo

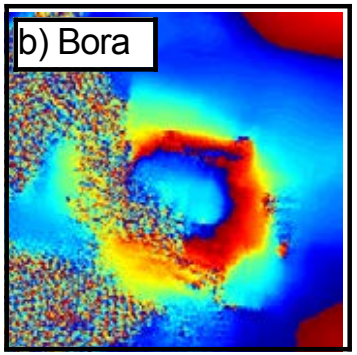
e.g. Cayol; Waulthier et al, 2012.

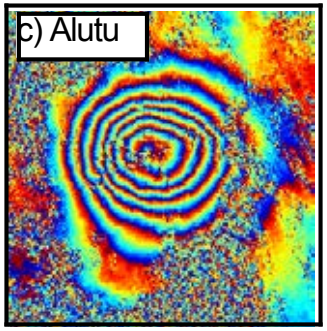
2008: Lengai

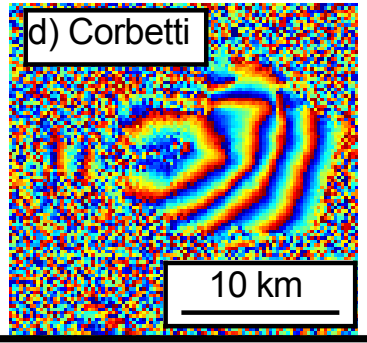
e.g. Biggs (in rev.)



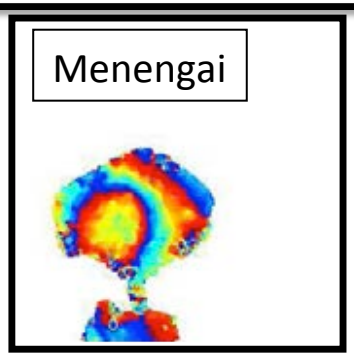


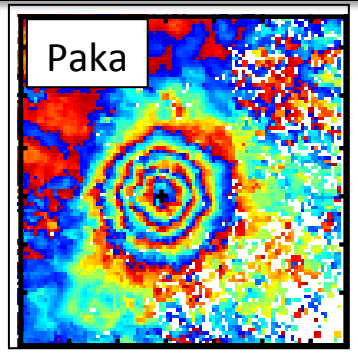


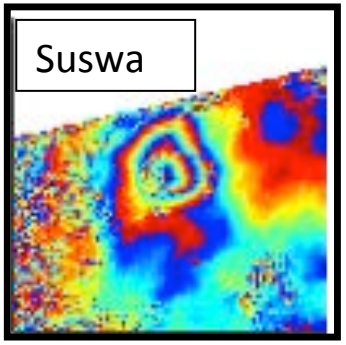


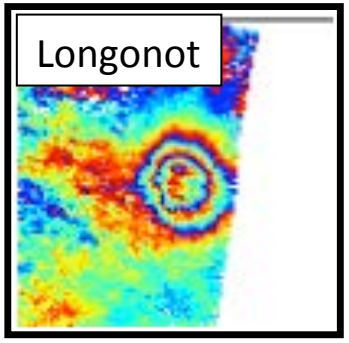


MER









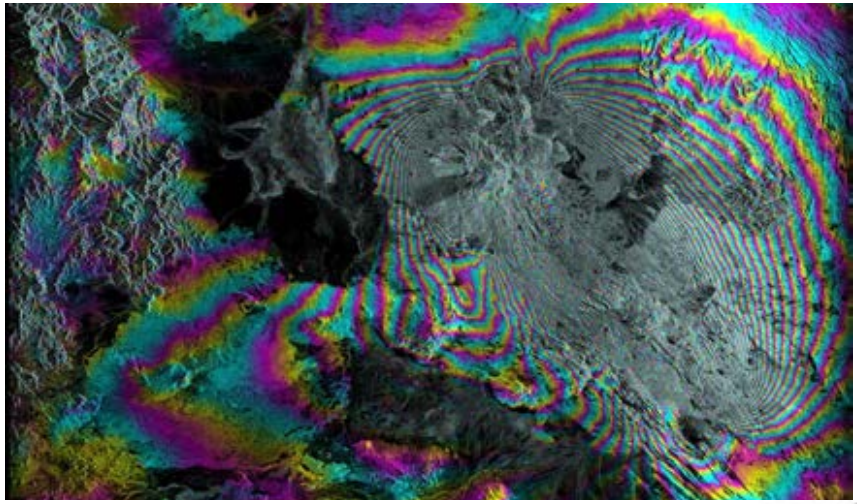
Kenya

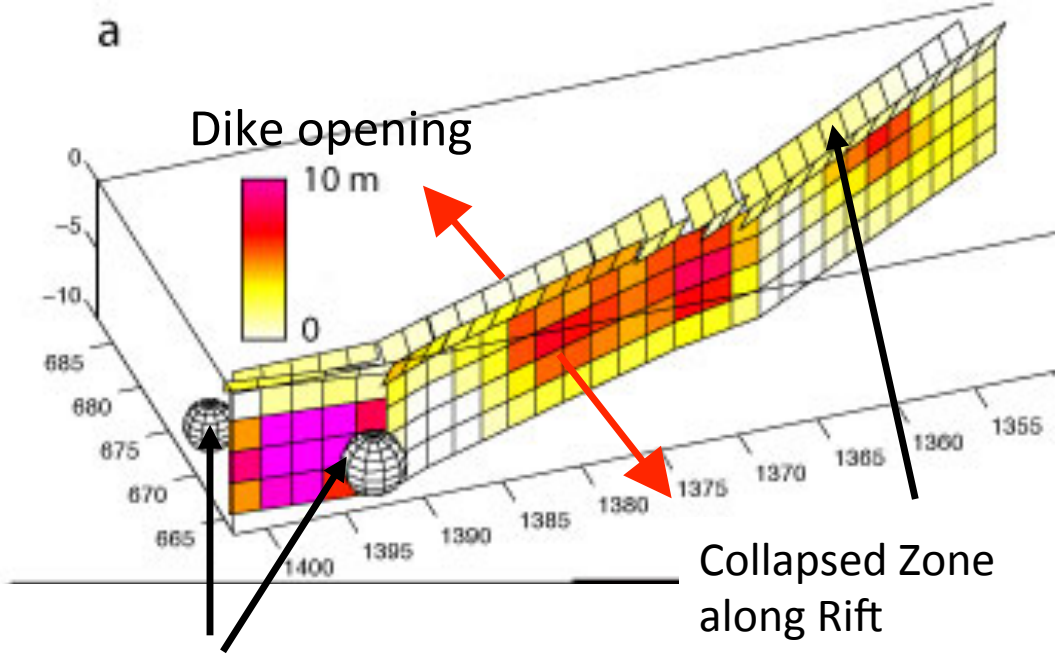
Biggs et al, 2009; Biggs et al, 2011

Dabbahu Swarm

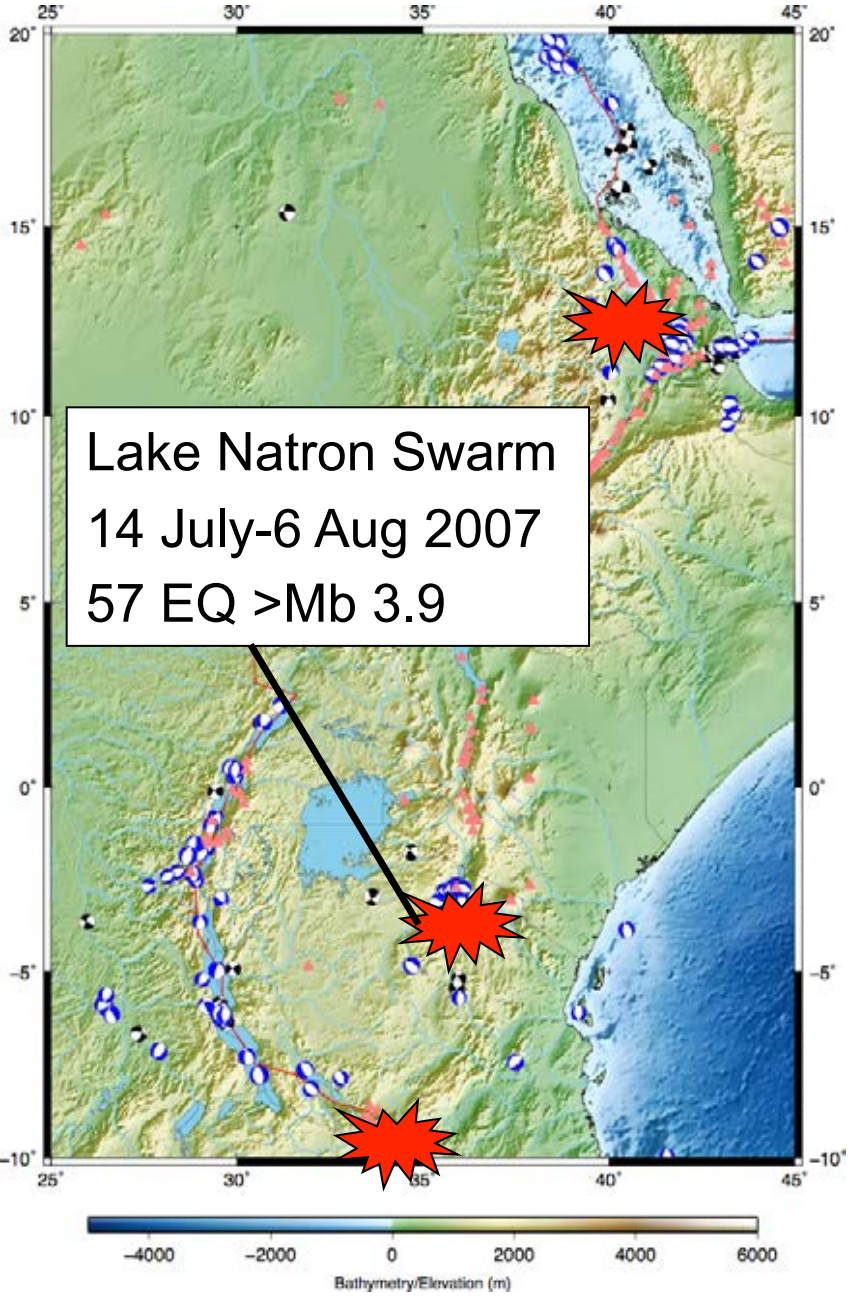
14 Sept-5 Oct 2005

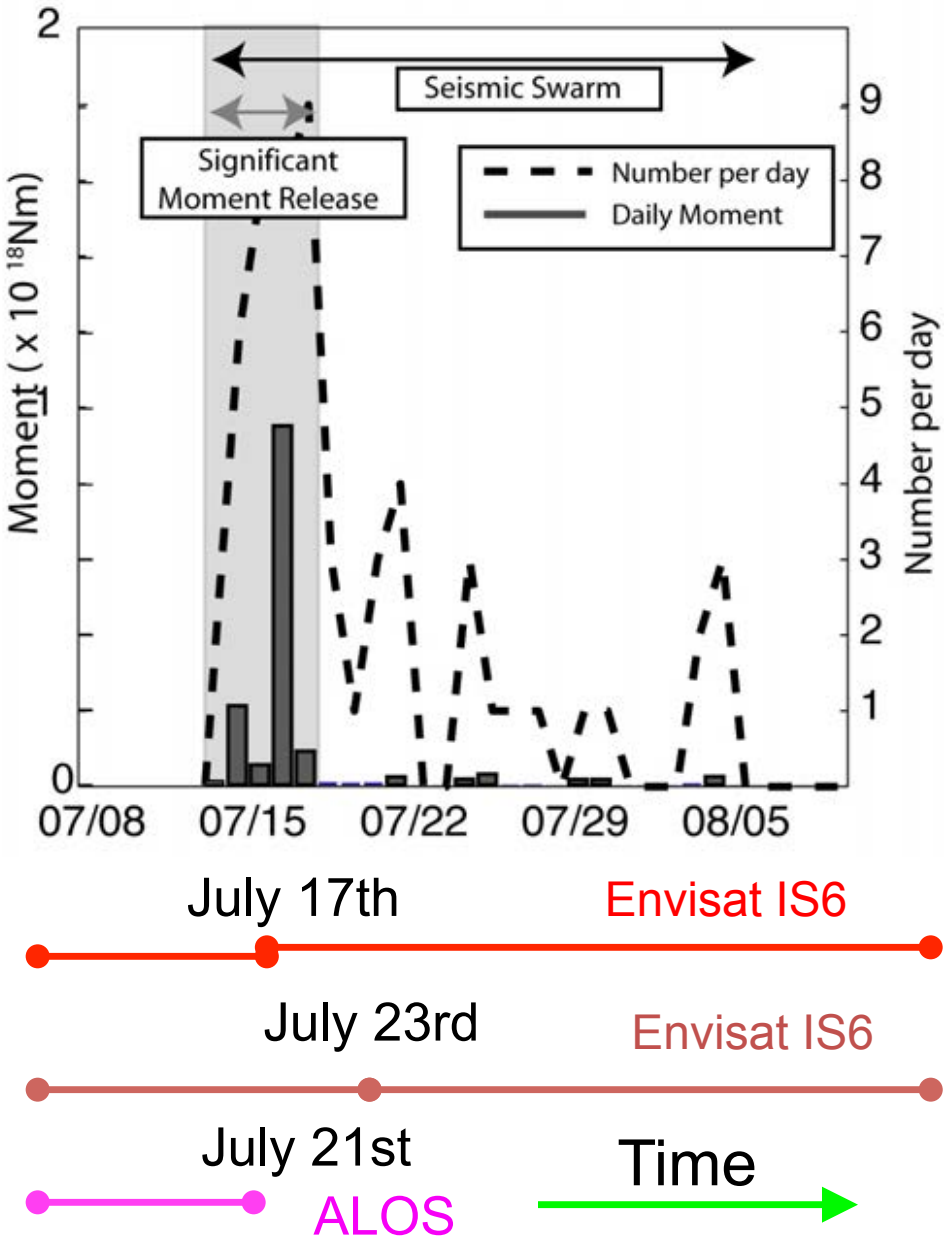
163 EQ >Mw 3.9



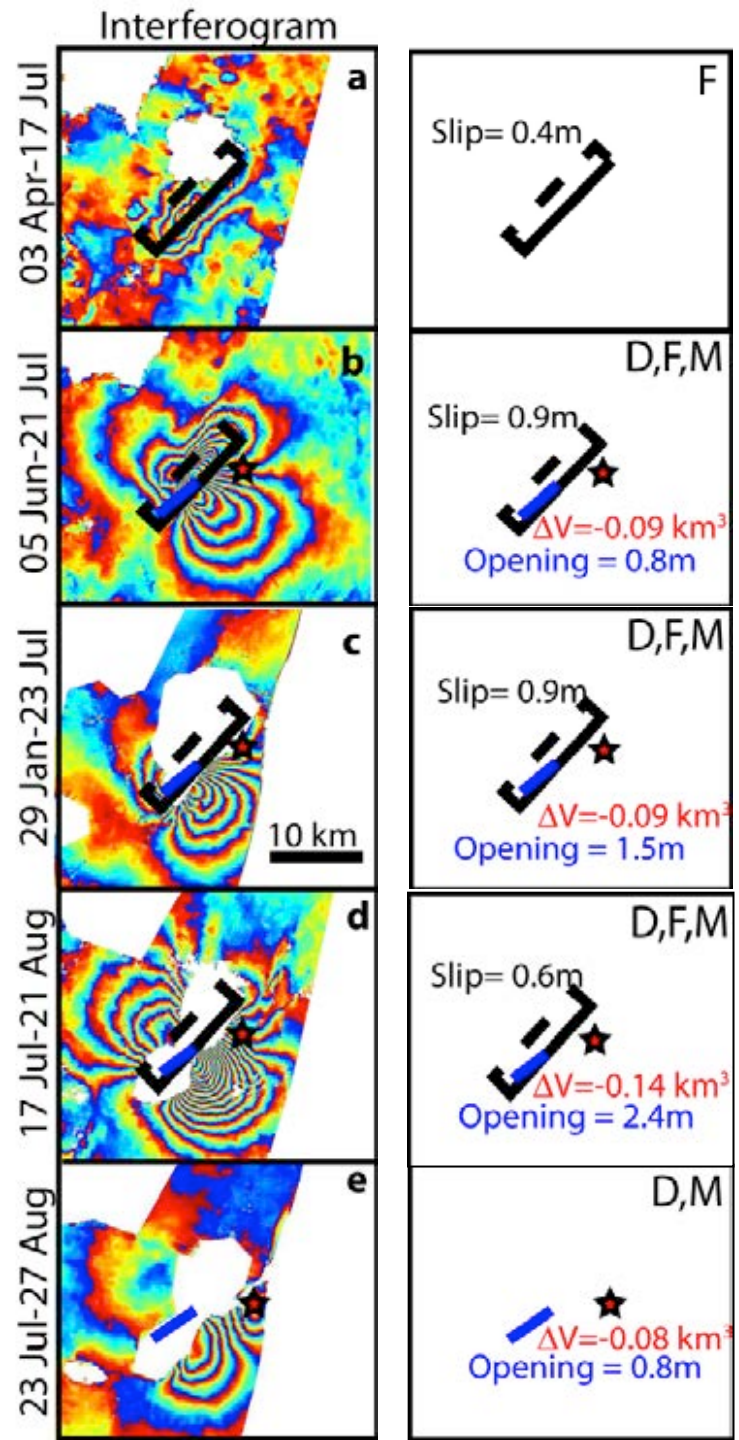


Wright, Ebinger, Biggs et al.
Nature. 2006





Biggs et al, GJI, 2009



Time Sequence

Days 1-3: Fault Slip

Days 3-5: Dyke opening begins

Days 5-7: Shallow collapse (graben)

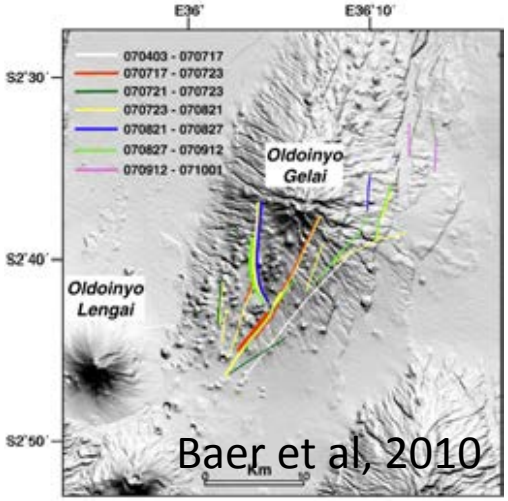
Day 5-: Dyke continues opening, but does not lengthen.

Day 7-: Magma chamber deflation clearly visible.

Biggs et al, GJI, 2009

2008-2010

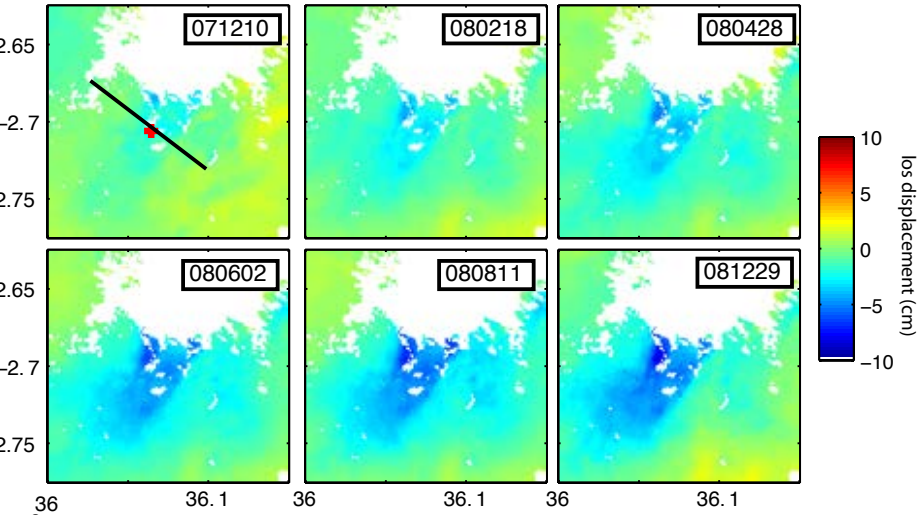
Continuing subsidence of the graben along faults

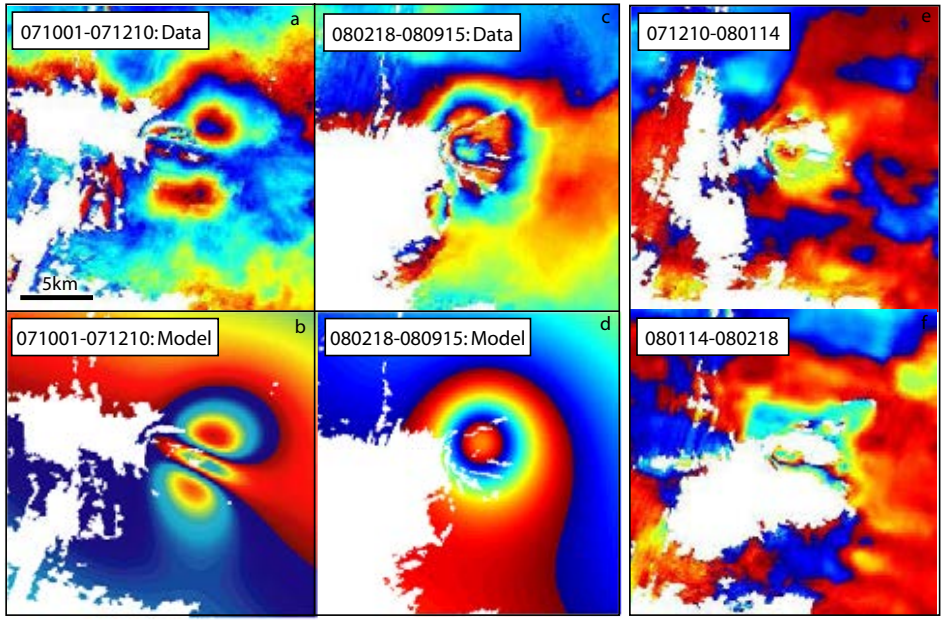


Baer et al, 2010

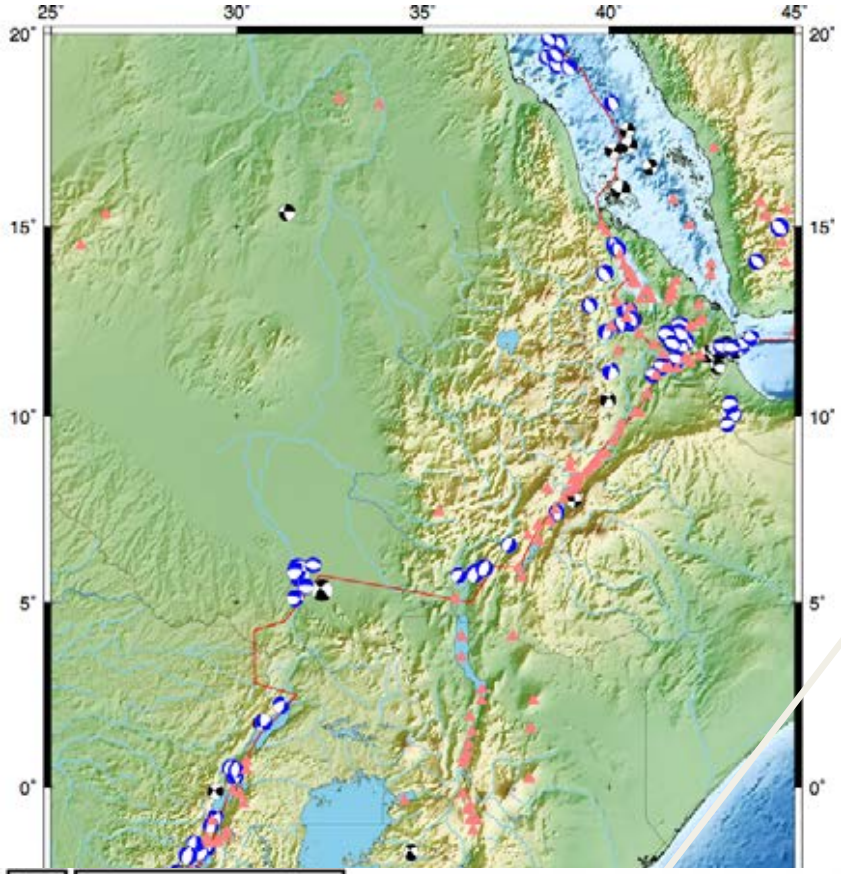
Intrusion of E-W and subsidence assoiciated with change in behaviour at Ol Doinyo Lengai

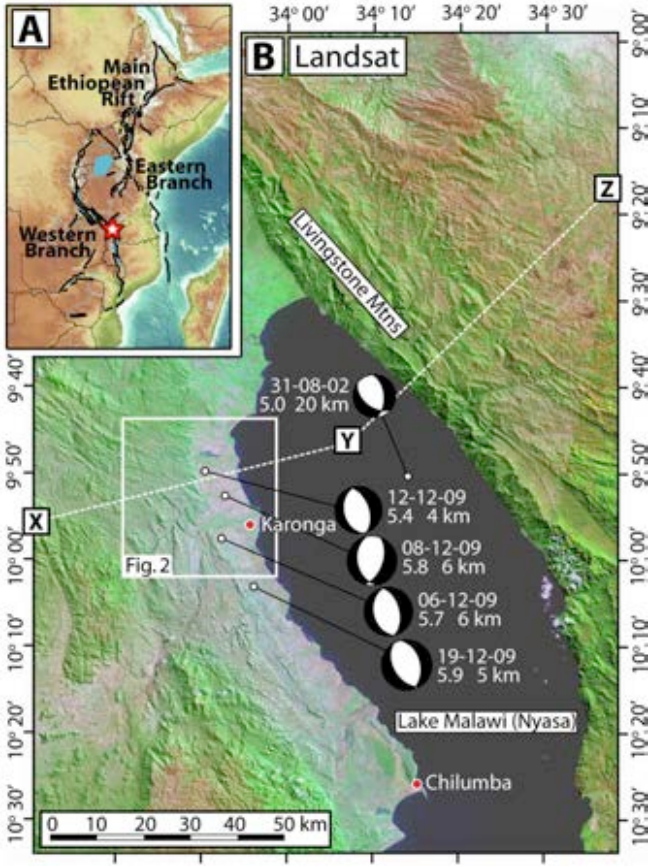
Kervyn et al, 2012



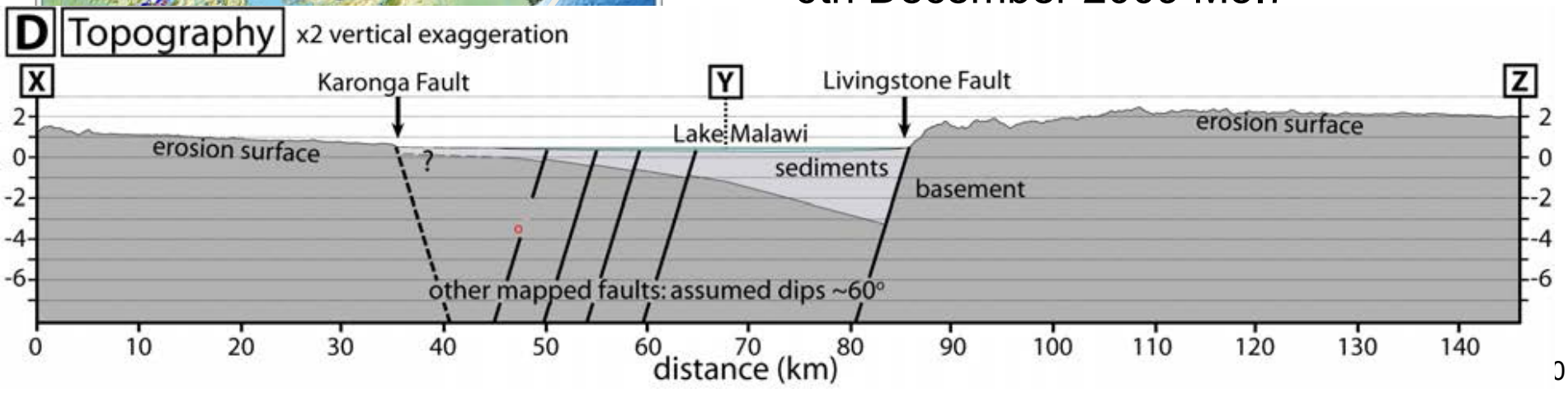


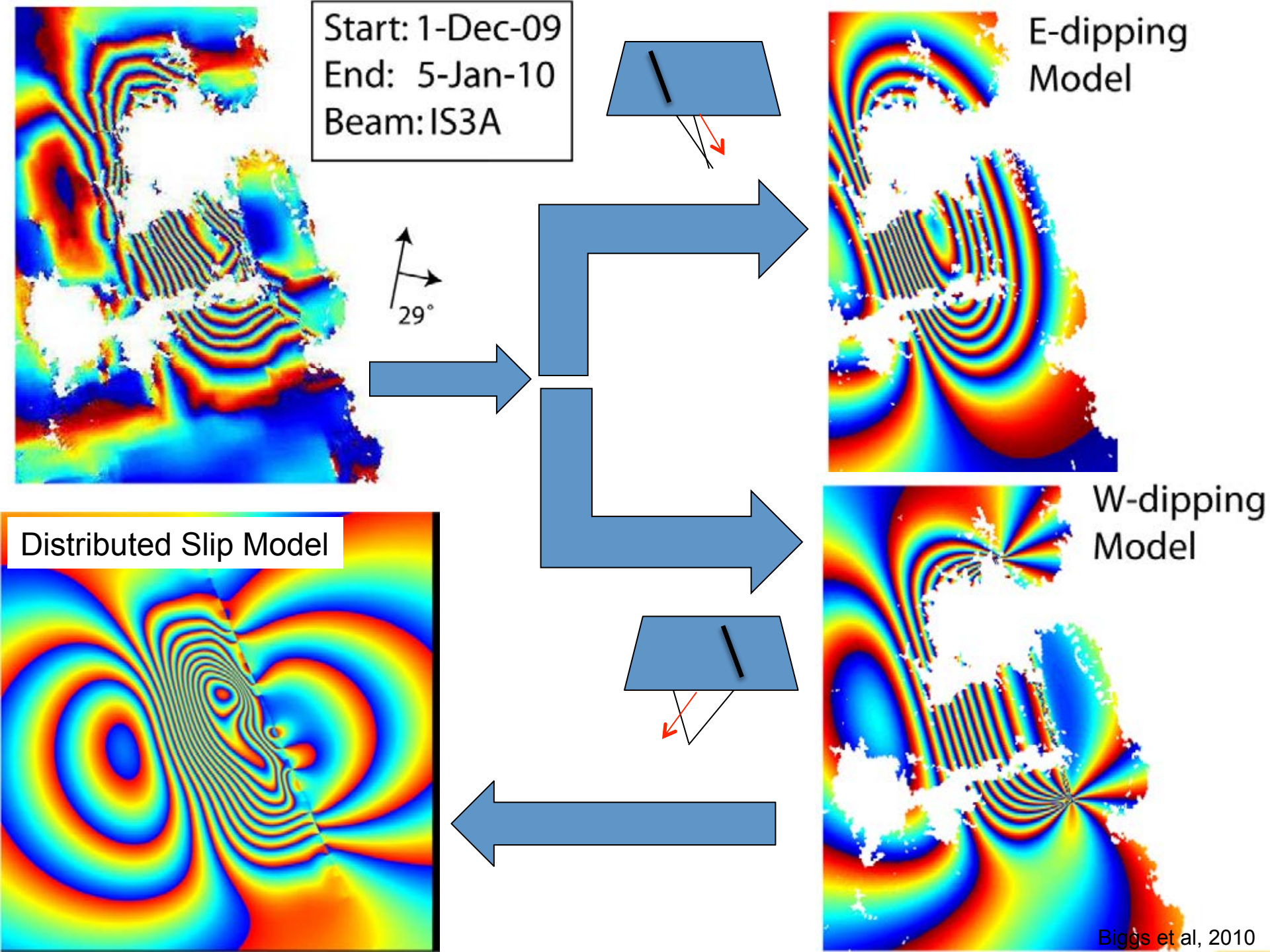
Biggs et al, GJI, in rev.

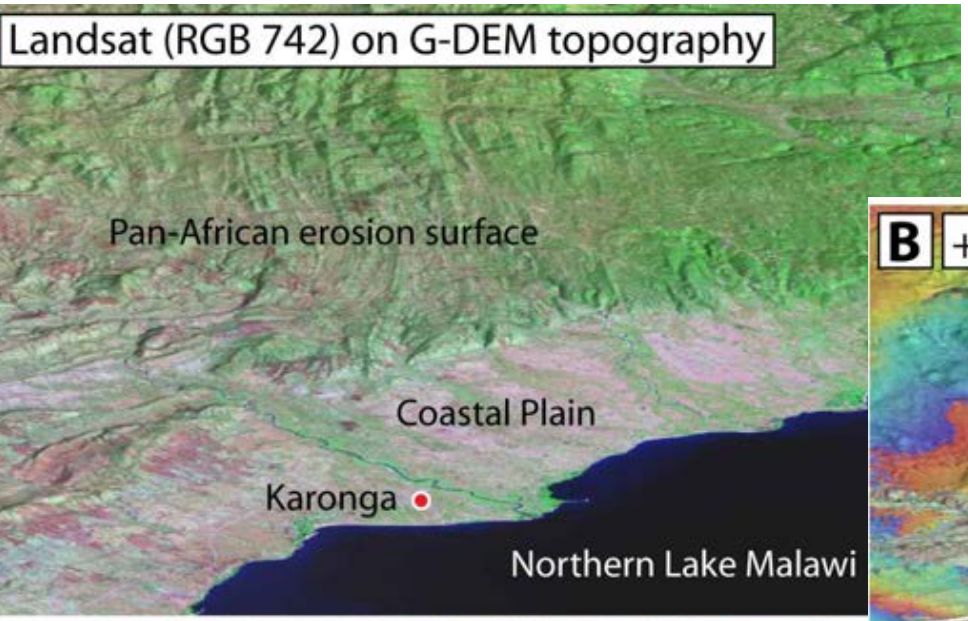


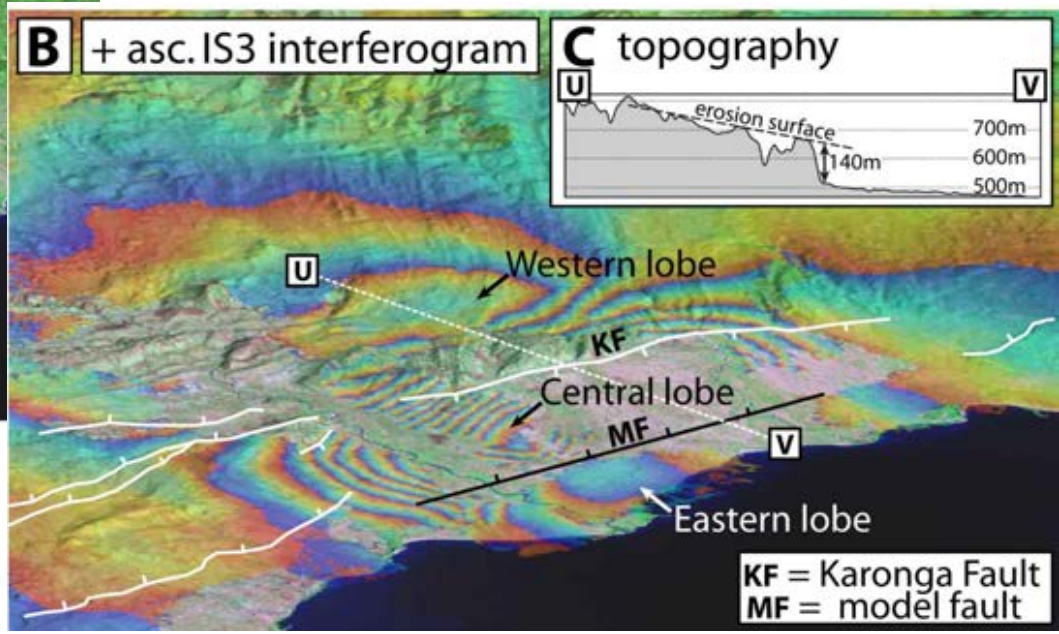


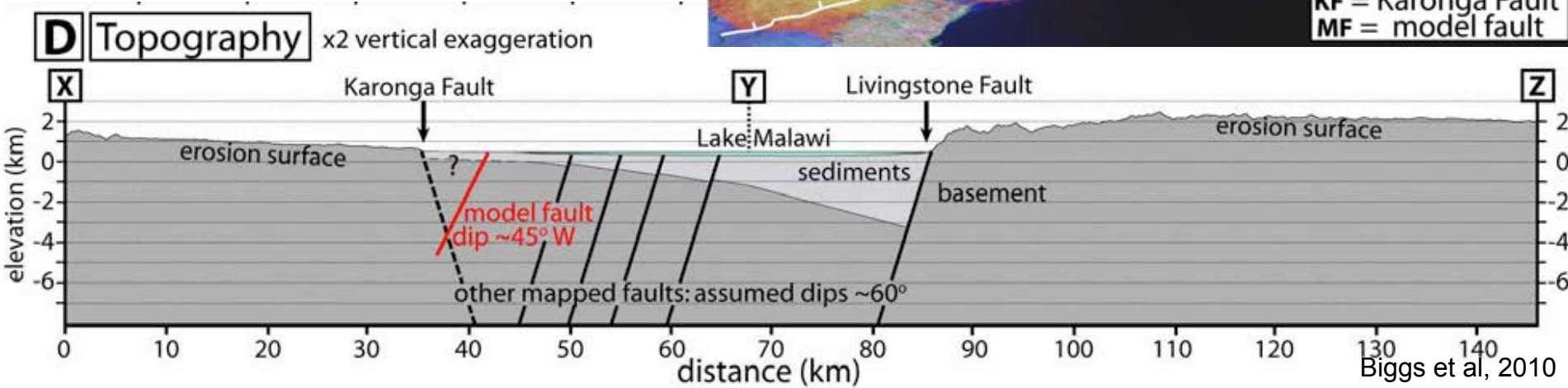
•6th December 2009 M5.7



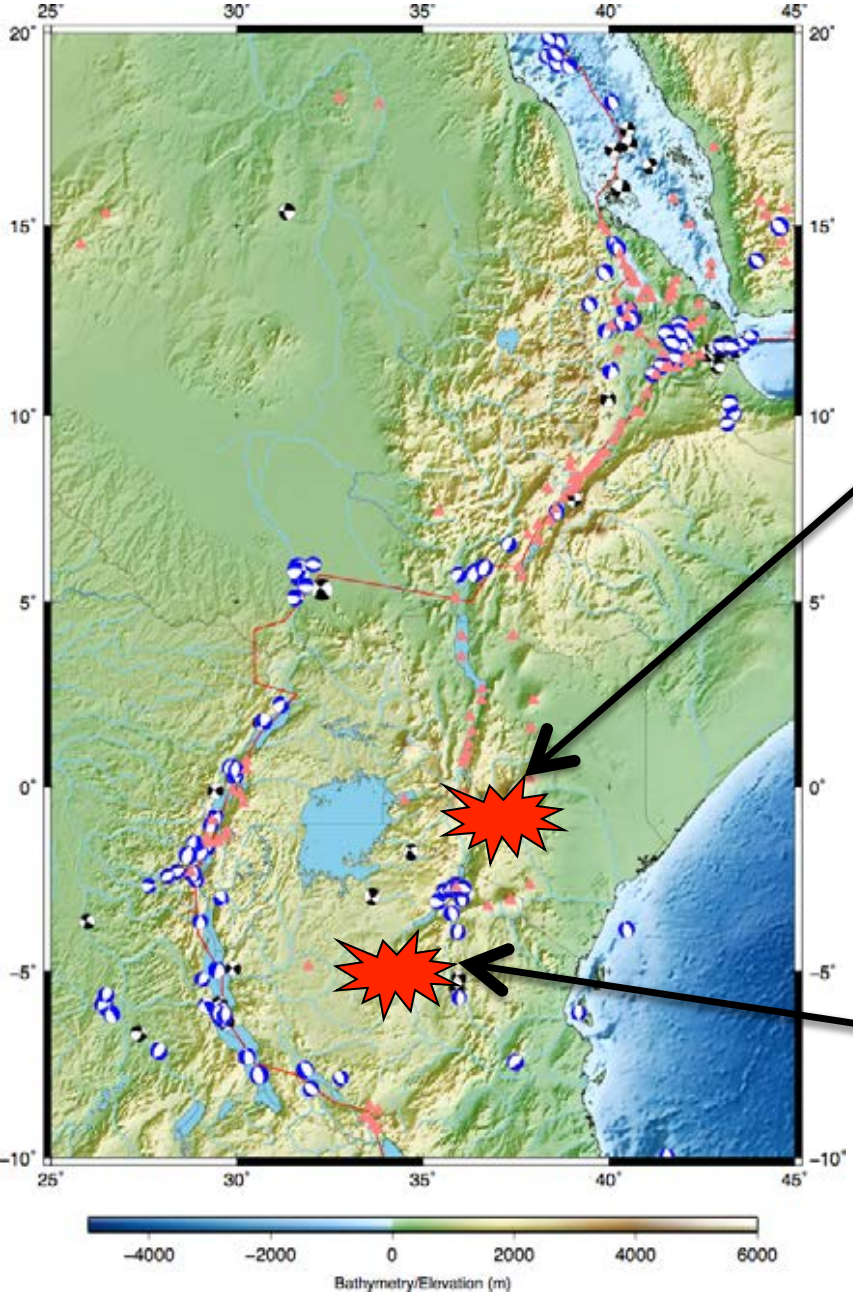

Start: 1-Dec-09
End: 5-Jan-10
Beam: IS3A
29°
E-dipping
Model
W-dipping
Model
Distributed Slip Model
Biggs et al, 2010



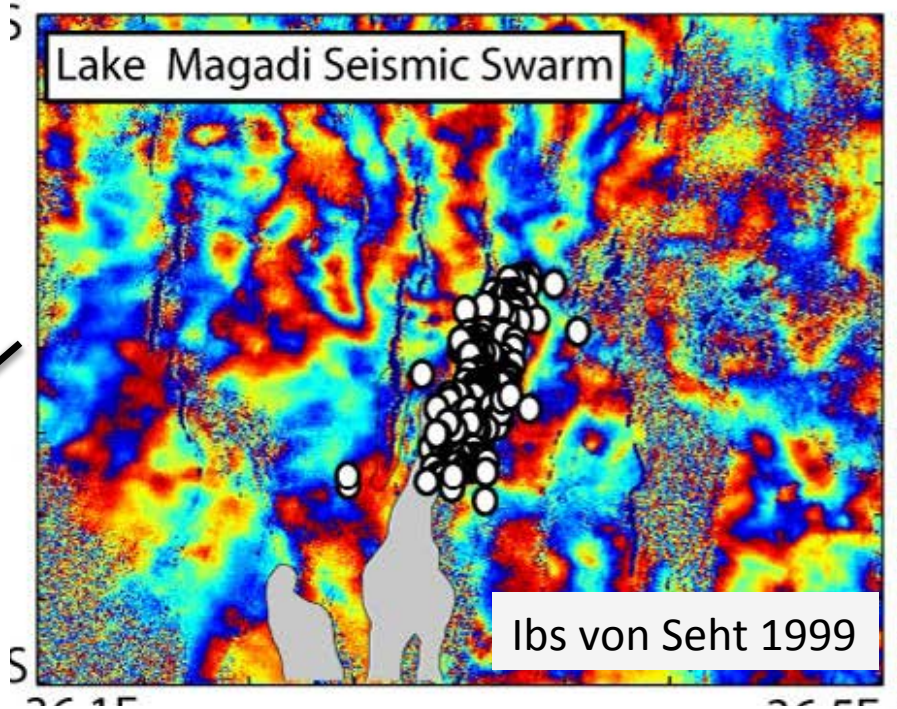


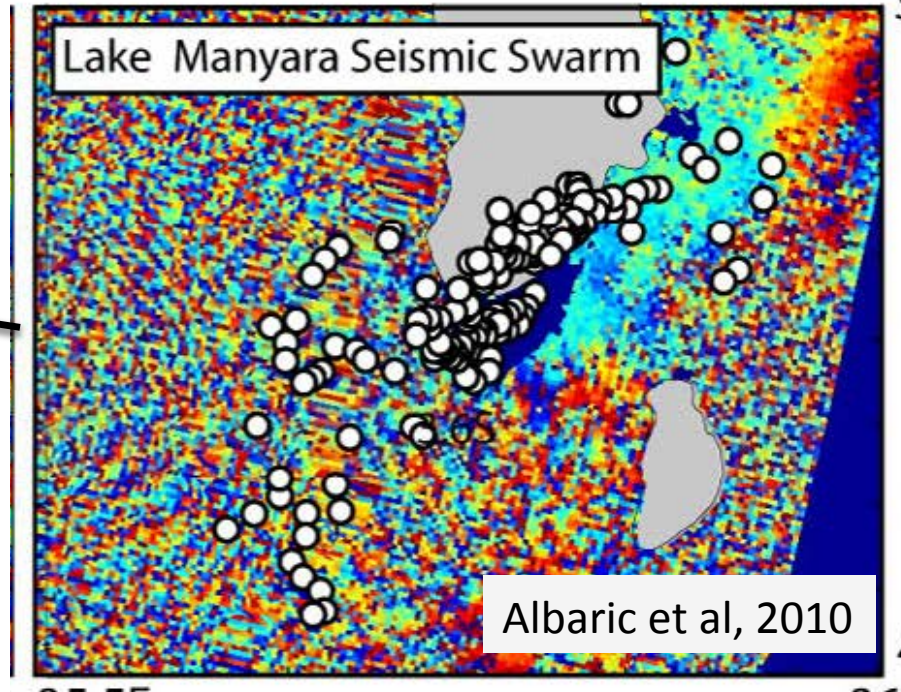


Biggs et al, 2010

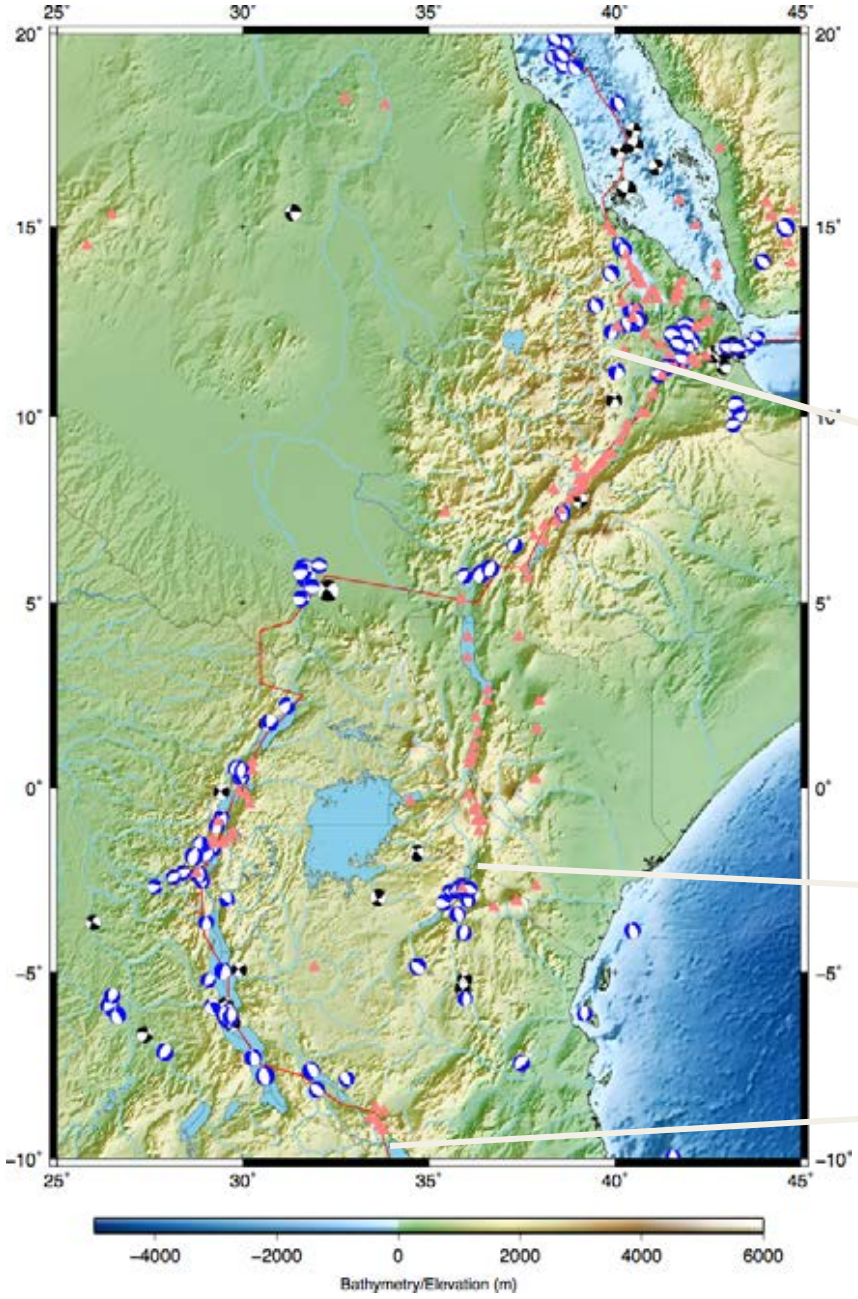


Biggs et al, in press



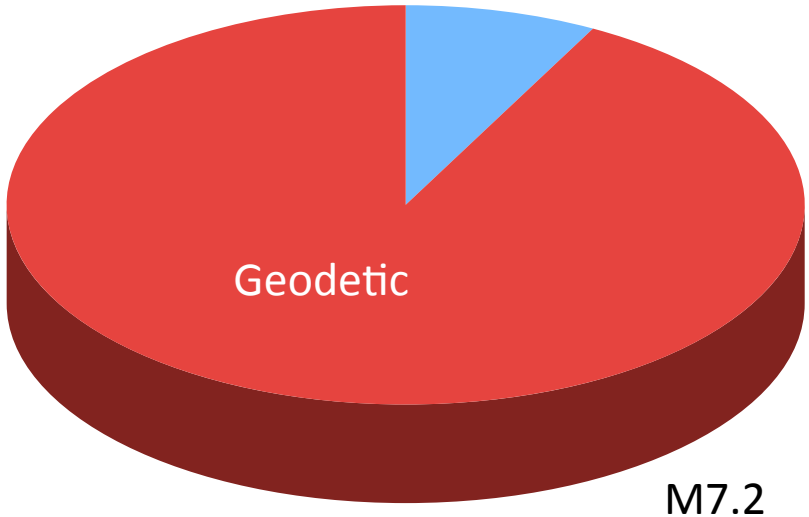


Moment Release



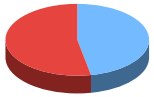
Afar

Seismic



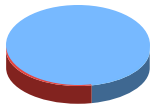
M7.2

Lake Natron



M6.2

Karonga



M6.2

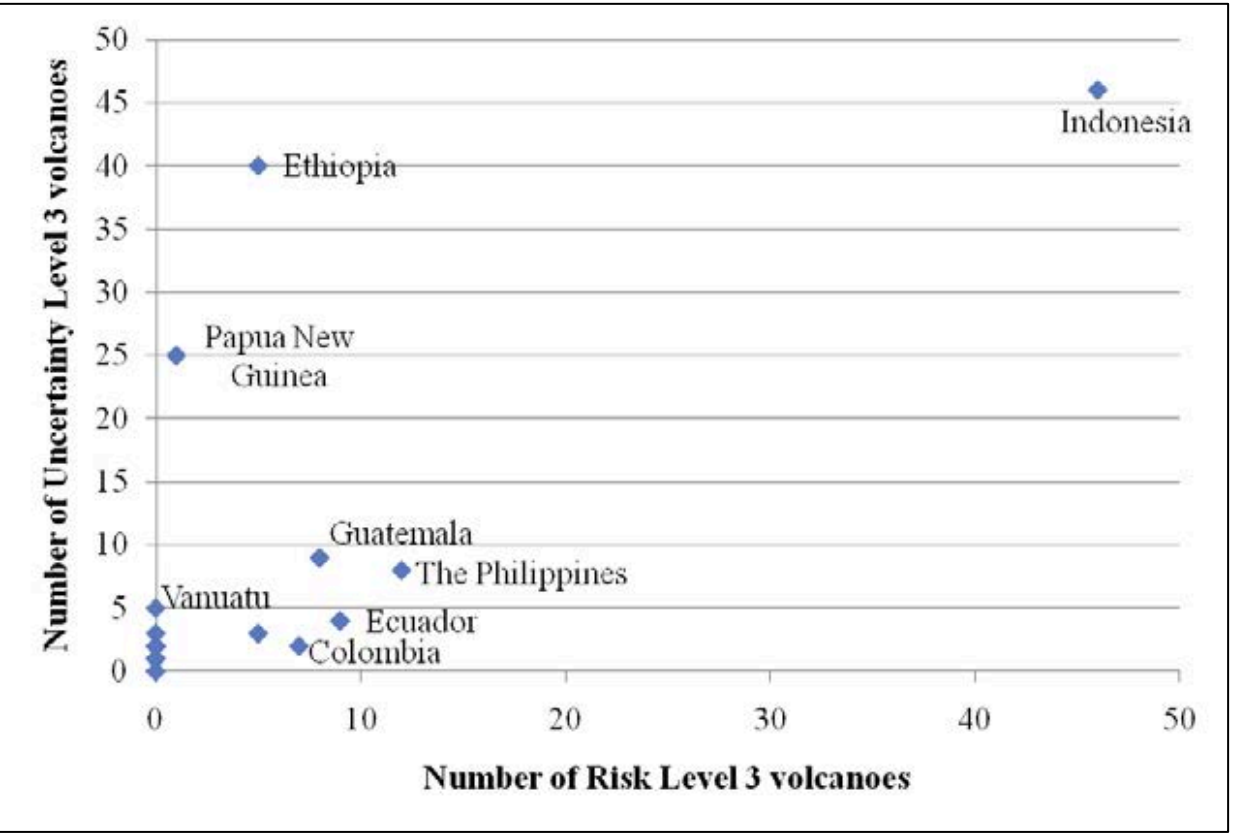
Conclusions

InSAR: Global coverage and high spatial resolution

- Wide range of processes: Individual earthquakes; Seismic swarms; Dyke intrusions; Eruptions; Volcanic unrest.
- Plate boundary scale comparisons
- Identifying areas for detailed, ground-based investigation.
- Hazard assessment of un-monitored volcanoes with poorly-documented eruptive histories.

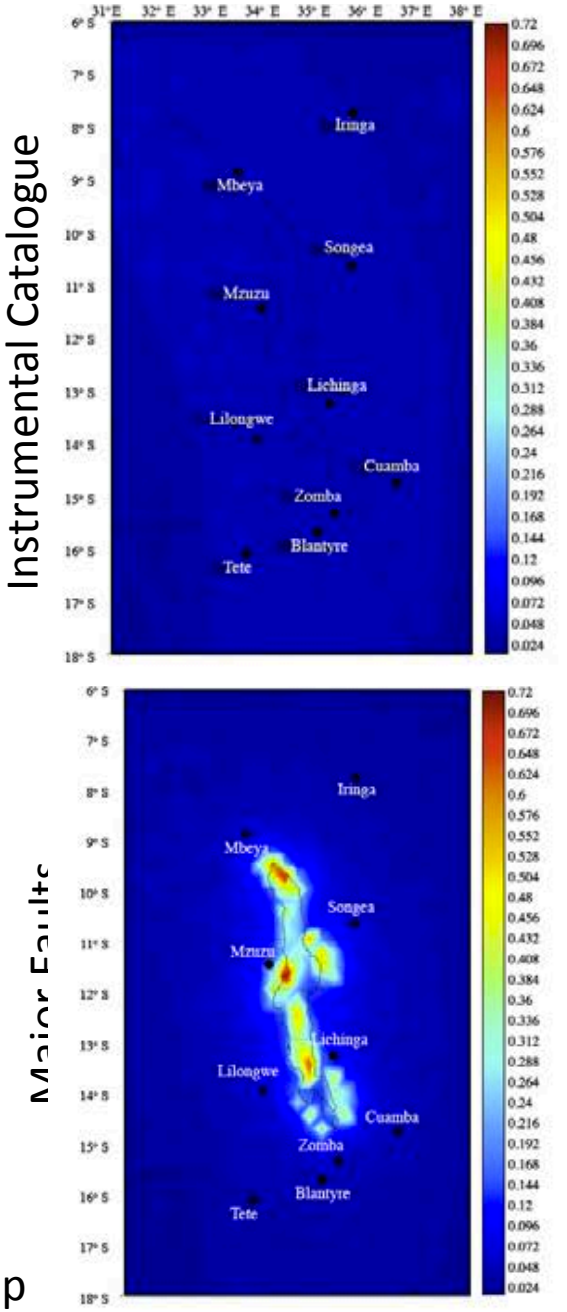
But: Dataset is short
(Envisat 2003-2010).
Expansion with Sentinel 2013-

Hazard Assessment:



Aspinall et al, World Bank 2012

Seismic Hazard Map for Malawi (10,000 years, SA@2s)_.



2000% percent increase when strain accumulation on major faults is included

Hodge et al, in prep