Present-Day Strain Field of Africa derived from the GNSS Velocity Field

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Project IGCP-601

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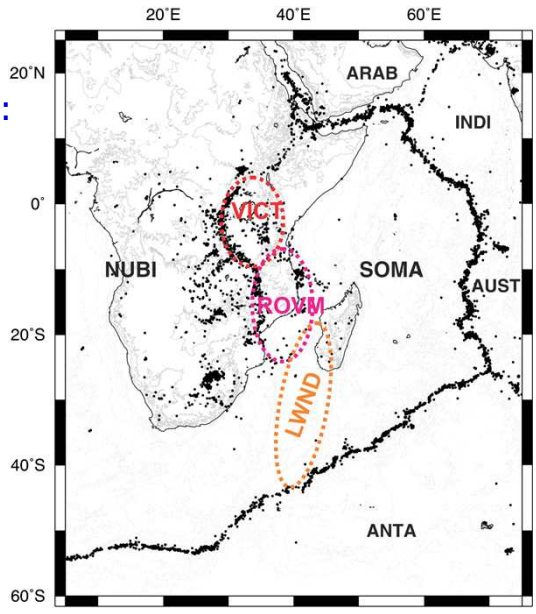
Tectonic Framework – Africa

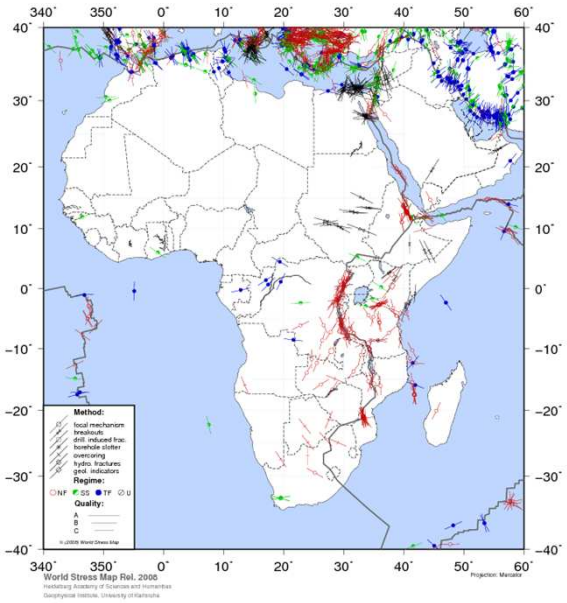
Two major tectonic plates:
Nubia
Somalia
plus some small blocks:
Victoria
Rovuma
Lwandle (?)



after Stamps et al., 2008

Stress map of Africa

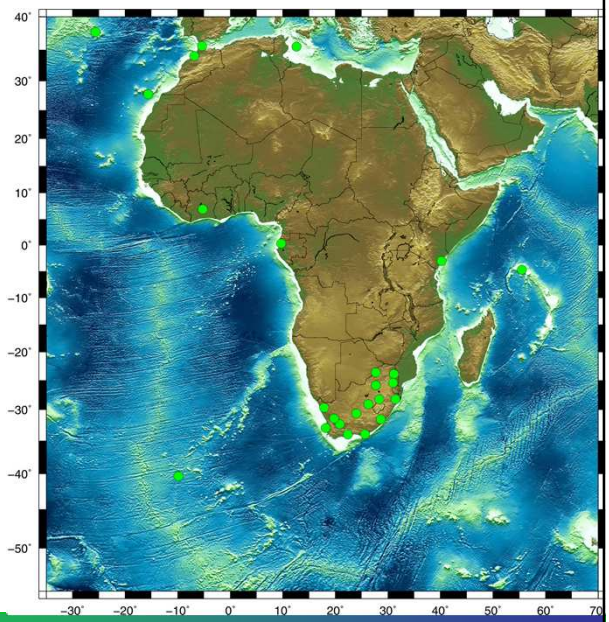
World Stress Map
(1:5,000,000)
of the IUGG - ILP Project



CORS GNSS stations – Africa

With more than 10 years of observations

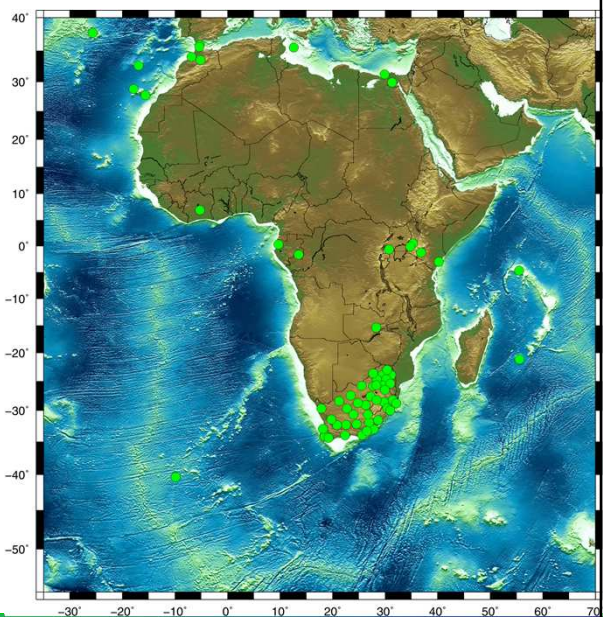
28 sites



GNSS stations – Africa

With more than 05 years of observations

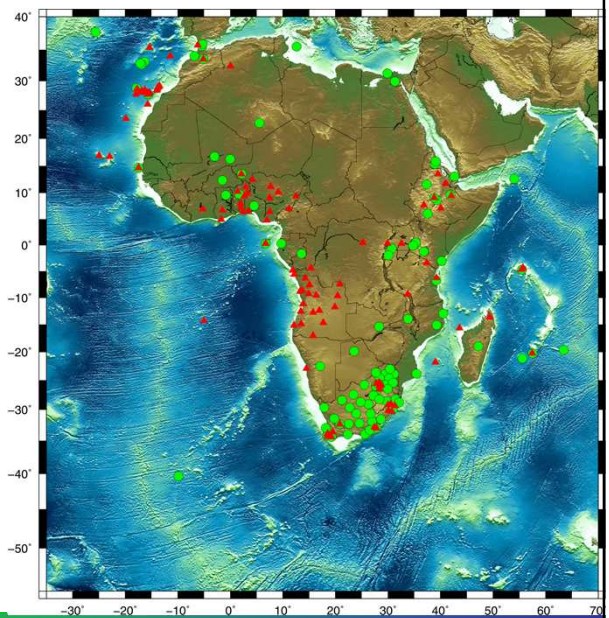
70 sites



GNSS stations – Africa

With more than 03 years of observations

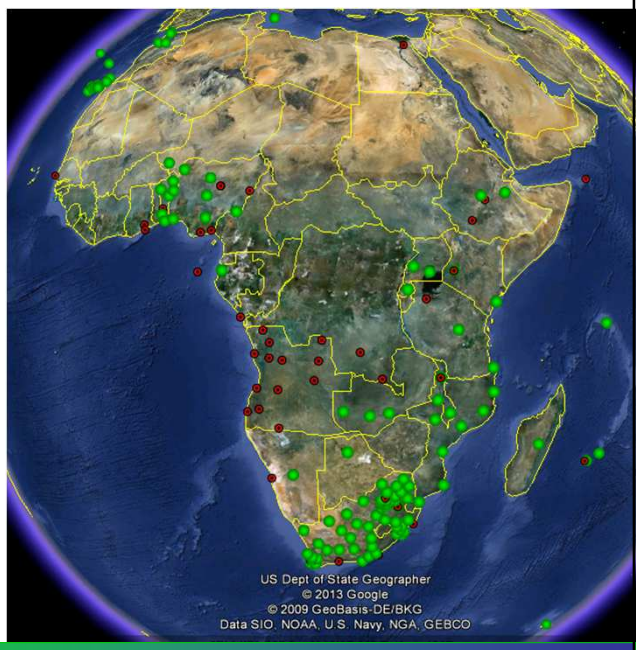
116 sites



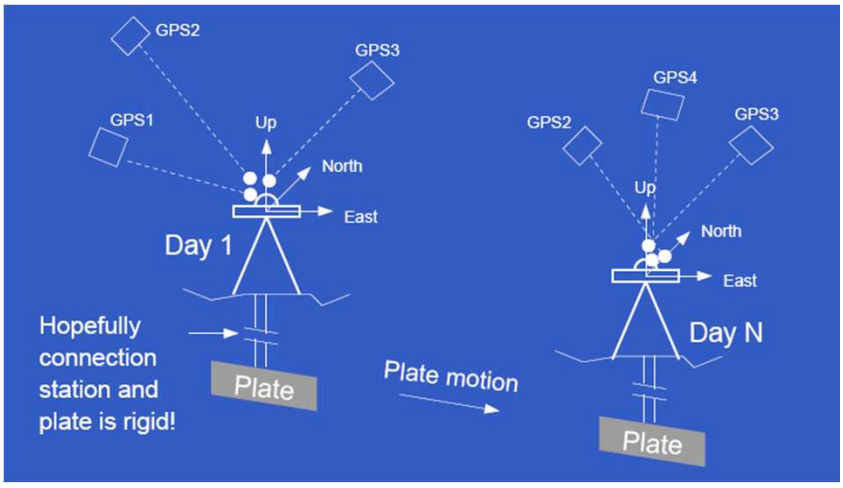
GNSS stations – Africa

Processed data
2012

Oct Nov Dec
All Year

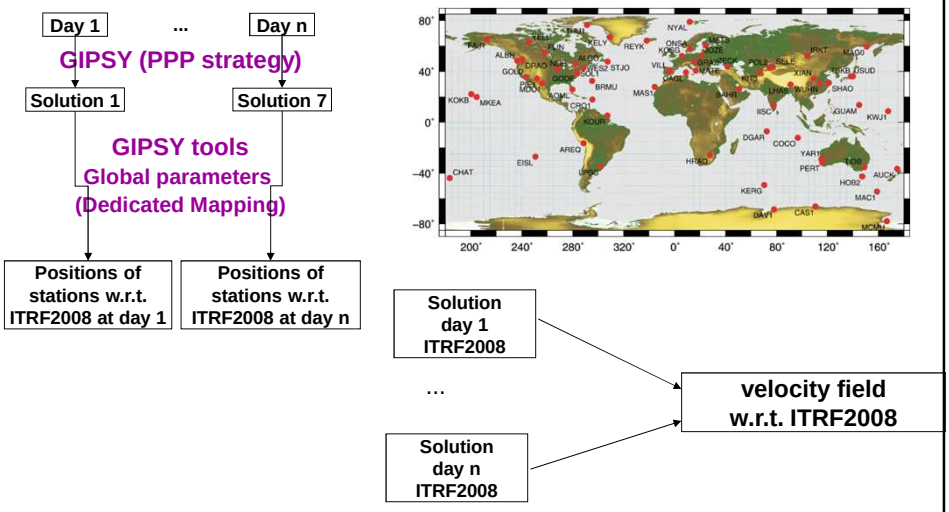


Time-Series
Secular Motion



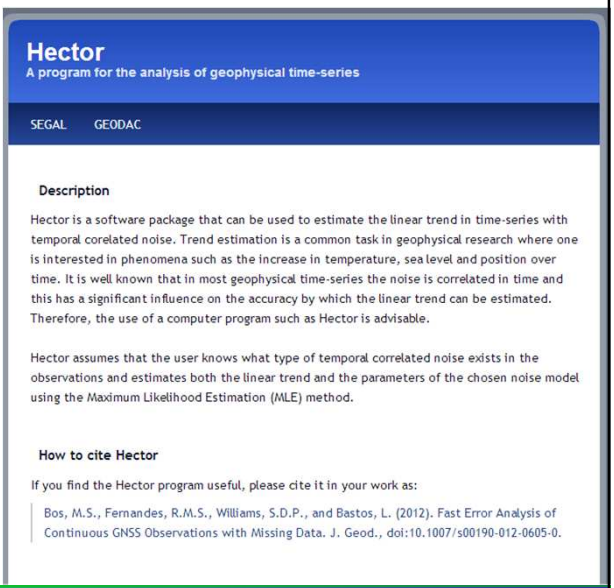
Analysis Methodology GIPSY

Stations

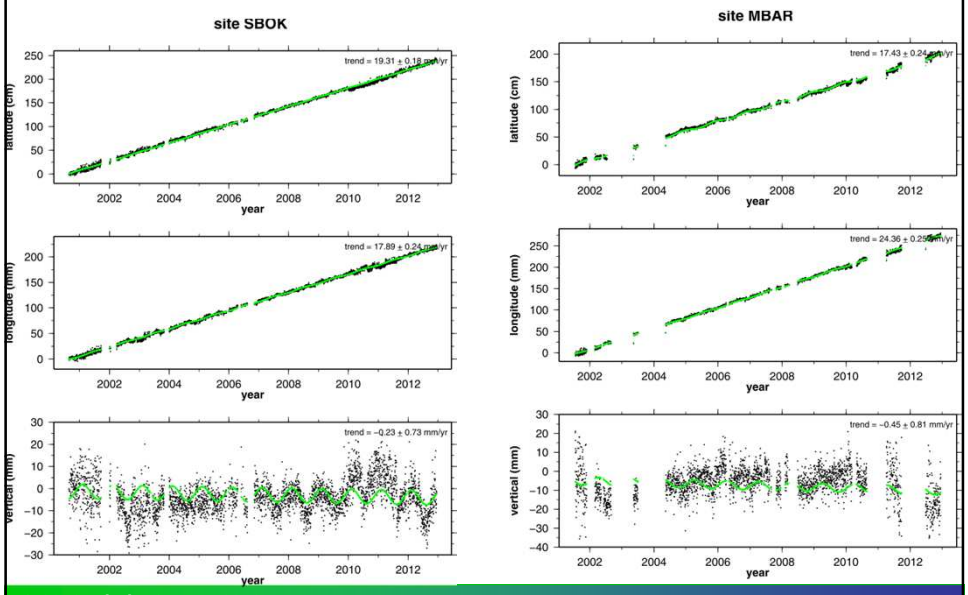


HECTOR – Time-Series Analysis
available at: http://segal.ubi.pt/hector/

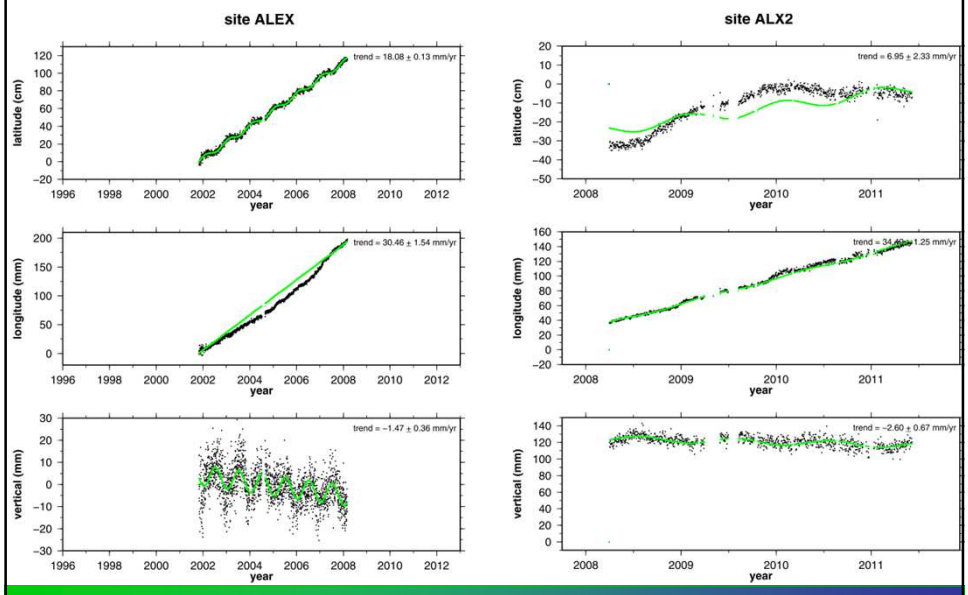
Computation of:
- **Secular Trend**
- **Seasonal Signals**
- **Jumps**
- **Power-law errors**
- **Spectrum Index**



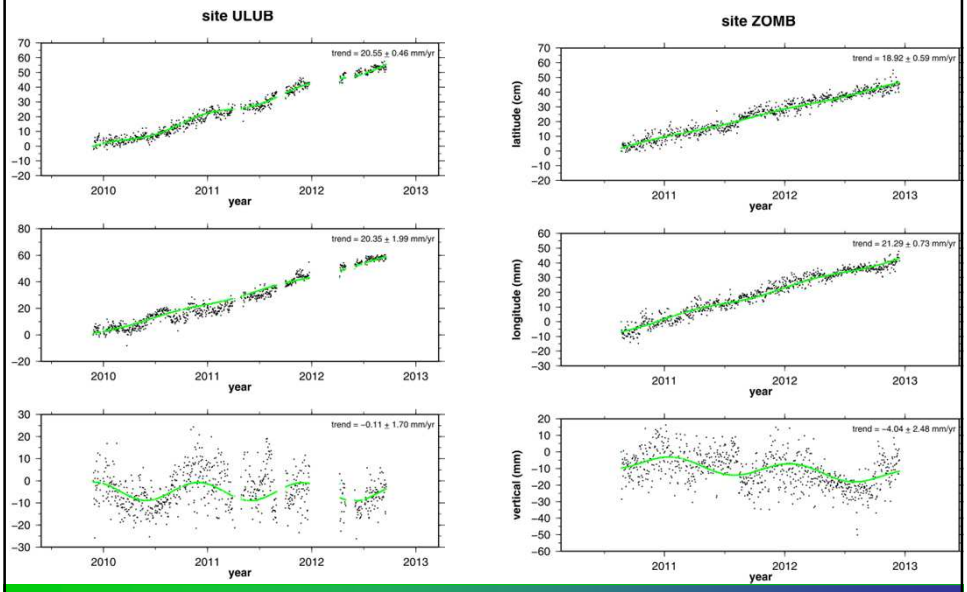
Time-Series
examples



Time-Series
examples

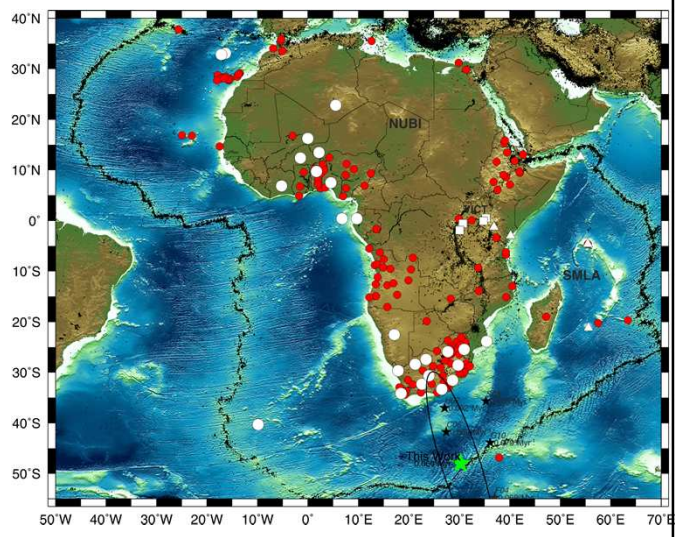


Time-Series
examples – Africa Array



Angular Velocities

Used Sites
NUBI: 25
SMLA: 07
VICT: 05

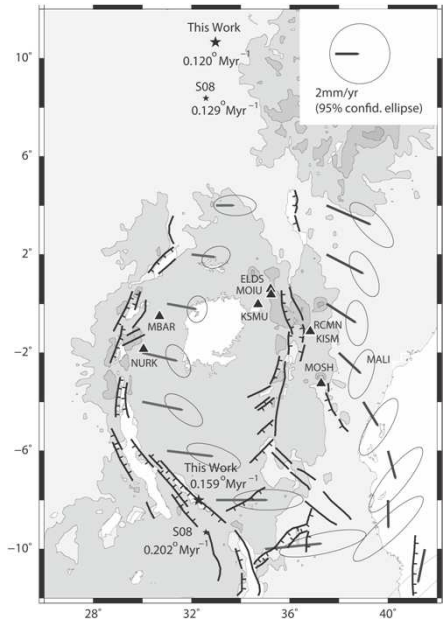


Fernandes et al.
GJI, 2013

Based on stations with more than 3.5 yrs of observations (with the exception of Victoria where sites with the thresold value was 2.5 yr)

Victoria Block

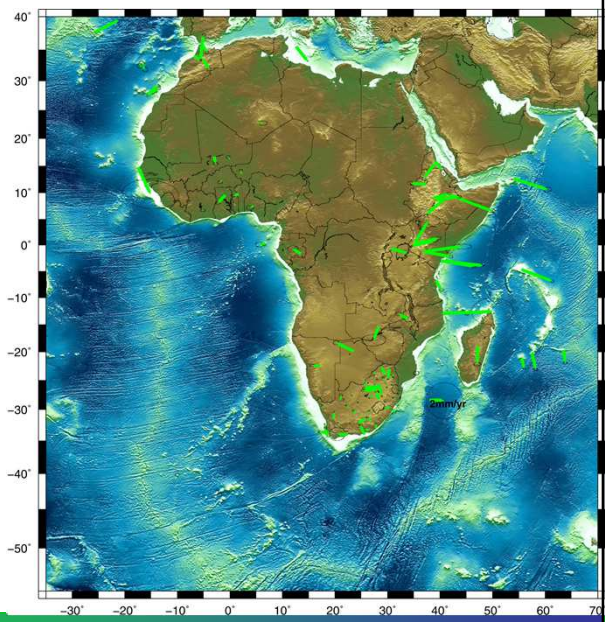
Location of the rotation poles for Nubia-Victoria and Victoria-Somalia plate pairs.
Small black stars indicate the determinations made by Stamps *et al.* (2008).
Relative motions represented by dark grey vectors along the Nubia-Victoria plate boundary are referred to fixed Nubia, while relative motions along the Victoria-Somalia plate boundary are relative to fixed Victoria.



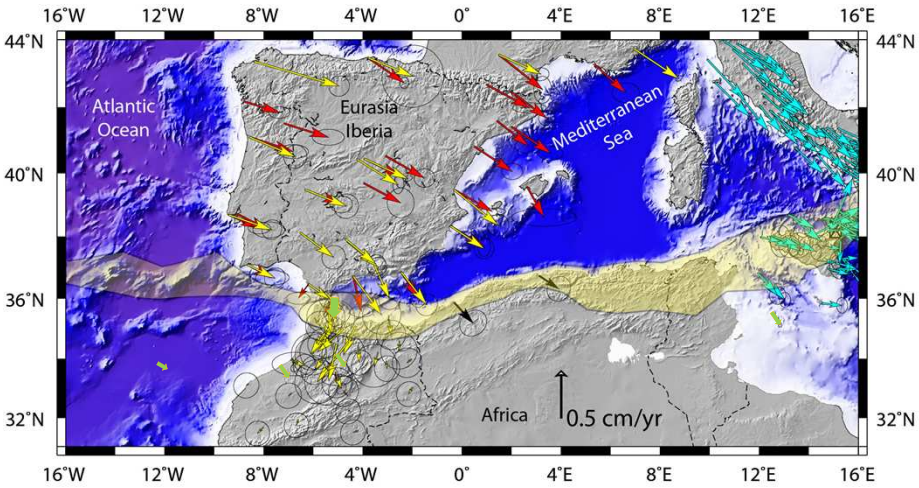
Velocity Field wrt NUBI

For stations with more then 3.0 yr

116 sites



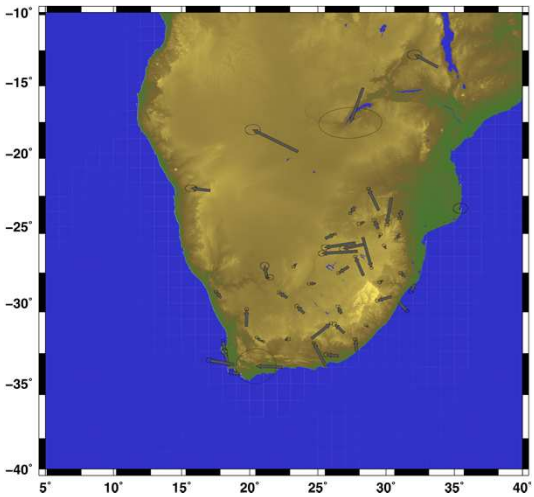
Ibero-Maghreb region
Oblique convergence along the plate boundary



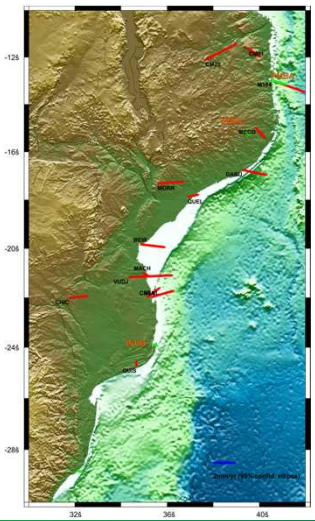
GPS results in North Africa: Yellow: Koulali et al., 2011; Red: Fernandes et al., 2007; Black: Anzidei et al., 2001; Blue: Serpelloni et al., 2007.

[Meghraoui & Pondrelli, 2012]

Southern Africa
Stability of Nubian plate

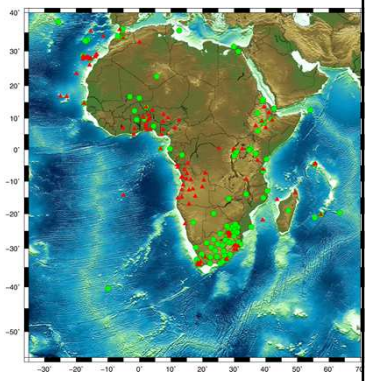


Definition of plate boundary



Westard Motions in Cape Region
Noiser solutions in Joburg area (human/mining?)

Comments on GNSS data



Lack of stations in some areas…

- Sahara (from Mauritania to Sudan)
- West Africa (Senegal, Guinea)
- Central Africa (CAR, DRC)
- North Africa (Libya, Tunisia)

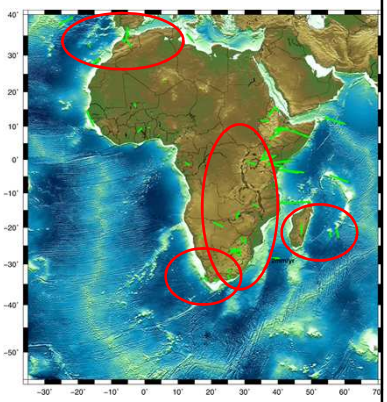
Access to data in many countries

- (e.g., Algeria, Angola)

Confidence on the solutions

- Still need to distinguish between signal and noise
- Some stations show significant data gaps to allow us a robust velocity model

Open Questions on results



Internal plate deformation ?

Important local effects ?

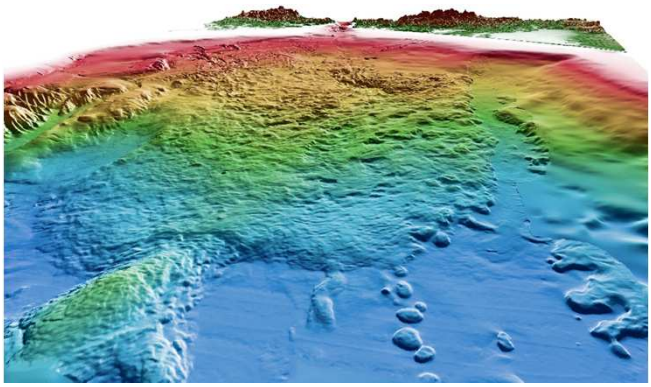
East African Rift block composition ?

Ibero-Maghreb (EURA-NUBI) plate boundary ?

And more and more questions…

(directly correlated with more and more data)

Questions?



Project
IGCP-601