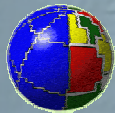


# Current geodetic deformation in the South Africa region

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EGU General Assembly 2009 - Wien

# *The study in the South Africa region*

- Preliminary GPS velocity field;
- Strain-Rate field;

## *? Question ?*

Can we infer some information about the Africa-Somalia boundary at the tip of the South Africa region by the analyzed GPS velocity field?



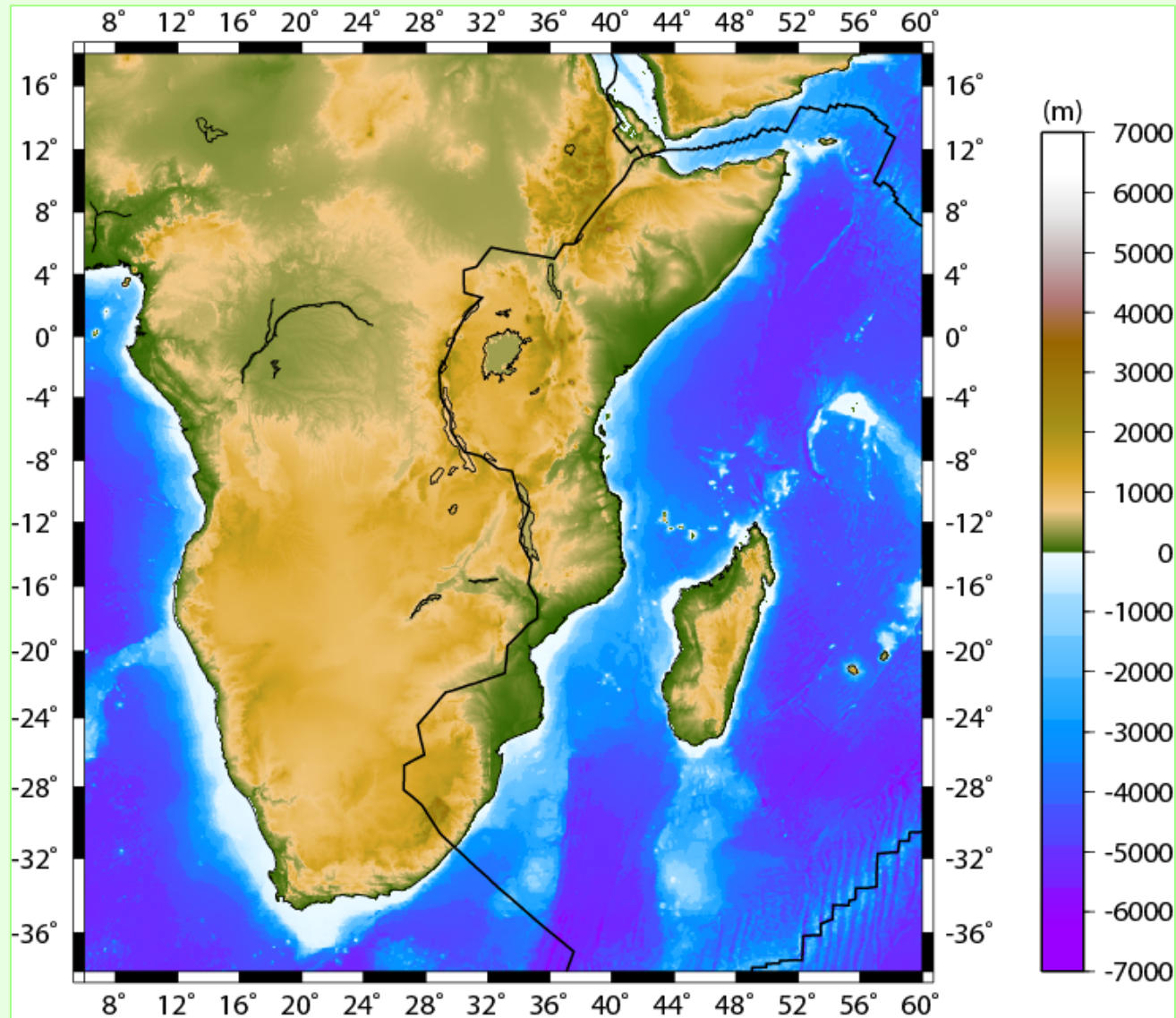


# Plate boundary model

The PB2002 plate boundary digital model, updates the plates from 14 (PB1999 version) to 52.

Model has been retrieved by means of studies on topography, volcanism, seismicity, magnetic anomalies, and geodesy.

*(P. Bird,  $G^3$  2003)*



# Velocity Field

- 107 GPS sites subdivided into 2 clusters of about 60 stations each, sharing 12 common sites.

- Networks analyzed:

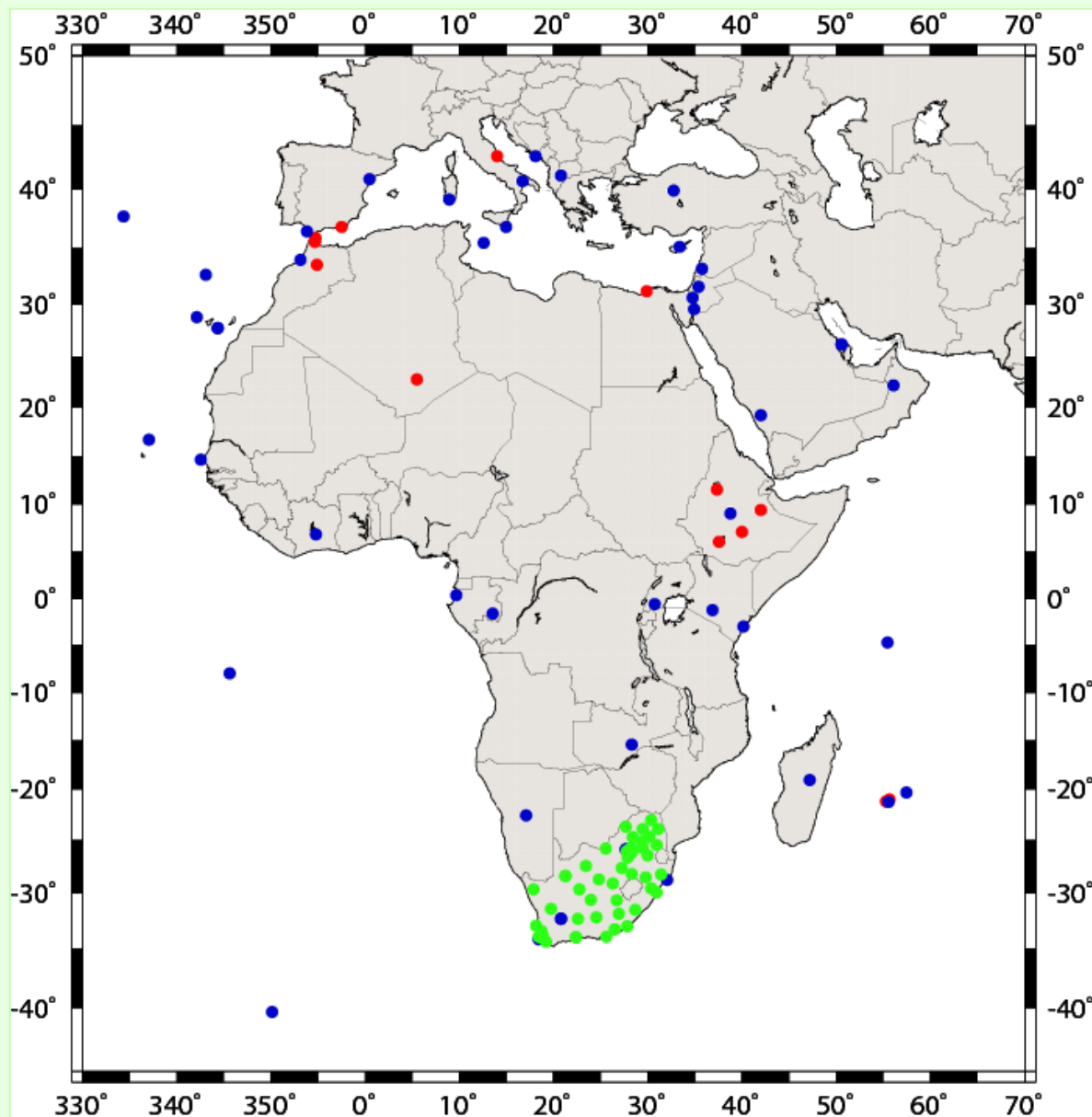
- ✓ TrigNet

- ([www.trignet.co.za](http://www.trignet.co.za))

- ✓ IGS

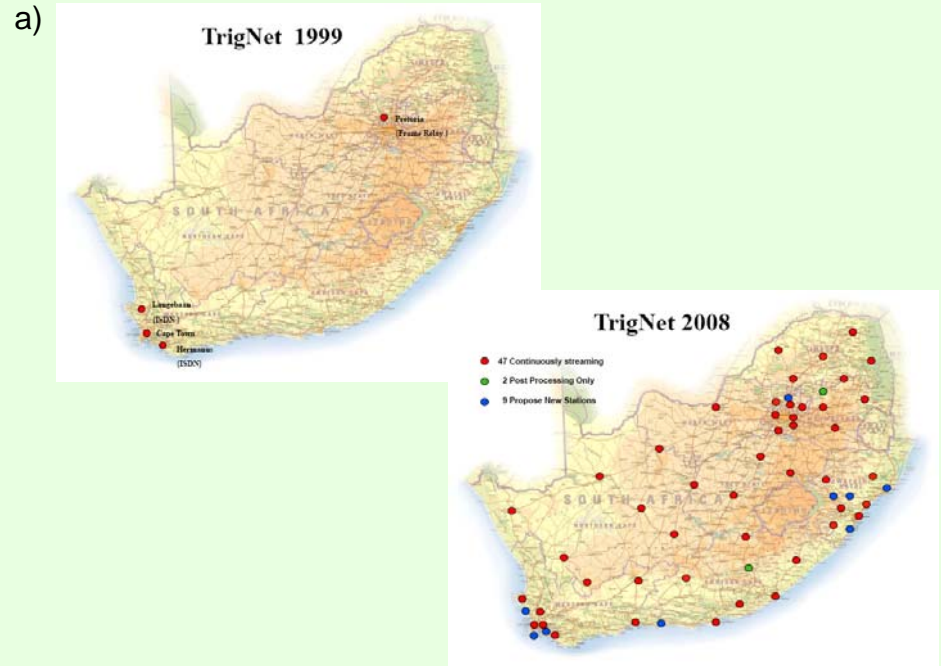
- ✓ OTHER (UNAVCO, RGP)

- Analysis time window 2004 - 2008



# The TrigNet Network

- ❖ TrigNet operated by the Chief Directorate: Surveys and Mapping (CDSM) of the Department of Land Affairs, data available on: [www.trignet.co.za](http://www.trignet.co.za);
- ❖ We consider data from 46 active Global Navigation Satellite System (GNSS) reference stations spaced roughly 200-300 kilometers apart;
- ❖ The network has also been used in scientific studies and experiments involving atmospheric science, space weather and other investigations;
- ❖ Sites informations about receivers and antenna (all provided with radom and mostly ASCHTECH antennas) are available at the <ftp://ftp.trignet.co.za>;
- ❖ 30 sec data in RINEX (Receiver INdependent EXchange) format analyzed.



Figures a) and b) by S. Koch - TrigNet Workshop 2008

Daily RINEX

## Data Processing and analysis

### Data Processing by the Bernese v5.0 software:

- Double difference observables;
- IGS precise orbits and EOP fixed;
- Absolute antenna phase center corrections applied;
- Ambiguity resolution by QIF (Quasi Ionosphere Free) strategy;
- Dry-Niell a priori troposphere model;
- All site coordinates constrained at 10 meters;
- The two cluster solutions are combined into daily solutions using the complete covariance matrix.

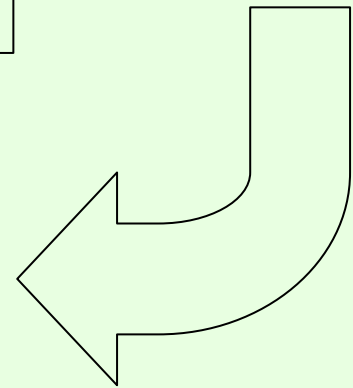
Daily loose coordinates

IGS05  
coordinates  
transformation  
by a 7-parameter  
Helmert  
transformation  
(translations, scale  
and rotation)

Daily IGS05 coordinates

Velocity field  
estimation  
together with  
annual signals and  
instrumental  
jumps

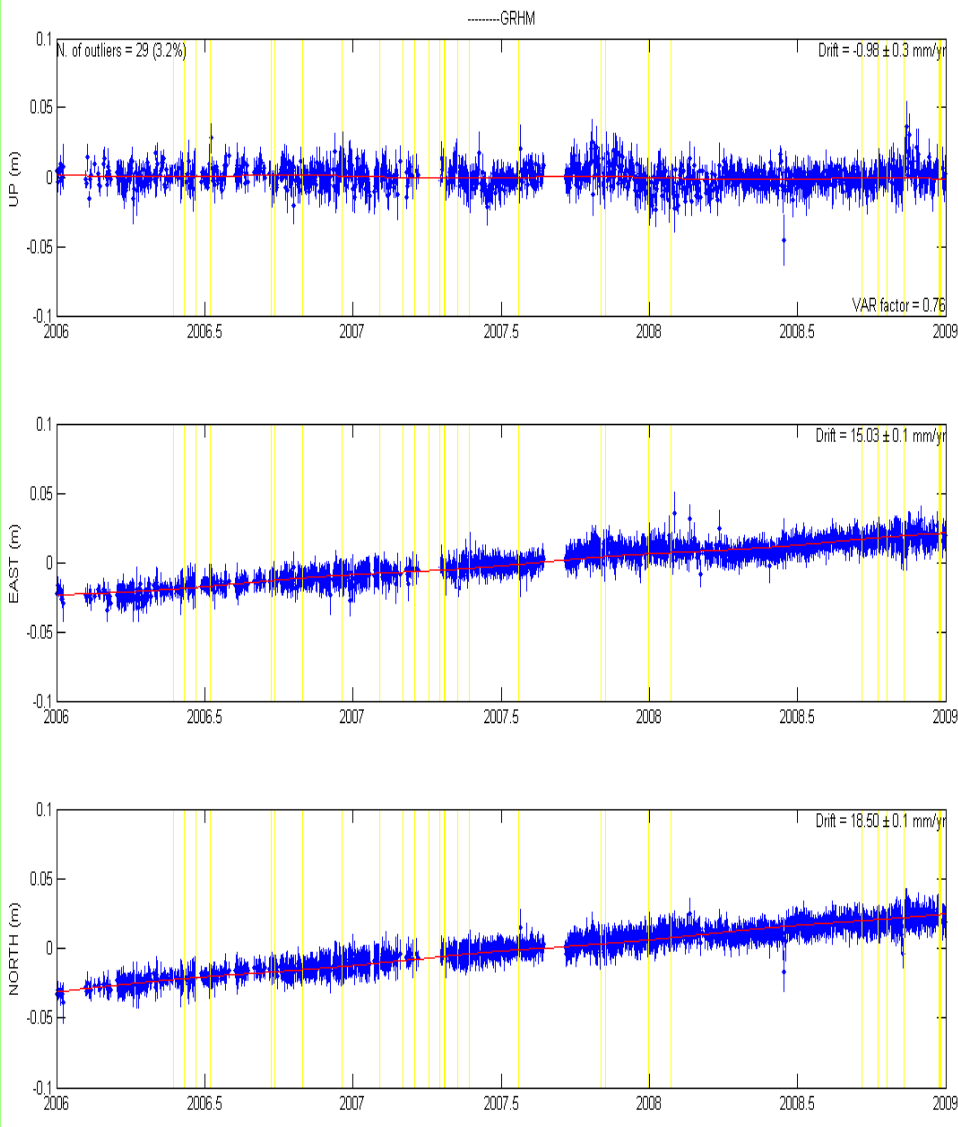
Velocity Field  
in SINEX  
format file



# TrigNet Time Series

IGS05 reference frame

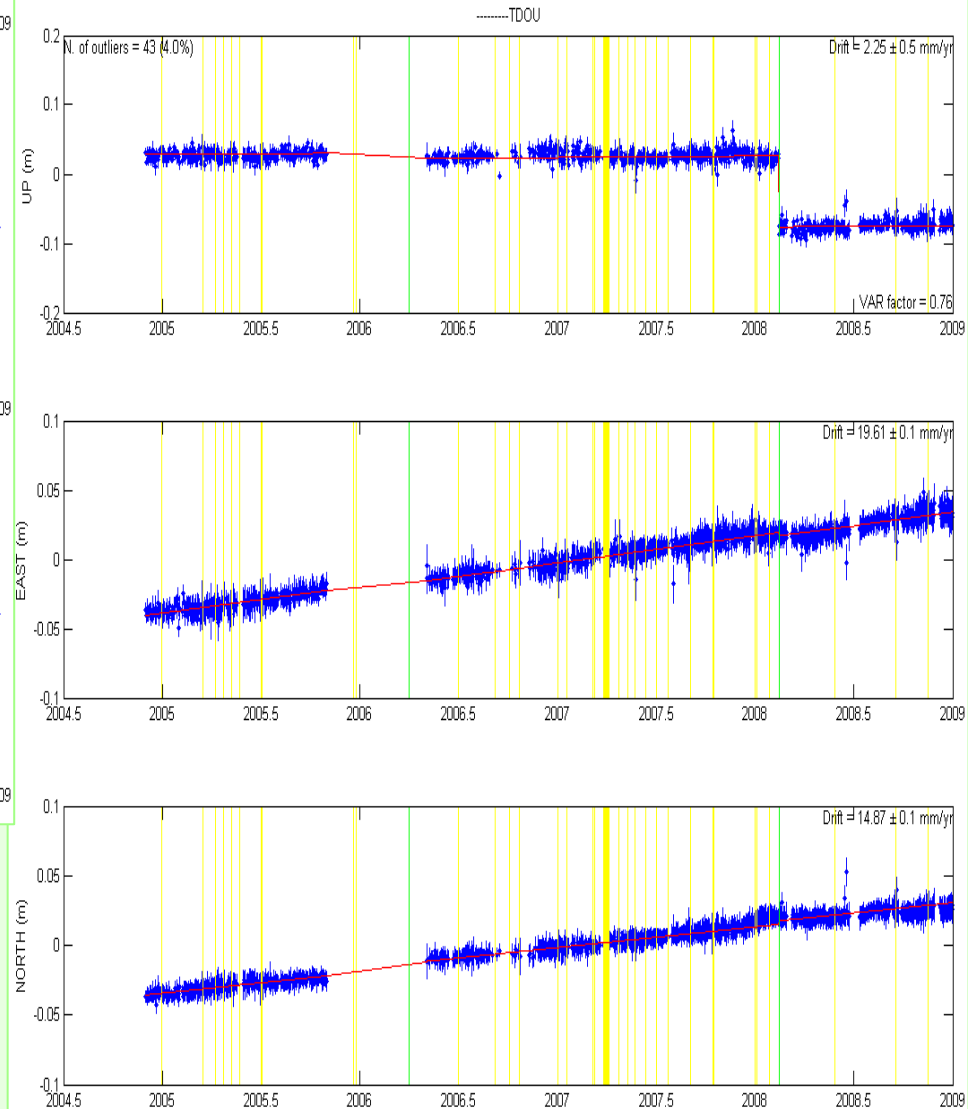
## TDOU - Thohoyandou



## GRHM - Grahamstown

Average WRMS:

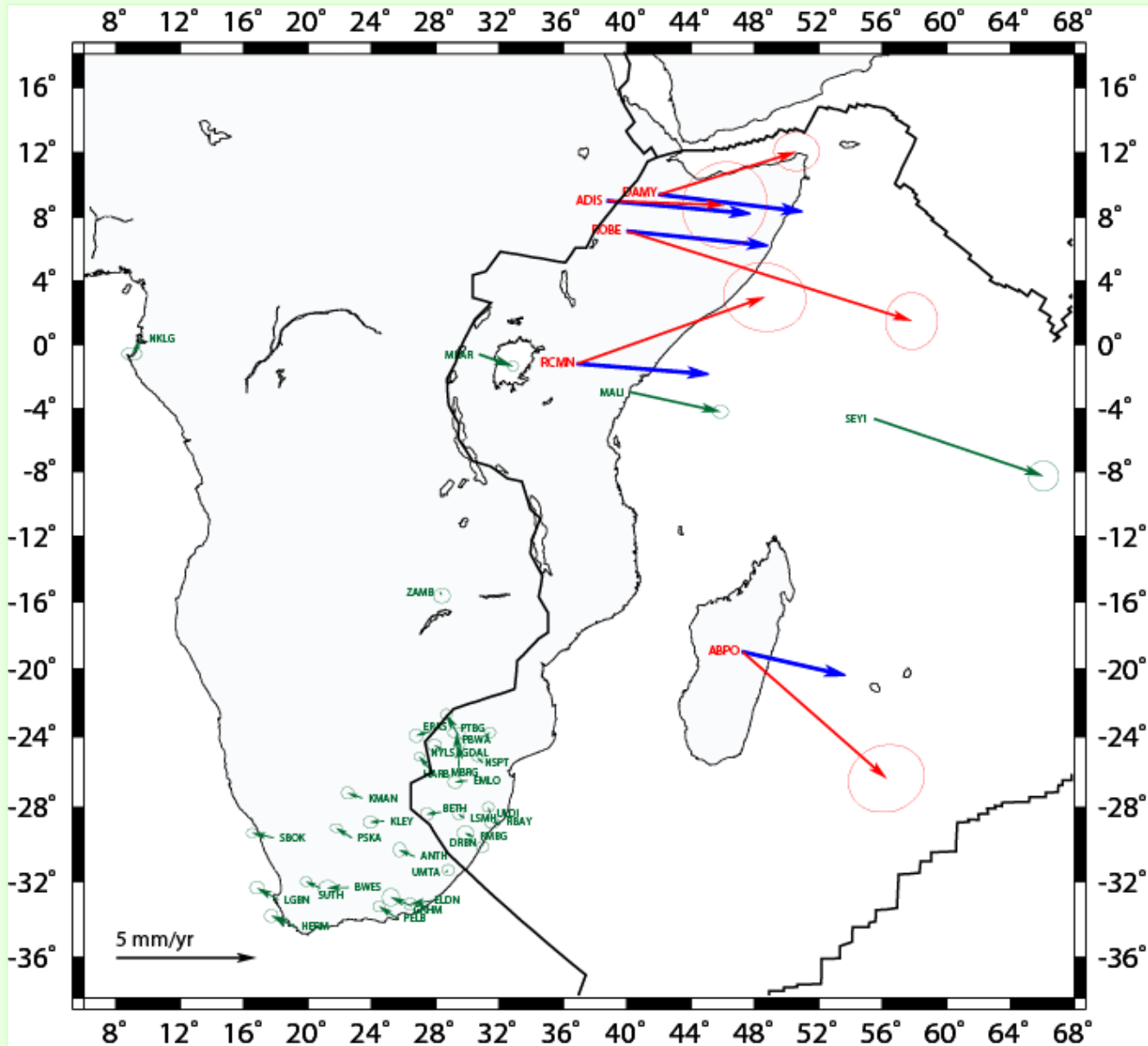
- 2.5-3.0 mm on the planar components;
- ~ 5.0 mm on the vertical component;





# Velocity field of the East Africa & South Africa respect to Altamimi Nubia pole (Altamimi et al. JGR 2007)

- Observed
- Observed (less than 2 years)
- Somalia Modelled

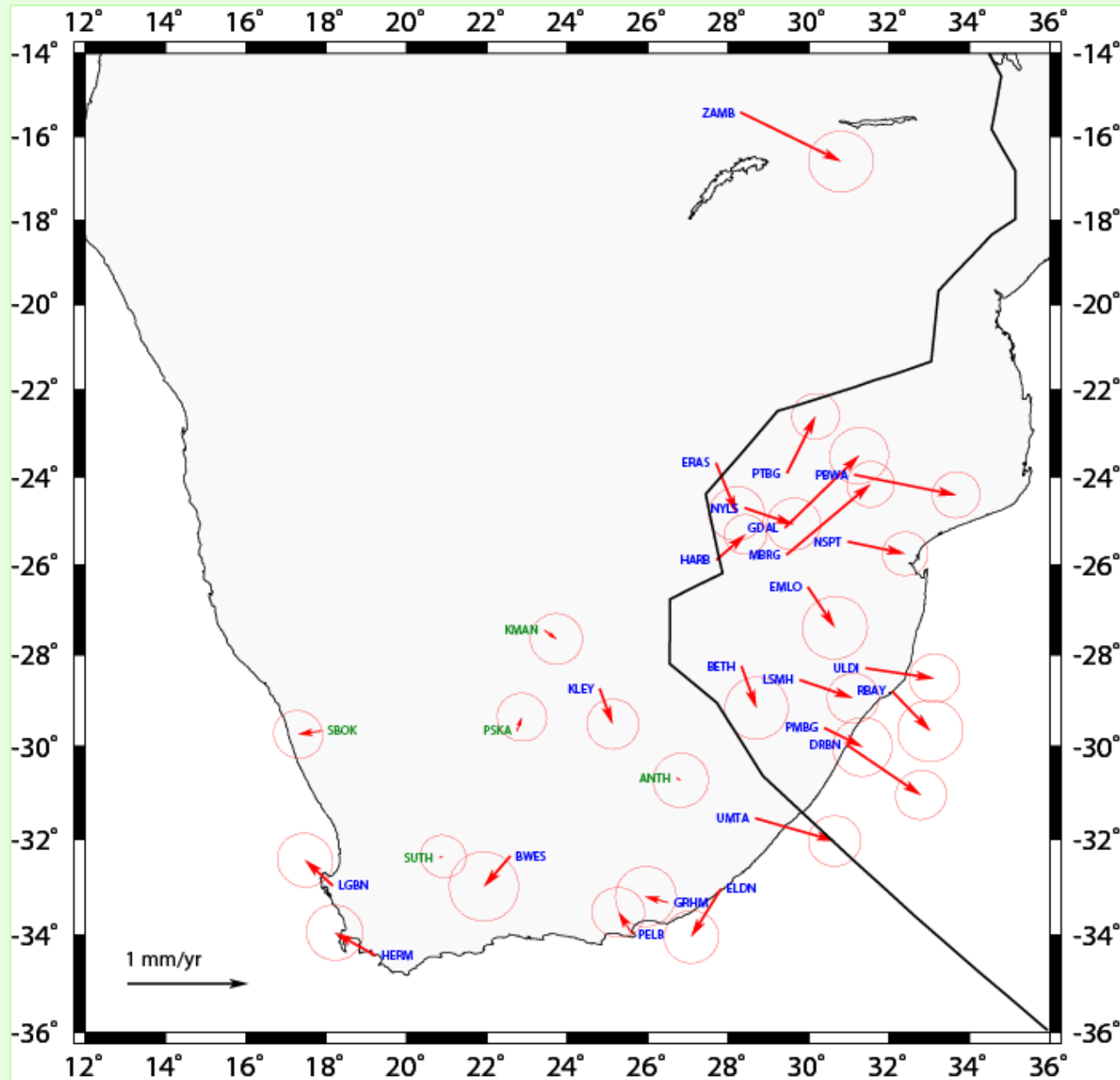




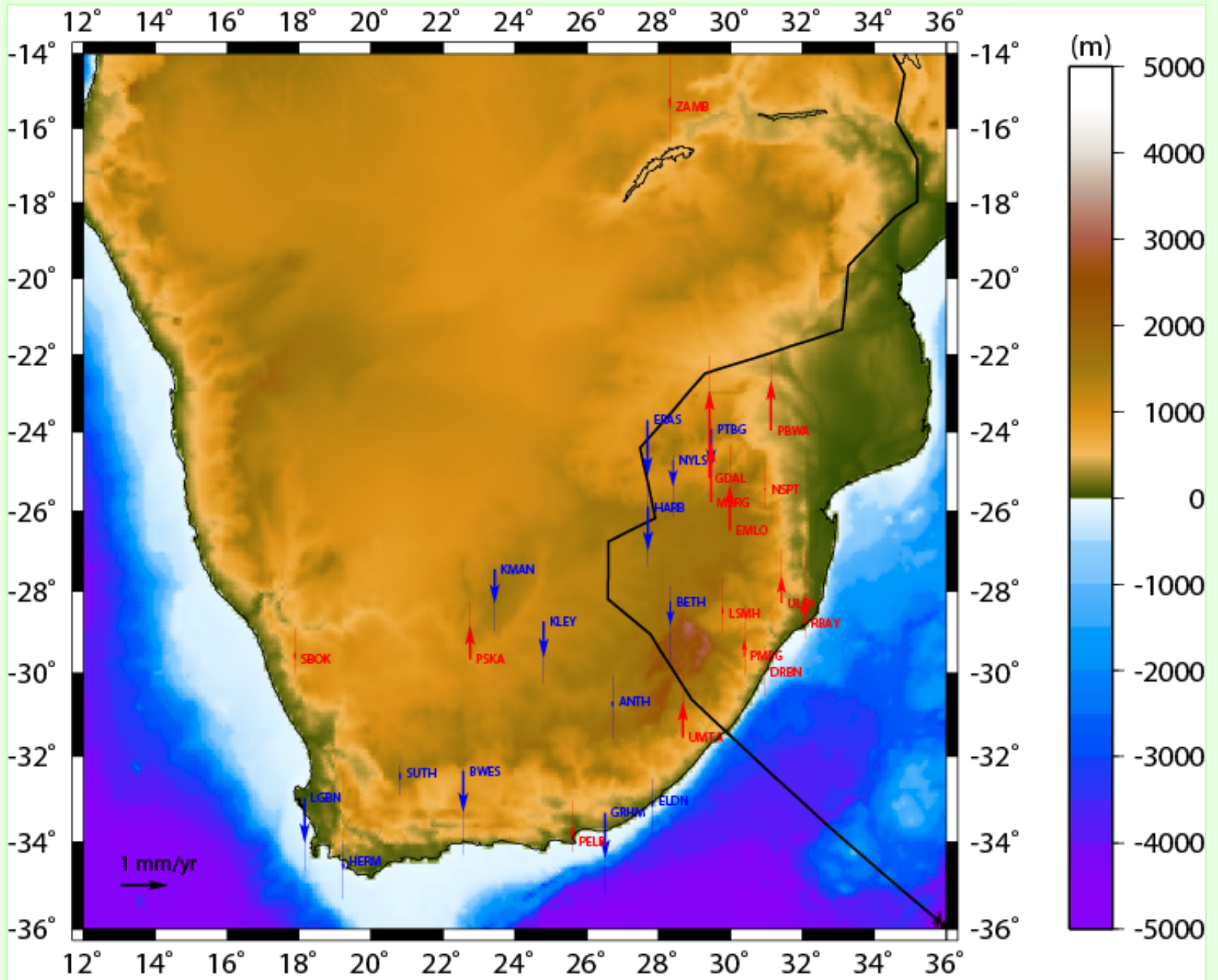
# Velocity field in the South Africa

● South Africa  
Euler pole  
 $0.2636 \pm 0.004$  °/Myr

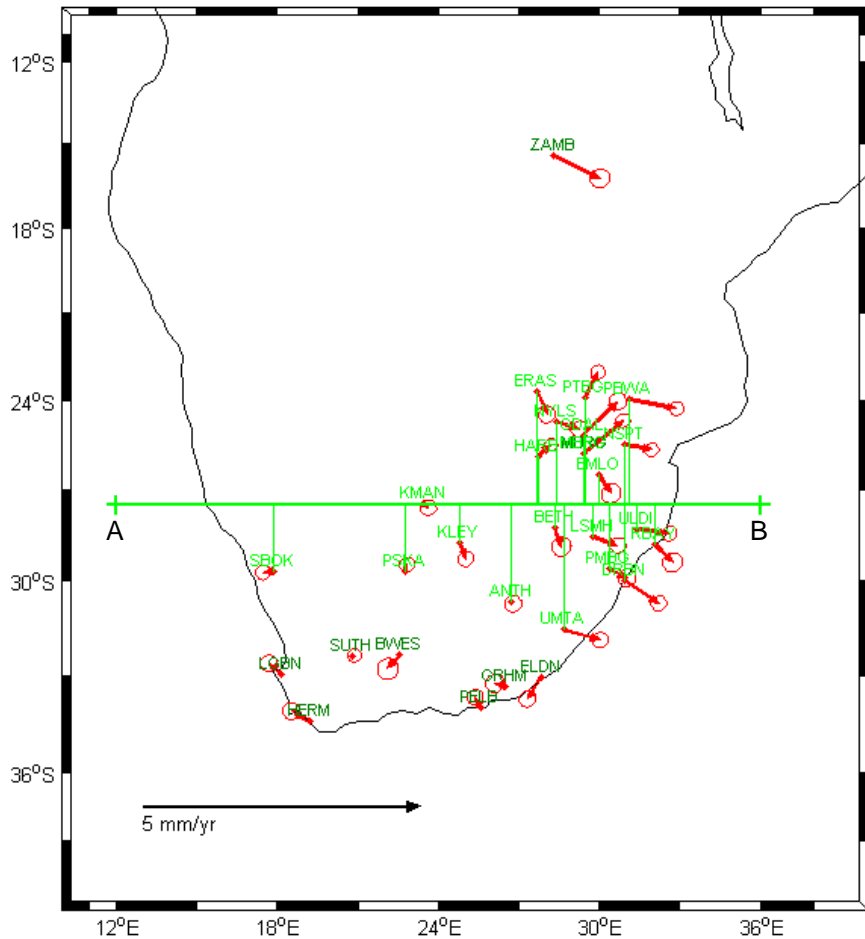
TrigNet and IGS  
(HARB, RBAY,  
SUTH, ZAMB) sites



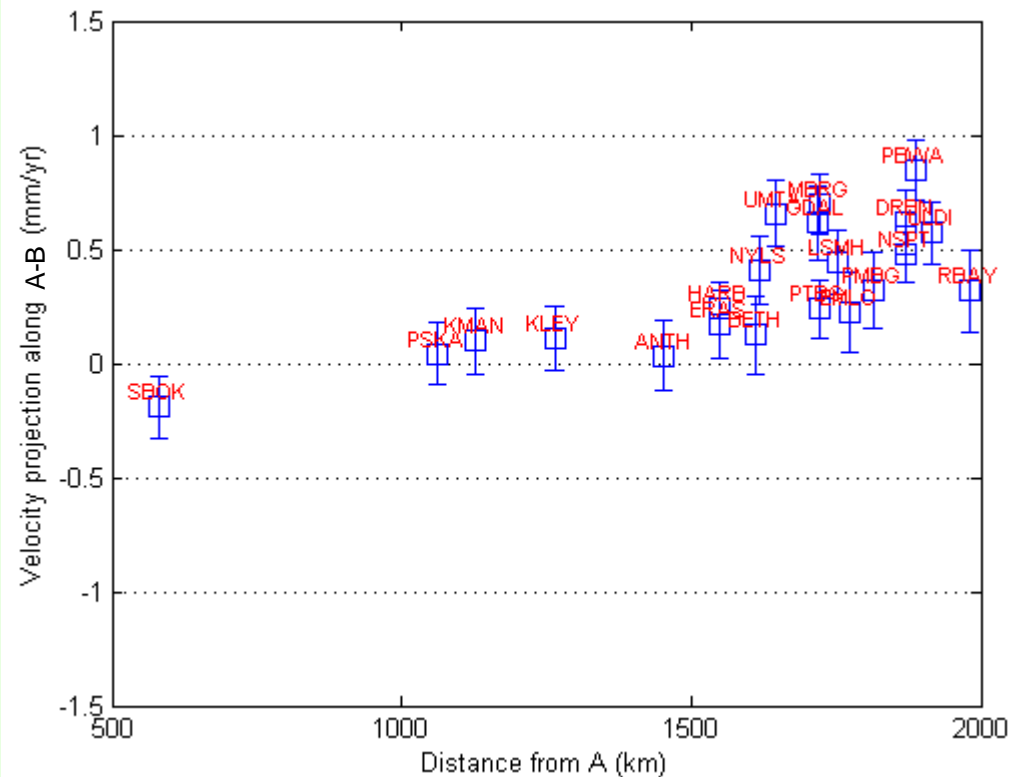
# The UP component of the velocity field



# Velocity profile in the South Africa



- Profile AB
- Distance from AB= 500 km



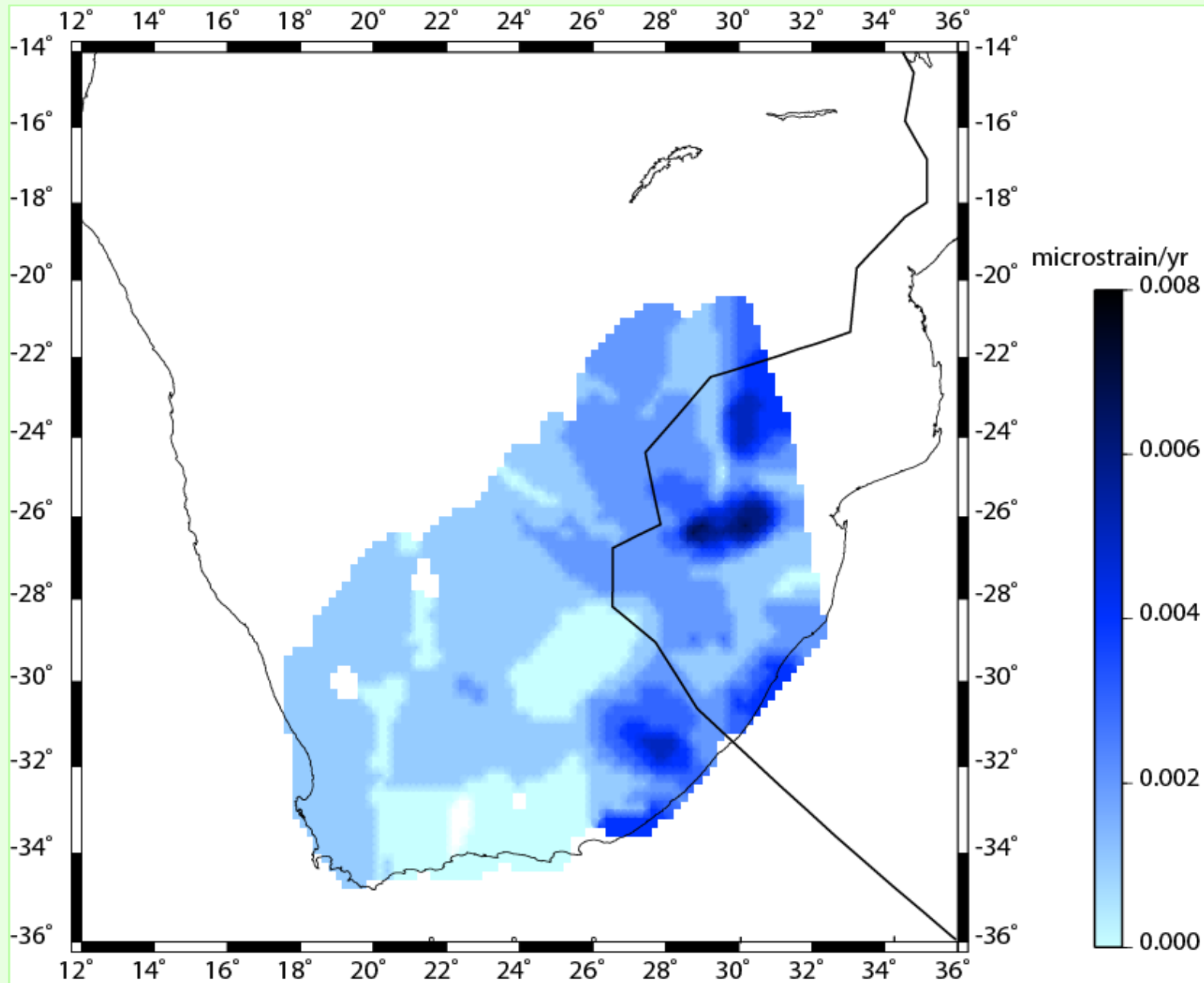


# *Strain-Rate field by means of the algorithm of Shen*

*(Shen et al. JGR 1996)*

- Strain-Rate on a regular grid;
- Strain-Rates on each grid node;
- Weight of each GPS site to the Strain-Rates on the spots:  $\sim \exp\left(-\frac{\Delta R^2}{D^2}\right)$

# *Extensional component of the strain-rate*



# *Summary and Conclusions*

- Preliminary velocity field analysis in the time window 2004-2008
- Map of the strain-rate field of the South Africa region

The GPS velocity field shows an eastward drift of the tip of South Africa region at the 1 mm/yr level.

## *Future Step:*

Increase the time series of the analyzed GPS sites in order to estimate more stable velocity solutions.



A satellite-style map of the Mediterranean region, showing the Italian peninsula, the Balkans, and the surrounding seas. The text "Thanks for your attention" is overlaid in a large, blue, sans-serif font with a white outline.

# Thanks for your attention

## Acknowledgment

This work is supported by *SIGRIS - Sistema di osservazione spaziale per la Gestione del RIschio Sismico*, an Italian Space Agency project.