Christian-Albrechts-Universität zu Kiel
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Crustal structure of the west and central African rift zone

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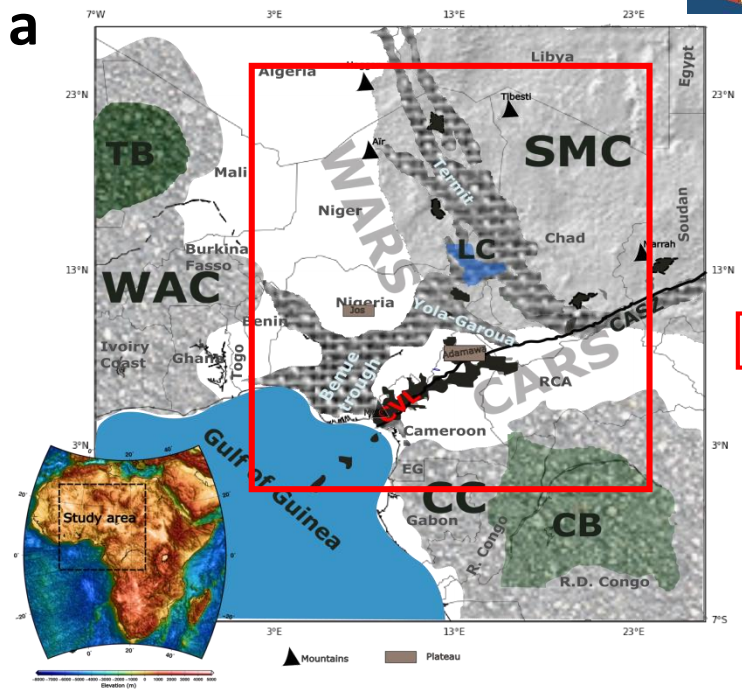
Introduction

- Conducting gravity and magnetic study to delineate variations in crustal density and magnetization.
- This study is intended to provide valuable information about the composition and thickness of crustal layers, as well as the presence of subsurface structures like fault zones and volcanic features, also about the evolution of rift basins in the area.

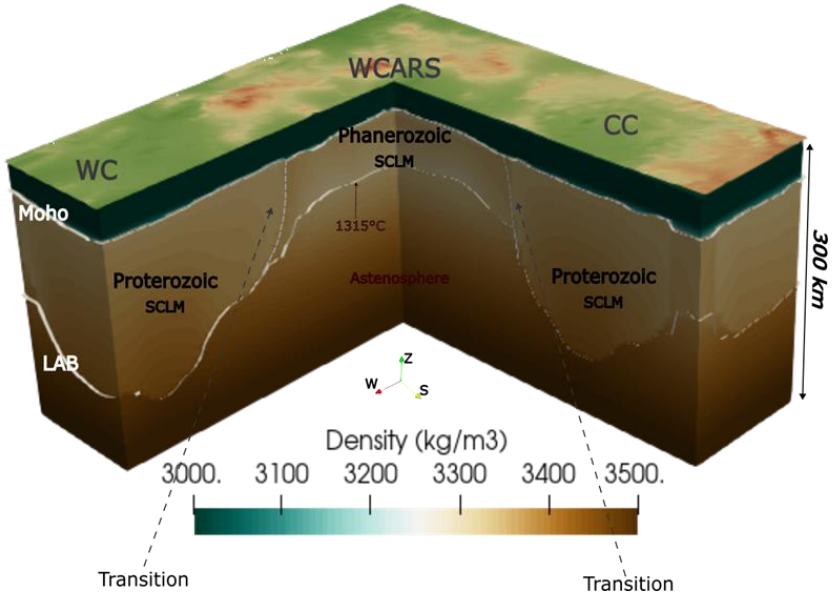
a



New study area

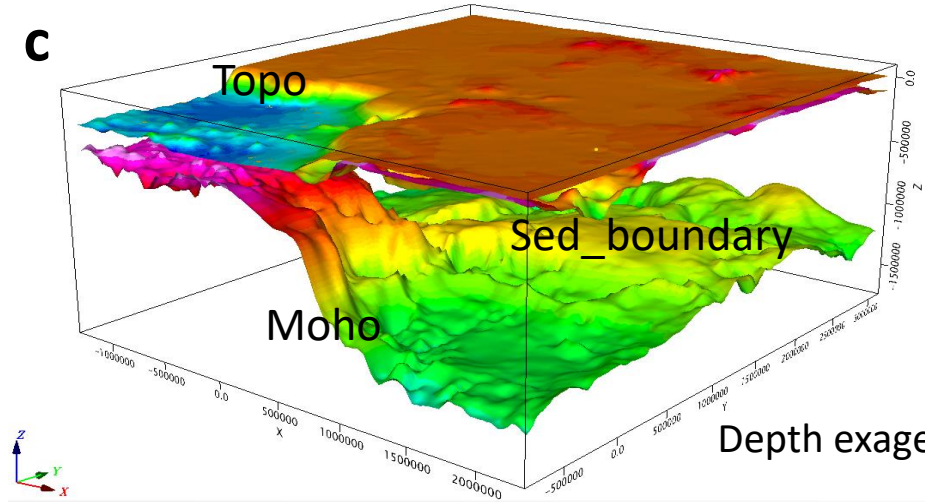
Previously done

b



Lithospheric structure

c



Zoom inside the crust

Depth exageration: 35

Data

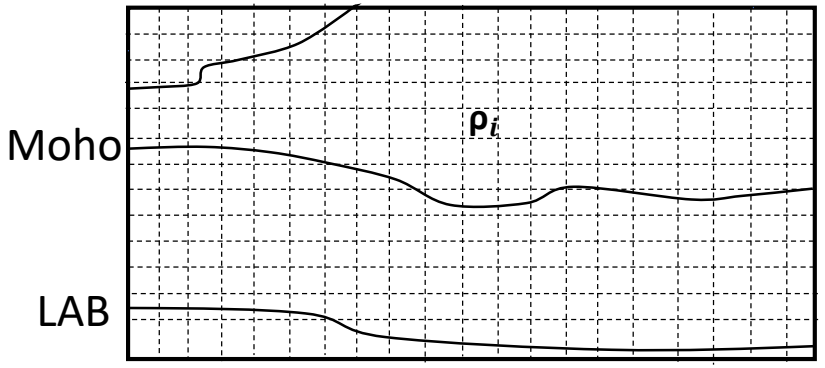
Free air anomaly (XGM2019e) —Tesseroid→ Bouguer anomaly

Crustal contribution = Bouguer anomaly - $f(\boldsymbol{C})$

$C = A - B$

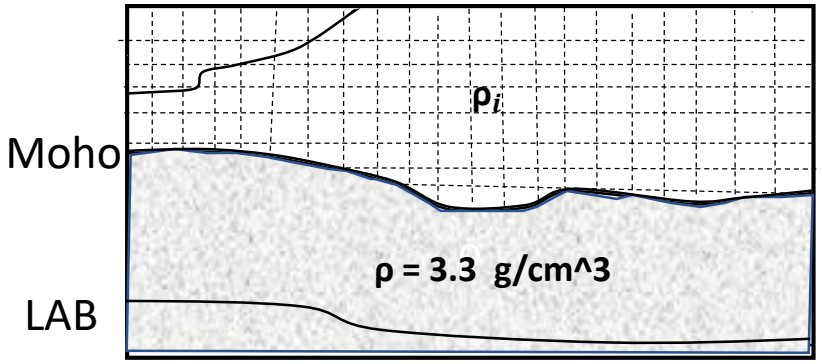
f : forward calculation

A



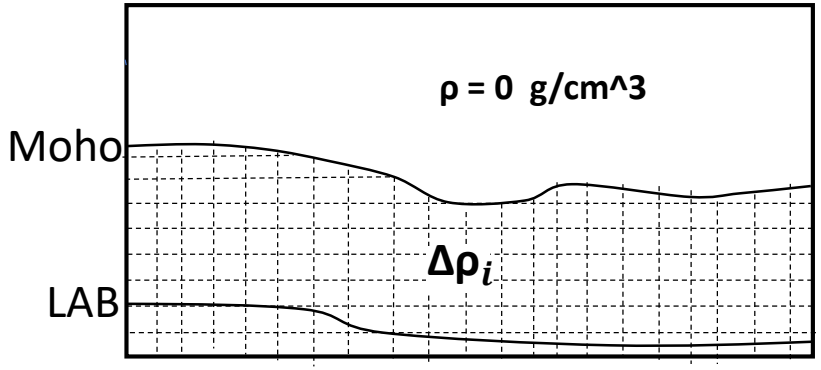
Density distribution from our lithospheric model

B



The density inside the lithospheric mantle is replaced by 3.3 g/cm^3 as reference value

C



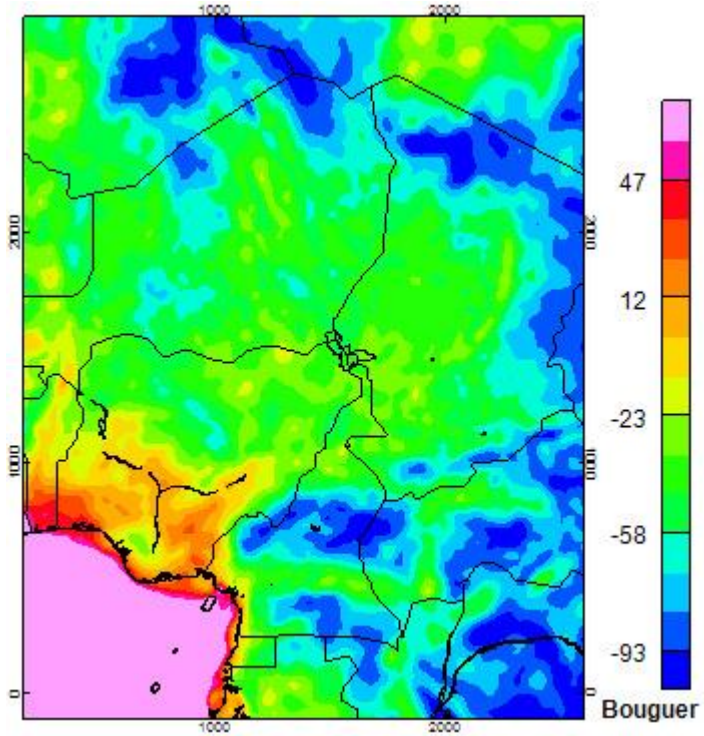
Distribution of density anomalies inside the lithospheric mantle

Data

- Sediments thickness is from Crust 1.0 model.
- Moho depth is provided by our previous 3D modelling of the lithosphere in the area.

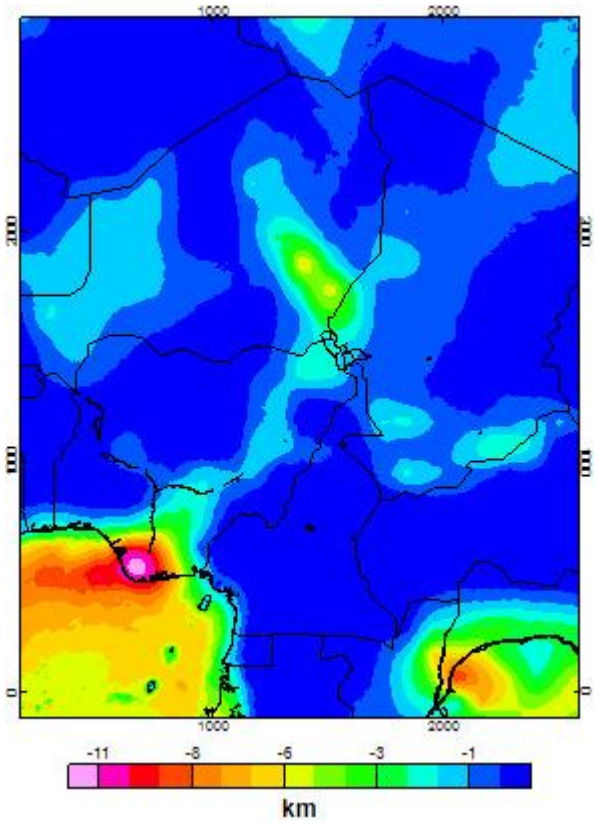
Densities for inversion
- Sediment density: 2.55g/cm^3
- Density below Moho: 3.3 g/cm^3

A



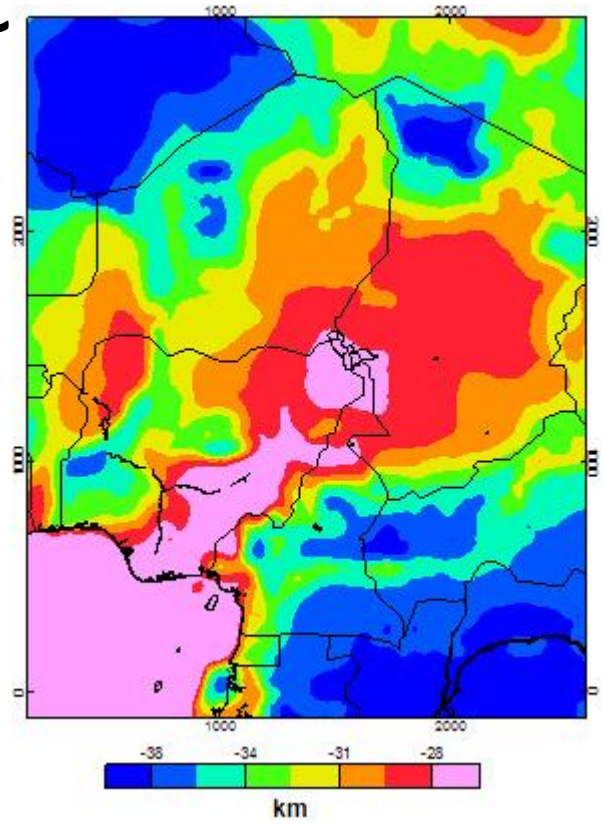
Crustal contribution in term of Bouguer anomaly

B



Sediments bottom

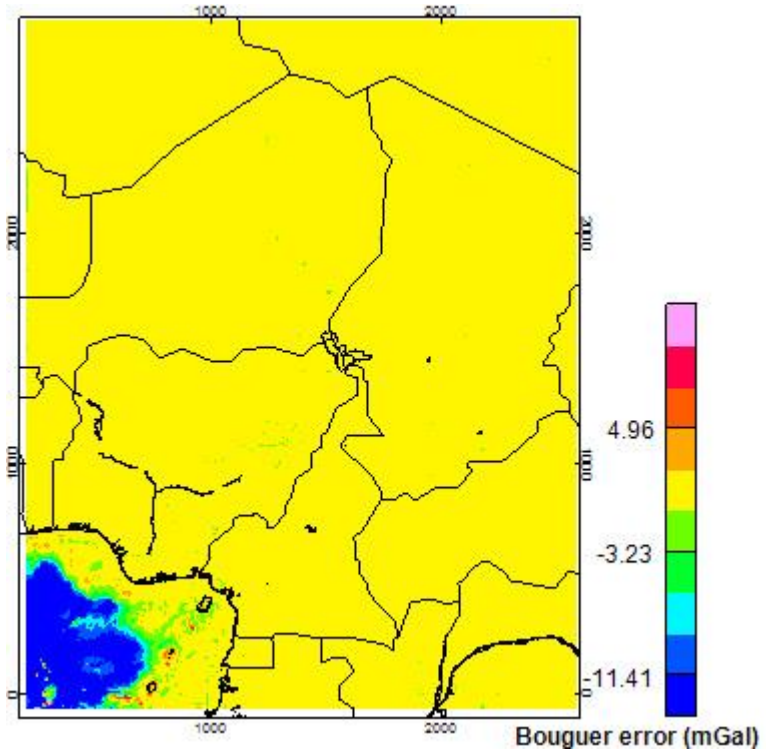
C



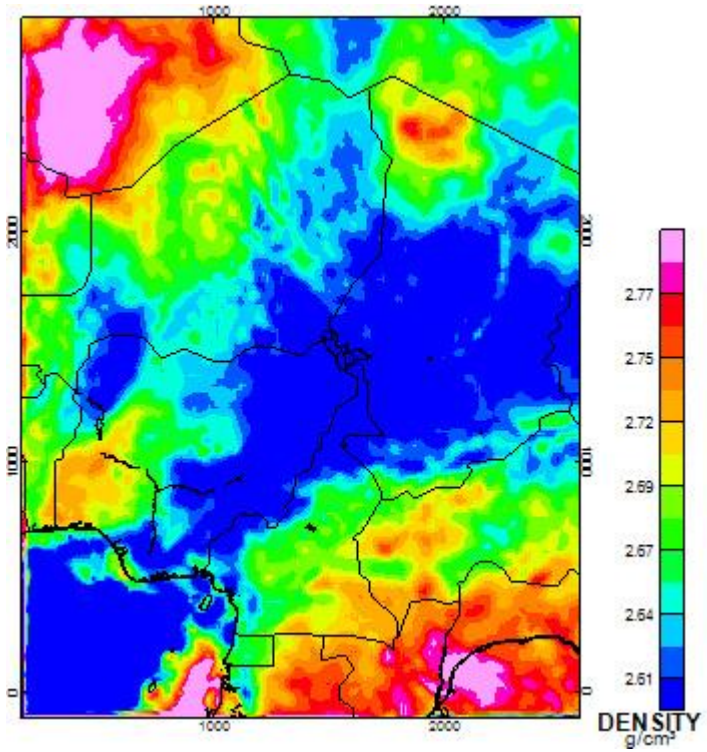
Moho depth

Modelling process

- Good agreement between observed and modelled Gravity anomaly
- Unexpected distribution of density.



Bouguer Misfit



Modelled density

Lower cross density

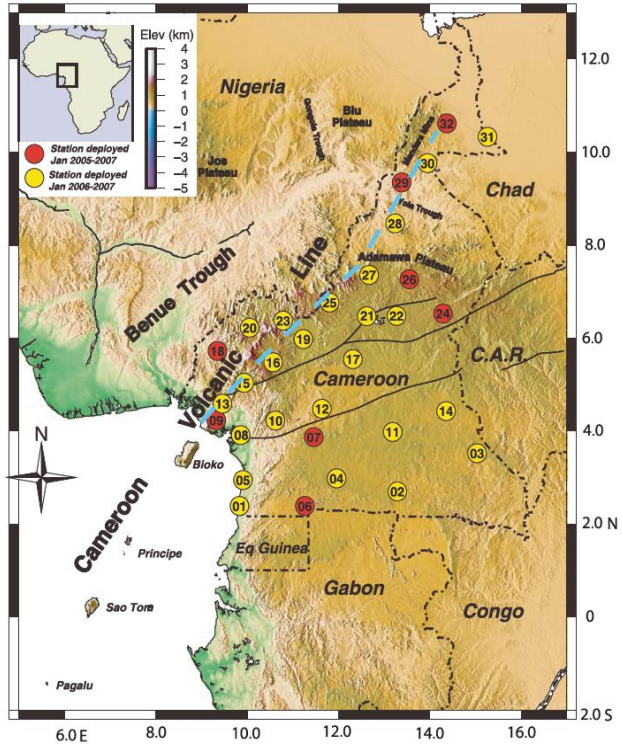
Available Vs have been converted into density. The correlation between the density of the lower crust and the Moho depth has been used in order to interpolate the density values across the entire study area.

Zoback and Moomey (2003)

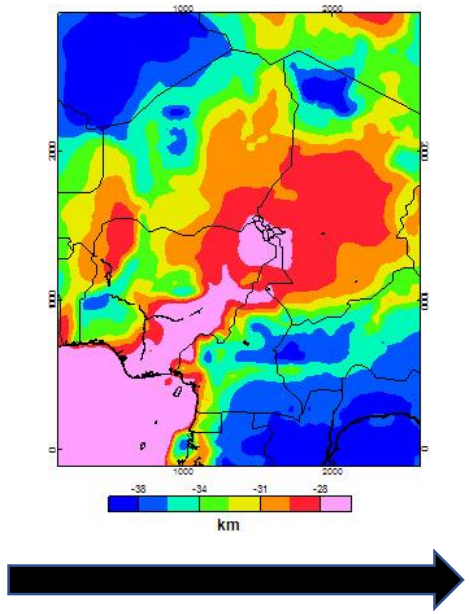
$$\rho = A + B.V_p$$

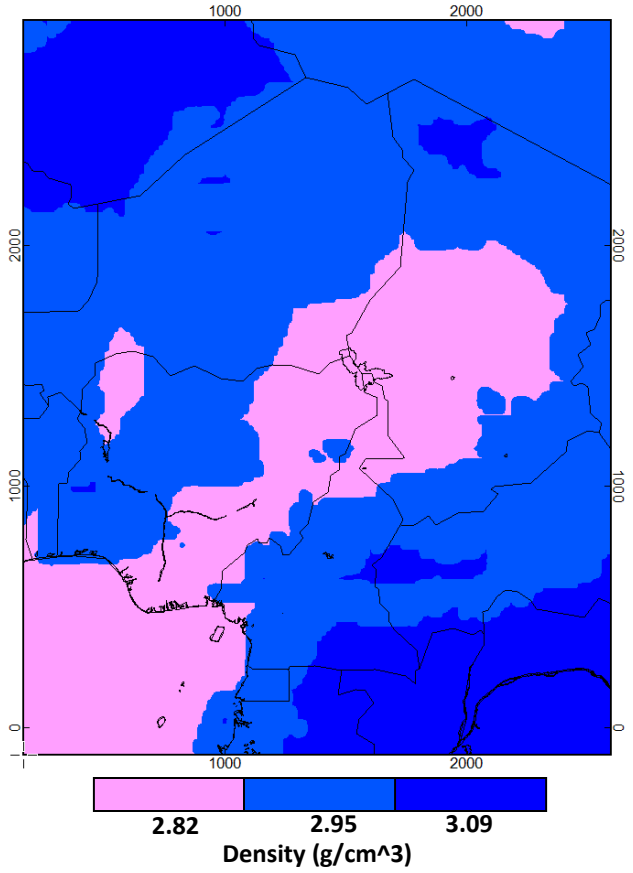
$$\sigma = 0.25$$

$$V_p.V_s^{-1} = 1.7$$



Location of available velocity (Vs) points
Tokam et al., 2010

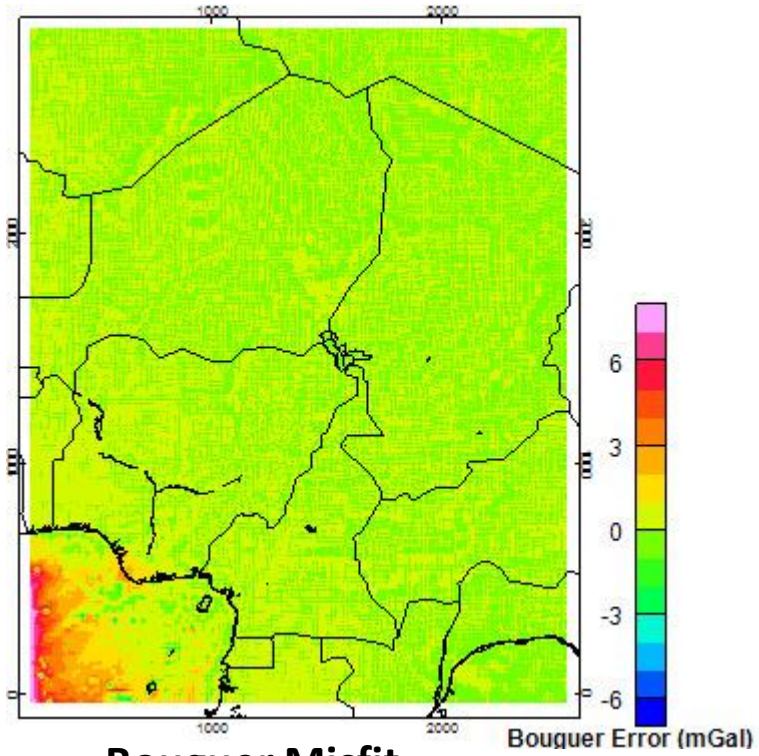




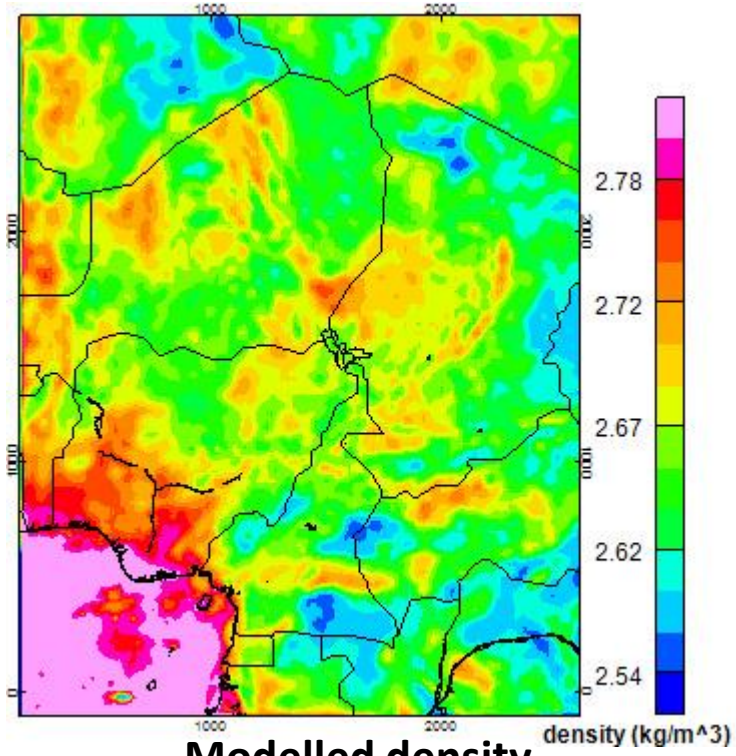
Density of the lower crust

Modelling process

- Very good agreement between observed and modelled gravity signals
- Reasonable distribution of density

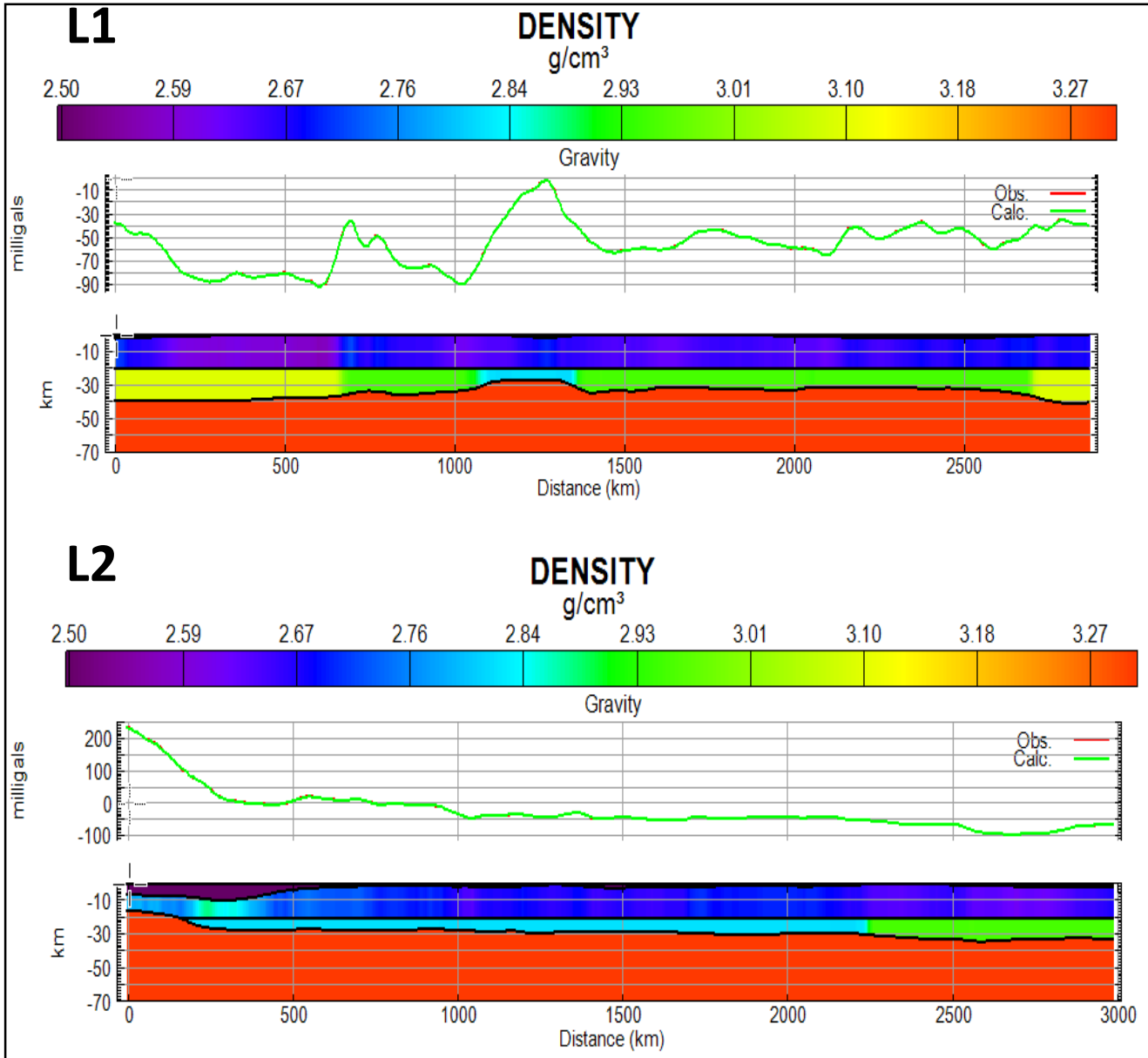


Bouguer Misfit

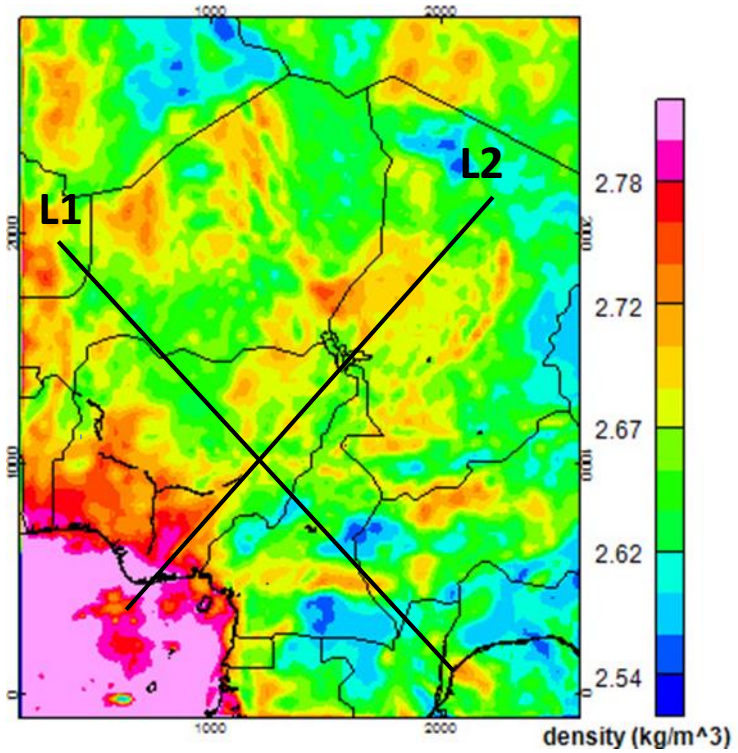


Modelled density

Model



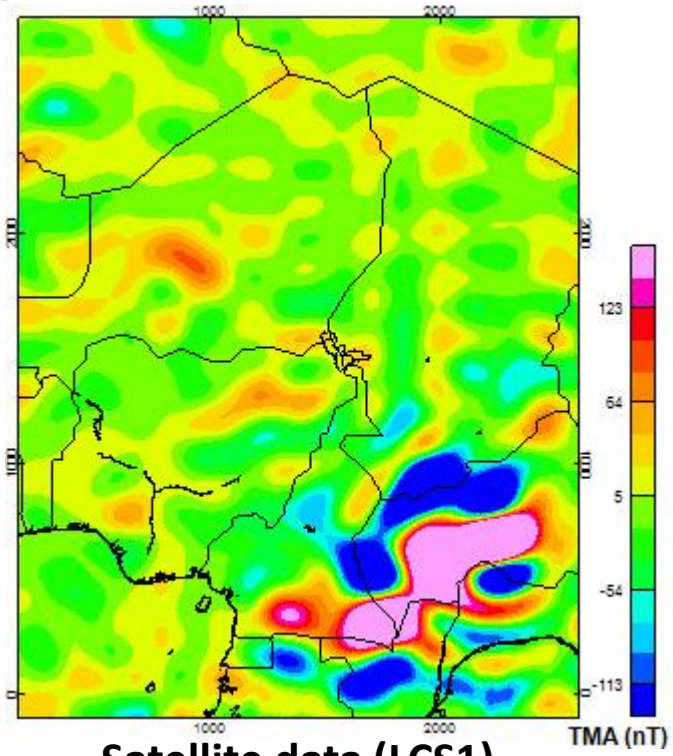
2D crust section along the axis of the rift (L2) and crossing it (L1).



L1, L2: profile sections

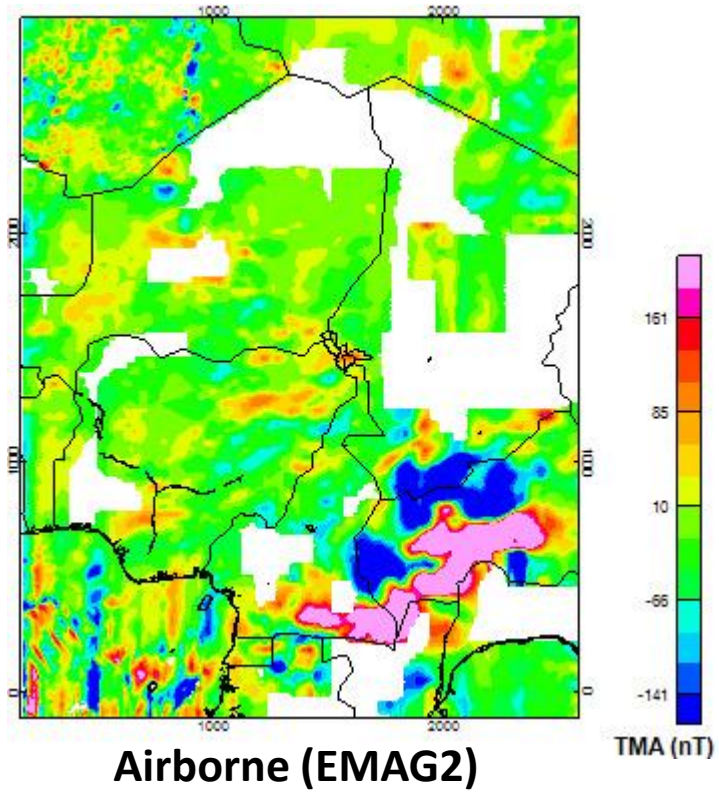
data

A



Satellite data (LCS1)

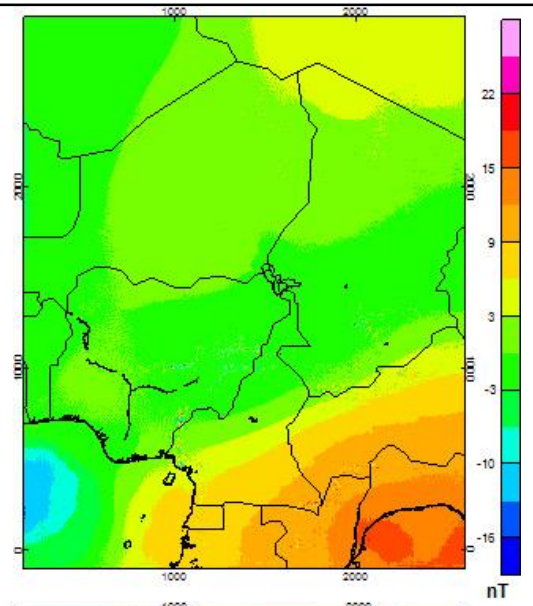
B



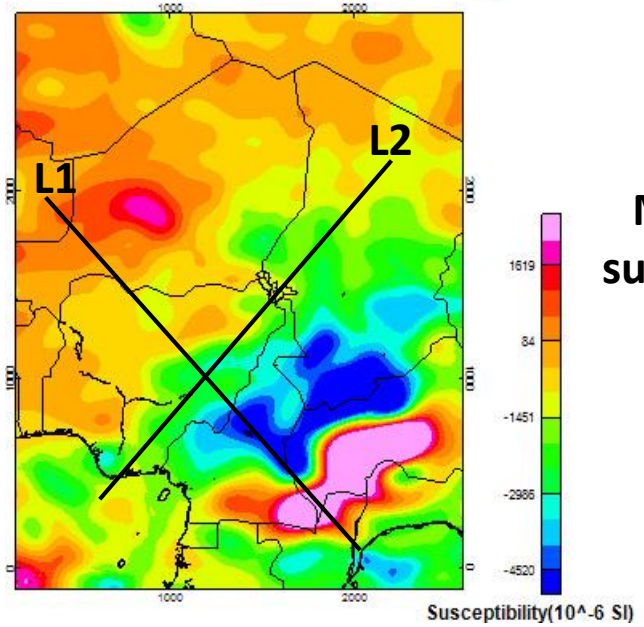
Airborne (EMAG2)

- Magnetic data (LCS1 and EMAG2) have been reduced to the pole.
- For the purposed of inversion, magnetized structures have been assumed to be contained inside the first 20km of the crust.

Model

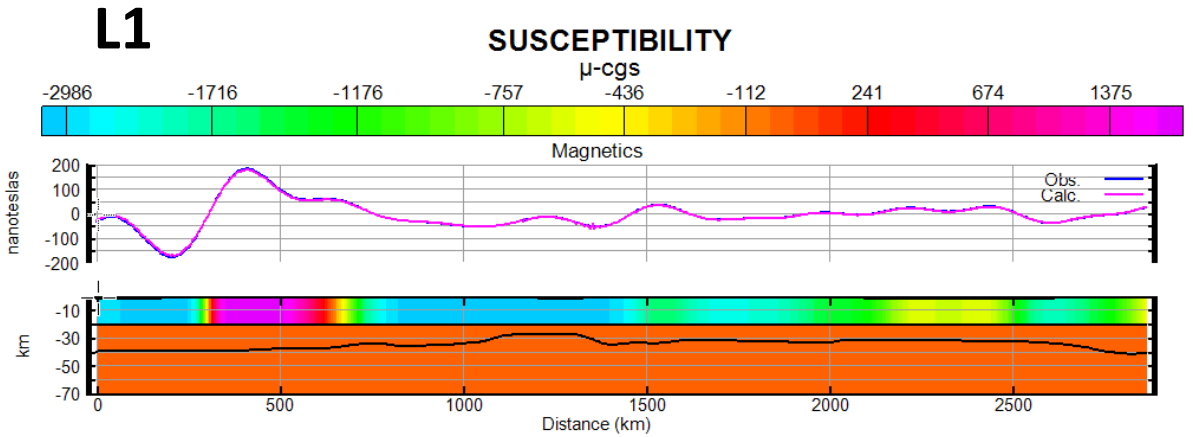


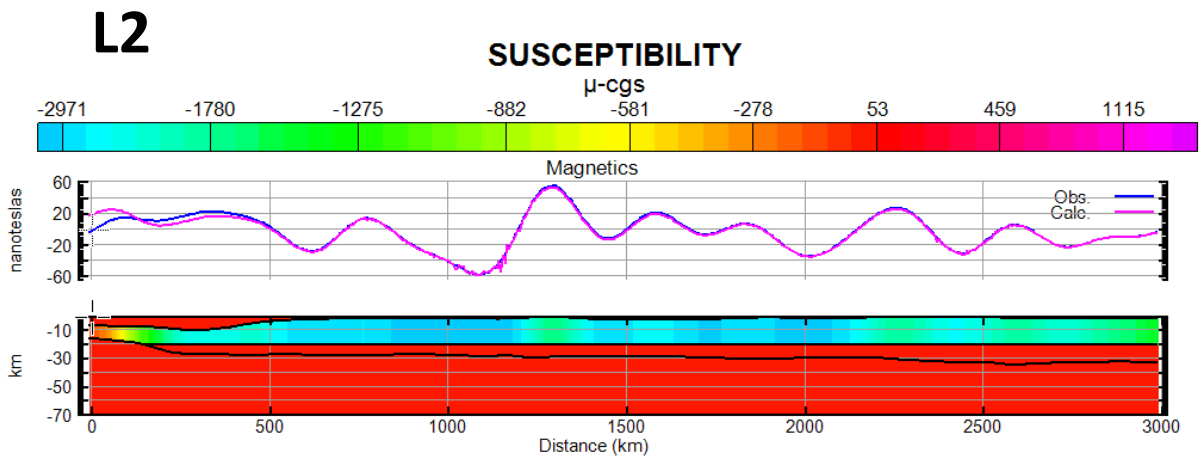
LCS1 Misfit



Modelled susceptibility

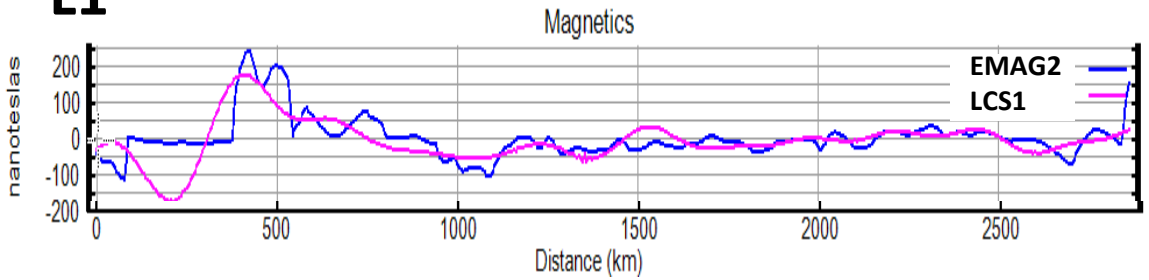
Only long wave effects are visible



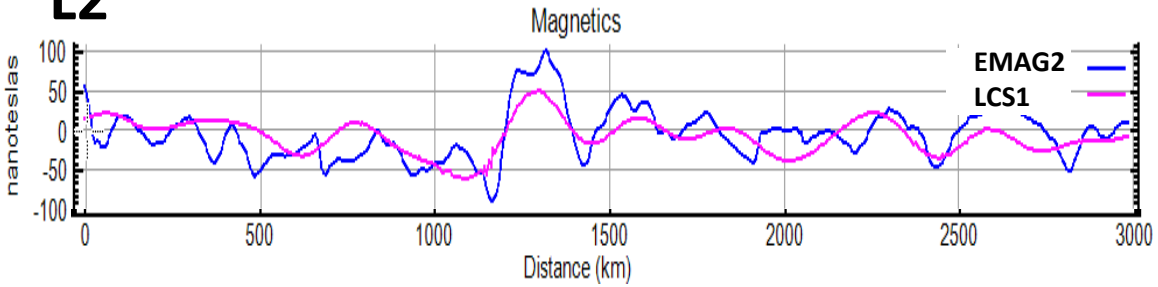


Model

L1

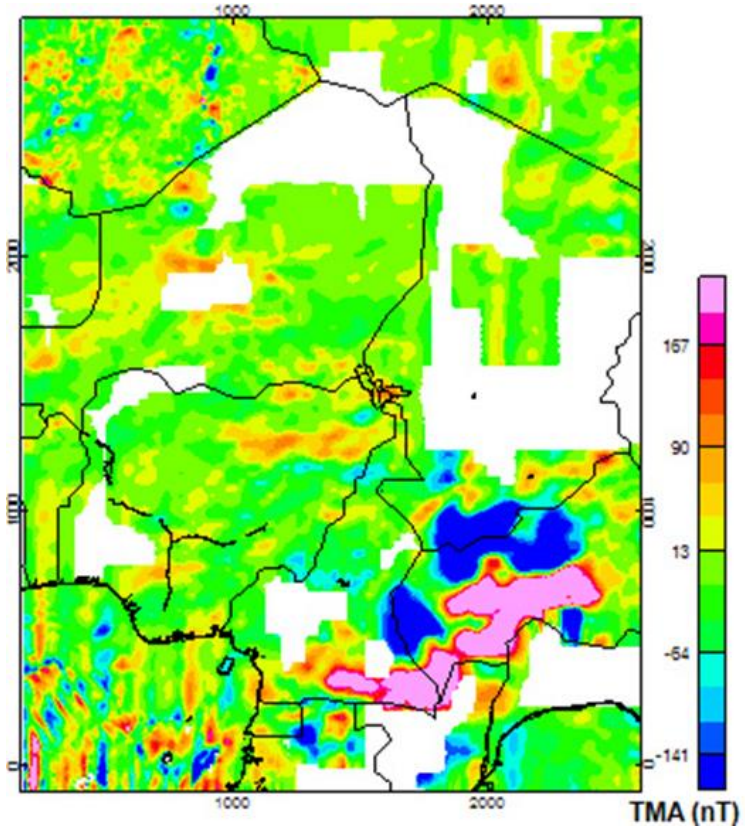


L2



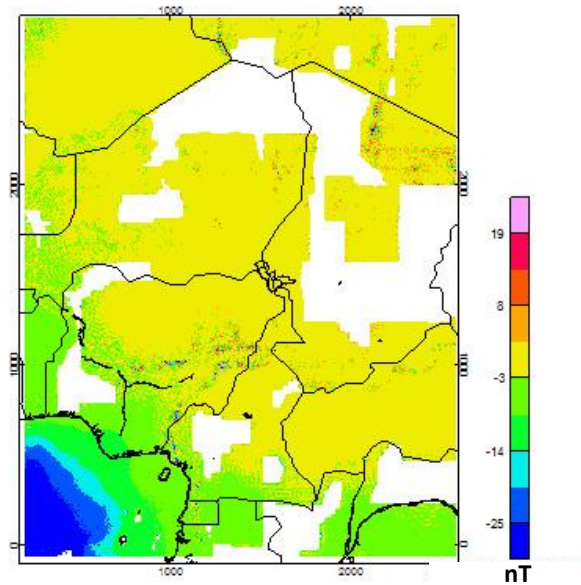
Glance at the difference in variations between EMAG2 and the magnetic signal generated by the susceptibility anomalies previously modelled with LCS1.

Combination of LCS1 and EMAG2

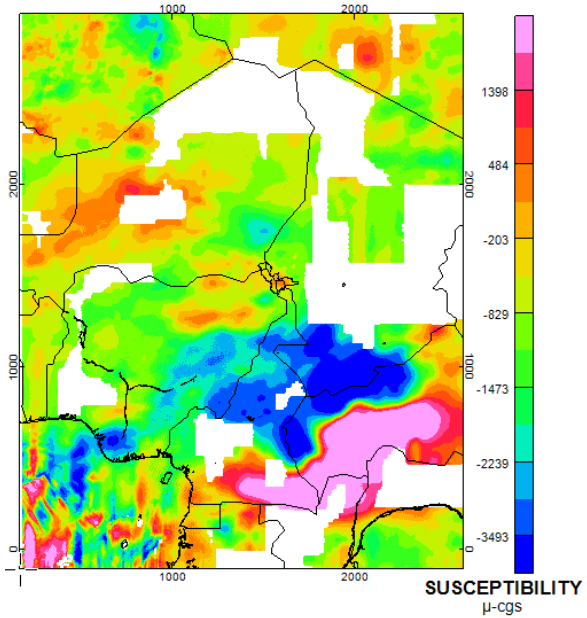


LCS1(300km LP) + EMAG2(300km HP)

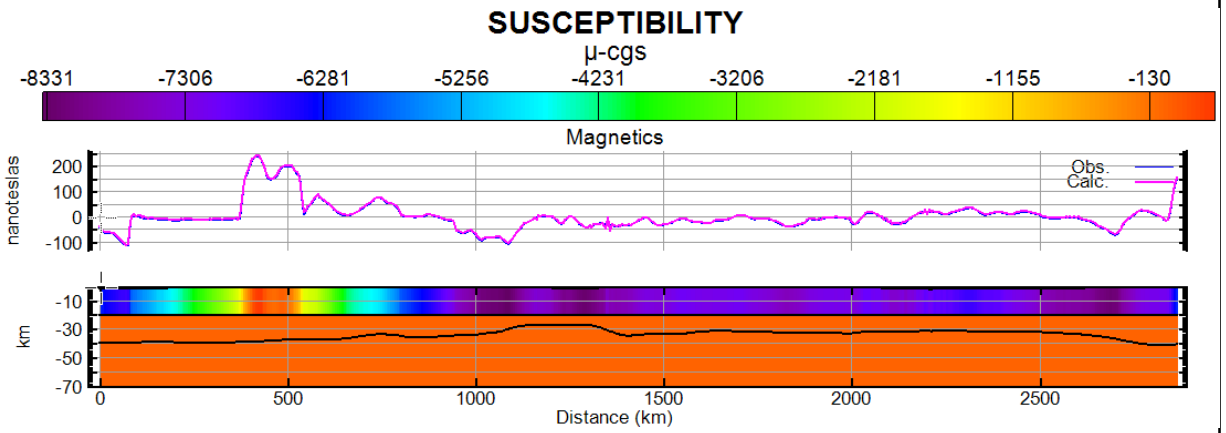
Models

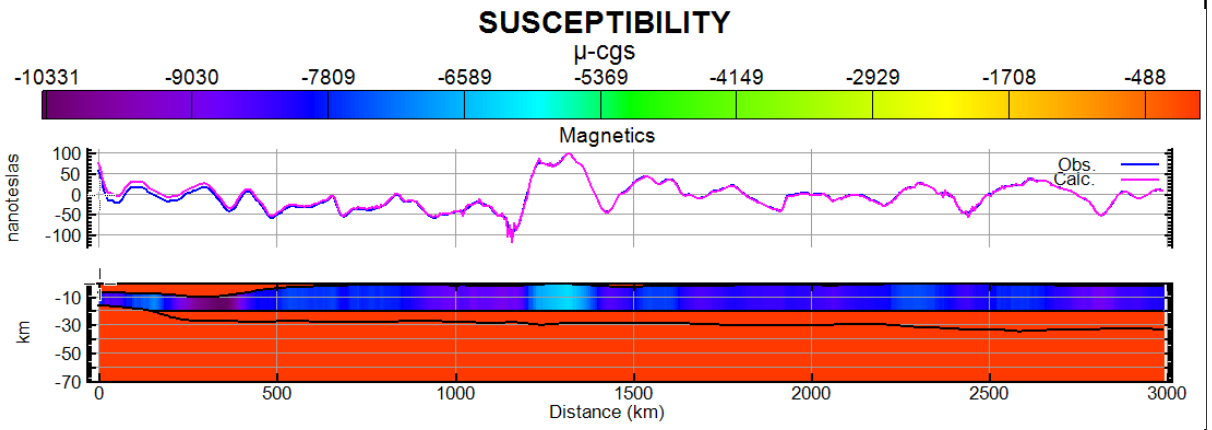


Magnetic Misfit



Modelled susceptibility





Conclusion

As known, the crustal structure of the West and Central African Rift System is characterized by a complex arrangement resulting from extensive tectonic activity, including rifting, volcanic activity, and sedimentation.

Next step

Integrat these density and susceptibility results for a clustering analysis