Gravity Models of The Budaghers Fault

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Questions

- Can we see the fault with gravity data?
- If so can we determine the offset?
- How good is the data?
- Can we model it with GM-SYS?
- How do the constraints improve the models?

Introduction

- Gravity Measured in Milligals
- (1milligal=1*10^-5 m/s^s)
- Denser Objects = Bigger Gravity Anomaly
- F=GMm/r^2 ----> Higher Up = Less Gravity
- Need Very Precise Insturments to Measure this
- How good of resolution do you need?

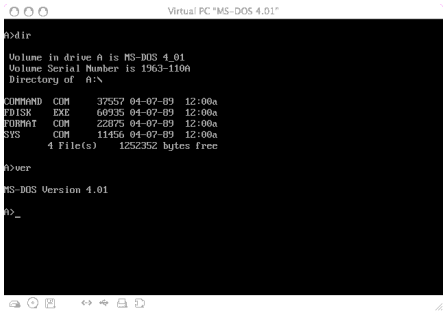
Closer Spacing=Higher Resolution

Equipment

Scintrex Digital Gravimeter

Differential GPS

Data Reduction

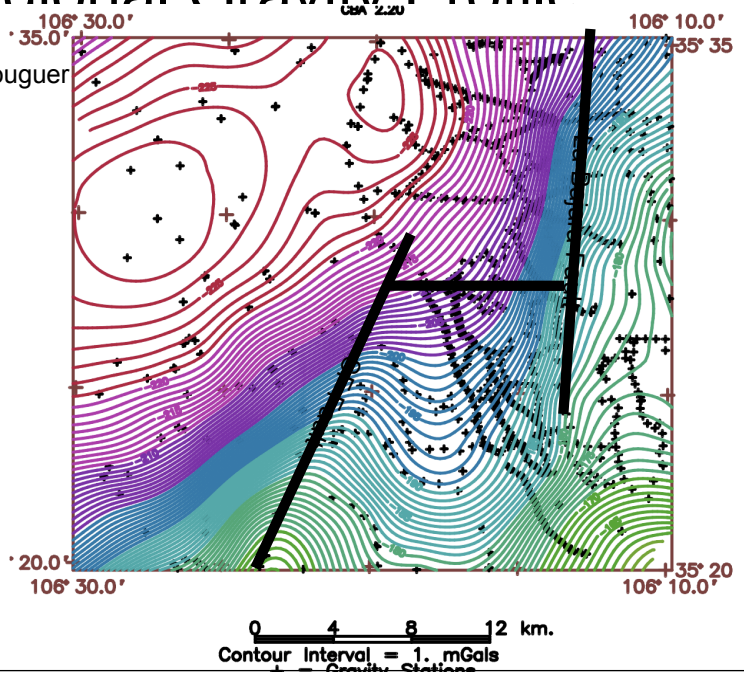


- Tidal Correction
- Free Air Correction
- Simple Bouguer Anomaly
- Terrain Correction
- Complete Bouguer Anomaly

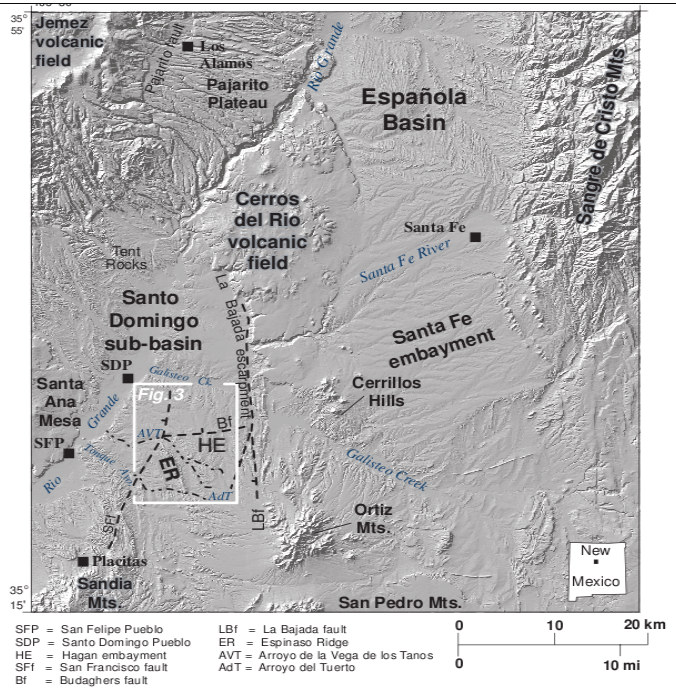
... Shawn did all for us this in DOS

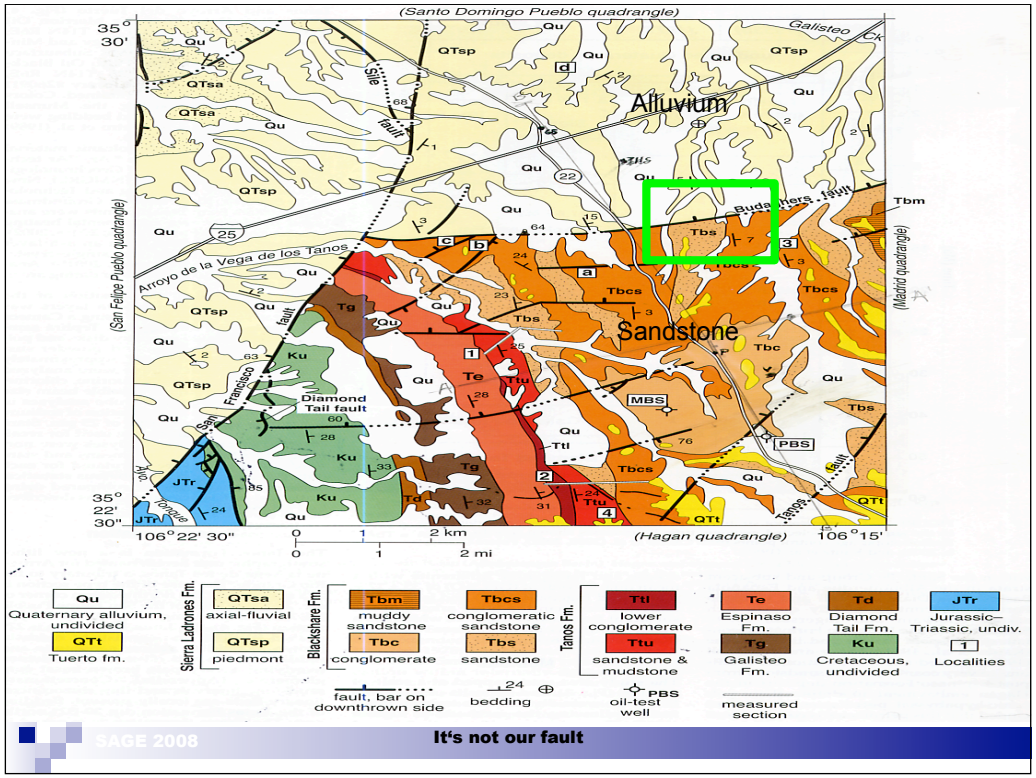
Regional Gravity Profile

Complete Bouguer Anomaly



Map of Field Area




(Santo Domingo Pueblo quadrangle)
(San Felipe Pueblo quadrangle)
(Madrid quadrangle)
(Hagan quadrangle)
Alluvium
Sandstone
Arroyo de la Vega de los Tanos
Diamond Tail fault
Galisteo Ck
Buda Pass fault
Tanos fault
Slide fault
Tbm
Tbcs
Tbs
Tbc
Ttu
Ttl
Te
Tg
Ku
JTr
QTt
QTsp
QTsa
Qu
MBS
PBS
106° 22' 30"
106° 15'
35° 30'
35° 22' 30"
0 1 2 km
0 1 2 mi
Qu Quaternary alluvium, undivided
QTt Tuerto fm.
Sierra Ladrones Fm.
QTsa axial-fluvial
QTsp piedmont
Blackshare Fm.
Tbm muddy sandstone
Tbc conglomerate
Tbcs conglomeratic sandstone
Tbs sandstone
Tanos Fm.
Ttl lower conglomerate
Ttu sandstone & mudstone
Te Espinaso Fm.
Tg Galisteo Fm.
Td Diamond Tail Fm.
Ku Cretaceous, undivided
JTr Jurassic–Triassic, undiv.
1 Localities
fault, bar on downthrown side
24 bedding
PBS oil-test well
measured section

GM-SYS

- GM-SYS is a 2.5D forward modeling program
- Take Constraints (density, thickness, etc.)
  - Draw a Model
    - Tweak it and Try to Fit it to Data
- It can be used for gravity and magnetic data

Limitations:

- In student Student Edition can only have 7 bodies and 35 data points
- Non-Unique (only as good as your constraints)

Constraints:

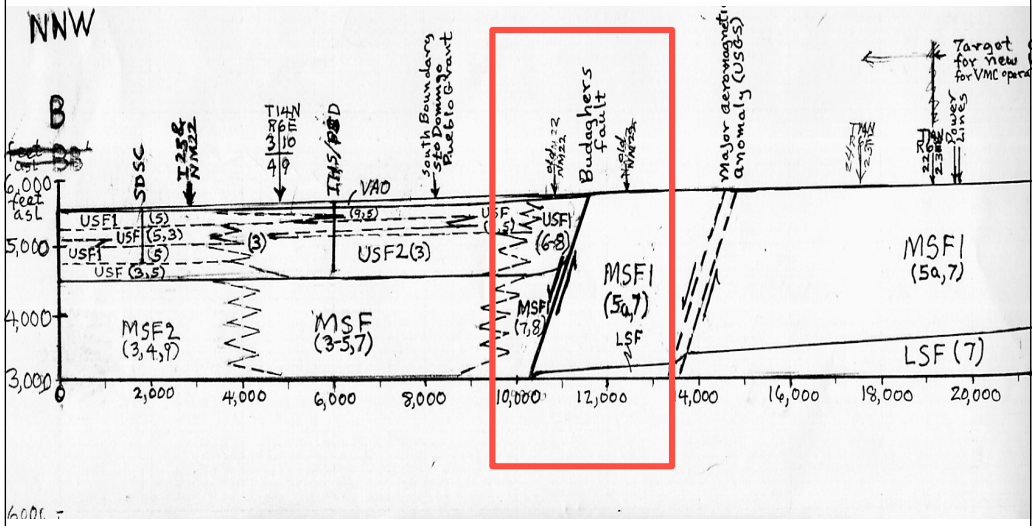
Depth to Basement- About 4km

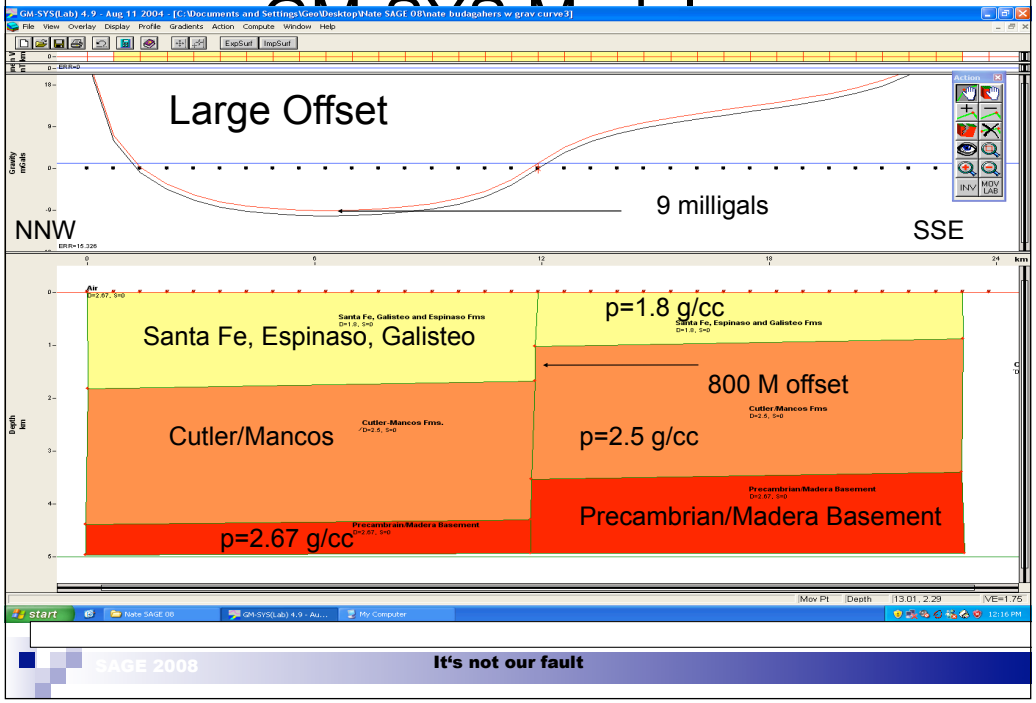
Density and Thickness of Units

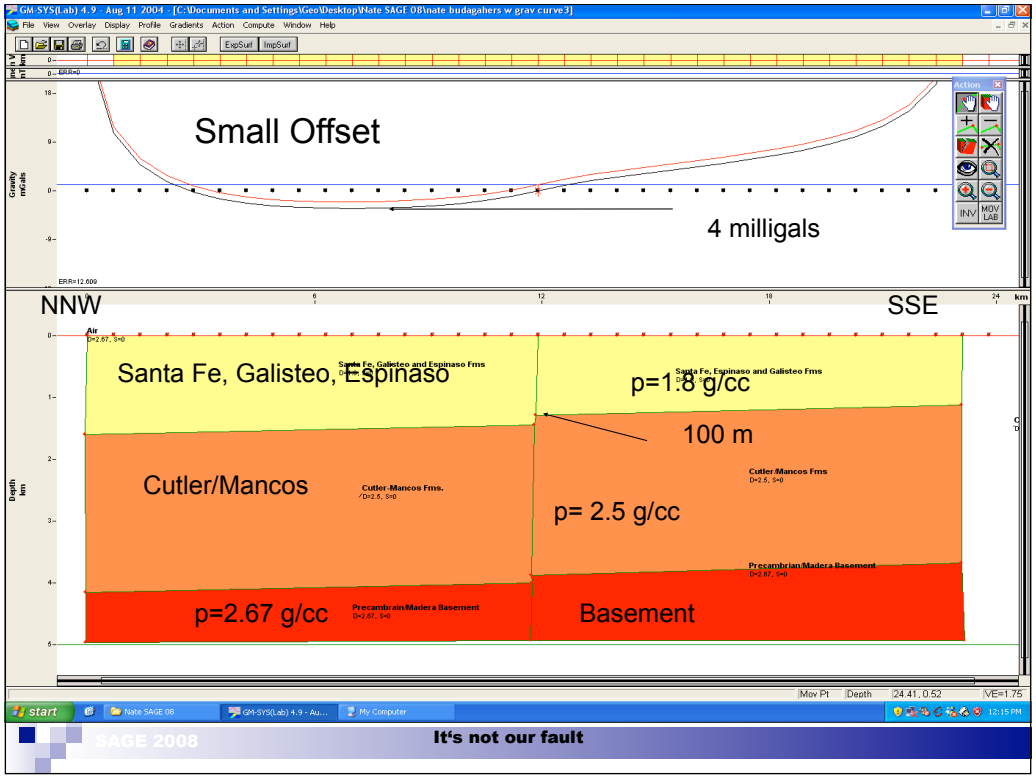
Hawley Model of Fault

Magnetics

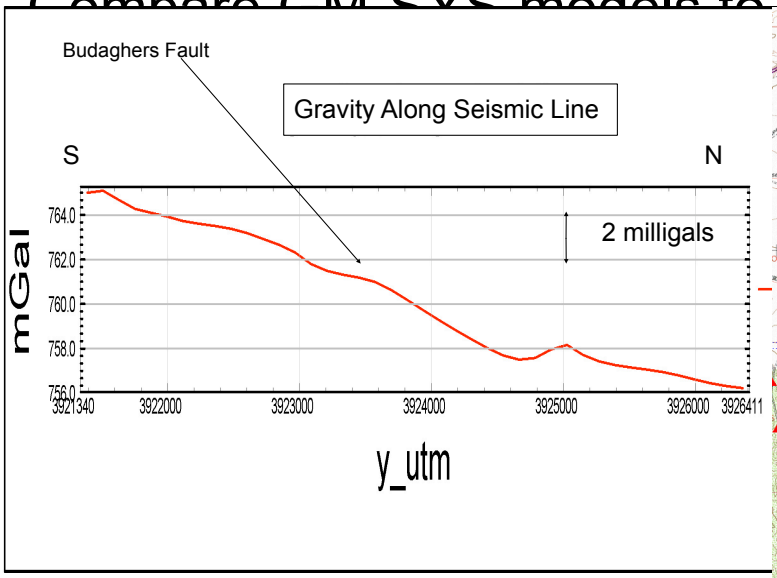
Hawley Model of Budaghers Fault

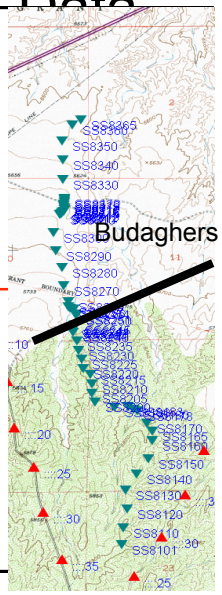



Large Offset
9 milligals
NNW
SSE
Santa Fe, Espinaso, Galisteo
Cutler/Mancos
p=2.67 g/cc
p=1.8 g/cc
800 M offset
p=2.5 g/cc
Precambrian/Madera Basement

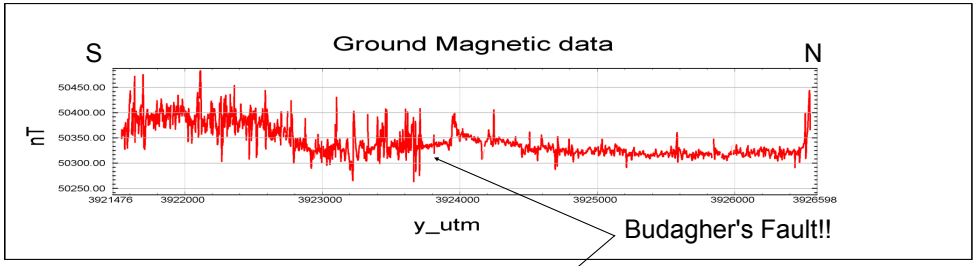

Small Offset
4 milligals
NNW
SSE
Santa Fe, Galisteo, Espinaso
p=1.8 g/cc
100 m
Cutler/Mancos
p= 2.5 g/cc
p=2.67 g/cc
Basement
Depth km

Compare CM-SYS models to Data

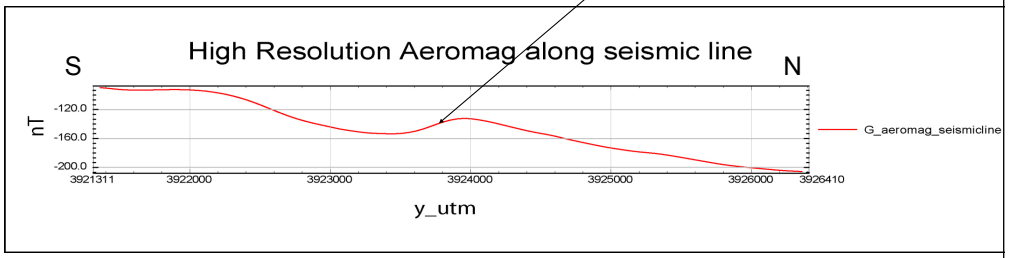




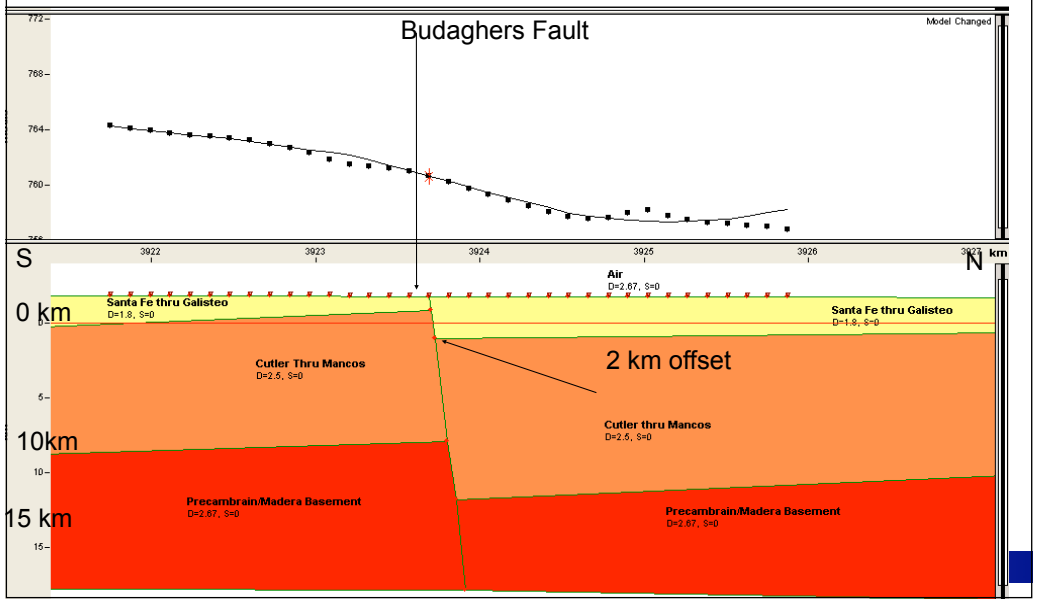
Magnetic Data:

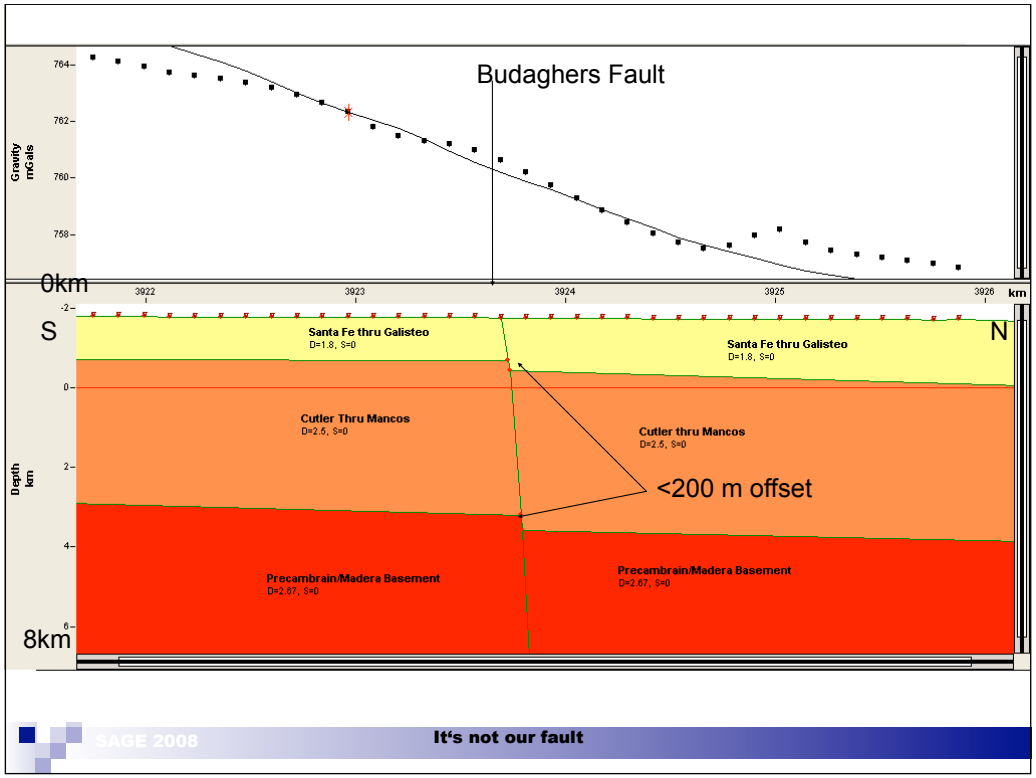


Budagher's Fault!!



Models are Non-Unique: Constraints are Important




Budaghers Fault
Gravity mGals
764
762
760
758
0km
3922
3923
3924
3925
3926
km
S
N
-2
0
2
4
6
Depth km
Santa Fe thru Galisteo
D=1.8, S=0
Santa Fe thru Galisteo
D=1.8, S=0
Cutler Thru Mancos
D=2.5, S=0
Cutler thru Mancos
D=2.5, S=0
<200 m offset
Precambrain/Madera Basement
D=2.67, S=0
Precambrain/Madera Basement
D=2.67, S=0
8km

Conclusions

- We see an inflection in our data that corresponds to the fault but can't interpret a fault with gravity data alone
- Offset of the Budaghers Fault is <200 m.
- To accurately model the fault we need higher resolution data since the difference we are looking for is <1 mgal.
- GM-SYS is a non-unique forward modelling tool that is only useful when several constraints are known.
- Constraints are VERY IMPORTANT!!

Thanks

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