

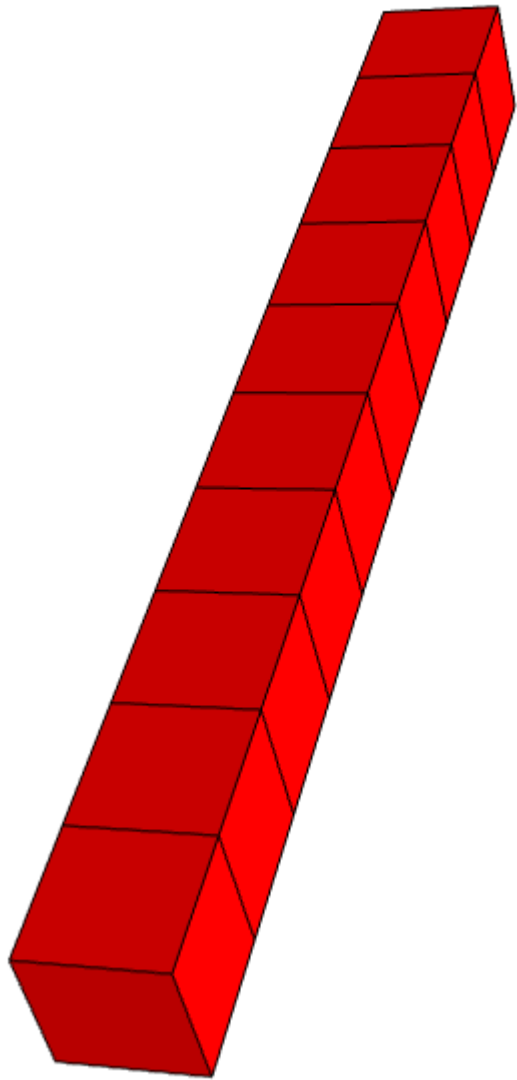
Gravity inversion in spherical coordinates using tesserooids

Leonardo Uieda

Valéria C. F. Barbosa

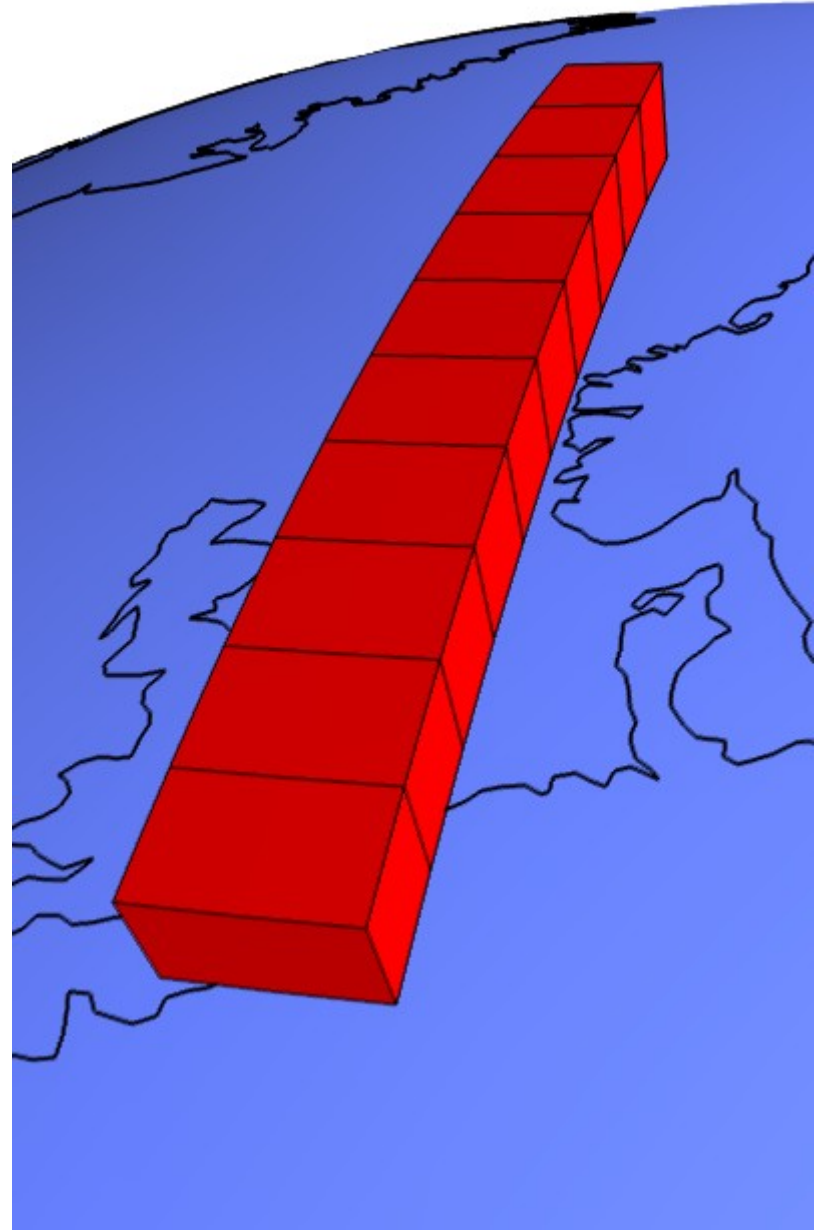


Cartesian



VS

Spherical



Existing inversion with tesserooids

(Chaves and Ussami, 2013)

- Geoid height anomalies
- Space domain
- Regularization:
 - Depth-weighted Minimum Volume
 - Similarity to seismic tomography

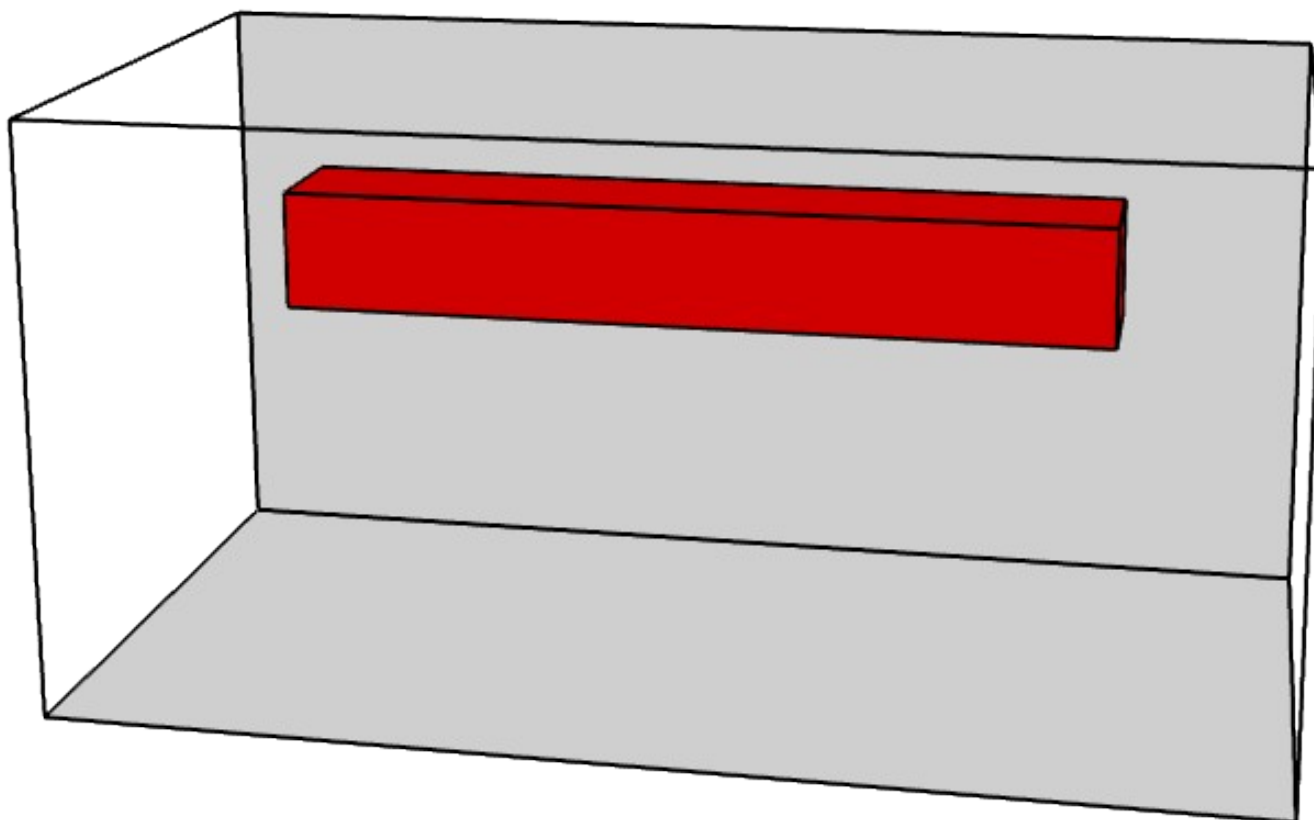
Adapt

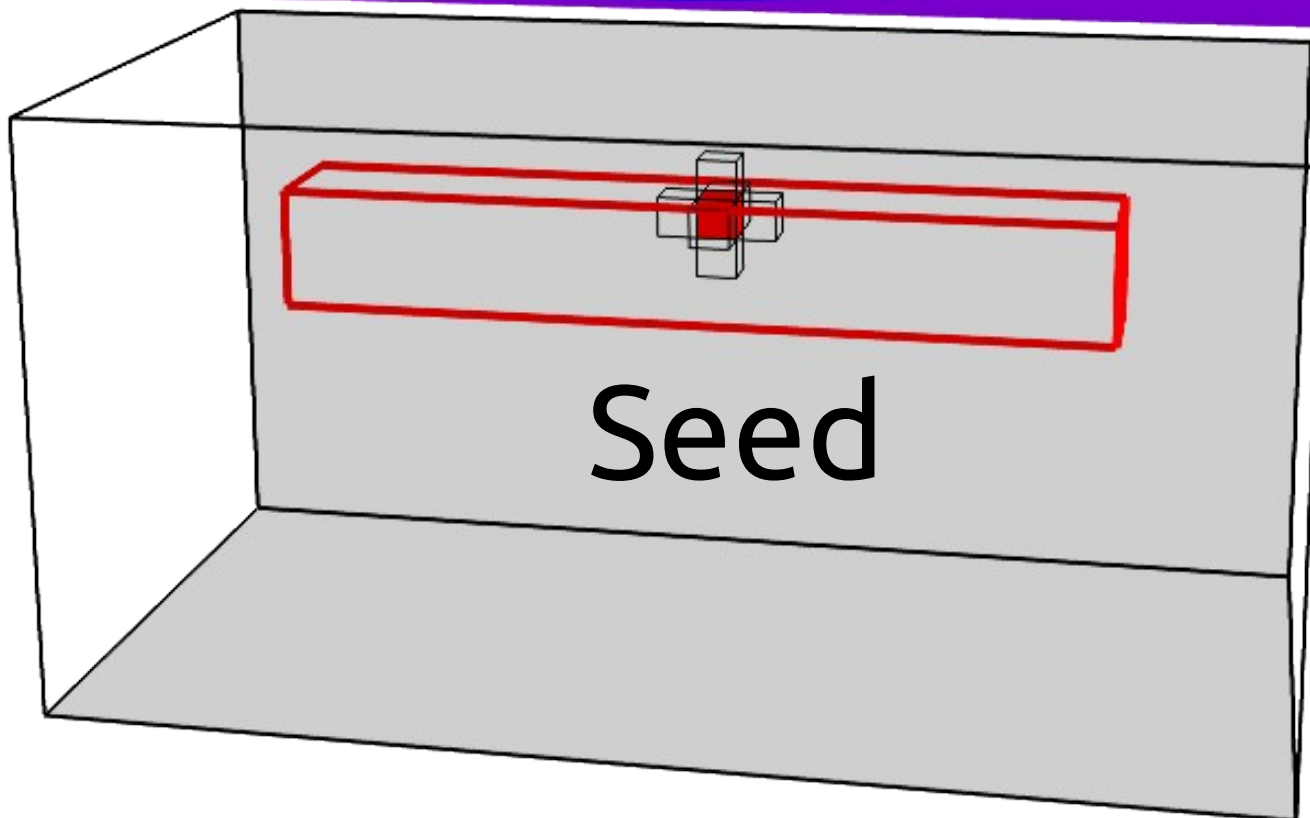
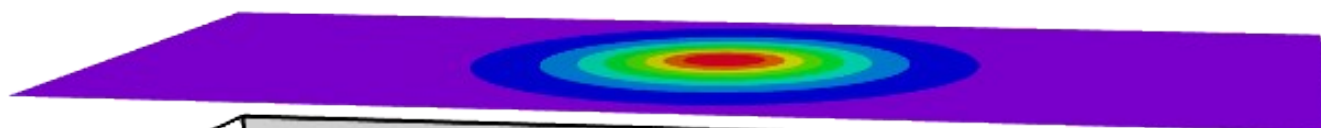
Planting anomalous densities

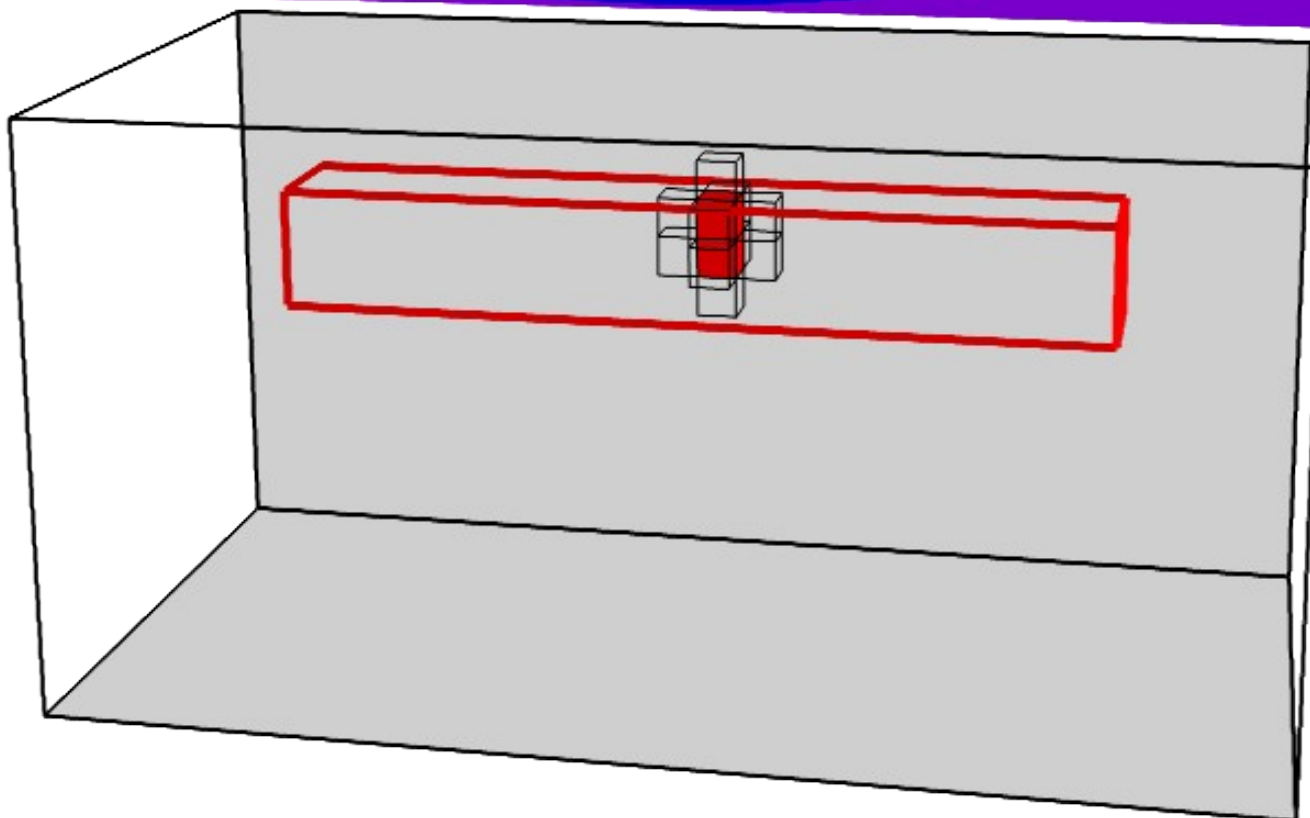
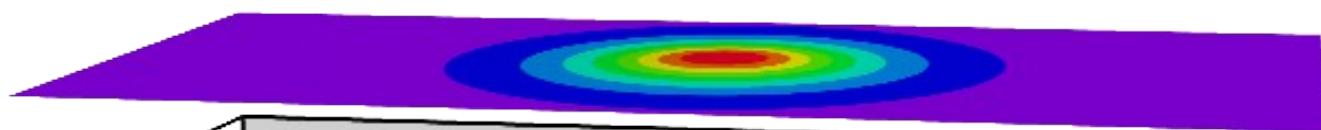
(Uieda and Barbosa, 2012)

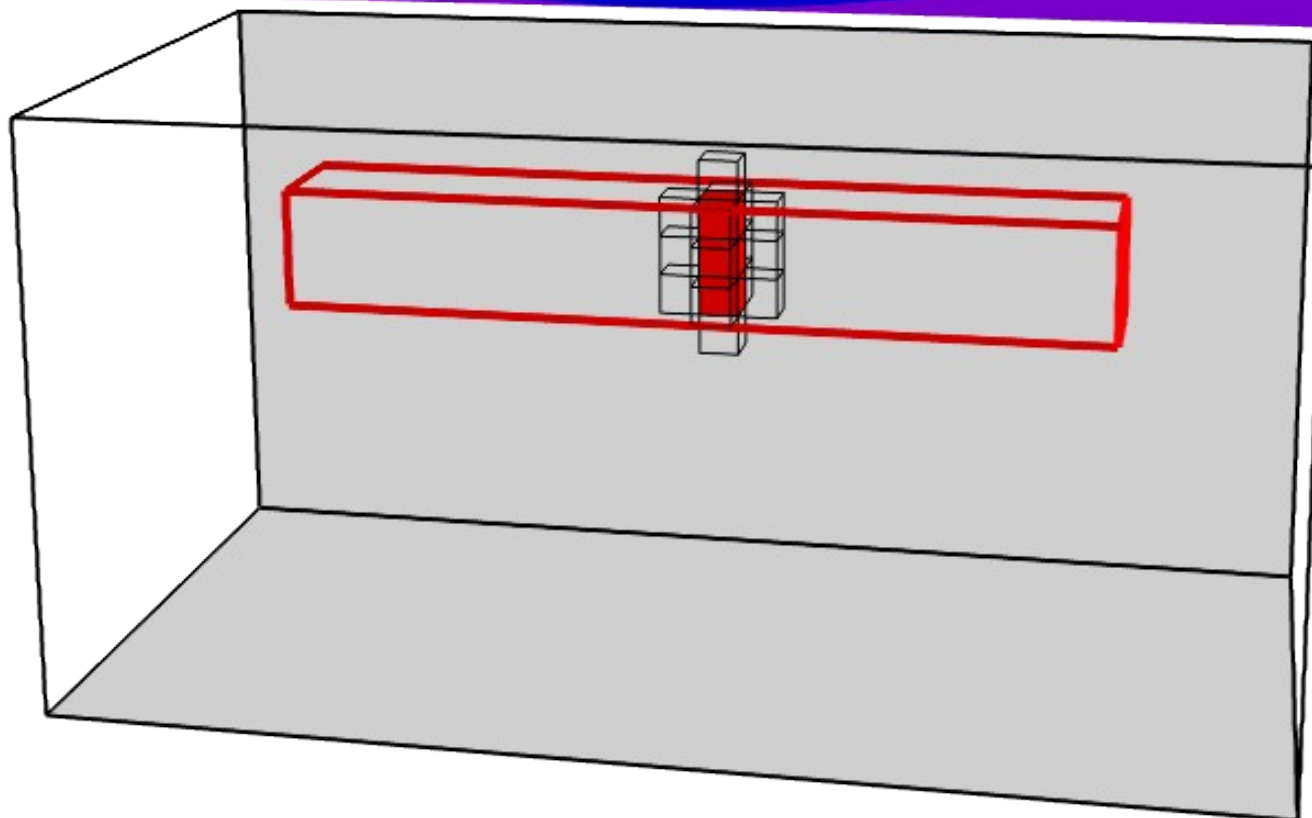
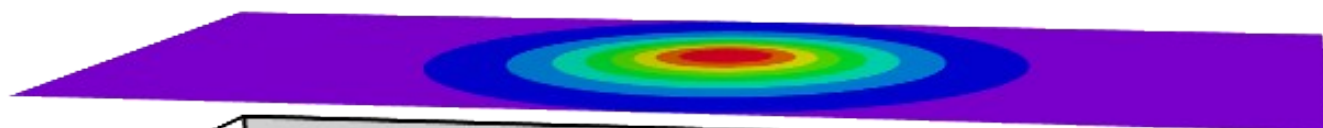
Planting anomalous densities

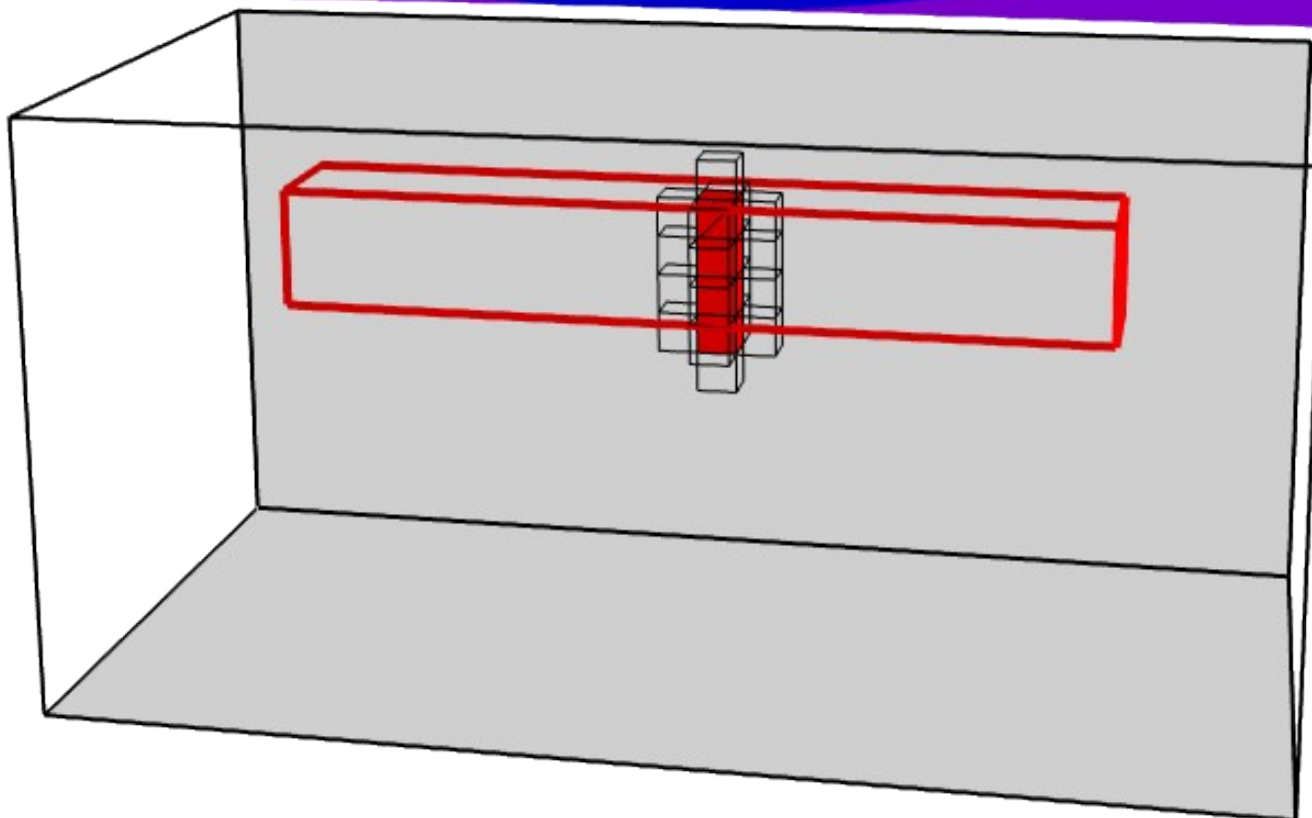
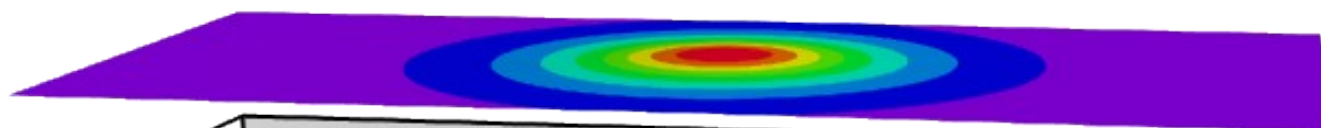
- Space domain
- Multicomponent: gravity + gradients
- Non-conventional inversion
 - Growth algorithm
 - No linear systems
 - Efficient sensitivity computations

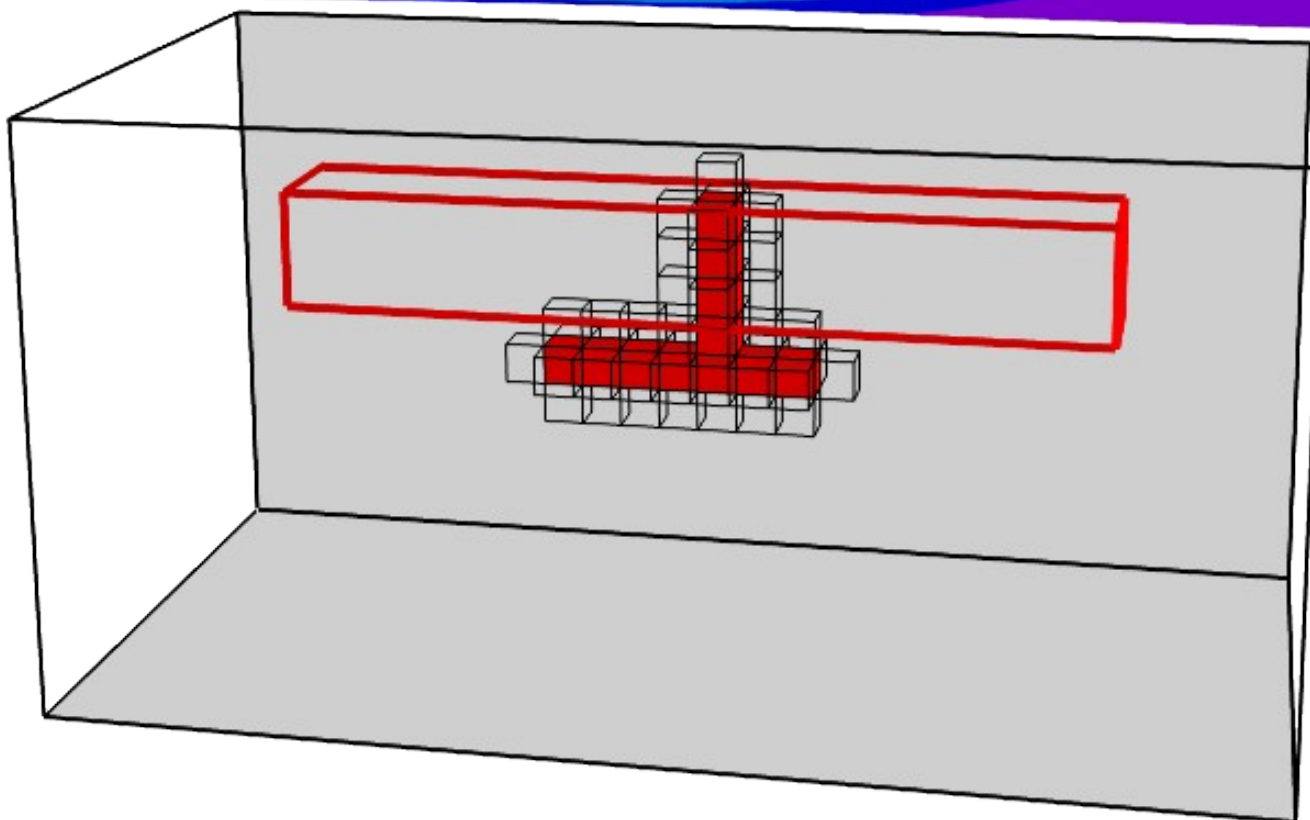
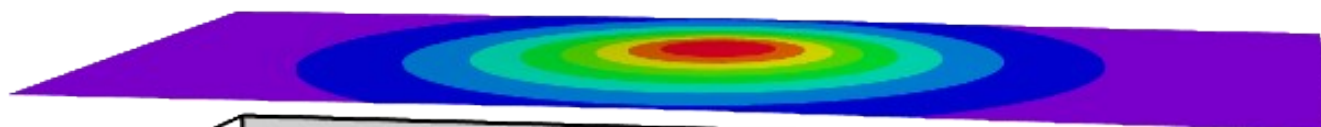


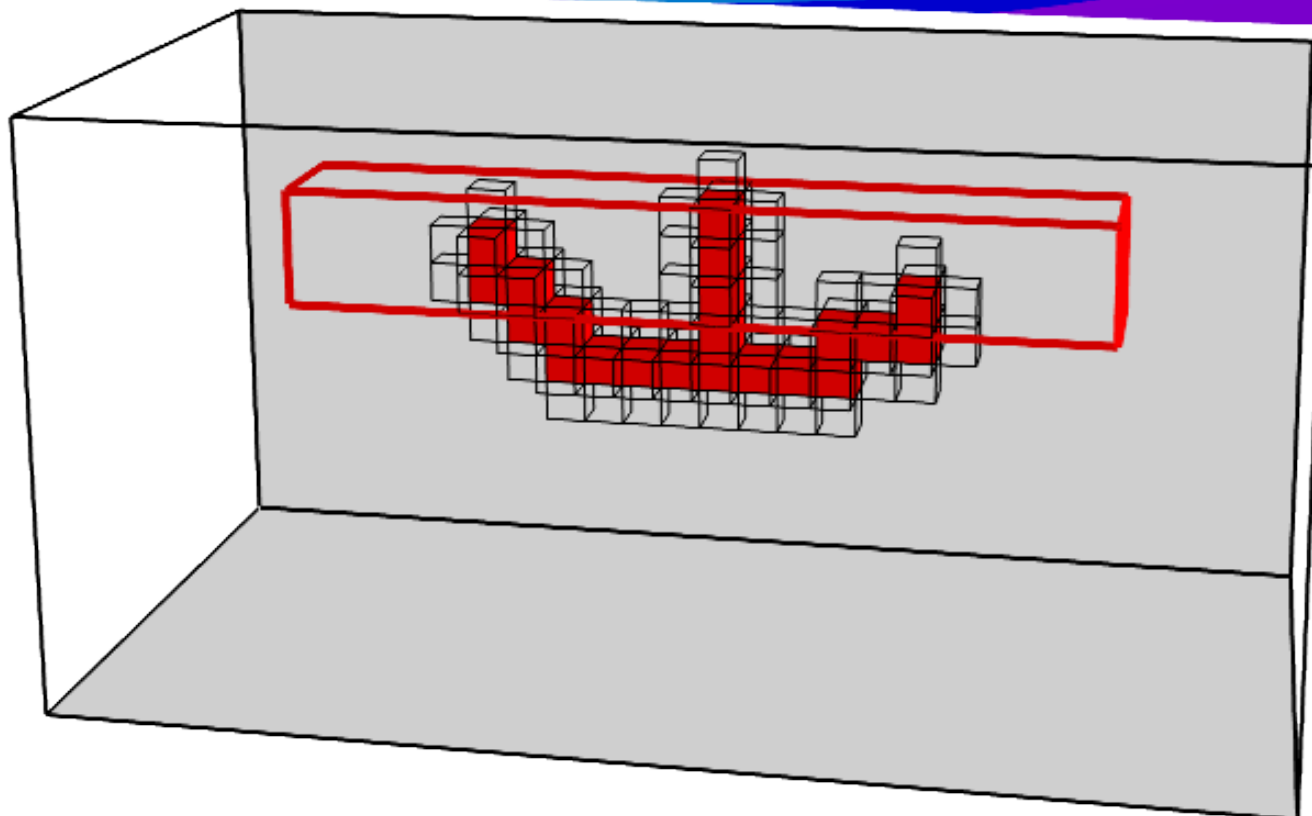
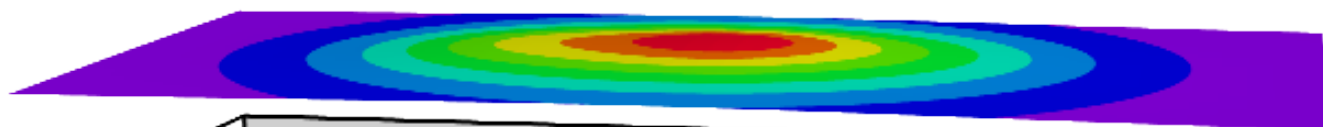


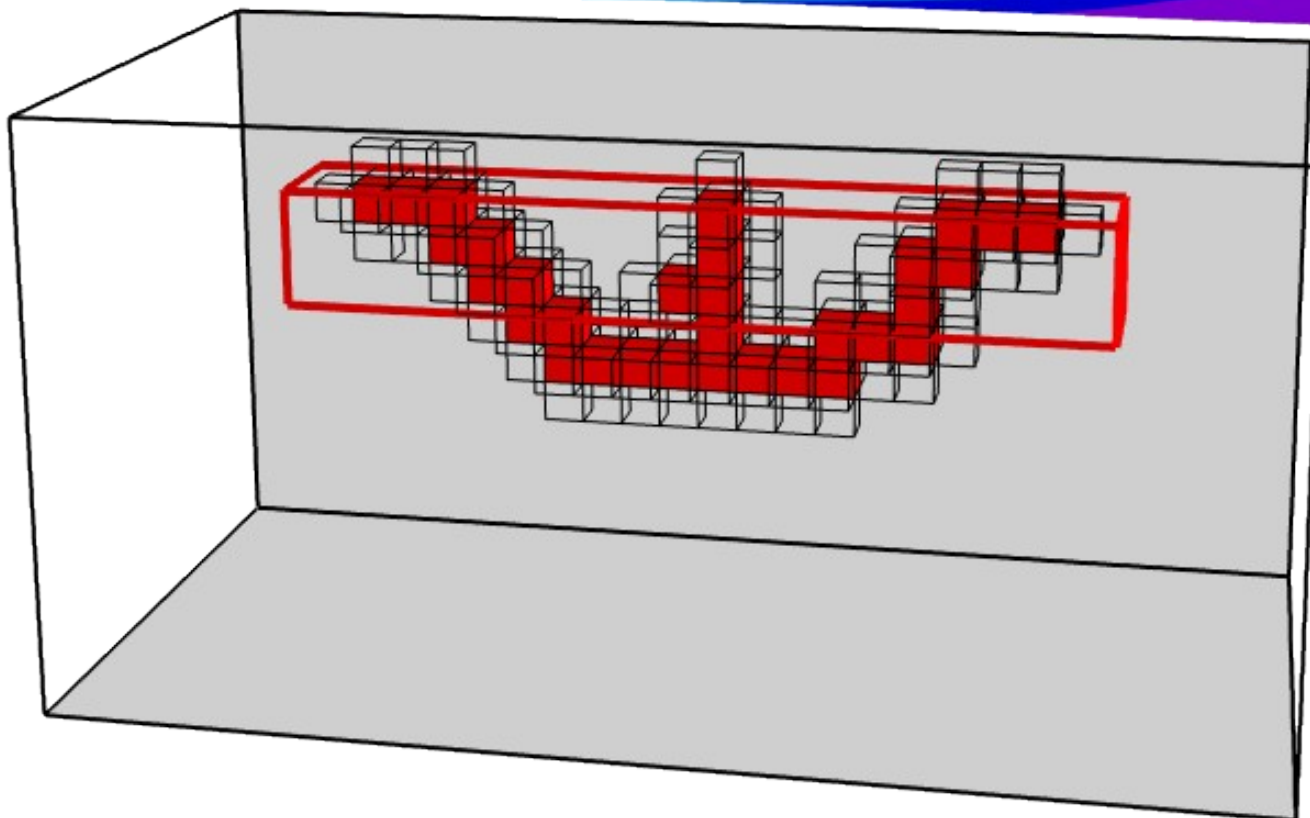
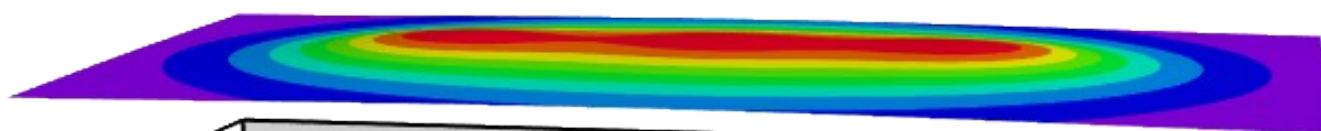


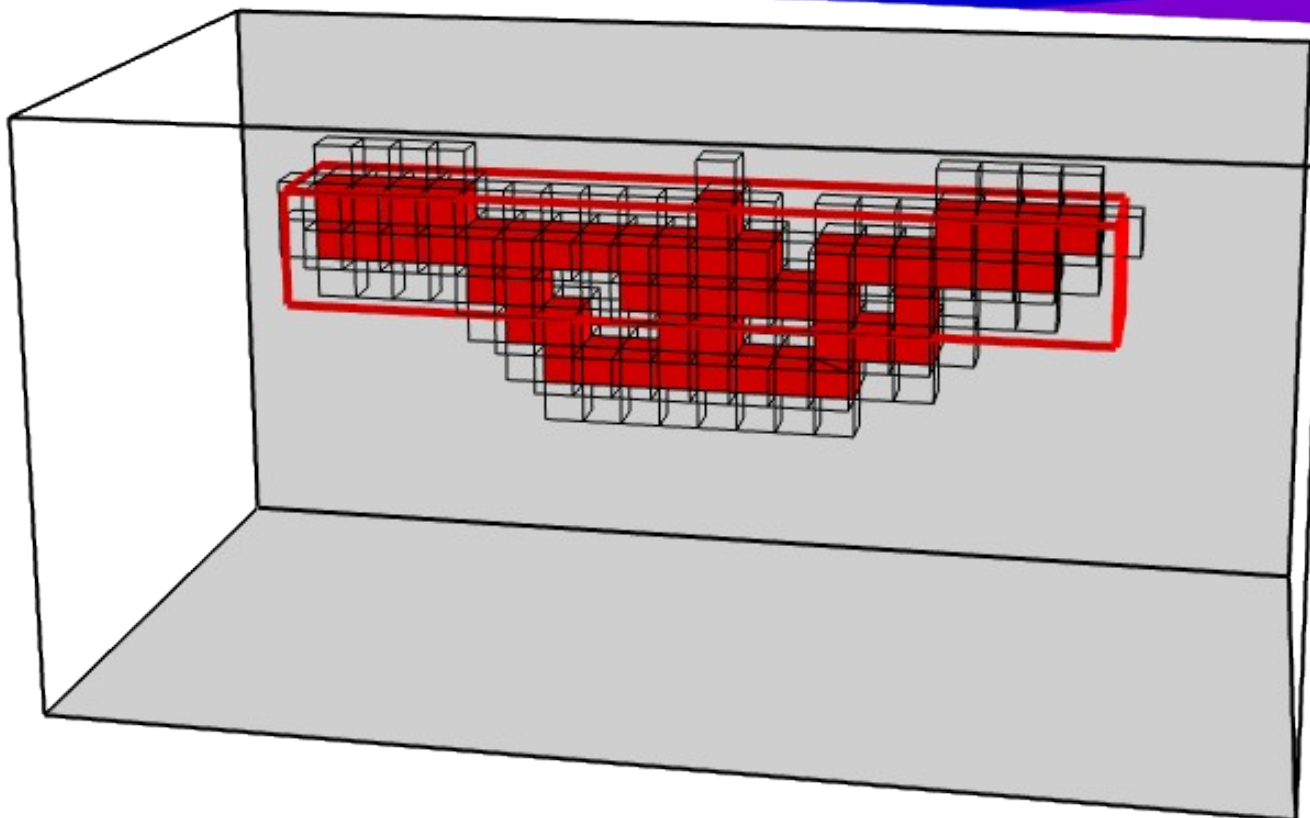
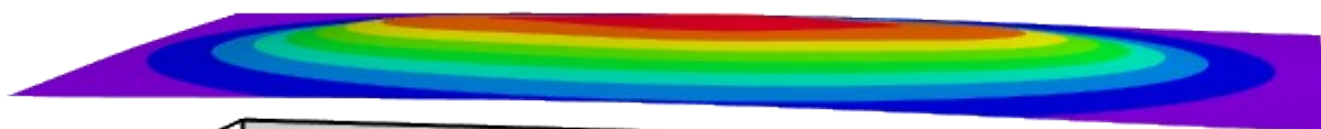


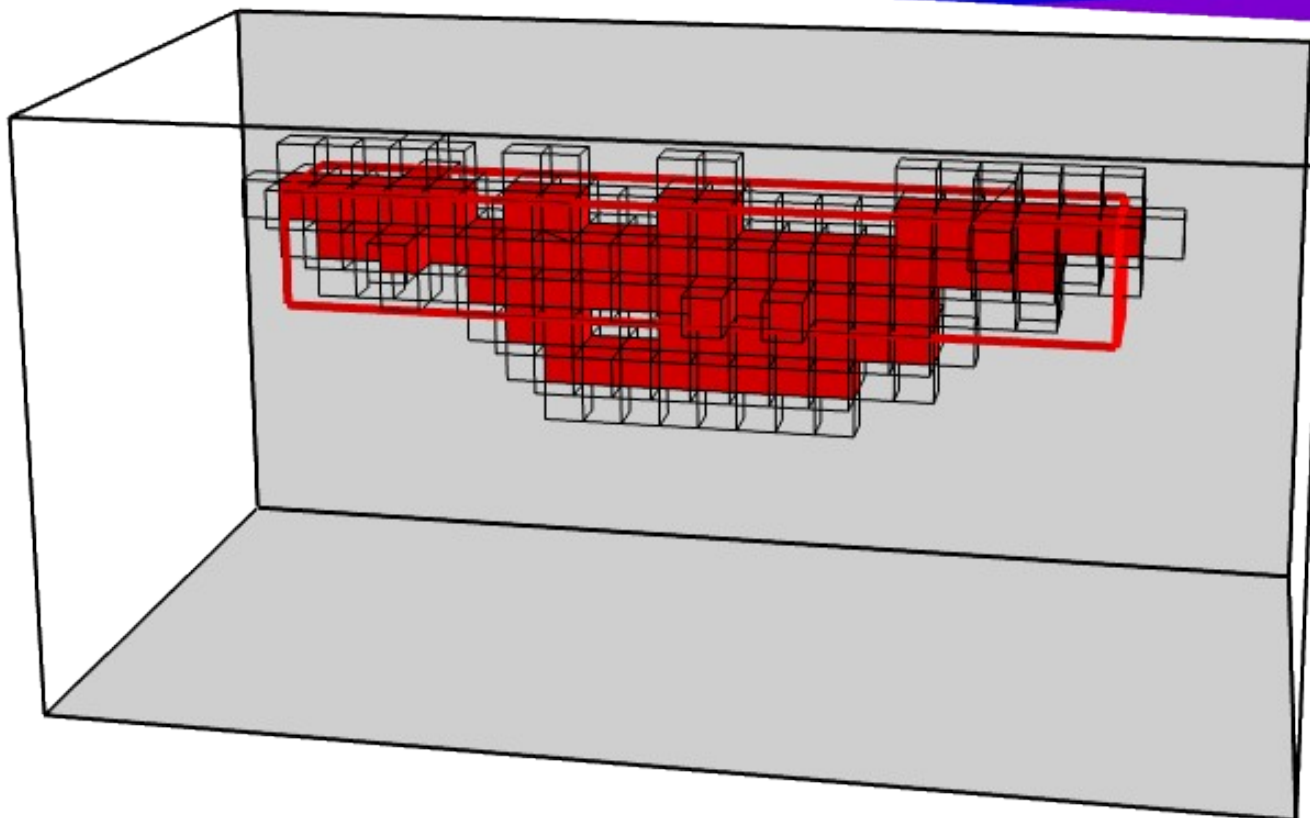


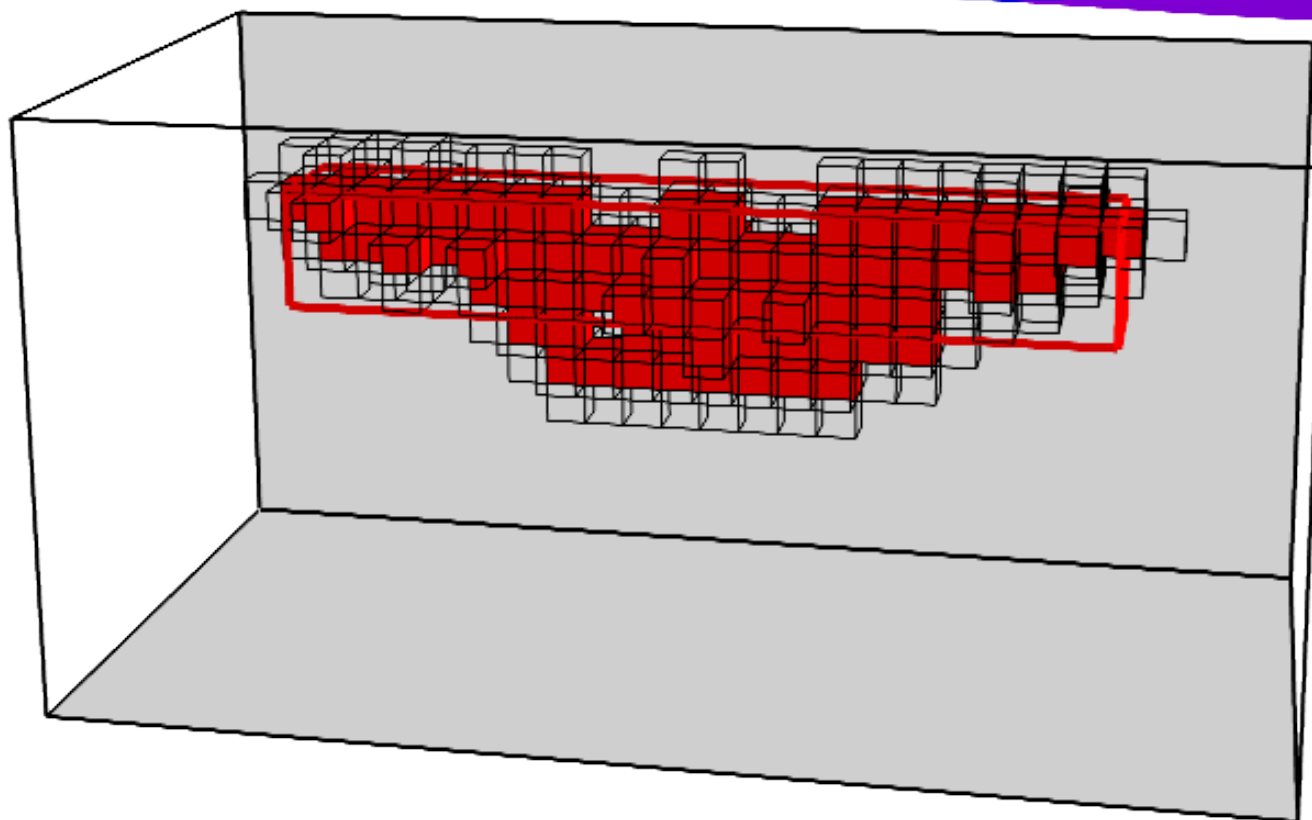


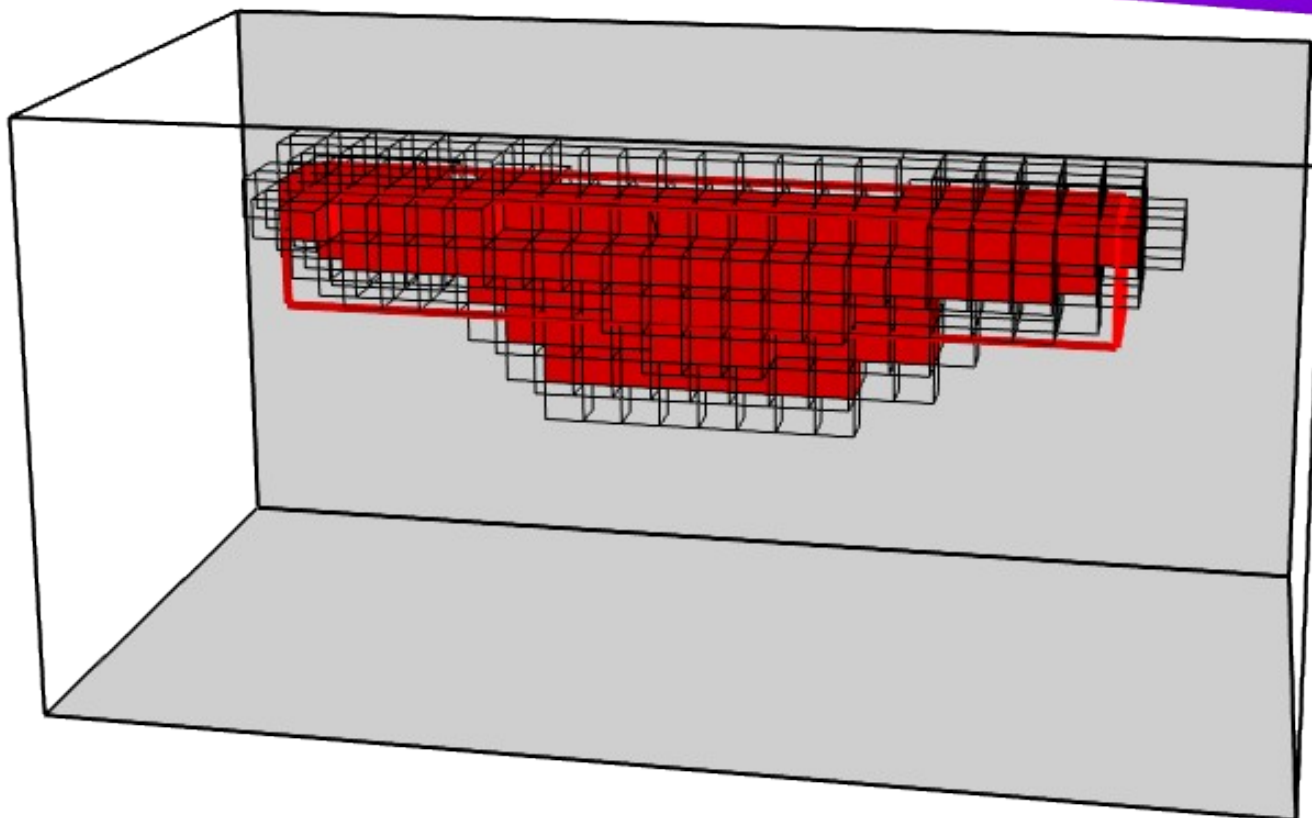


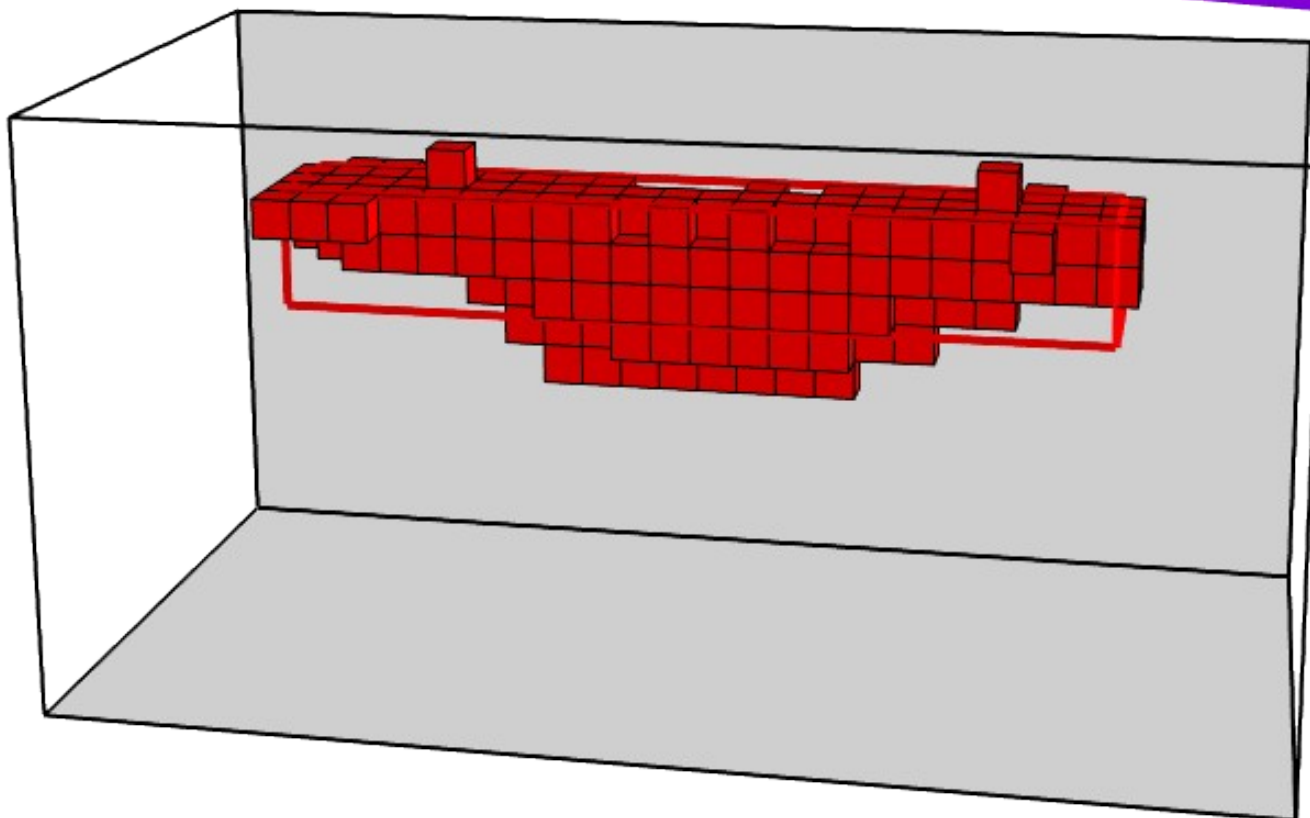










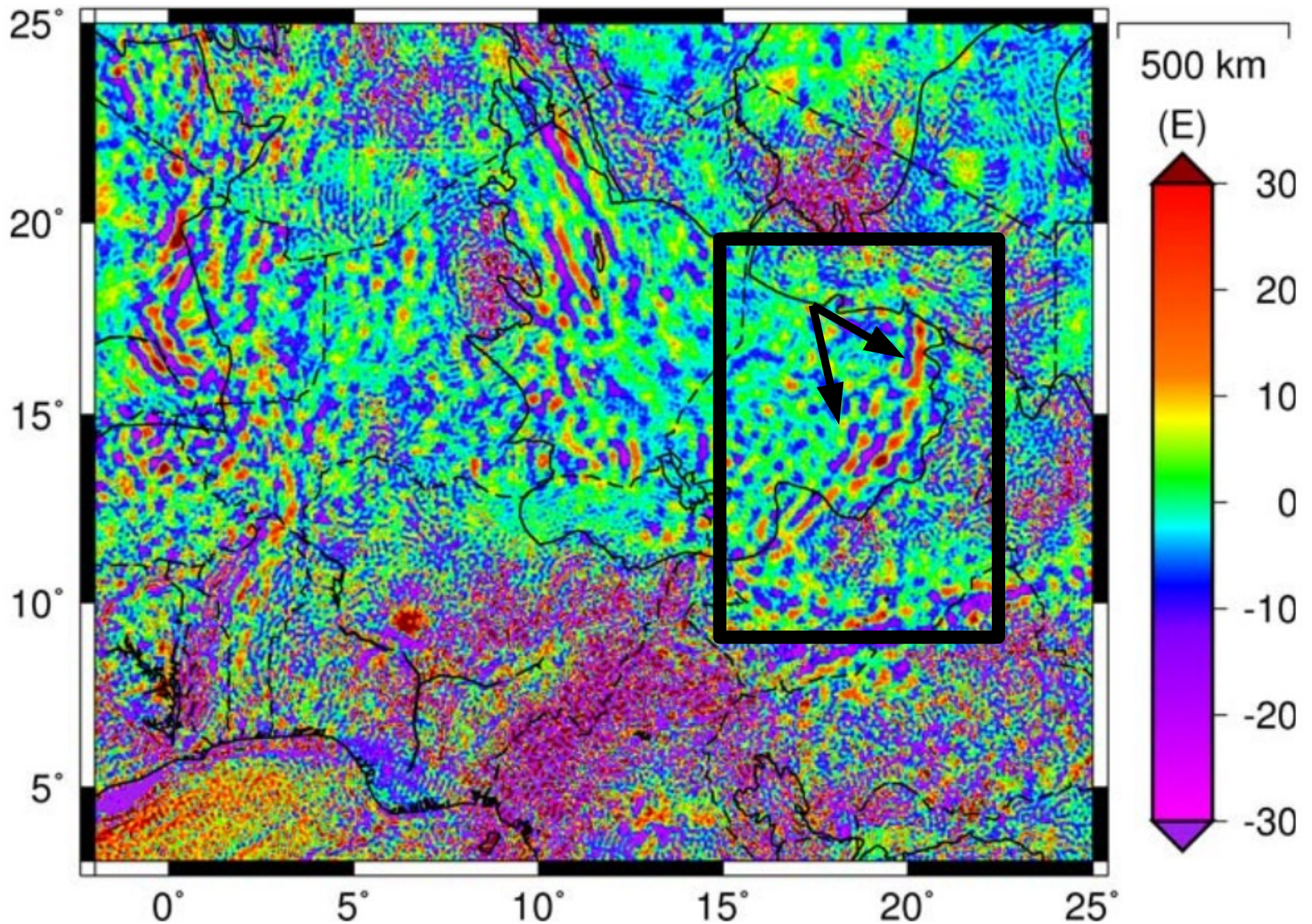


Synthetics

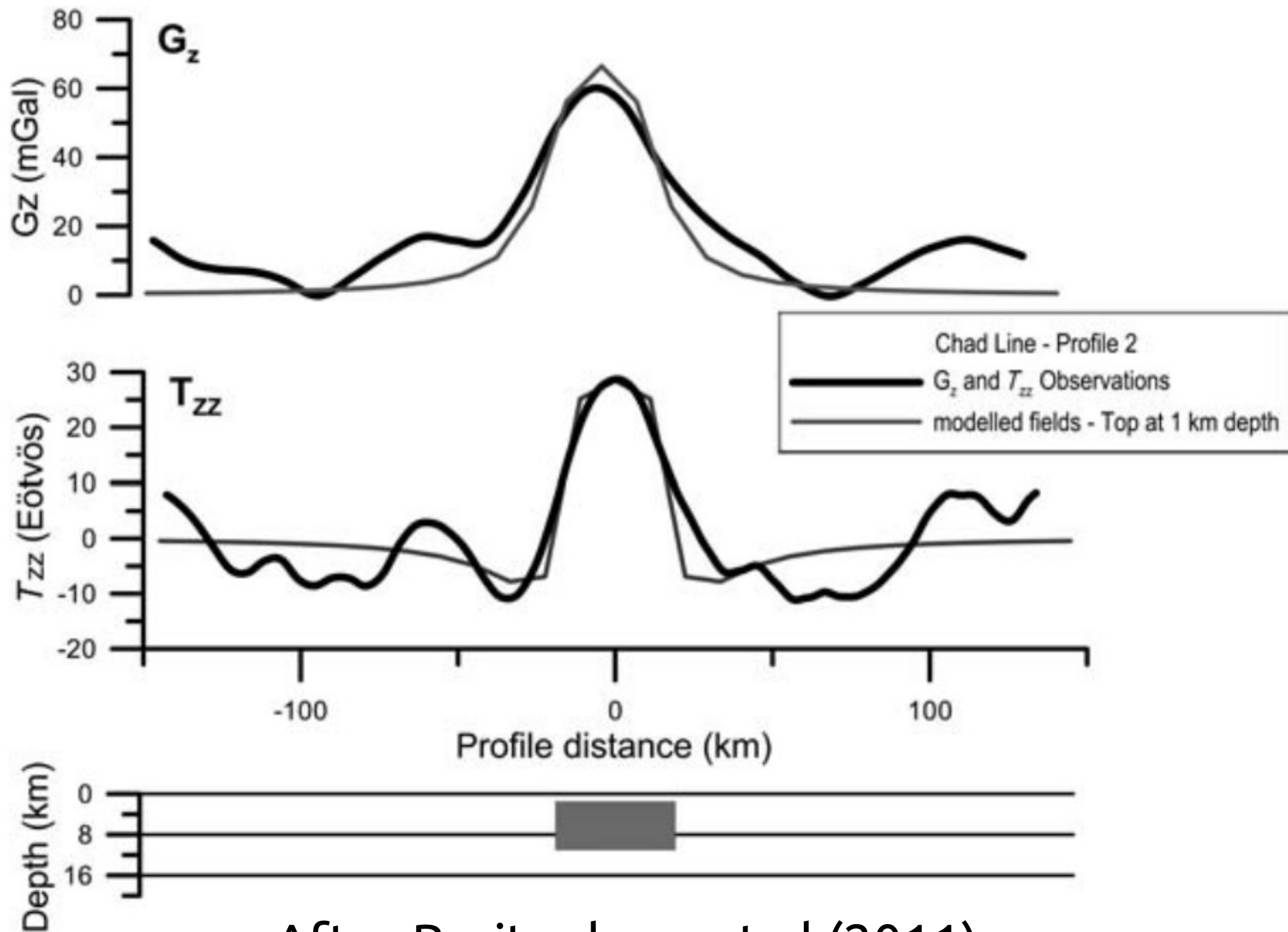
- Possible applications
- Advantages
- Shortcomings

Lineament with dense rocks (magmatic)

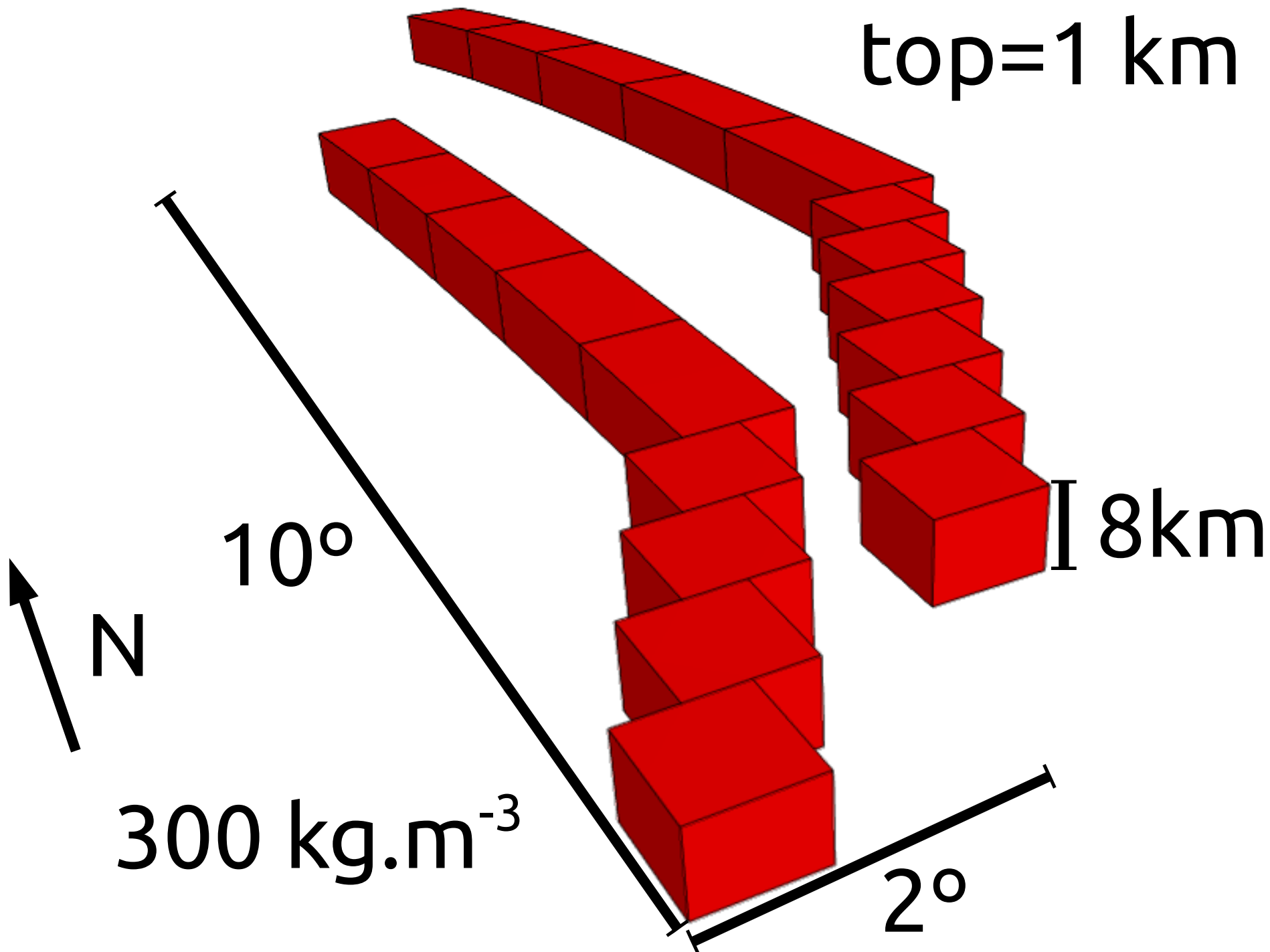
Inspired by Chad lineament model
(Braitenberg et al, 2011)



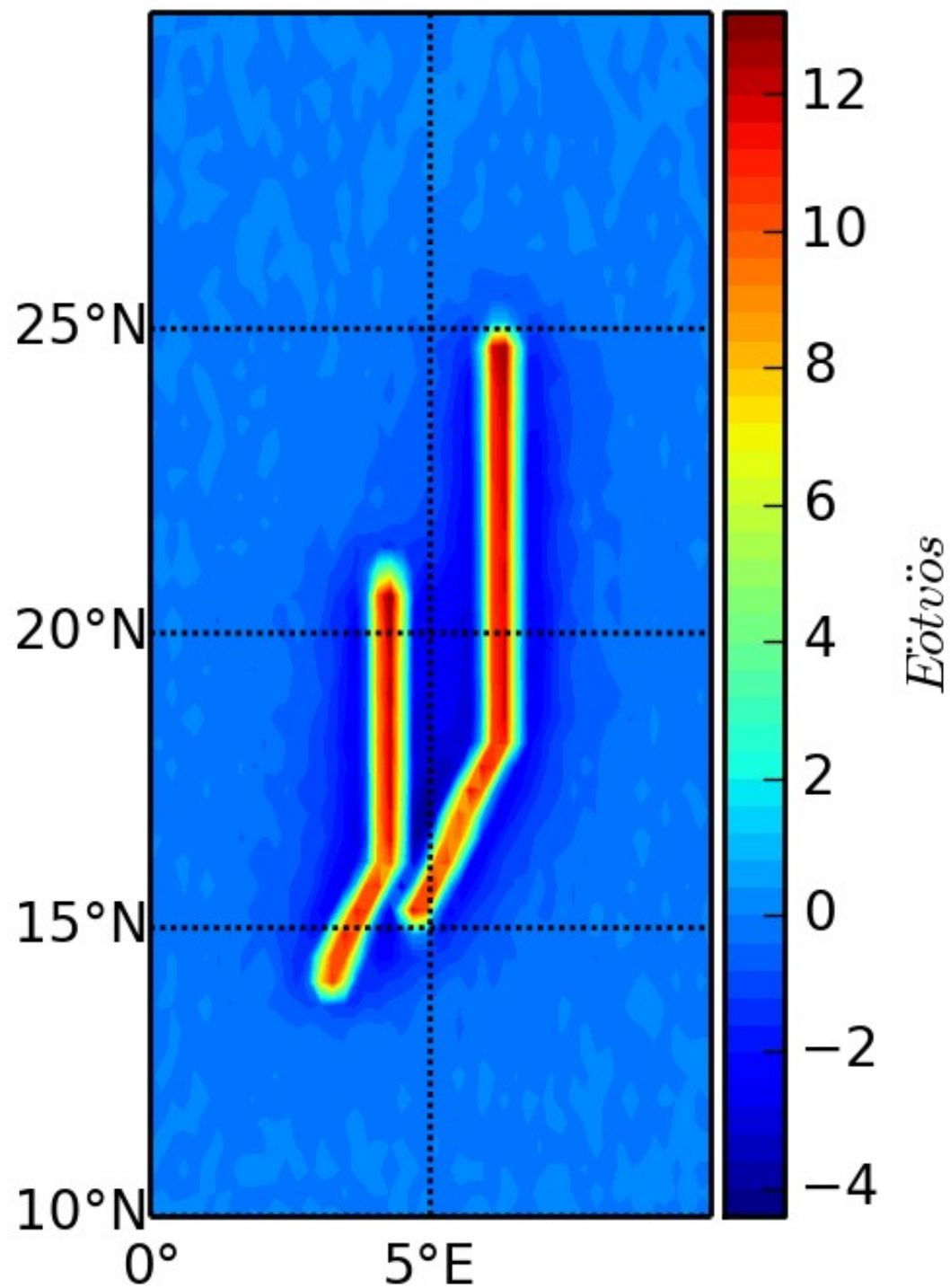
After Braitenberg et al (2011)



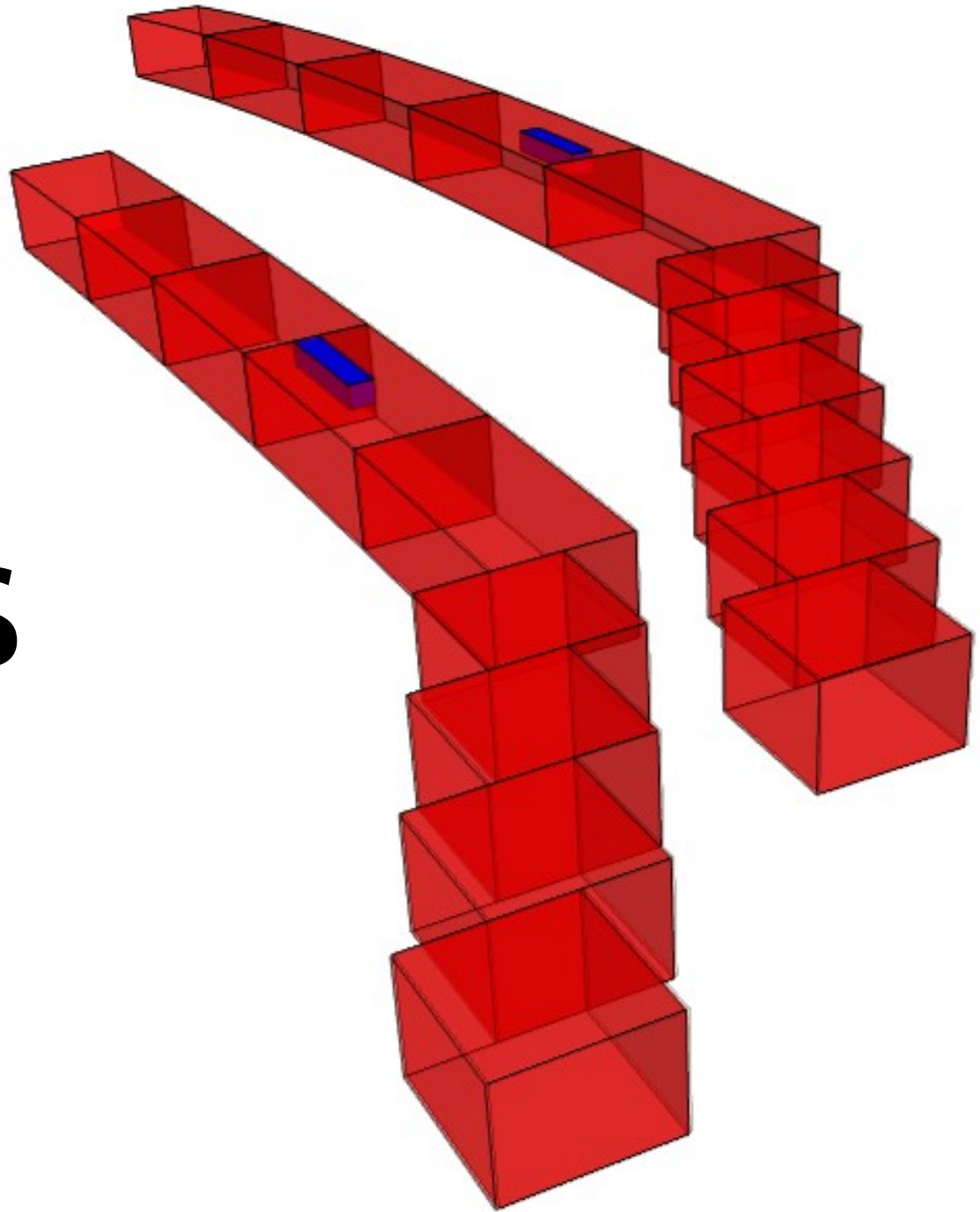
After Braitenberg et al (2011)



g_{zz}
At 20 km

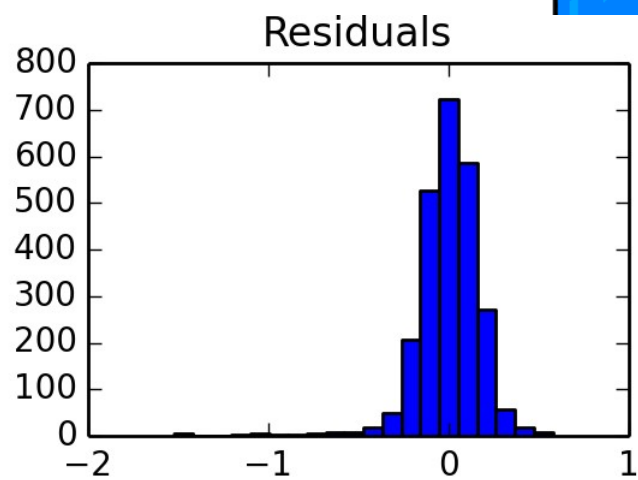
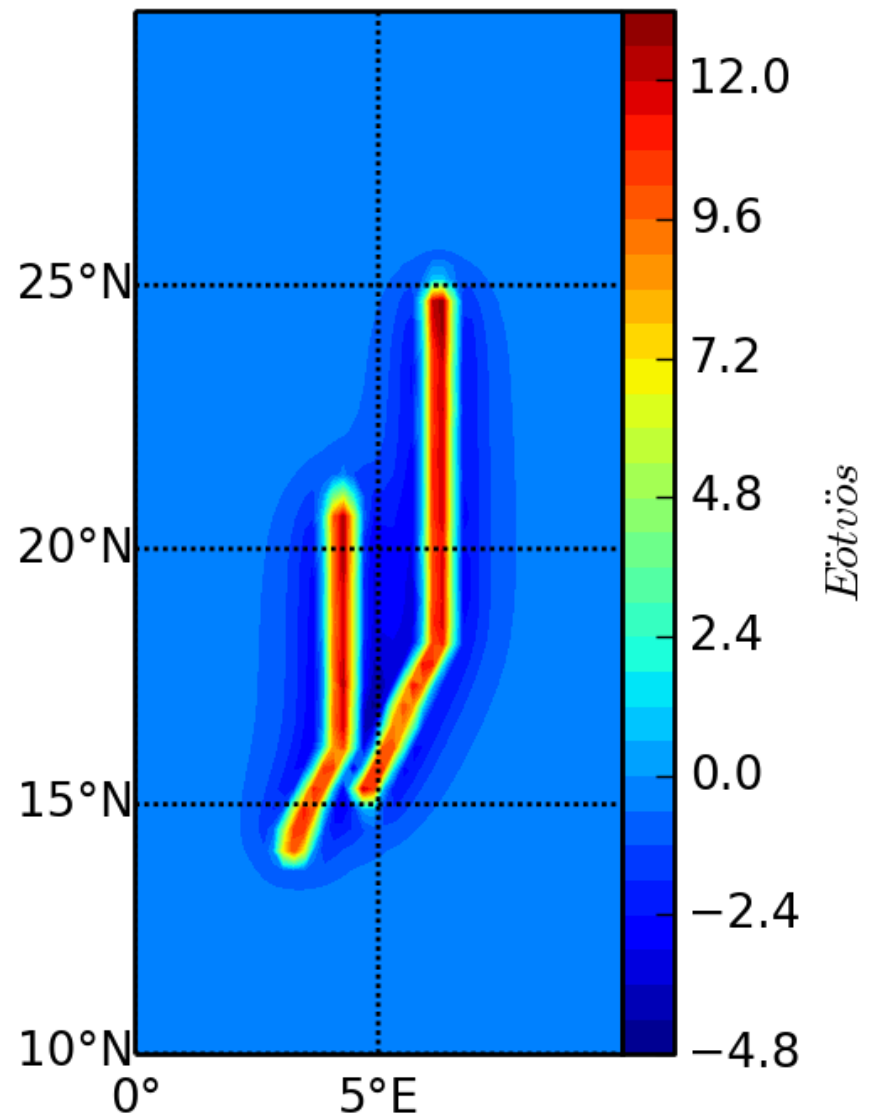
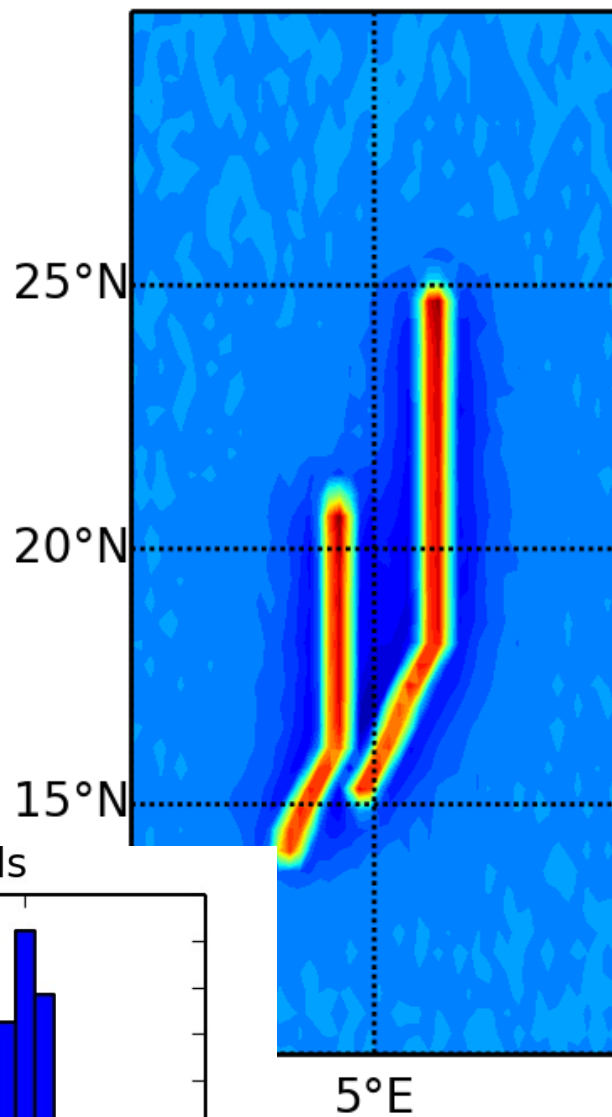


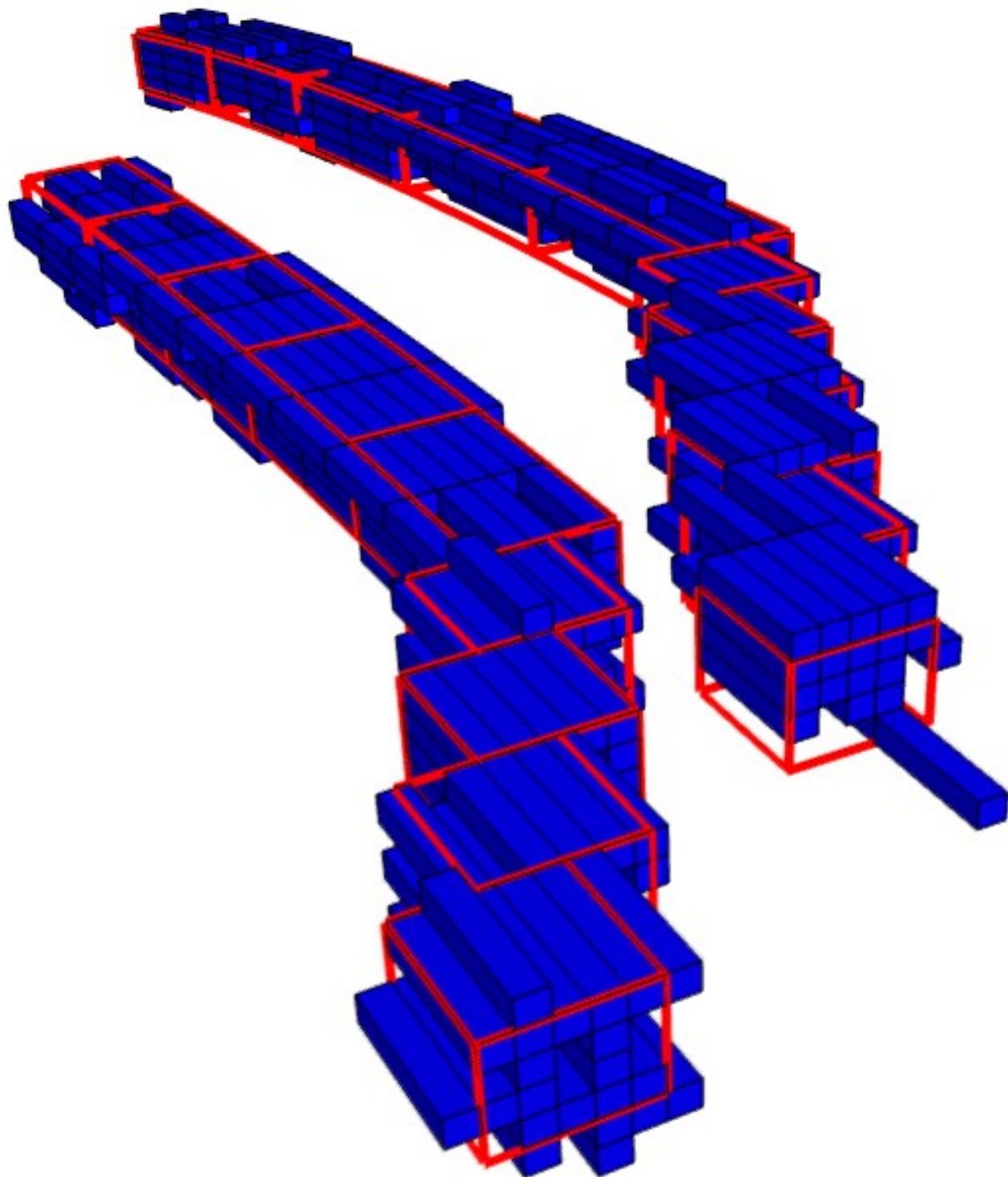
Seeds



observed

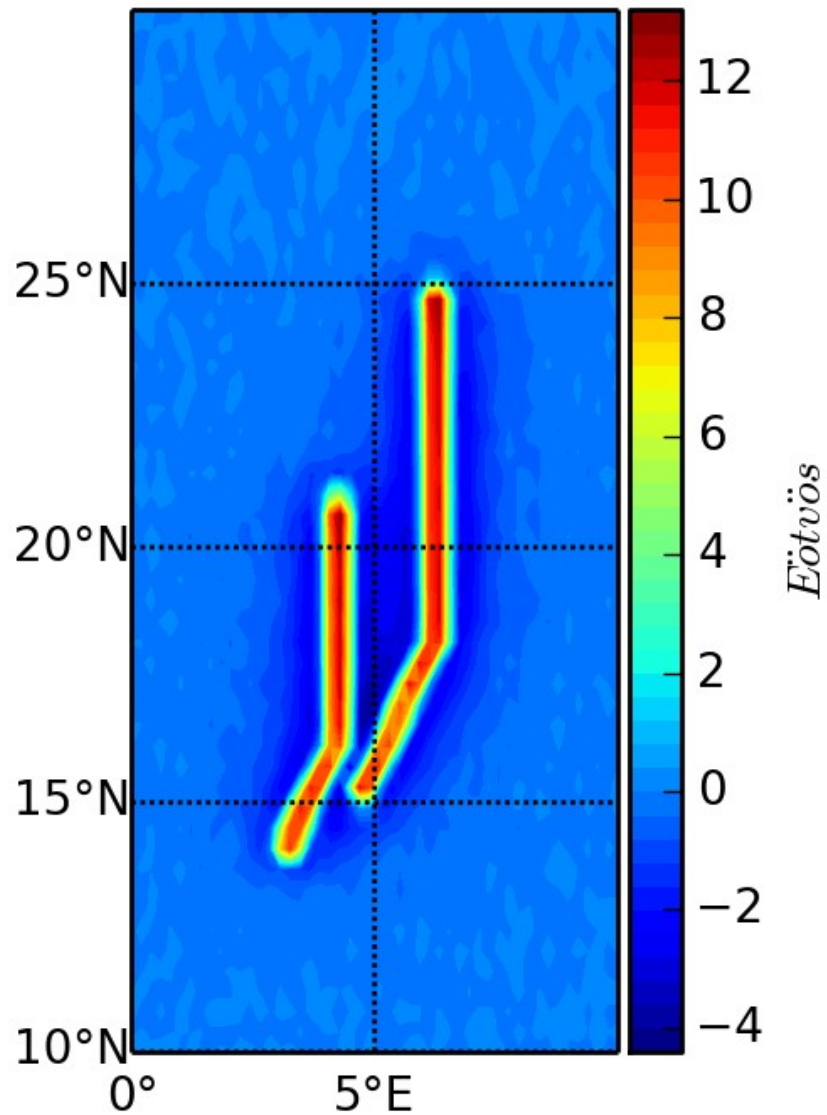
predicted



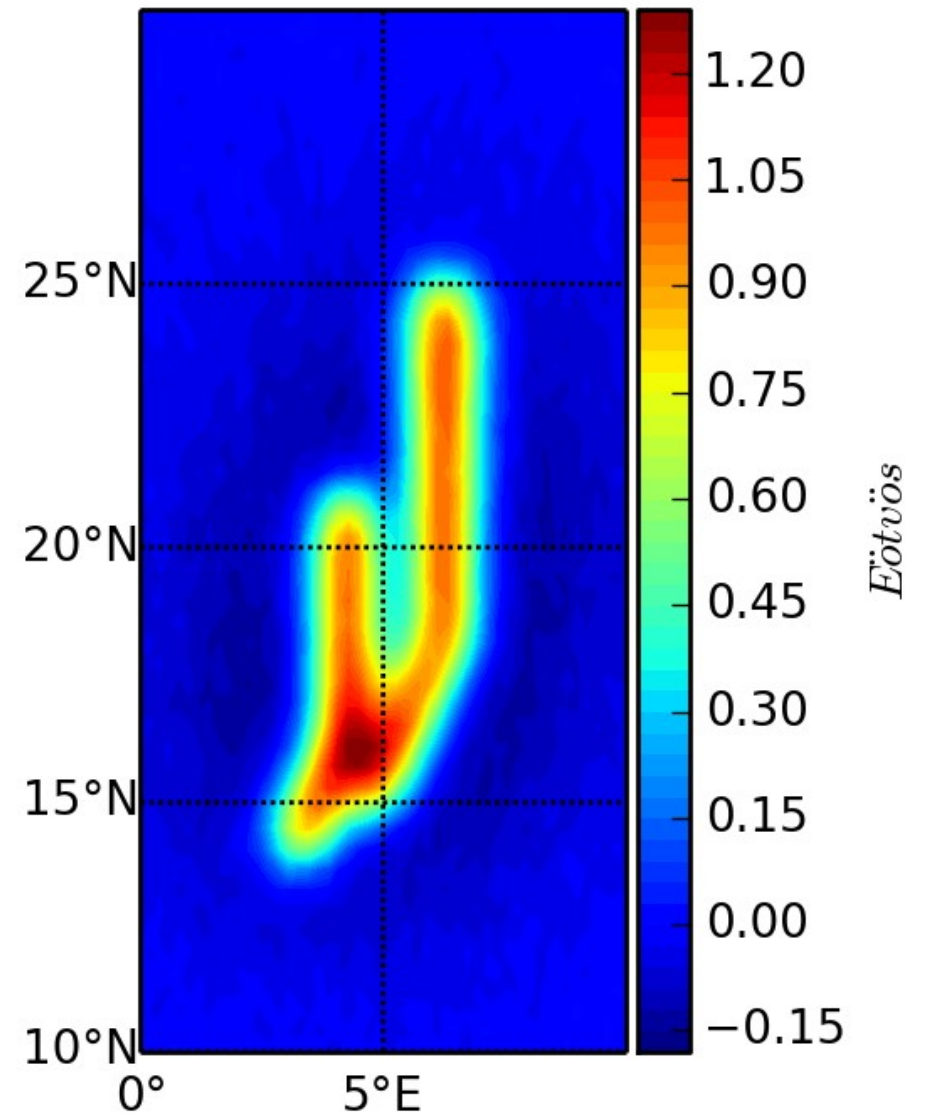


What if height=120 km?

at 20 km

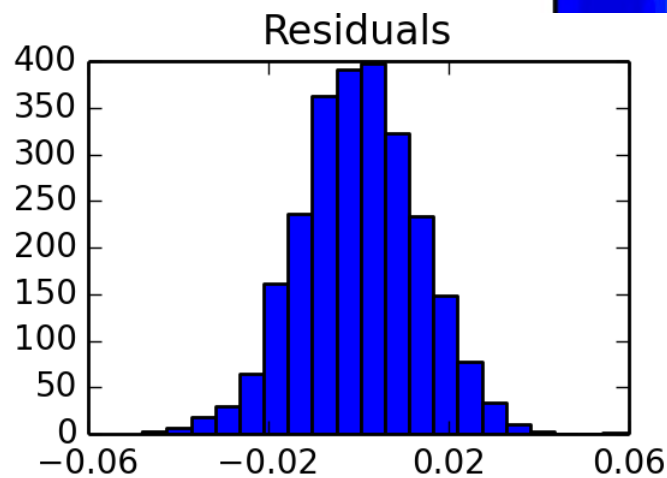
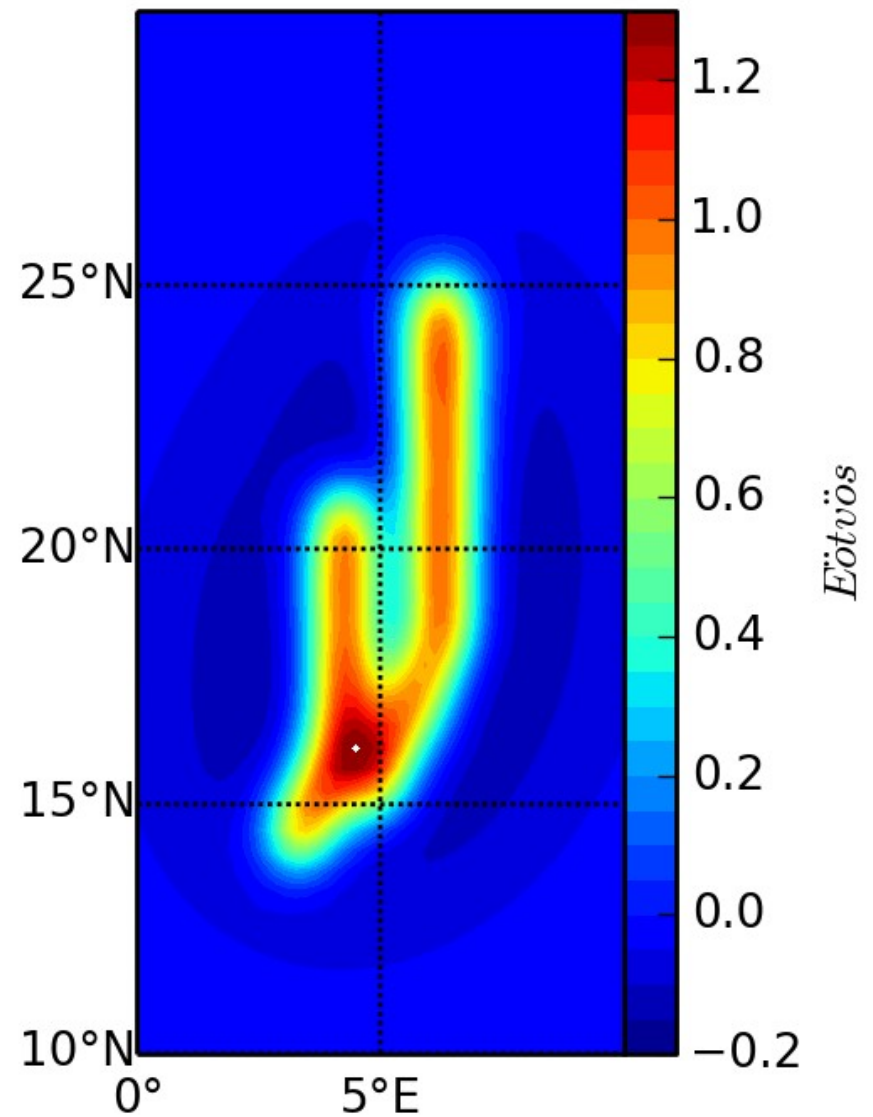
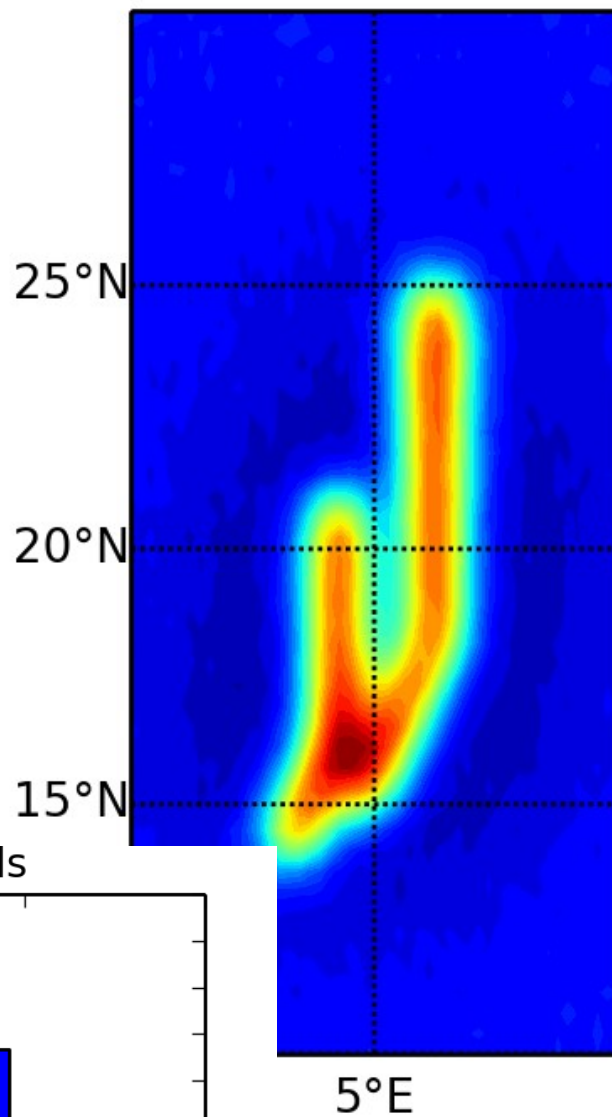


at 120 km

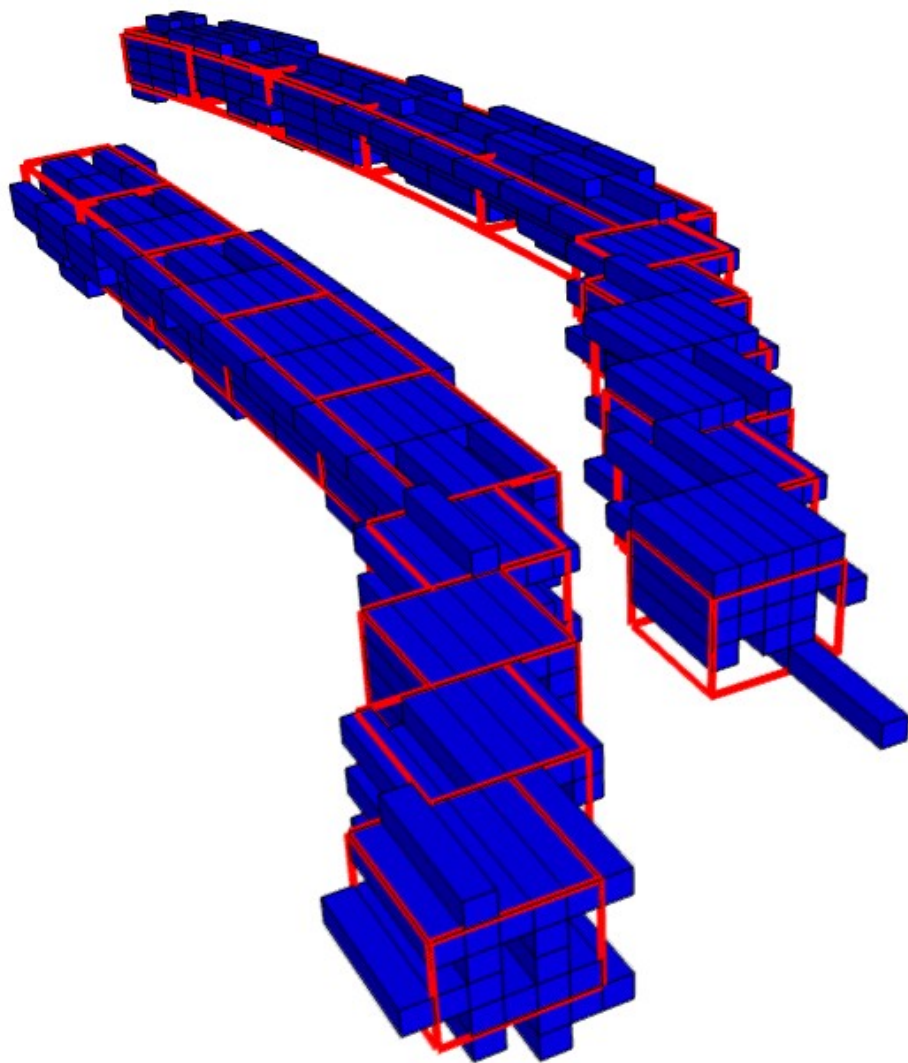


observed

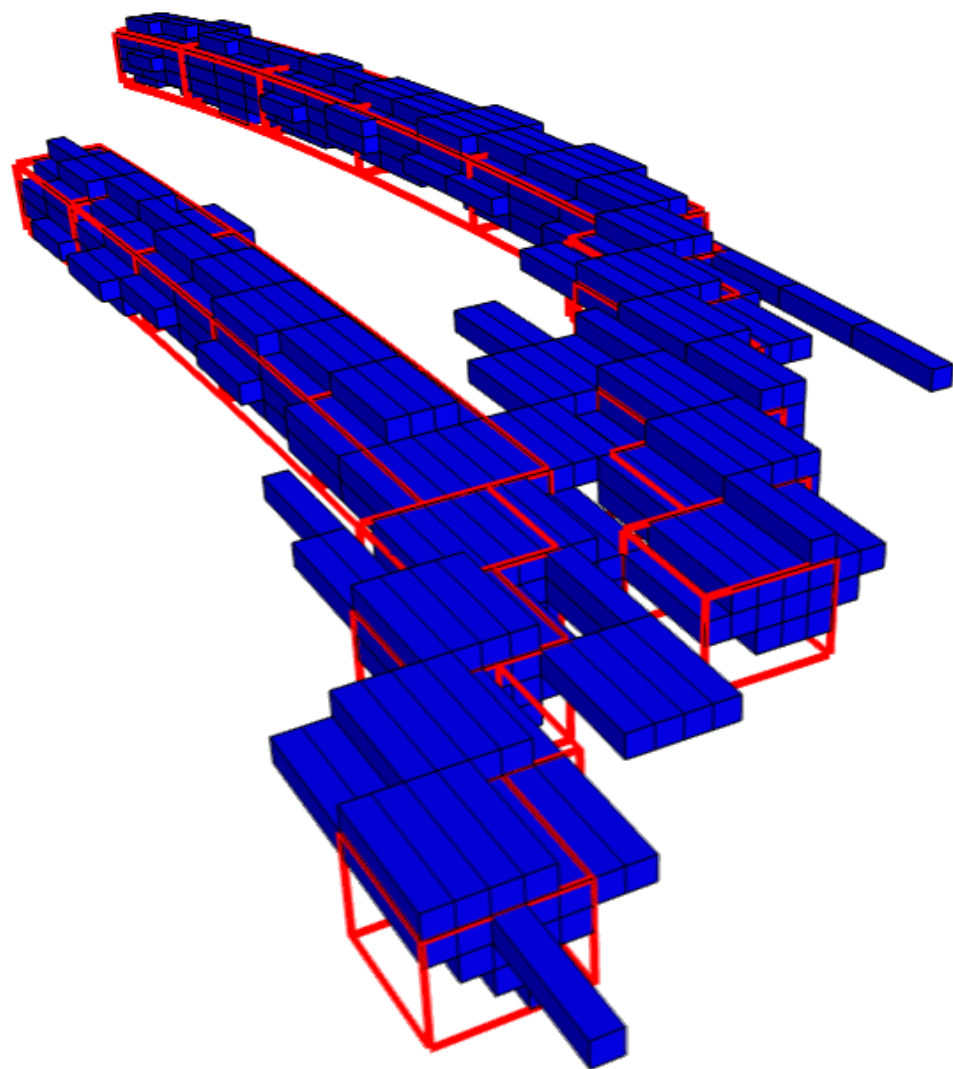
predicted



at 20 km

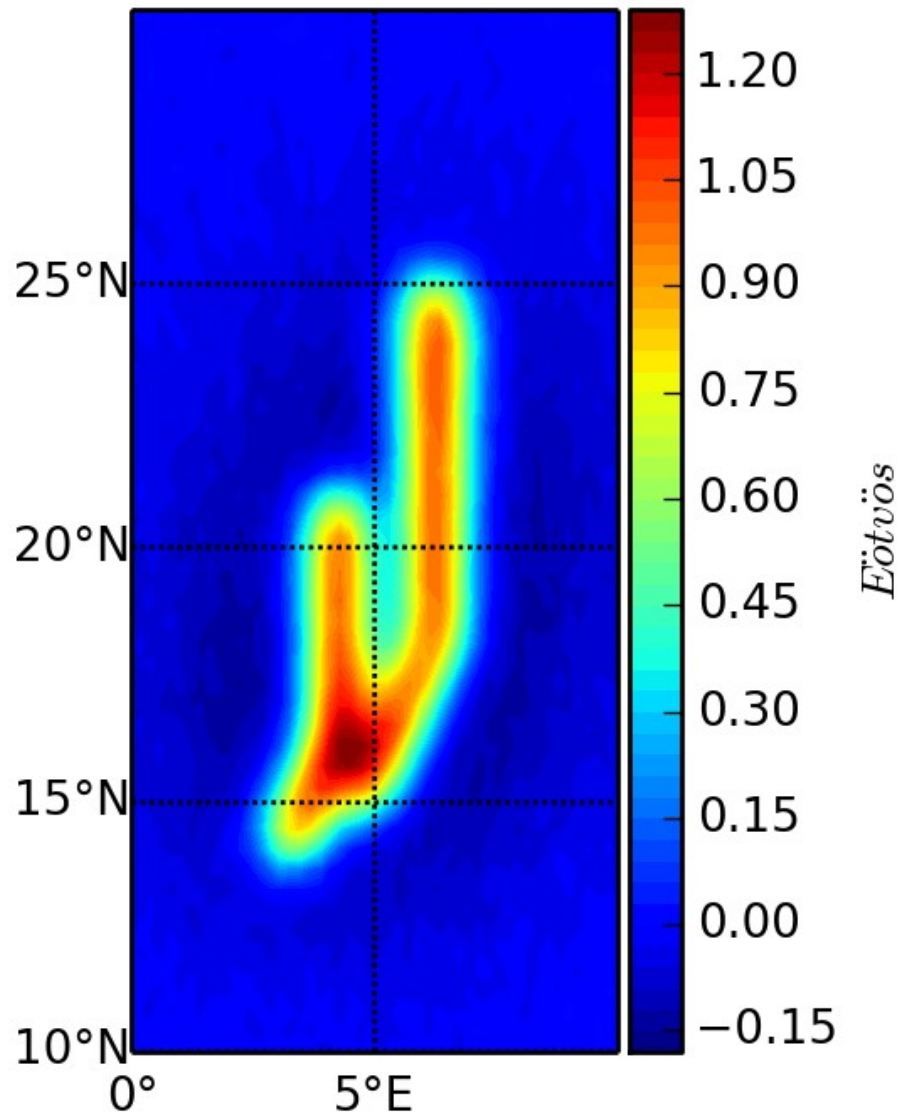


at 120 km

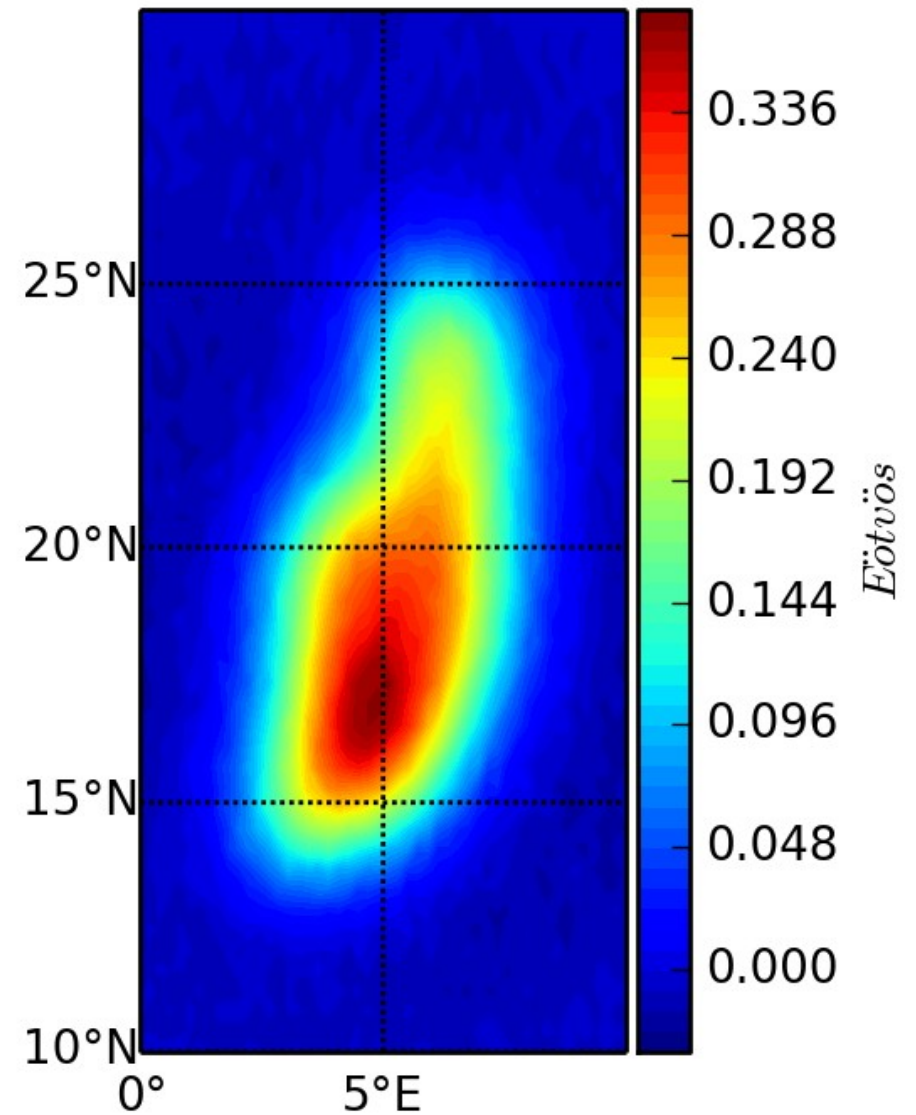


Even higher
height=270 km

at 120 km

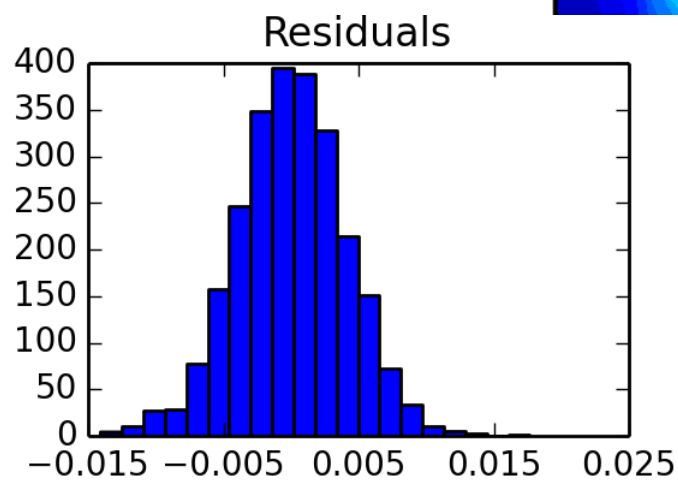
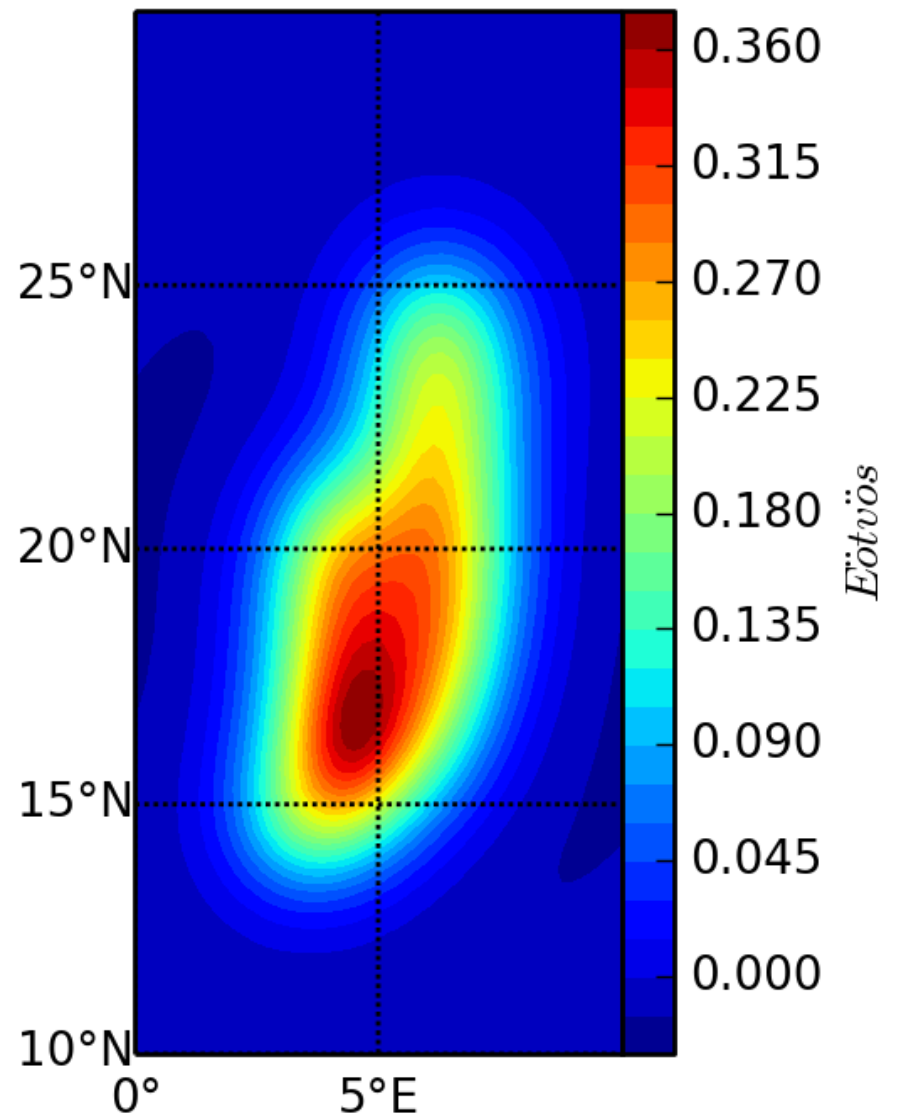
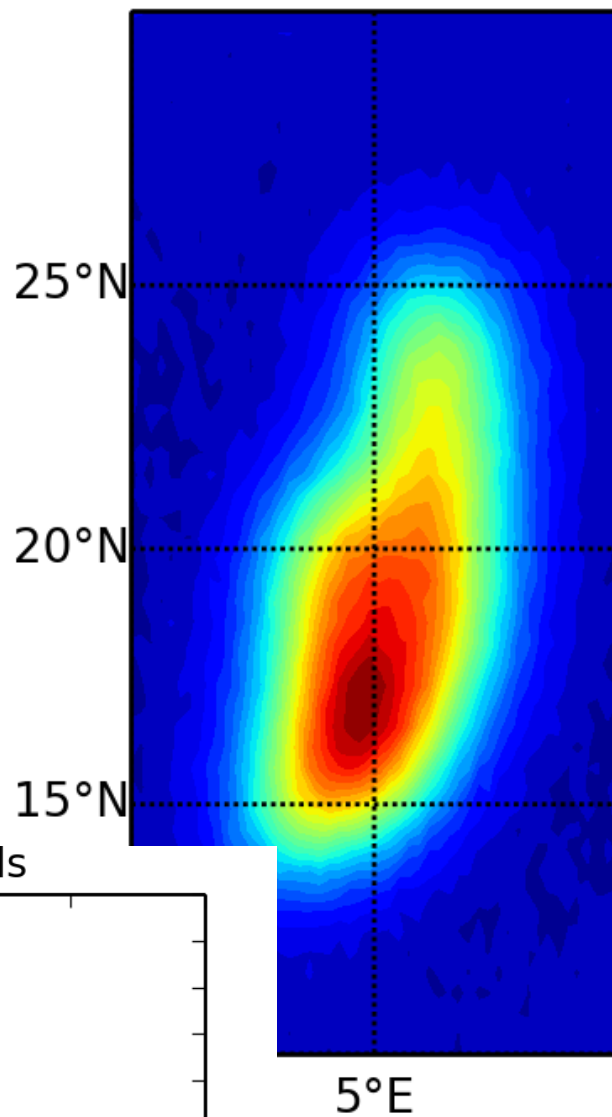


at 270 km

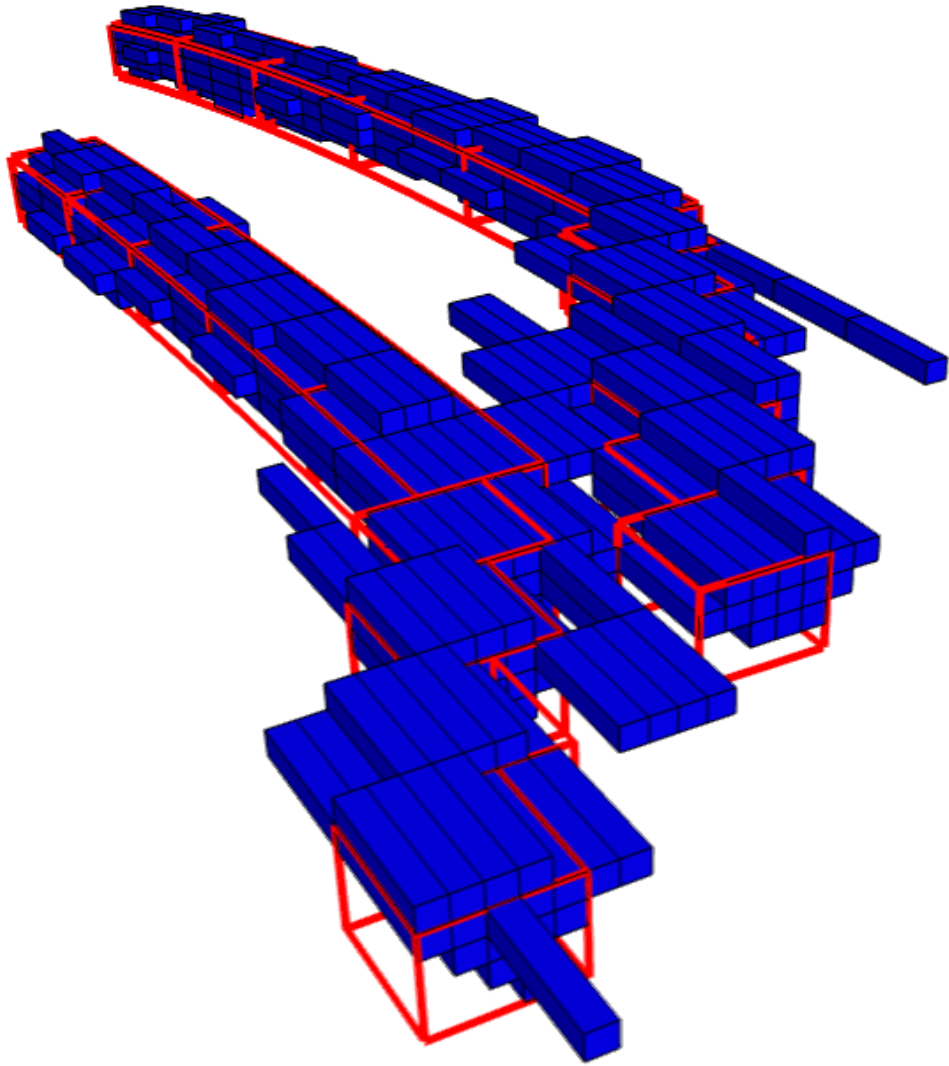


observed

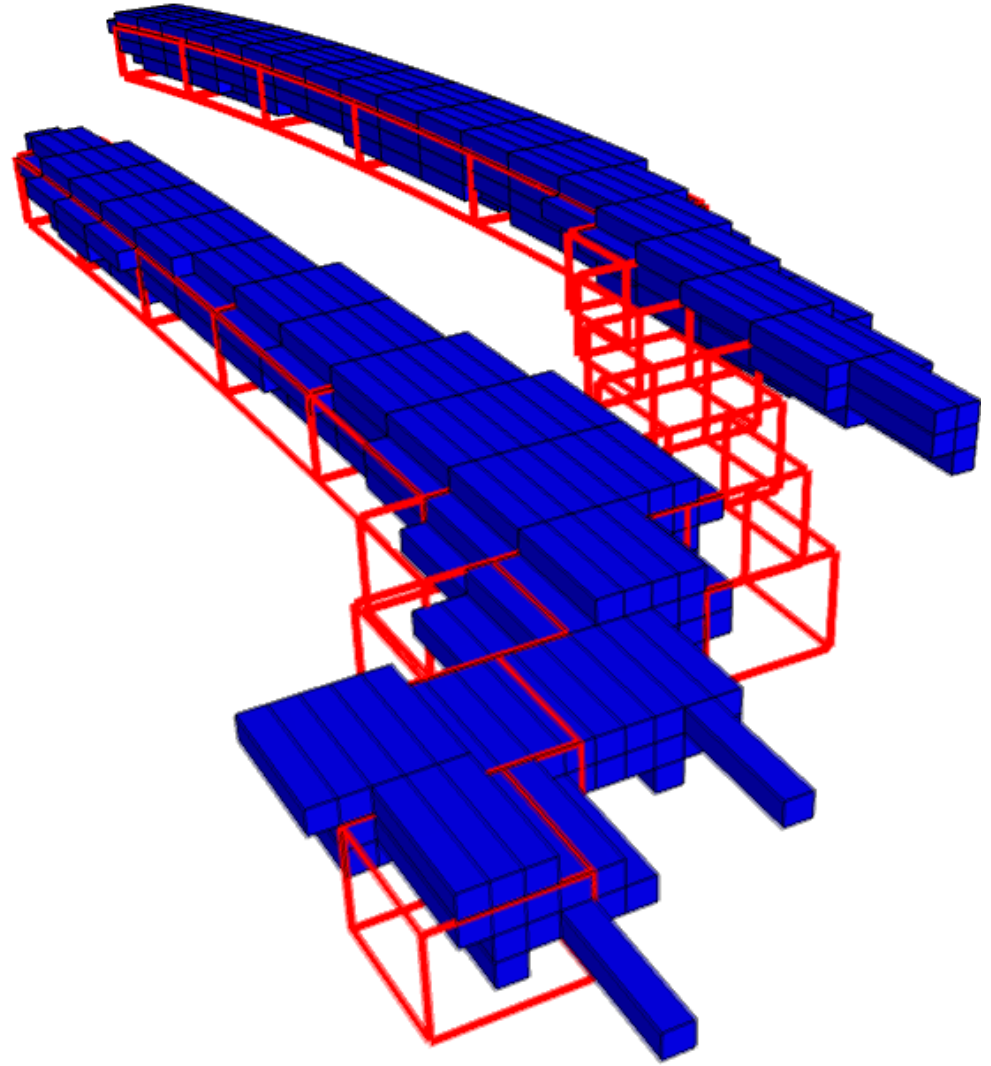
predicted



at 120 km

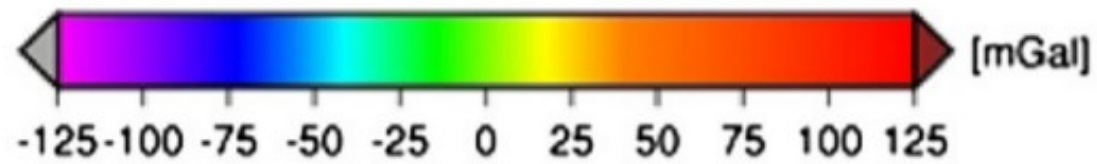


at 270 km

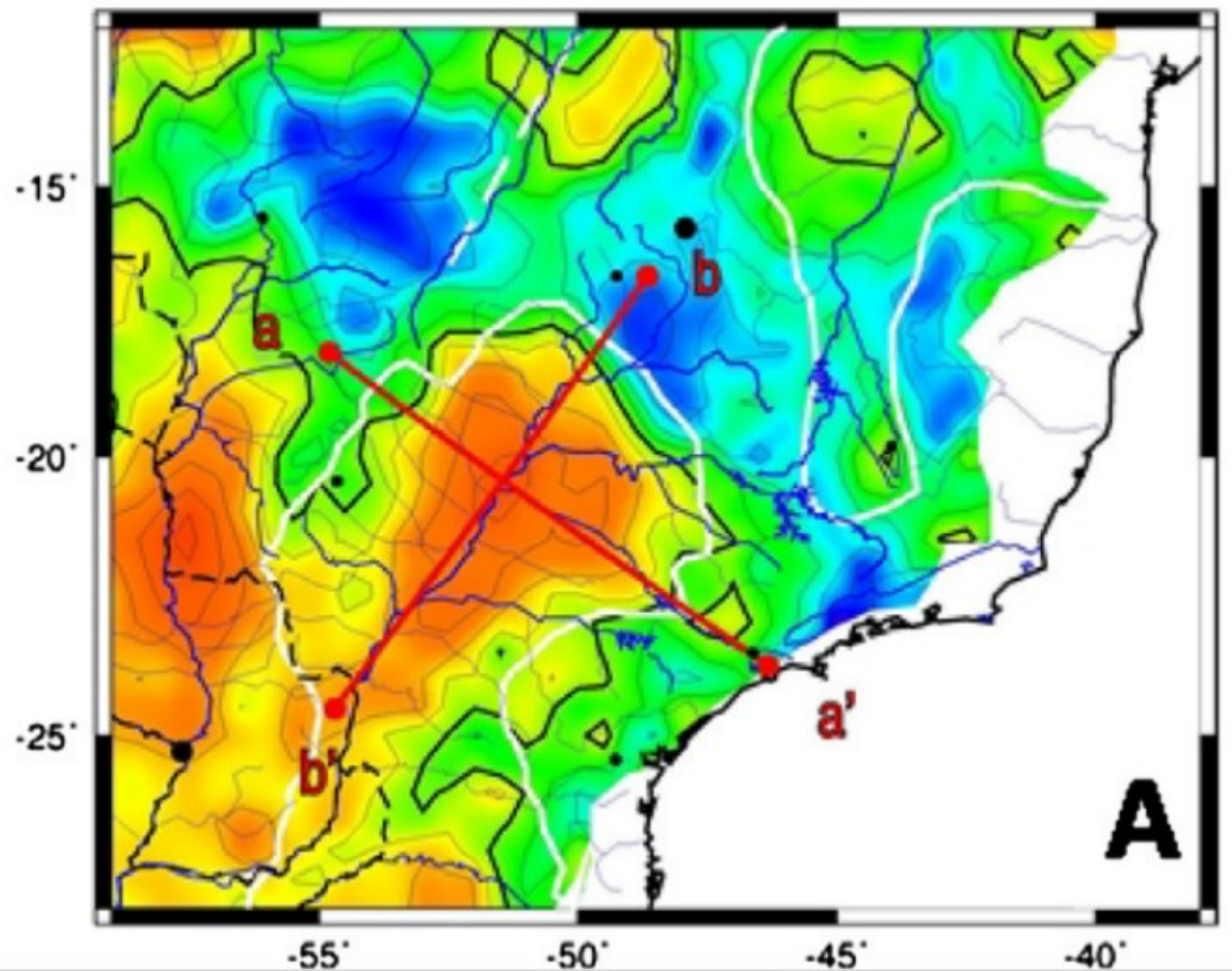


Magmatic underplating

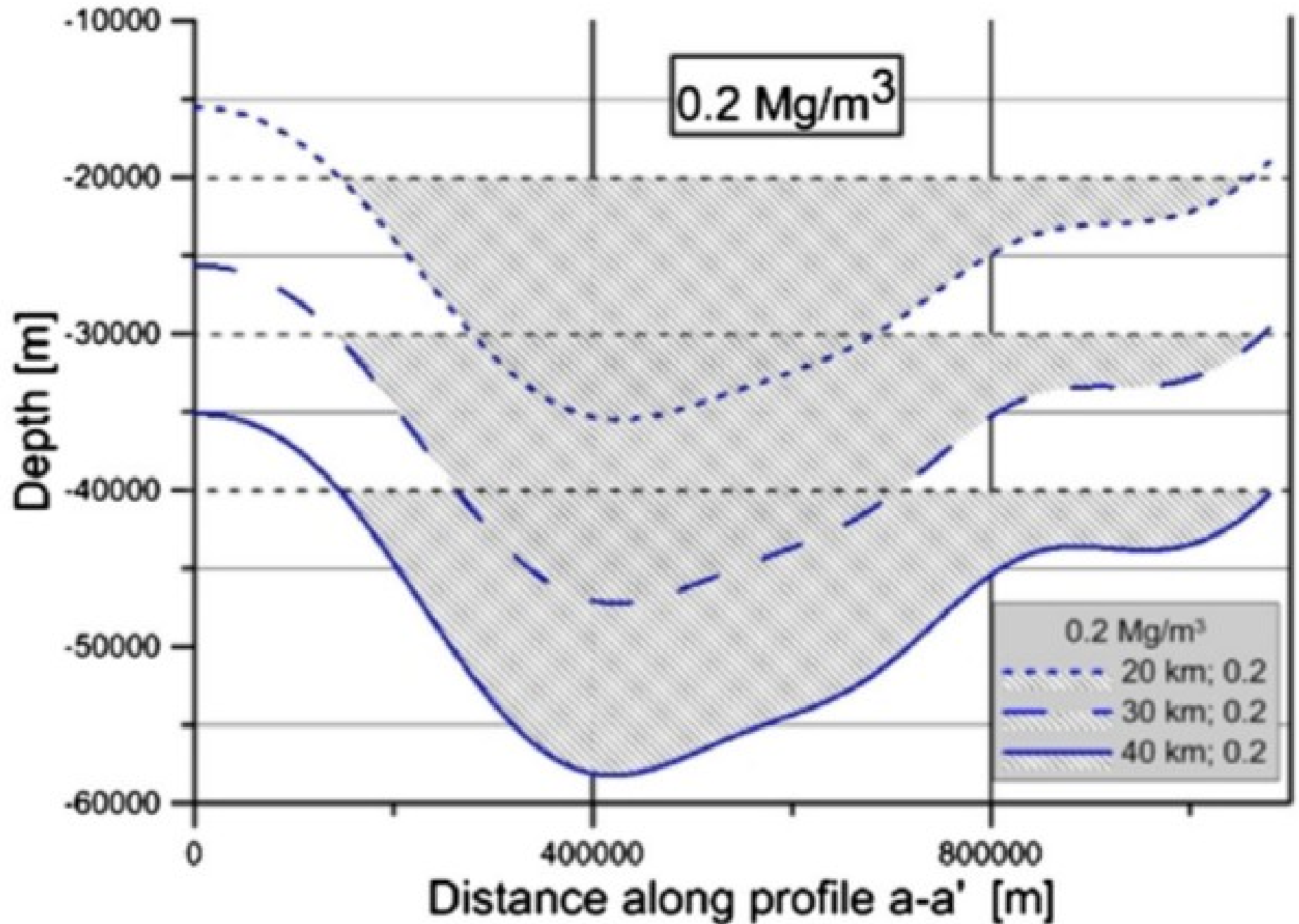
Inspired by model of the Paraná basin
by Mariani et al (2013)



BOUGUER CORR. MOHO_A_0.3 & SED



After Mariani et al (2013)



After Mariani et al (2013)

top=30 km

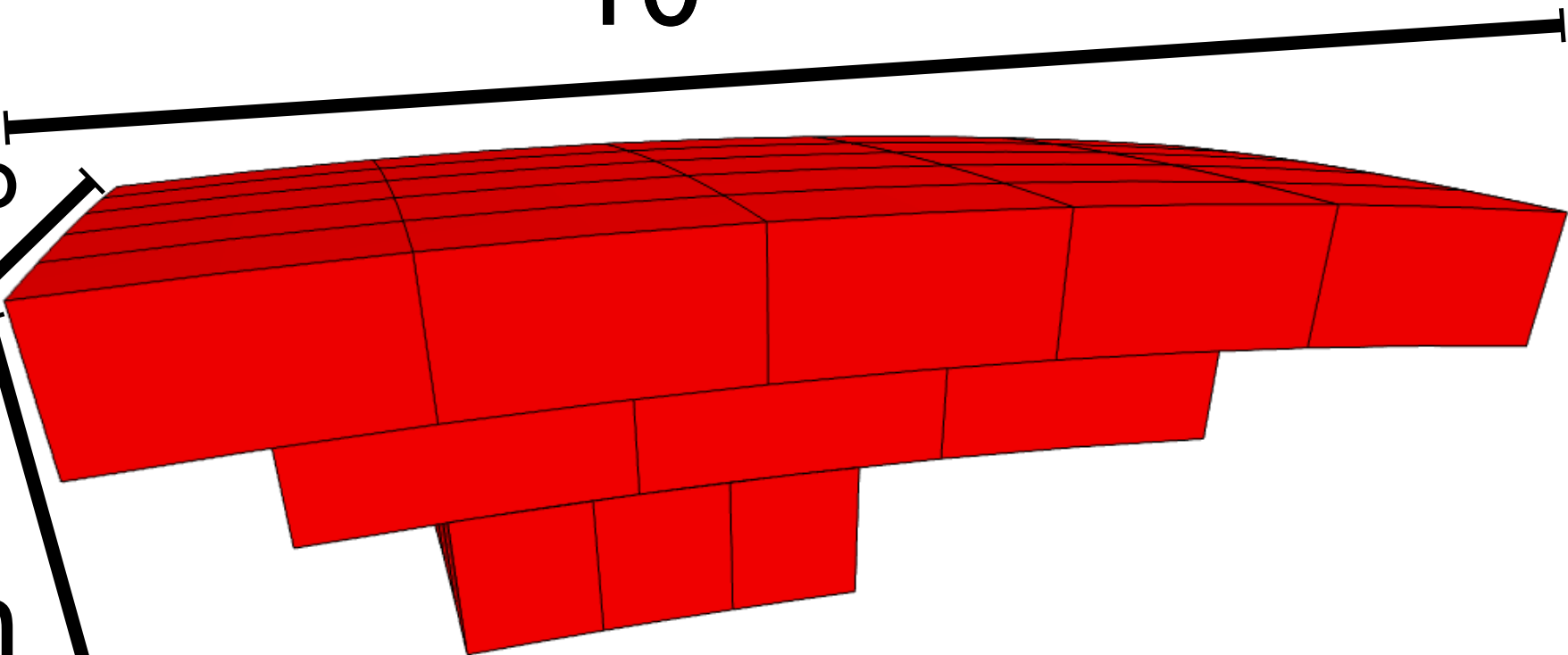
10°

5°

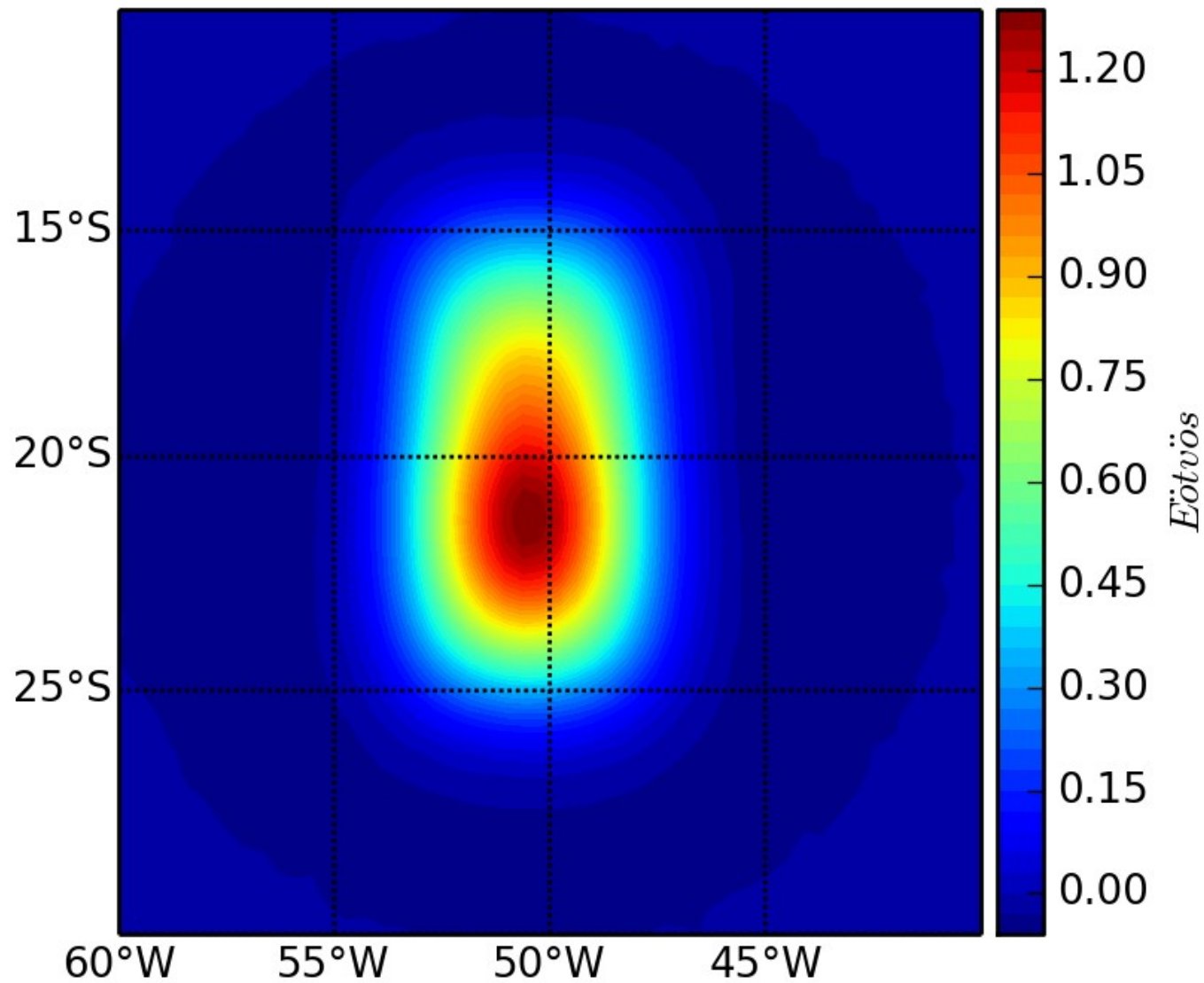
15
km

N

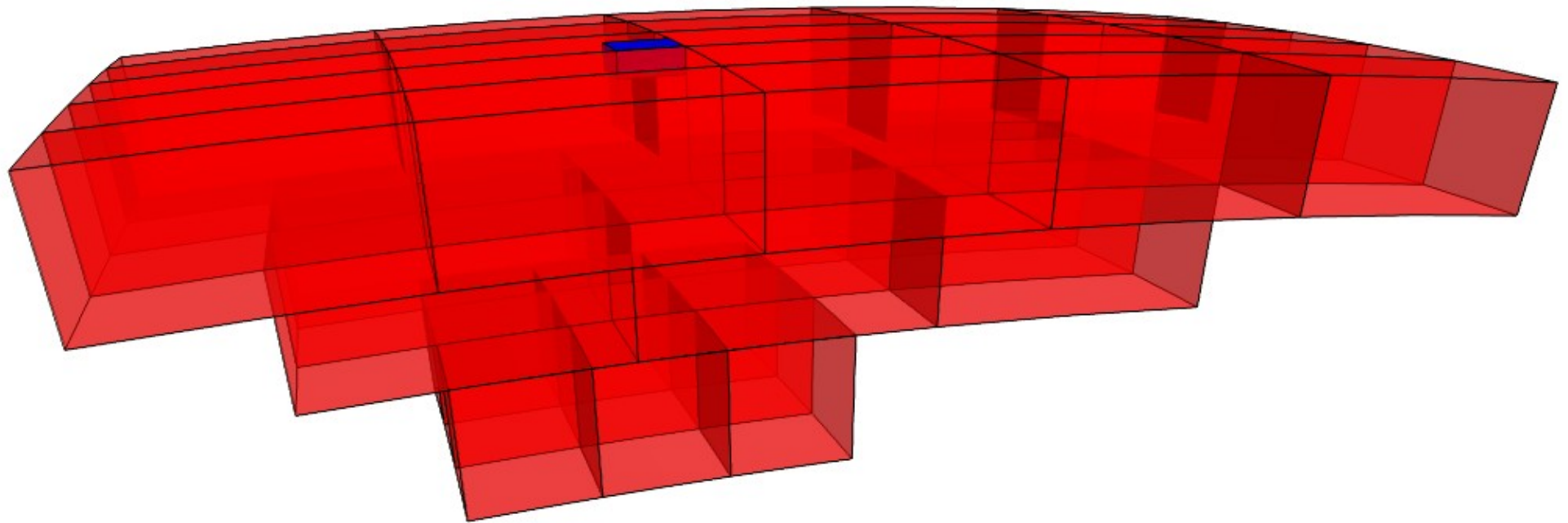
200 kg.m^{-3}

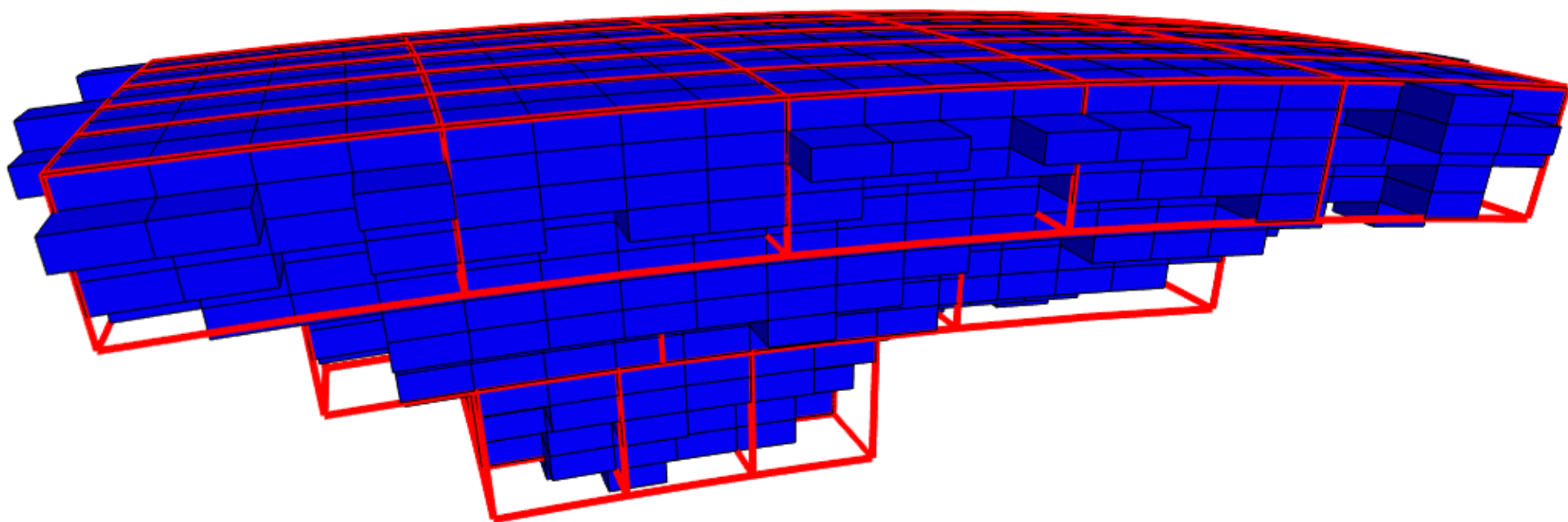
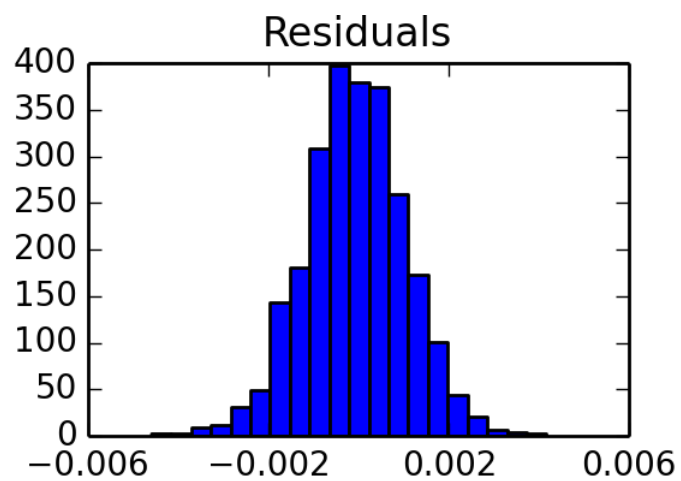
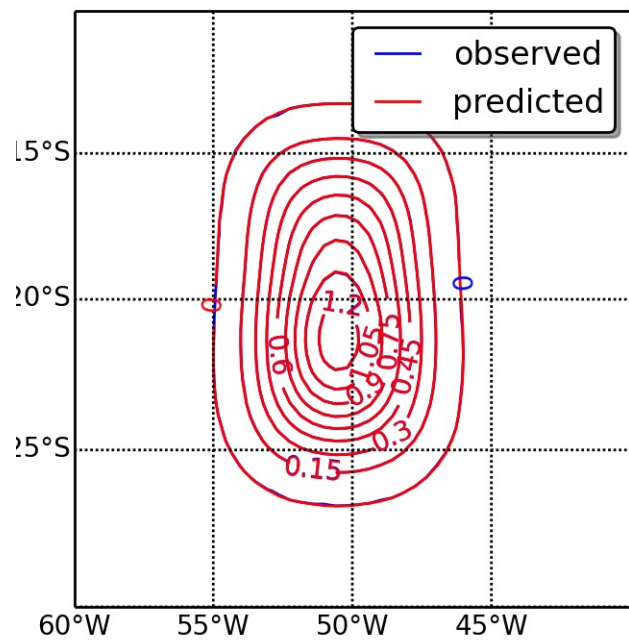


g_{zz} at 250 km

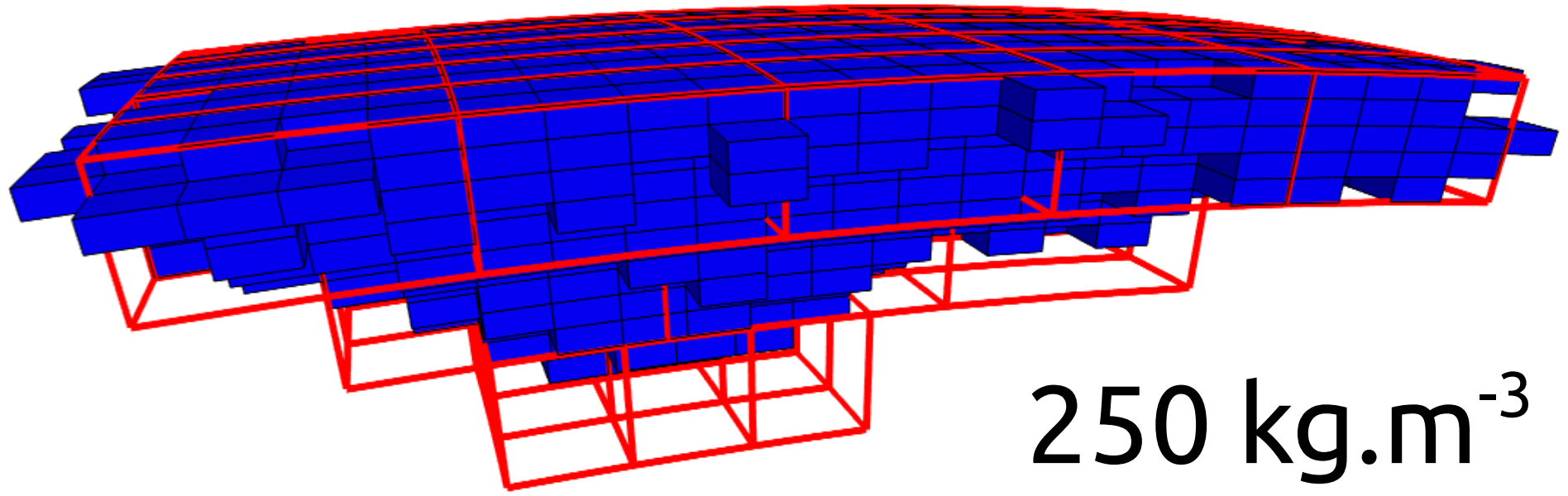


Seed

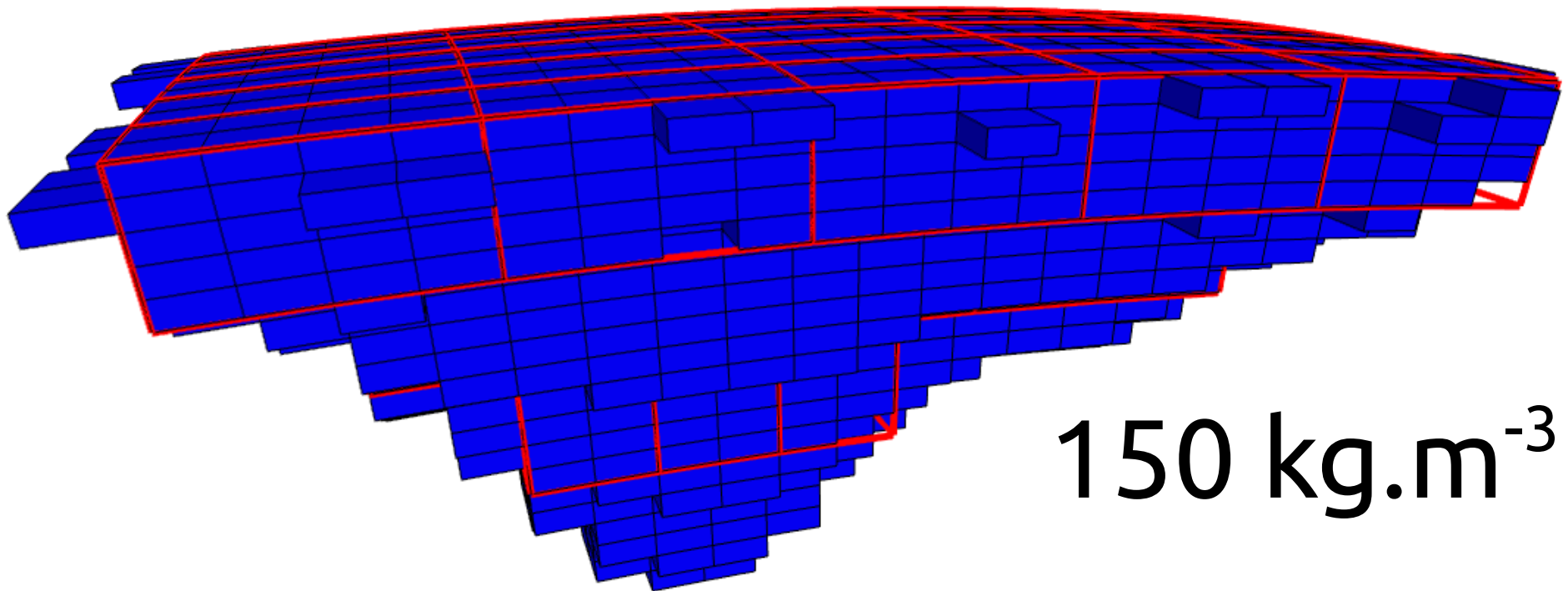




What if I use wrong density?

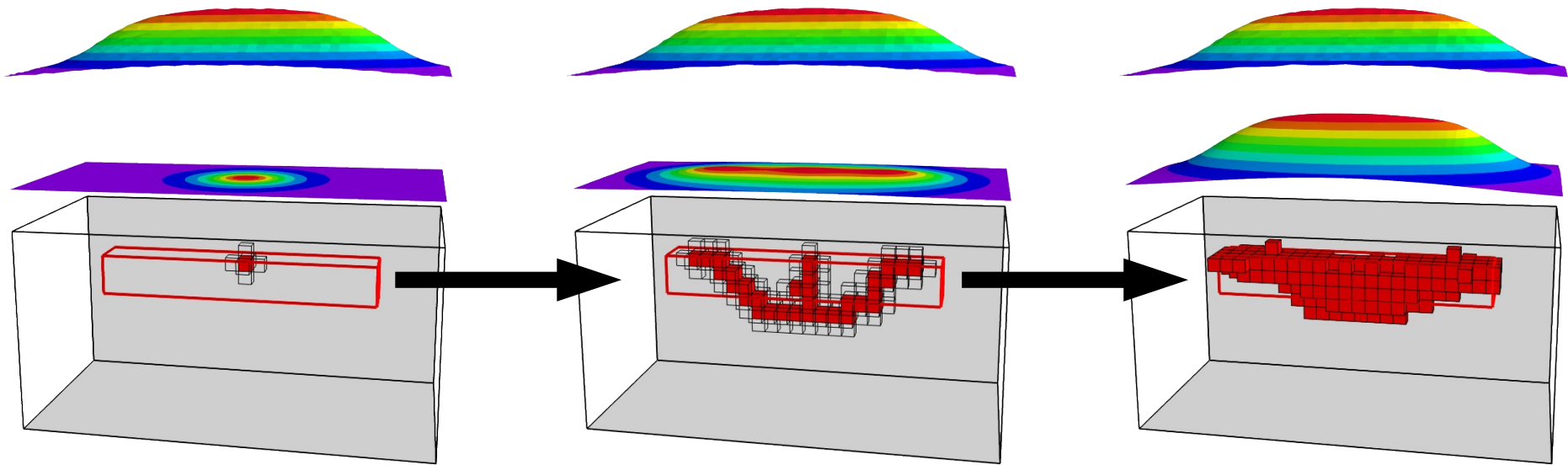


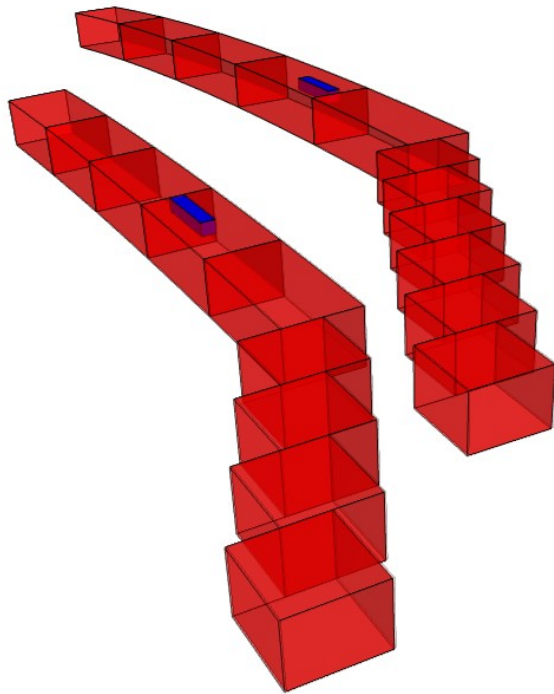
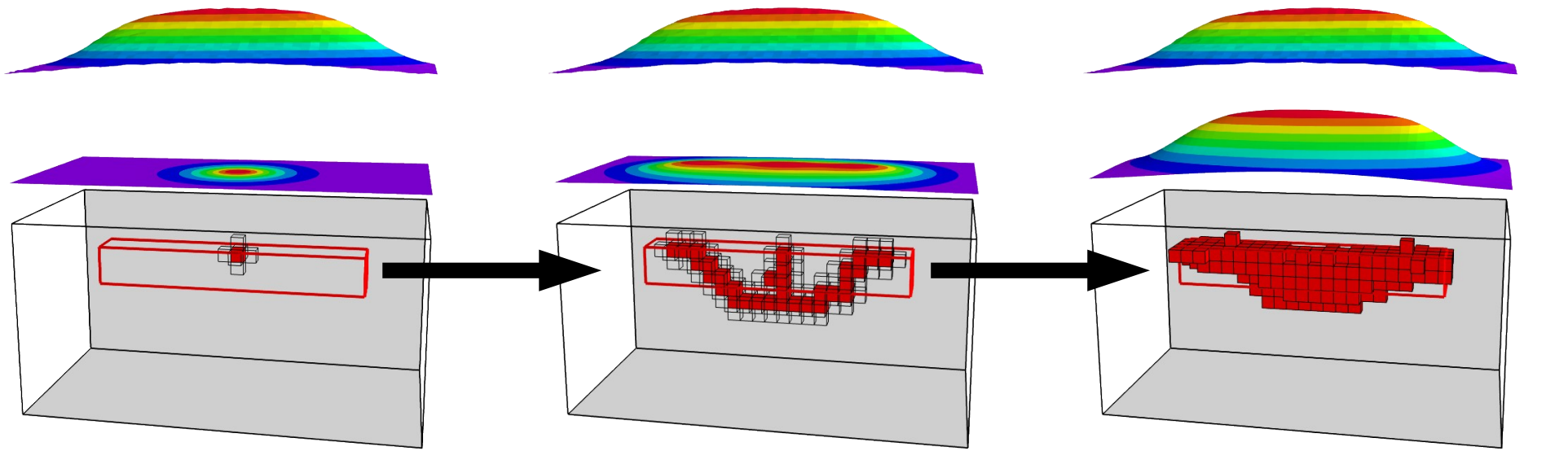
250 kg.m^{-3}



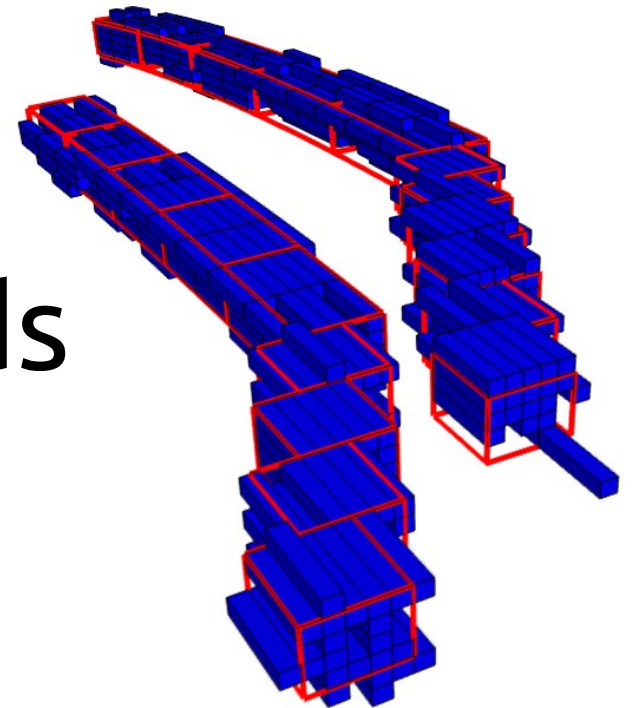
150 kg.m^{-3}

In conclusion

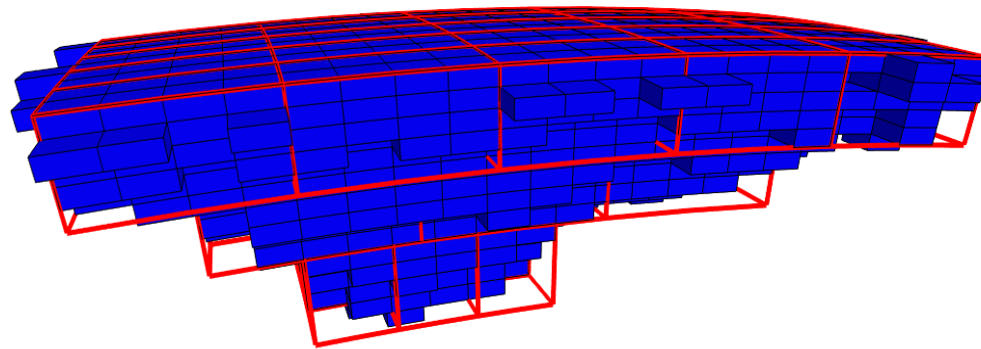
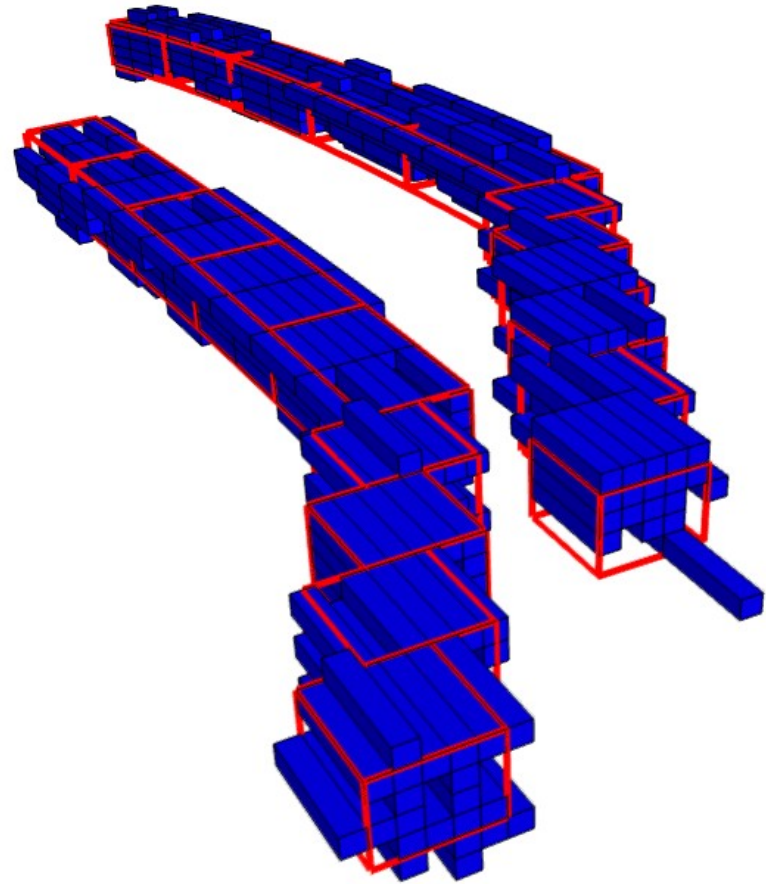
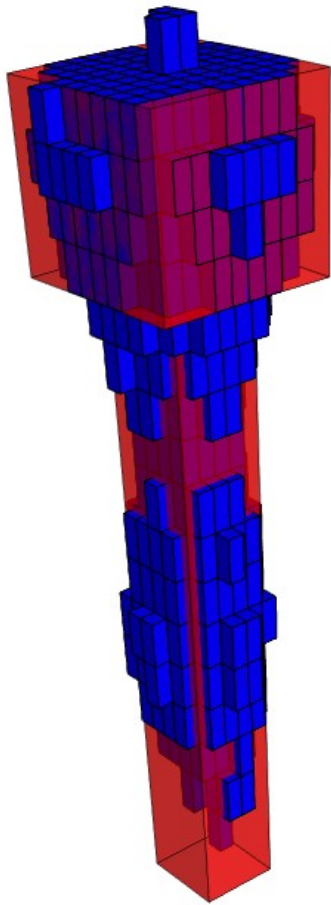




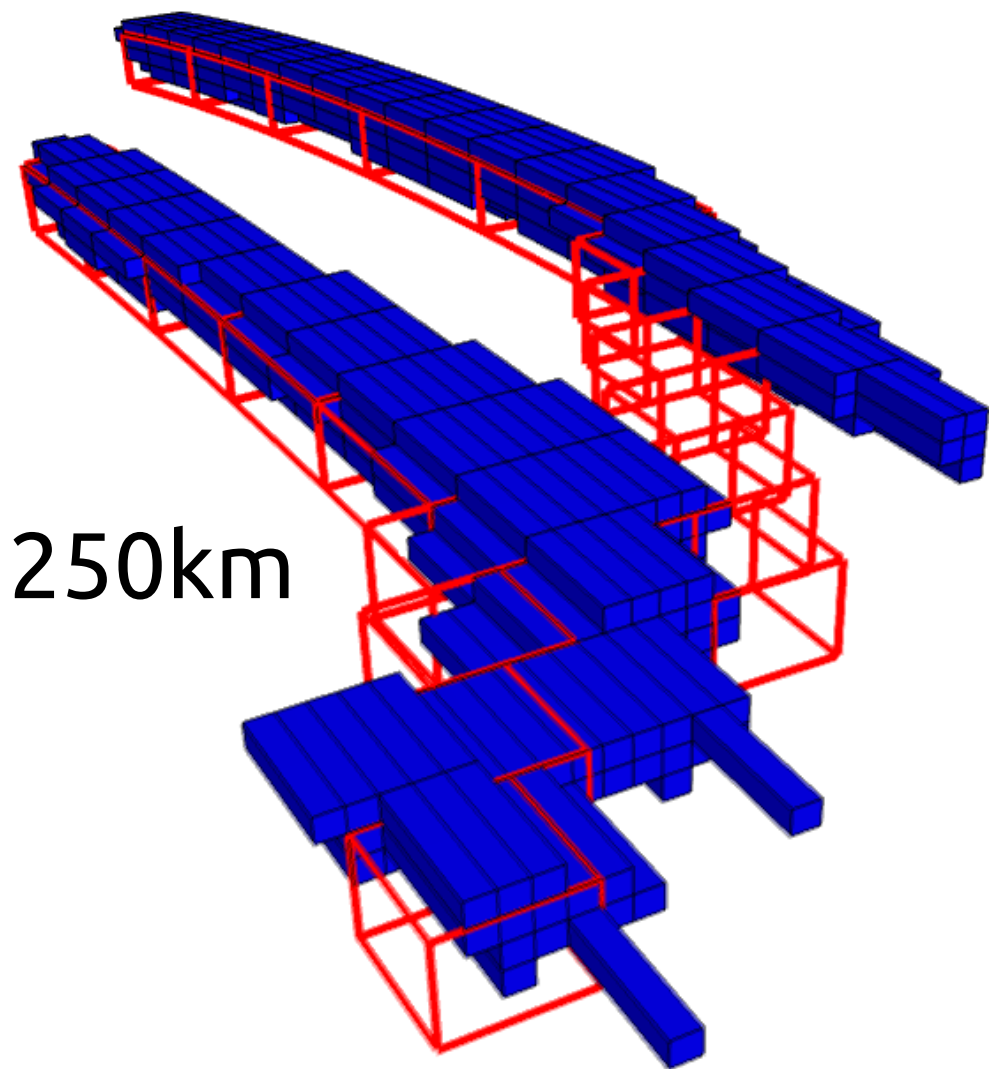
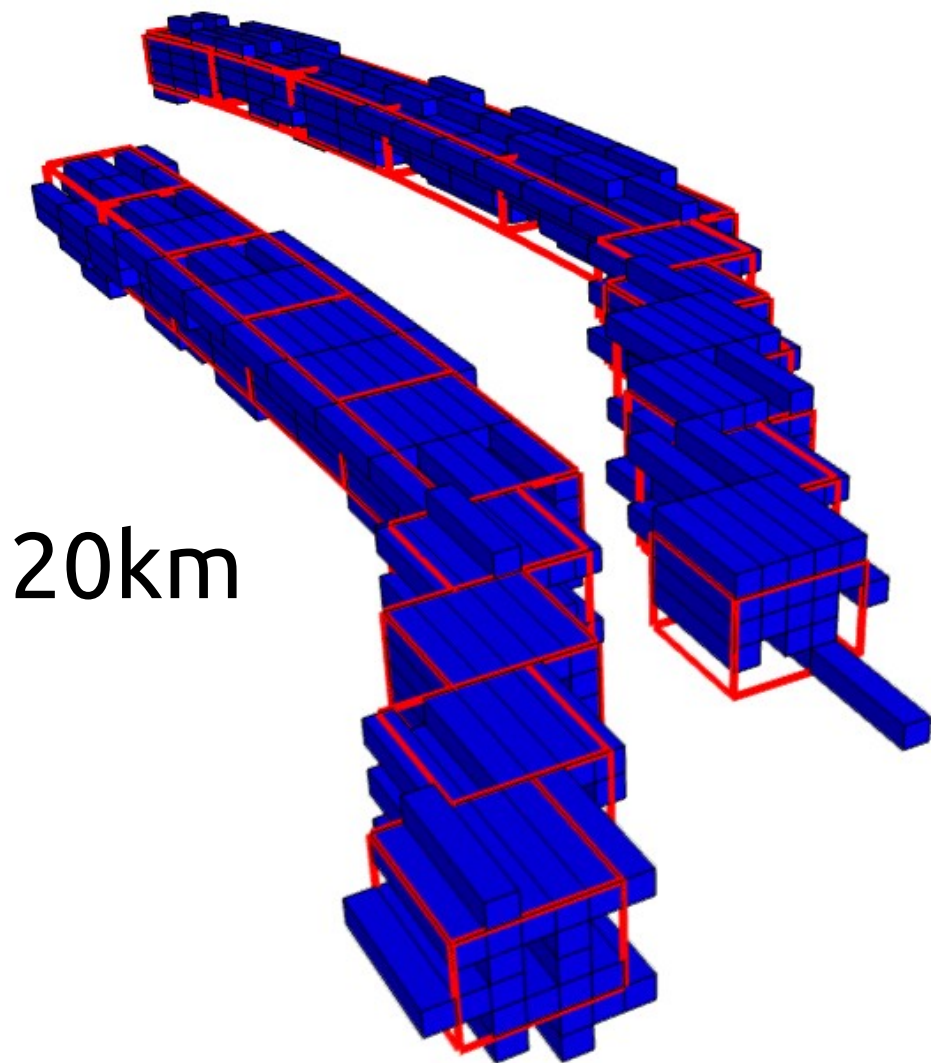
for tesseroids



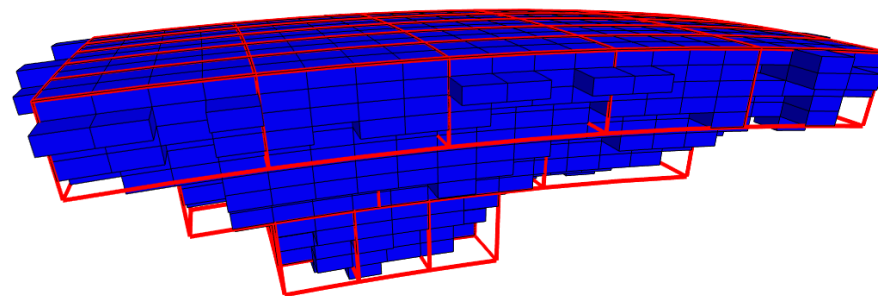
Works well



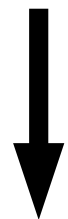
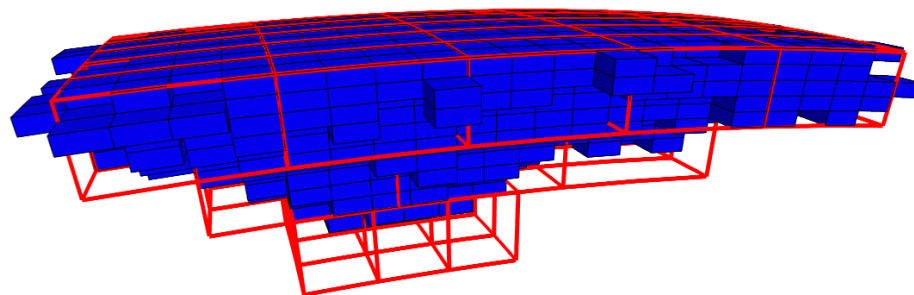
height matters



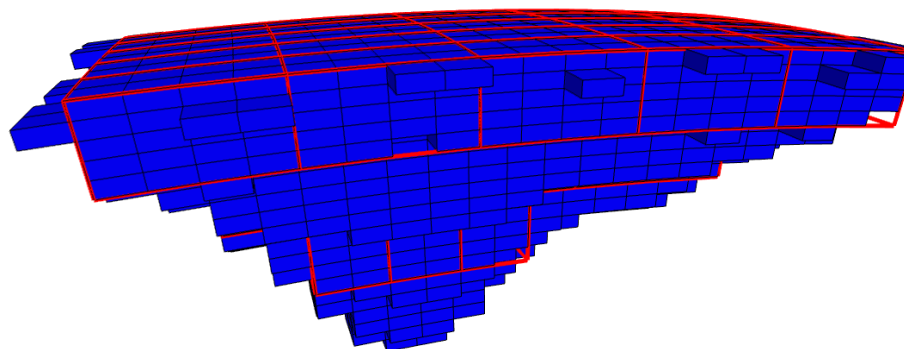
correct



dense



dense



Future

- Combinations of tensor components
- Dipping sources (subducting plate)
- Real data (open for collaboration)

OPEN SOURCE

Fatiando a Terra

Geophysical modeling and inversion



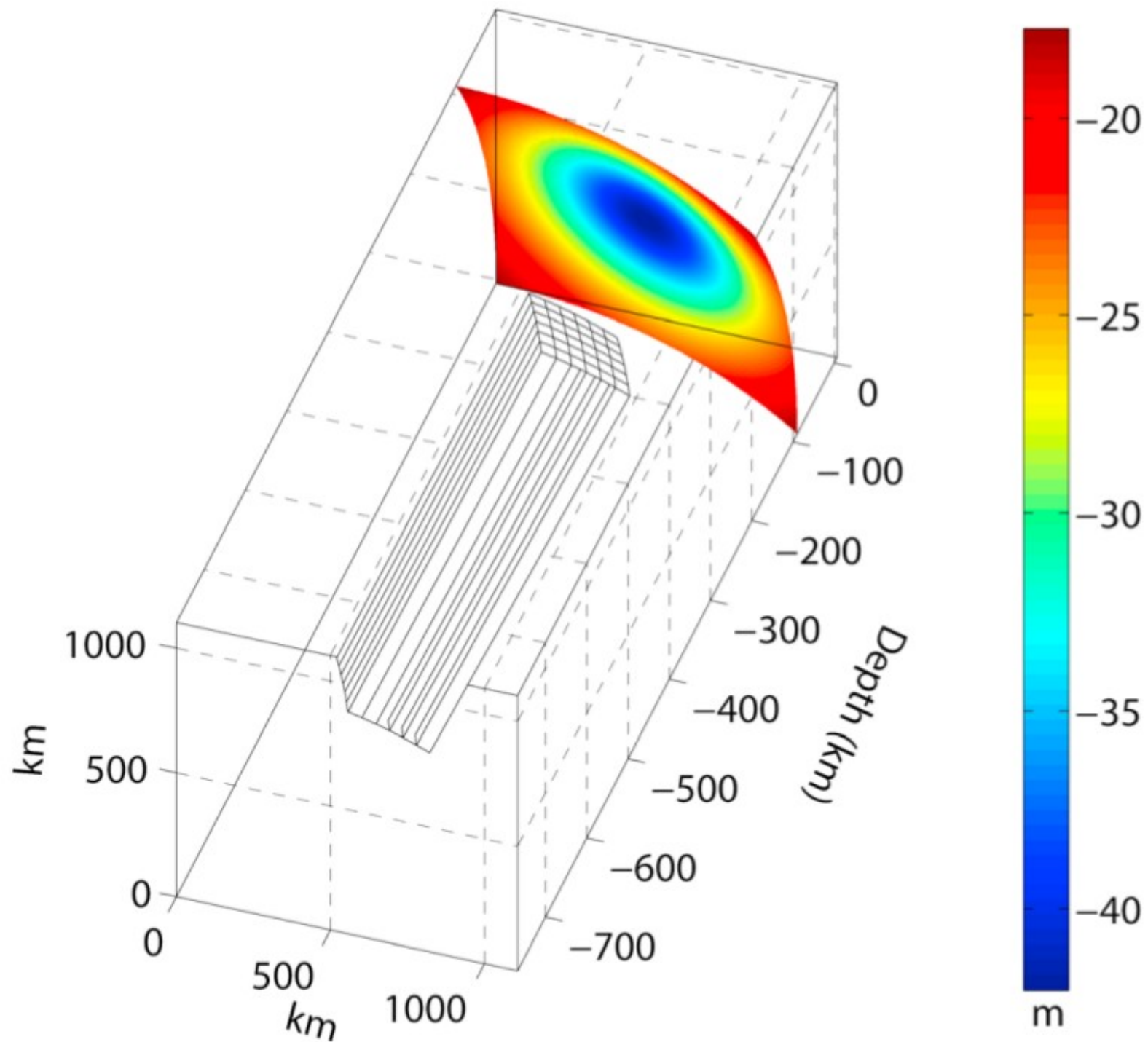
fatiando.org

github.com/leouieda/egu2014

Extra

(Hypothetical) Mantle Plume

Inspired by synthetics in Chaves and Ussami (2013)



After Chaves and Ussami (2013)

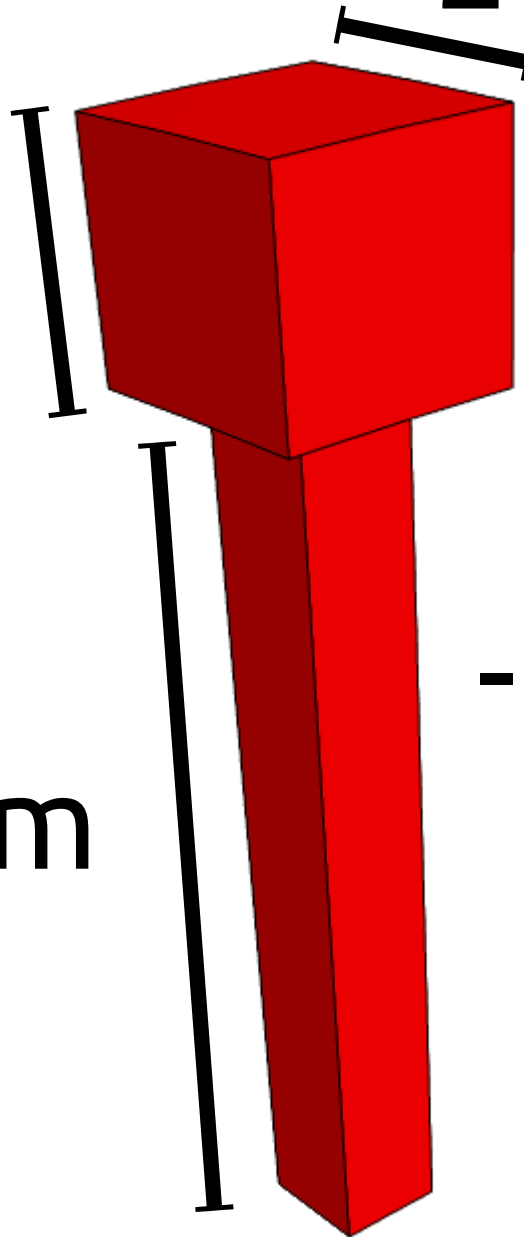
top=100 km

2°

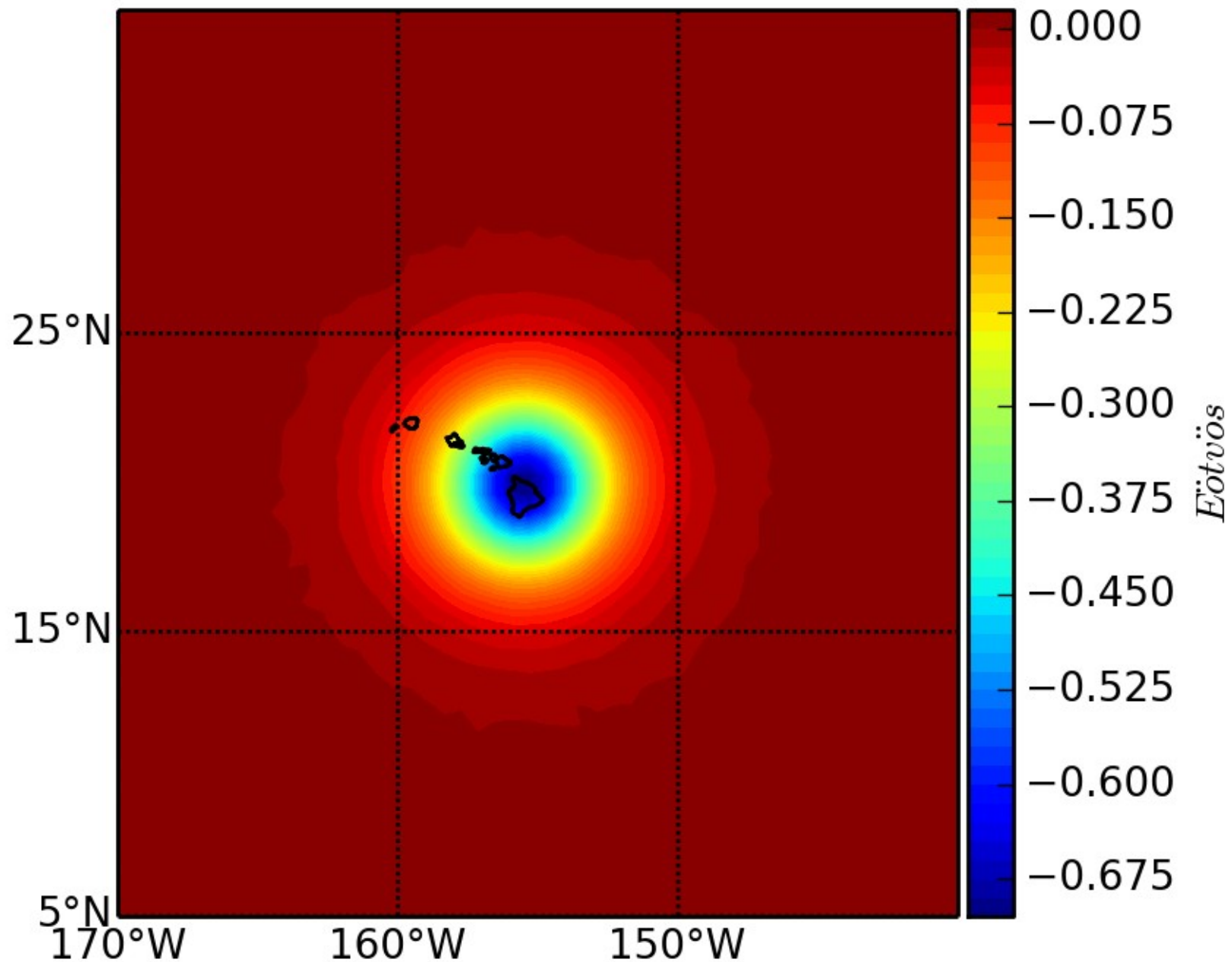
200 km

700 km

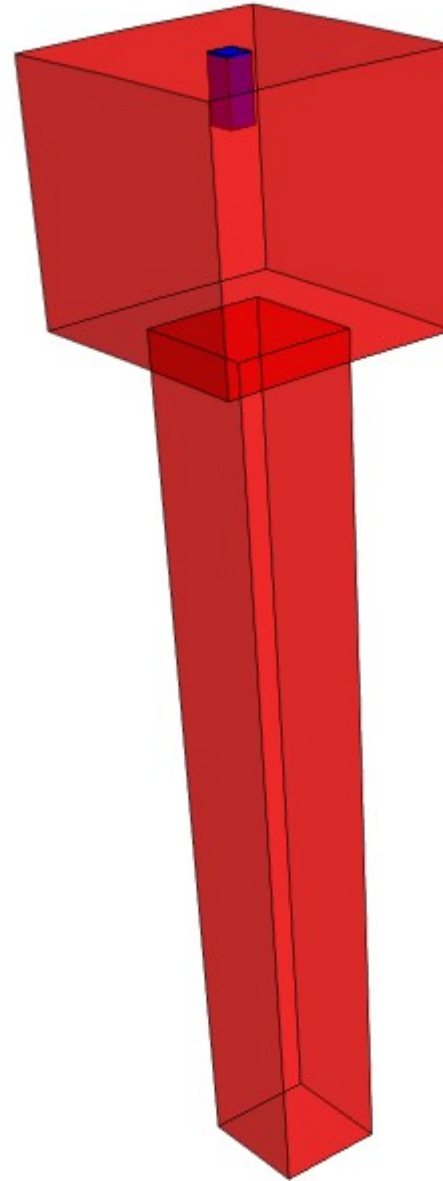
-50 kg.m⁻³

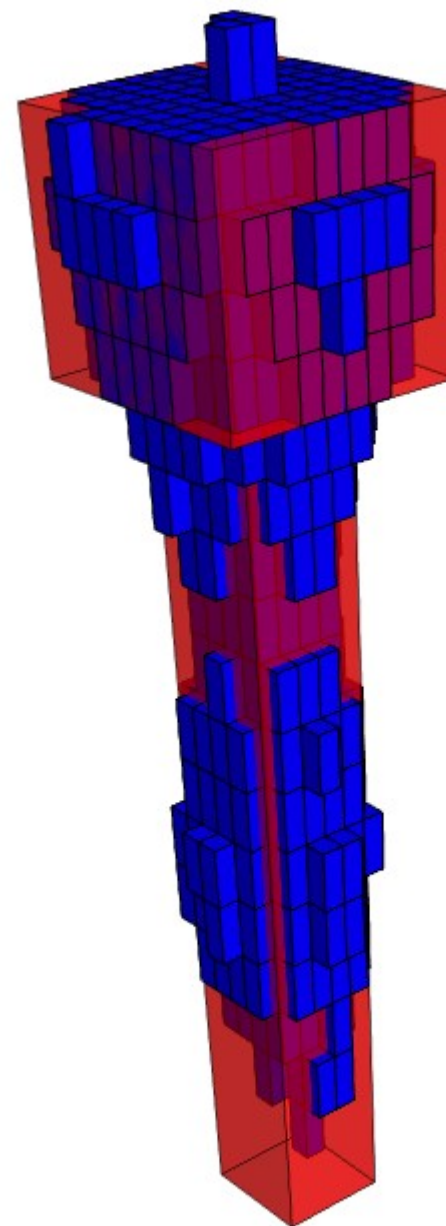
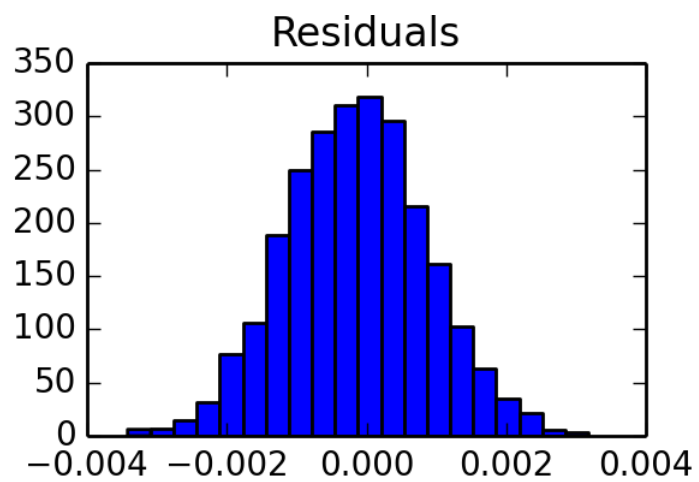
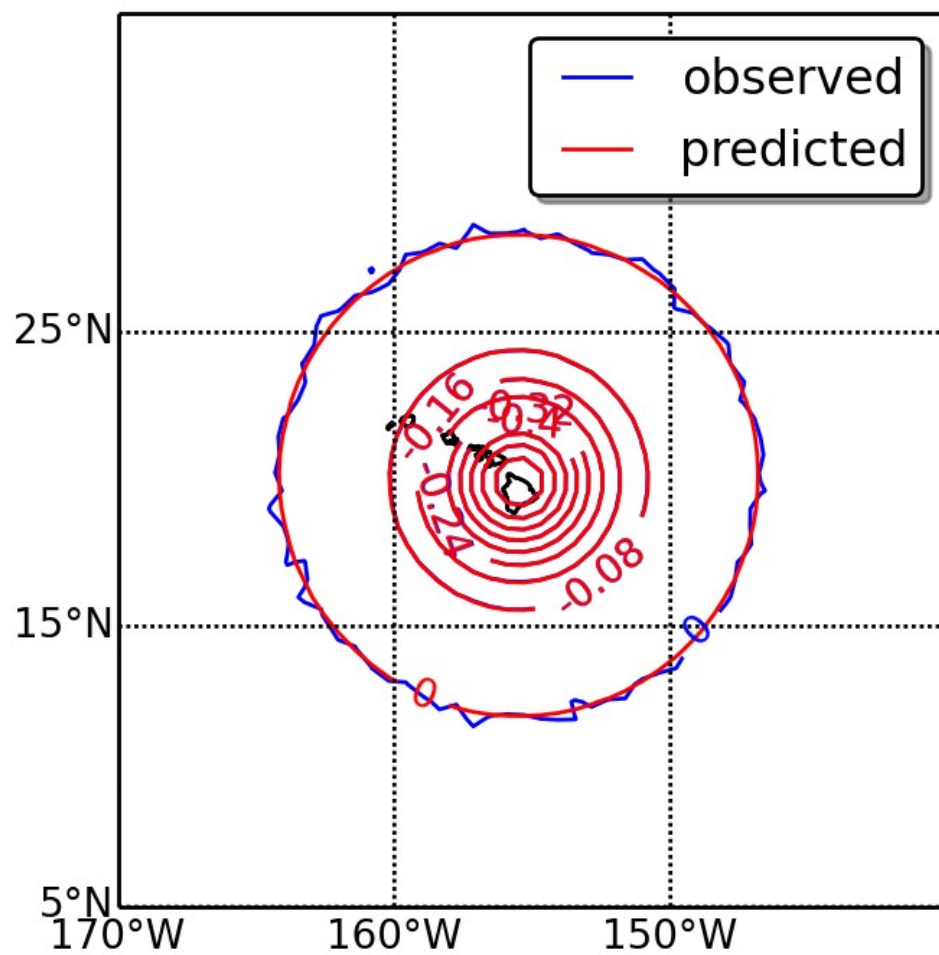


g_{zz} at 250 km

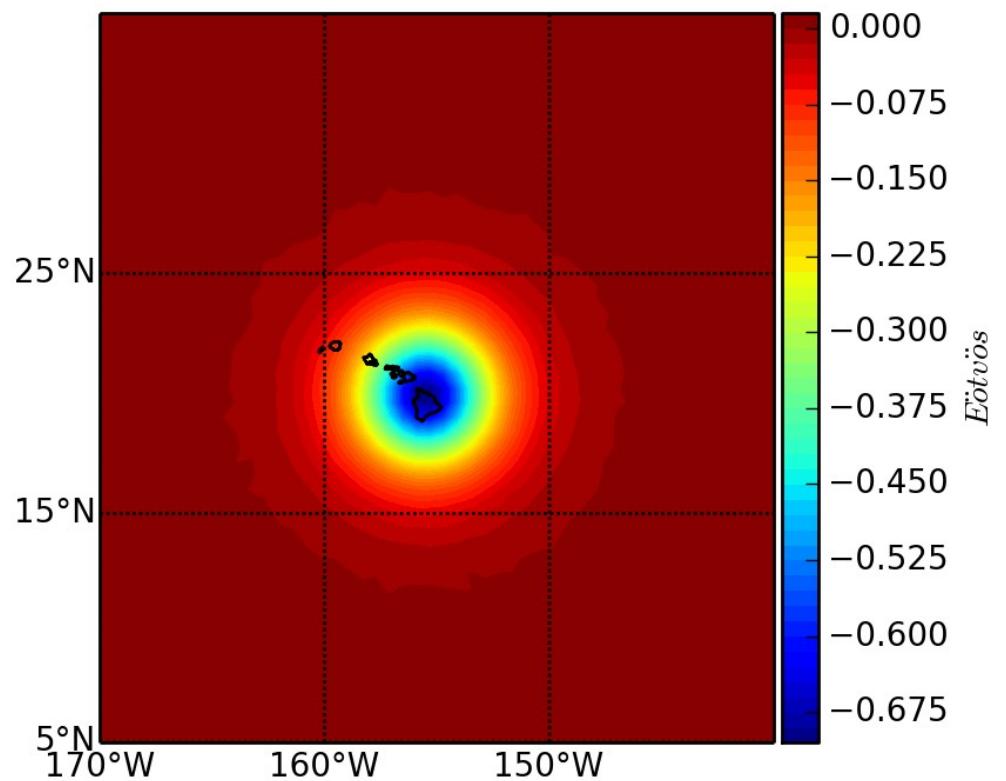
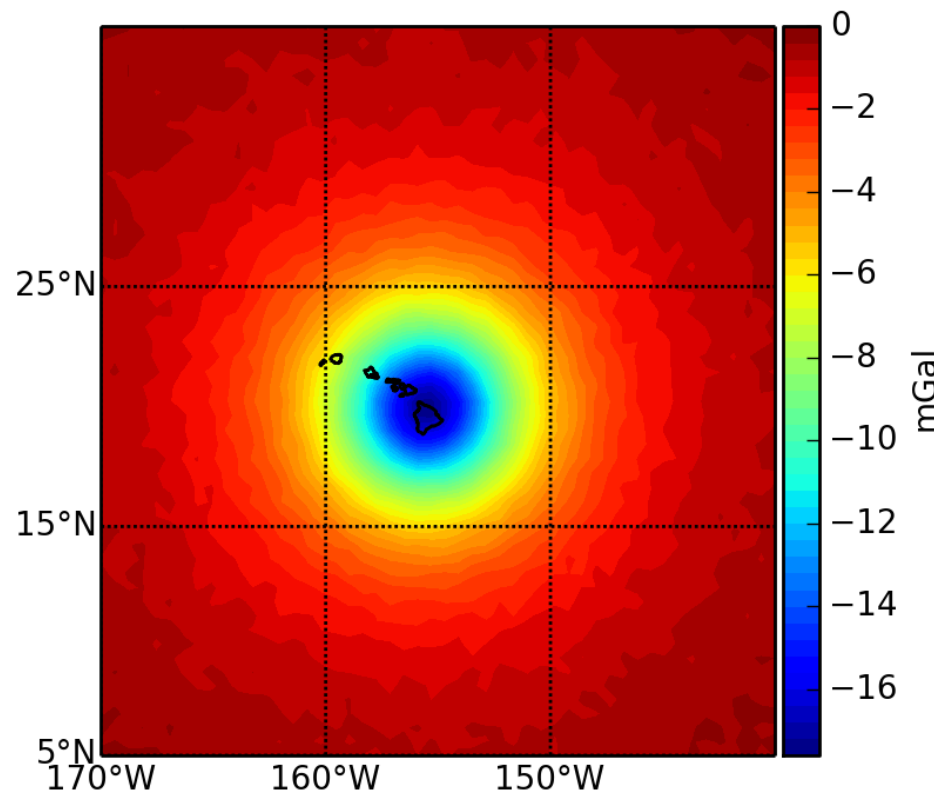


Seed

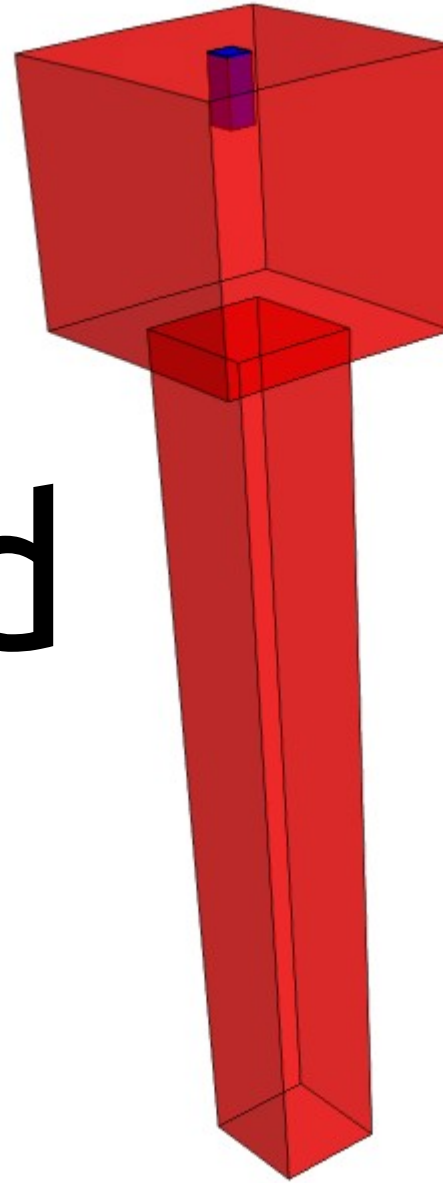


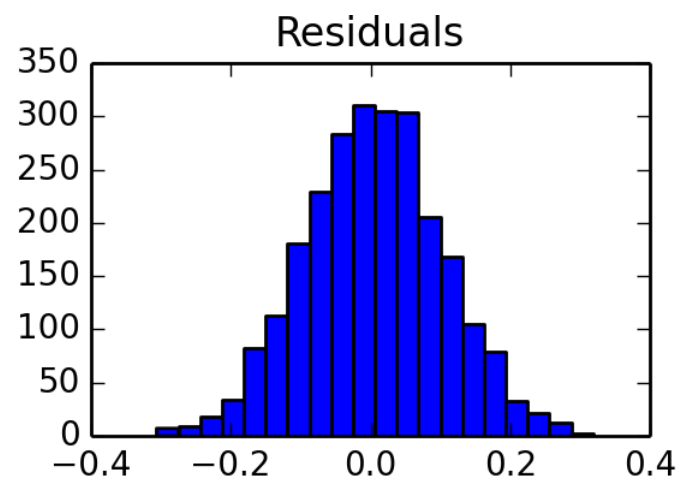
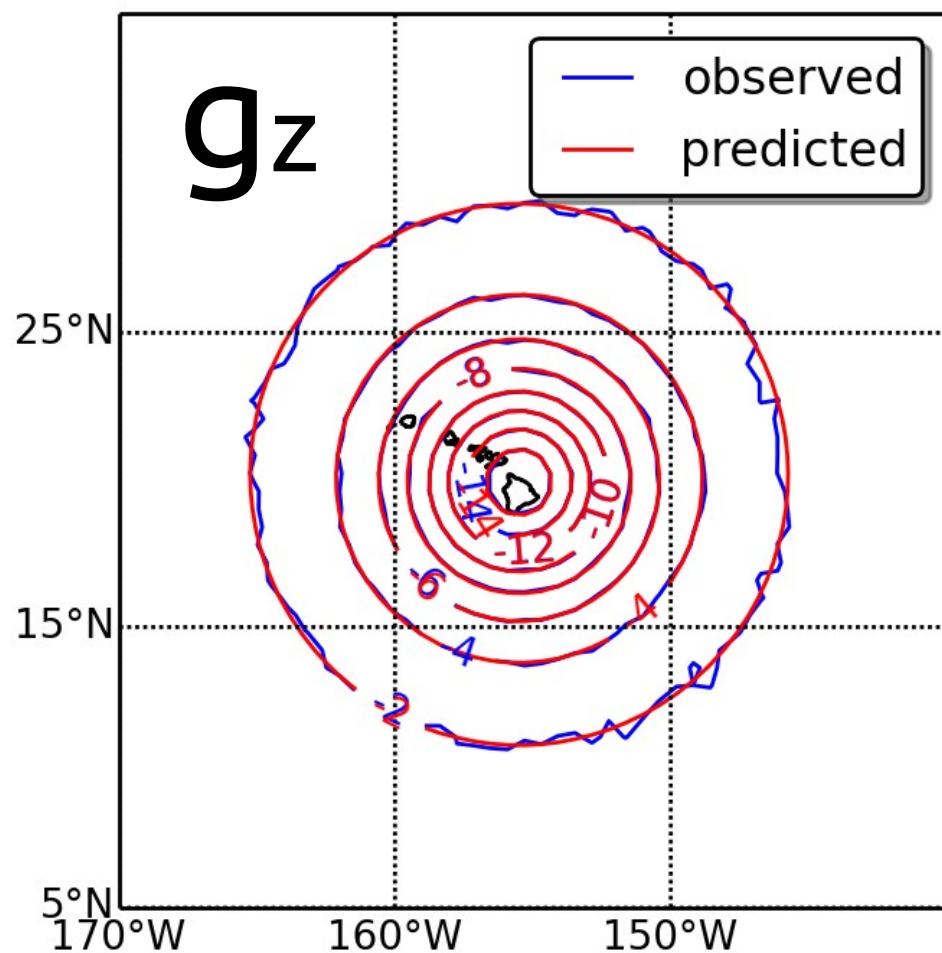
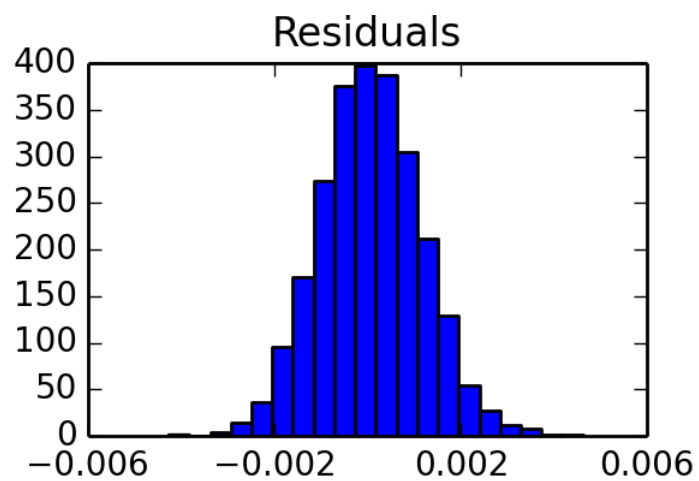
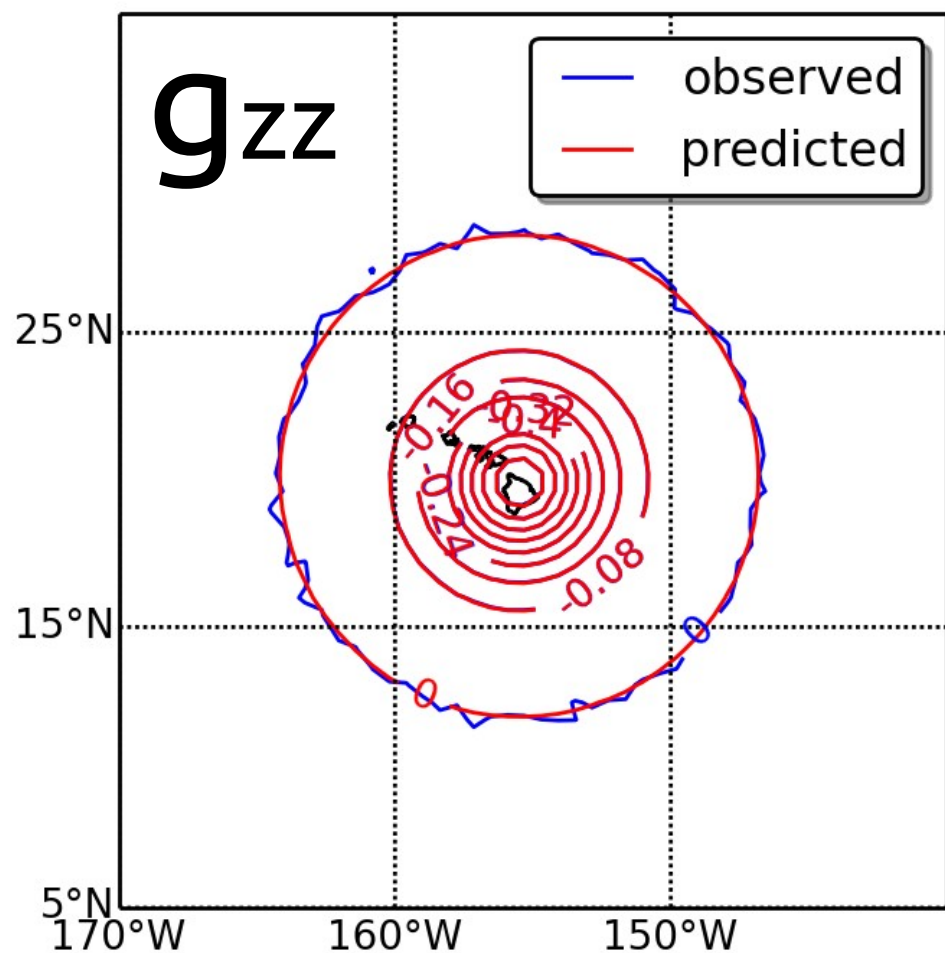


Joint $g_z + g_{zz}$?

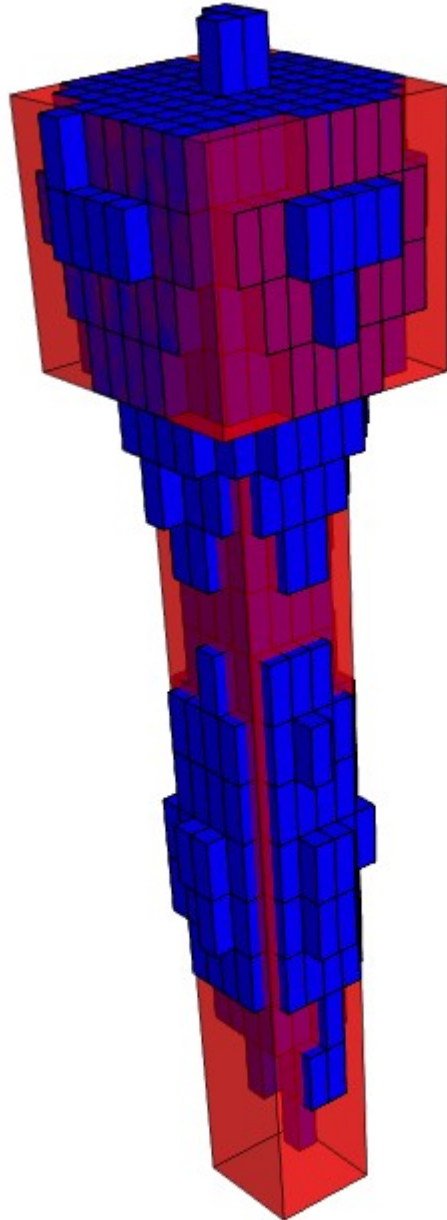


Same seed

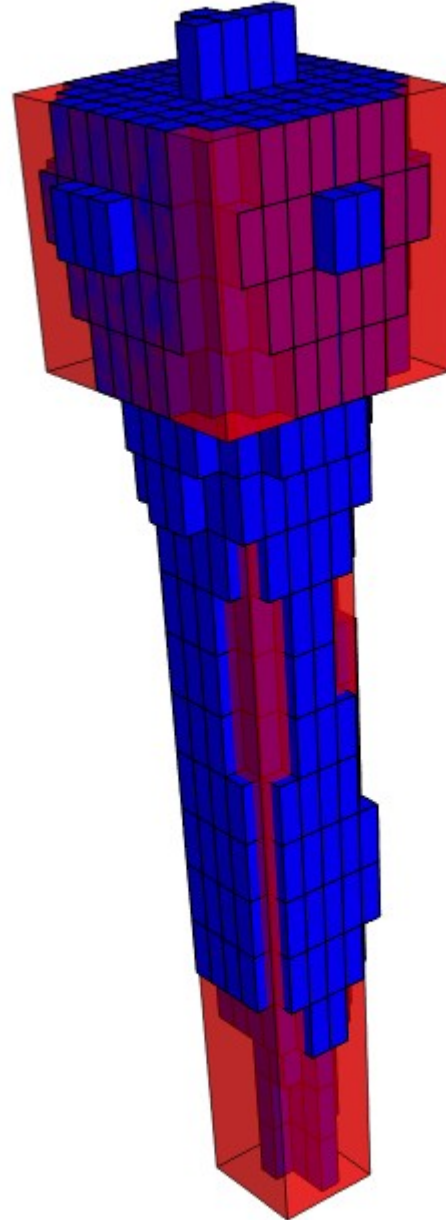




g_{zz}

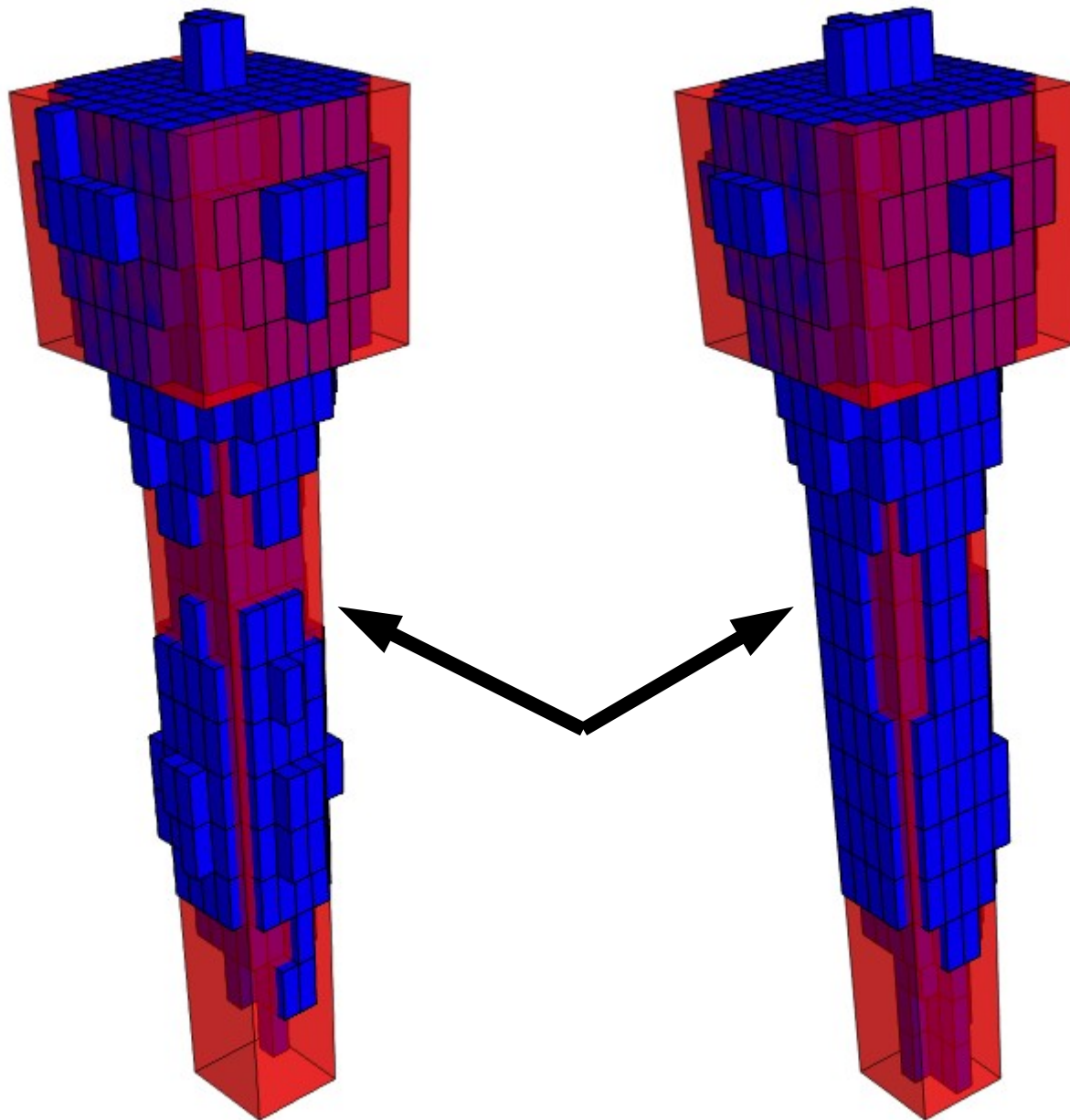


Joint



g_{zz}

Joint



single

vs

joint

