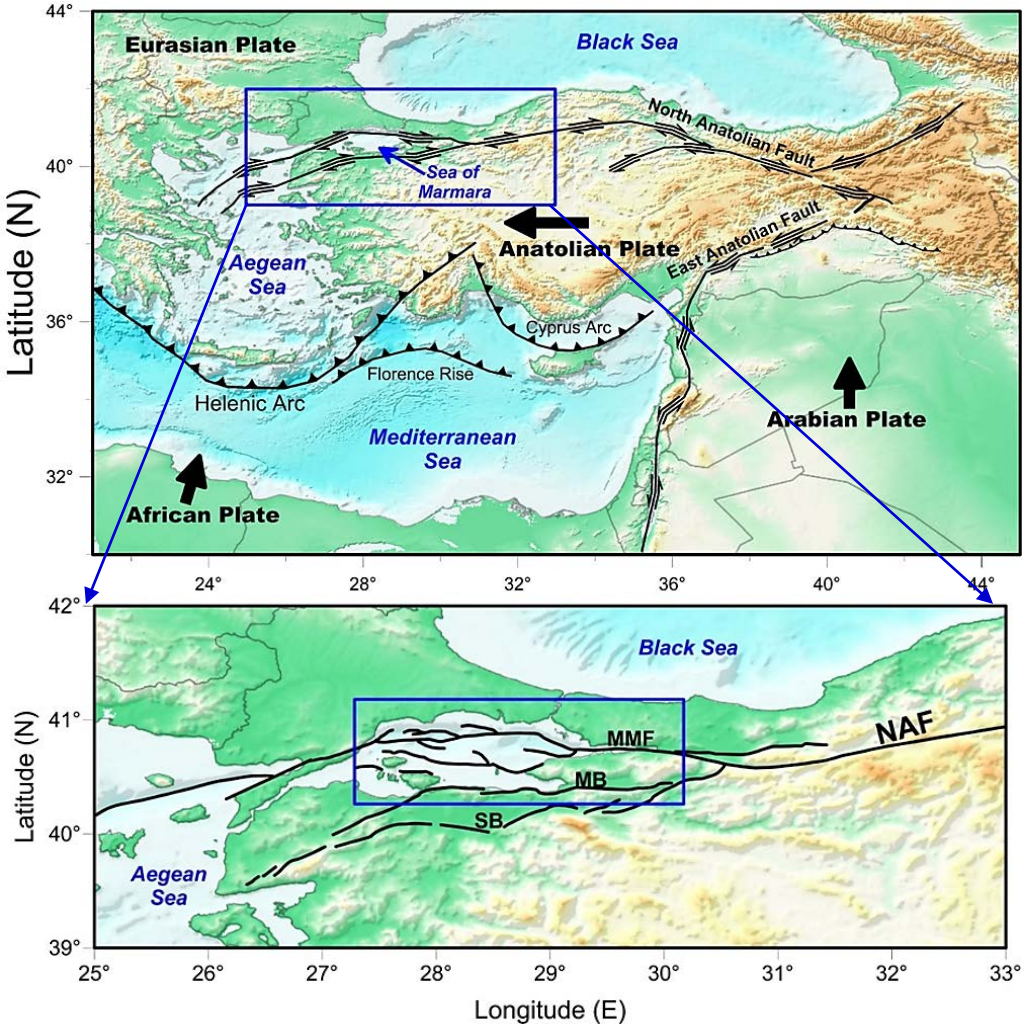
3-D lithospheric-scale rheological model of the Sea of Marmara

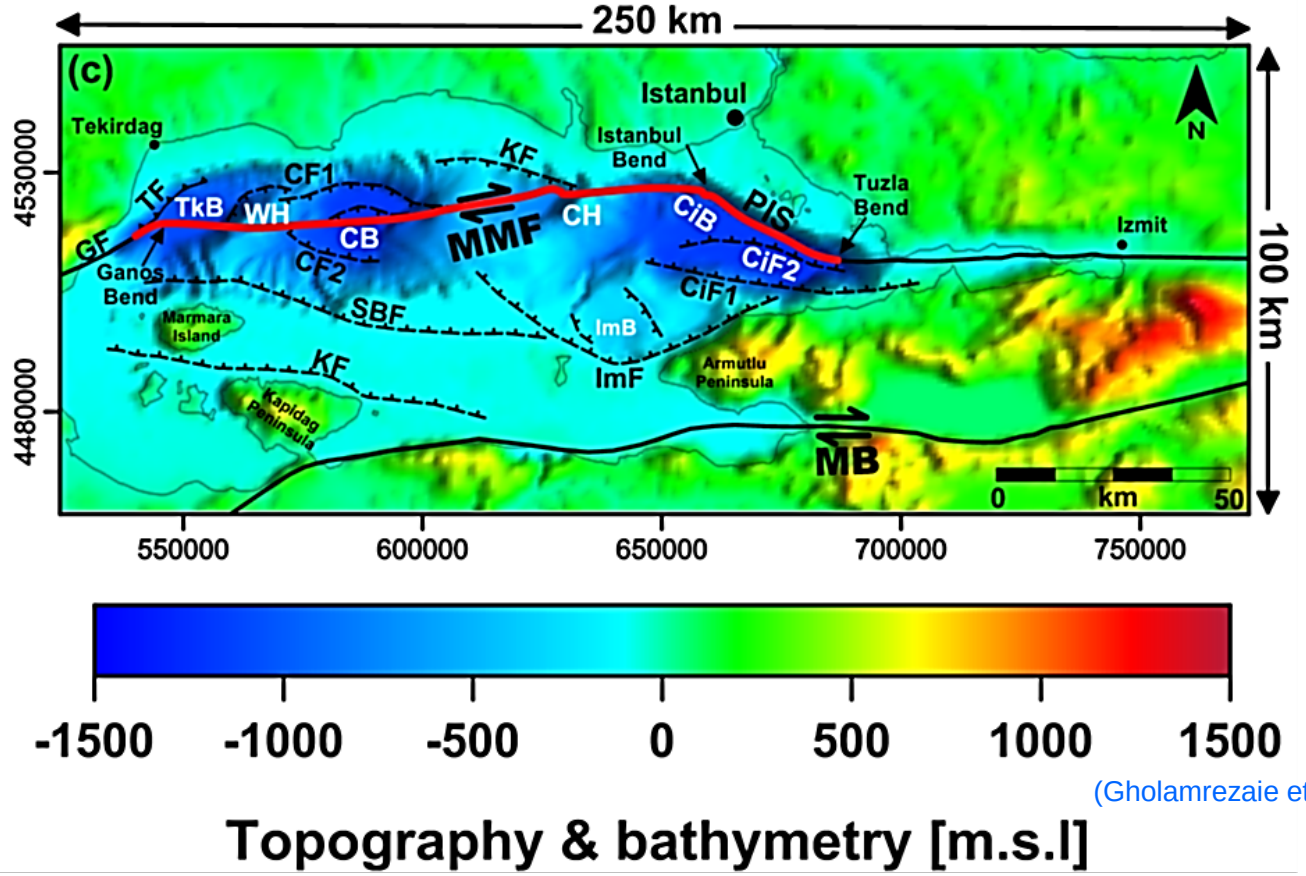
E. Gholamrezaie[1,2], M. Scheck-Wenderoth[1 3], J. Bott, O. Heidbach[1], Marco Bohnhoff[1], and Manfred R. Strecker[2]

1. GFZ German Research Centre for Geosciences
2. Institute of Earth and Environmental Science, University of Potsdam
3. Faculty of Georesources and Materials Engineering, RWTH Aachen University

EGU General Assembly
Sharing Geoscience Online
May 2020

Model Area

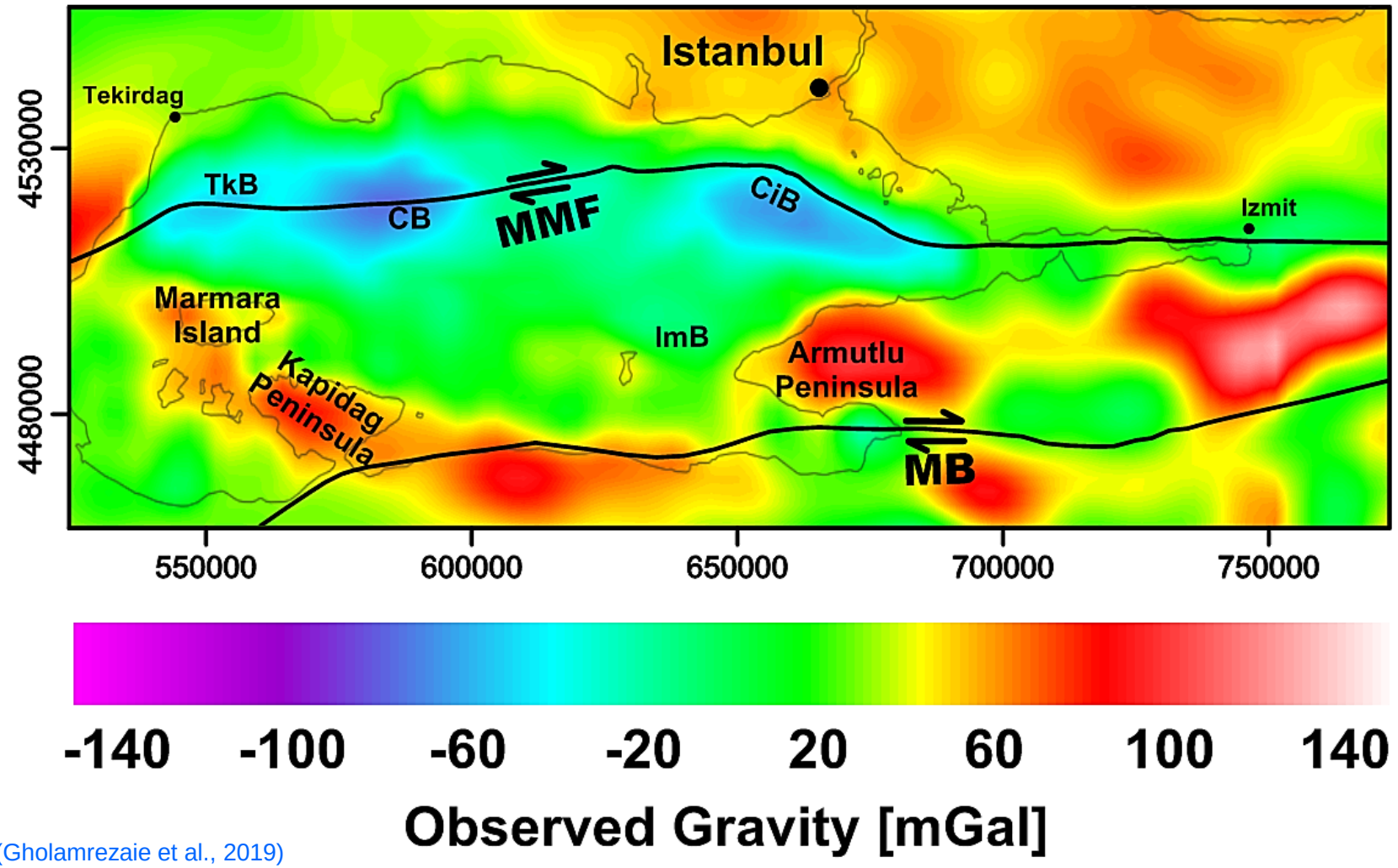




(Gholamrezaie et al., 2019)

- **How lithospheric heterogeneities are related to the Main Marmara Fault (MMF) segmentation?**

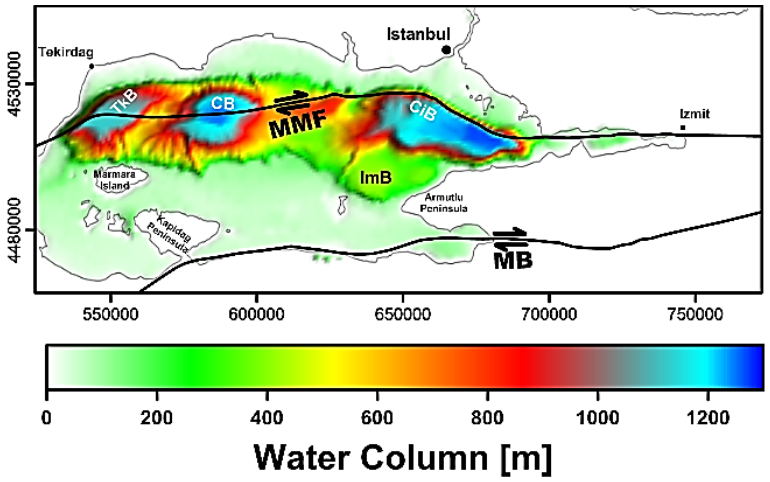
Free-air Gravity Data

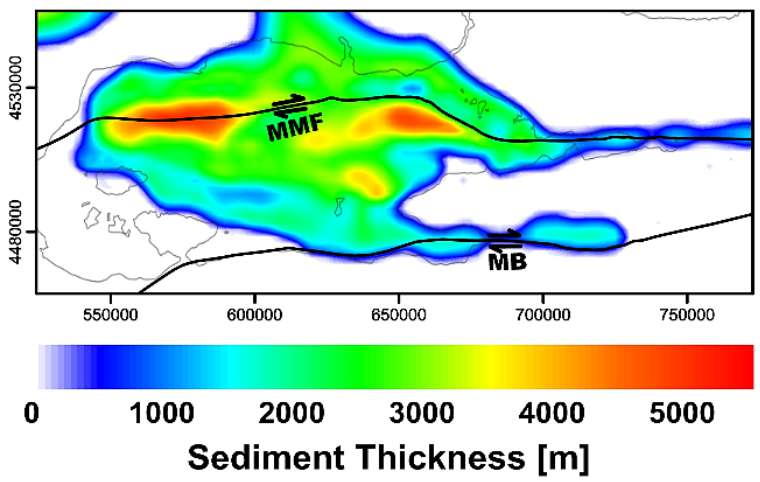


- Combined satellite and shipboard gravity observations (Kende et al., 2017)
- General low free-air absolute values (±20 mGal)
- Basin is largely isostatically compensated

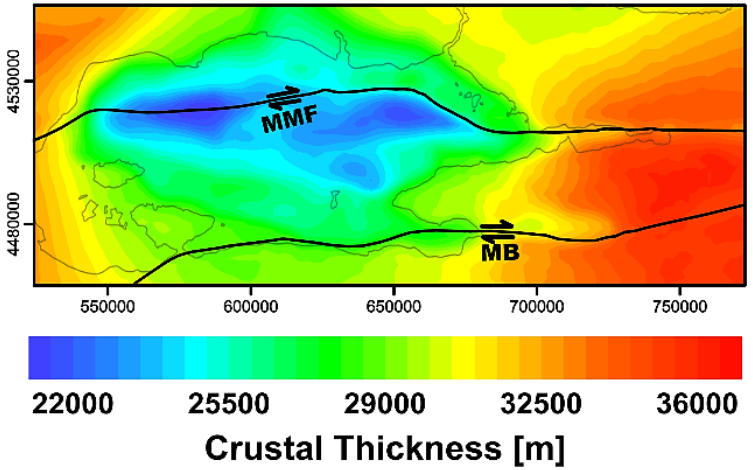
(Gholamrezaie et al., 2019)

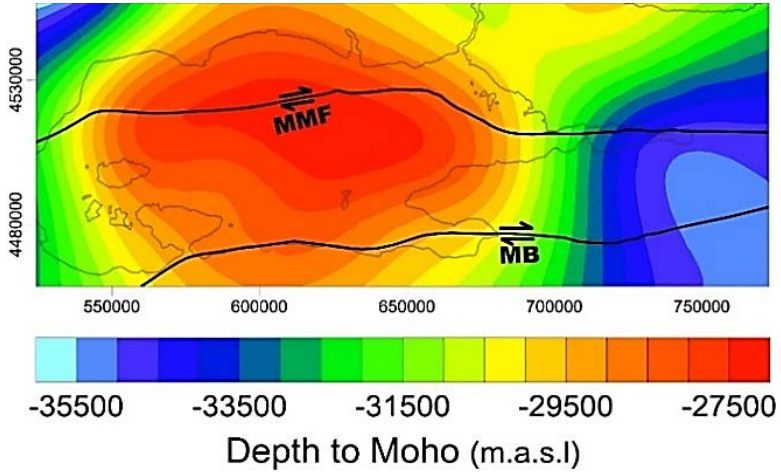
Initial Model

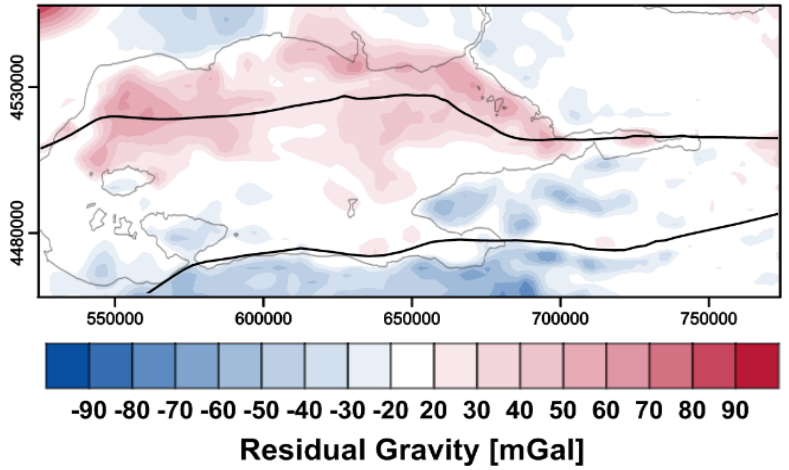




- Four-layer structural model (Hergert et al., 2010)
- Water (ρ = 1020 kg.cm^{-3})
- Sediments (ρ = 2000 kg.cm^{-3})
- Homogeneous crust (ρ = 2800 kg.cm^{-3})
- Homogeneous mantle (ρ = 3300 kg.cm^{-3})

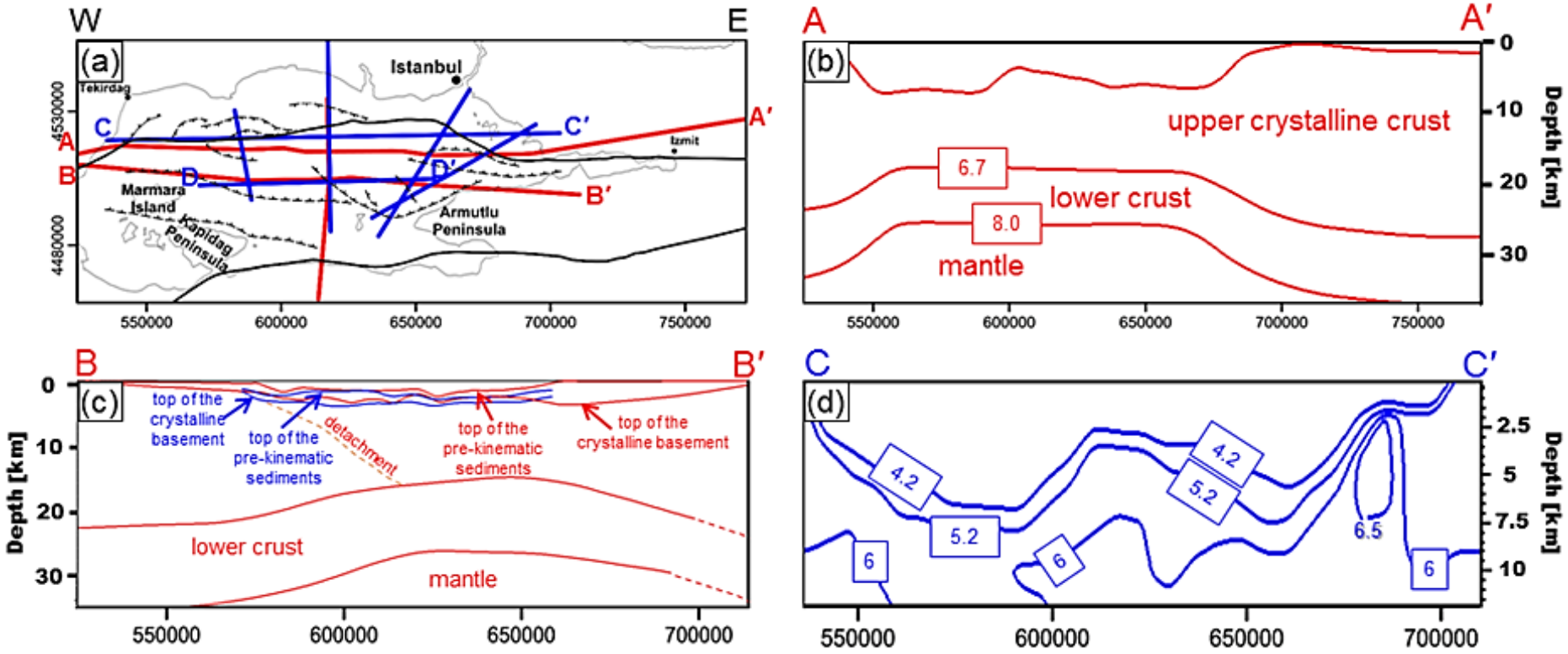






(Gholamrezaie et al., 2019)

Seismic Data



(Gholamrezaie et al., 2018)

- **WARR**
  (Becel et al., 2009)

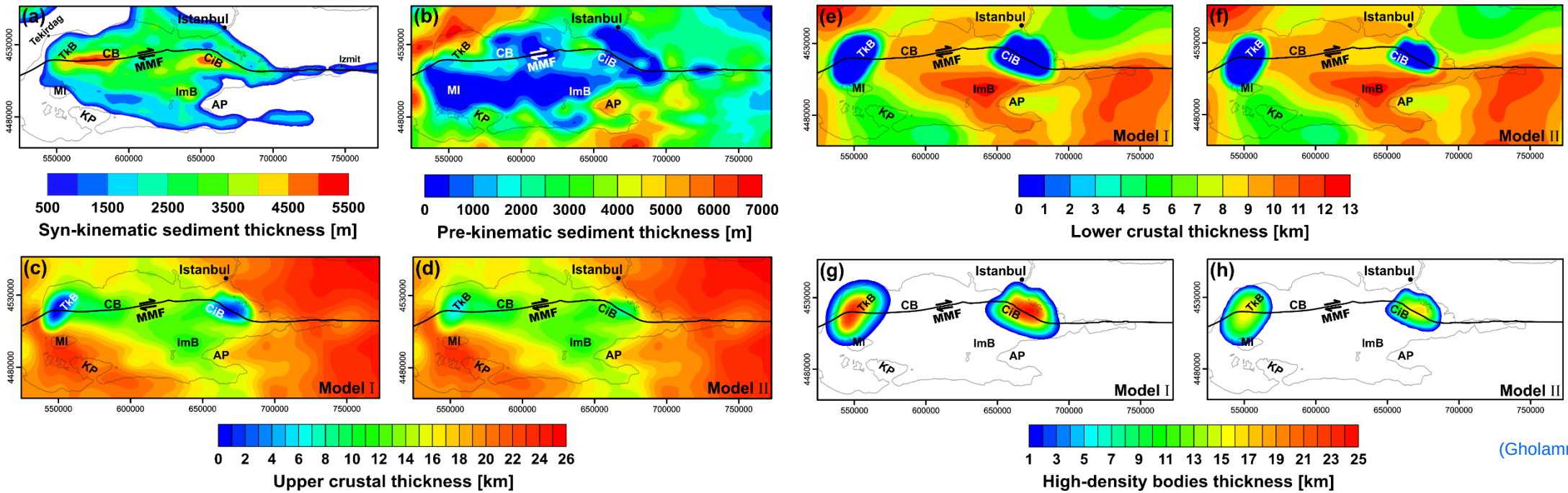
✓ *Red lines lines*
✓ *Top of the upper crust*
✓ *Top of the lower crust*

- **Tomography**
  (Bayrakci et al., 2013)

✓ *Blue lines*
✓ *Top of the pre-kinematic sediments*
✓ *Top of the upper crust*

- Pre-kinematic sediments: $V_p = 4.5\ km.s^{-1} \Rightarrow \rho \approx 2490\ kg.m^{-3}$
- Upper-crust: $V_p = 6.0\ km.s^{-1} \Rightarrow \rho \approx 2720\ kg.m^{-3}$
- Lower-crust: $V_p = 6.7\ km.s^{-1} \Rightarrow \rho \approx 2890\ kg.m^{-3}$

Gravity Modelling Results

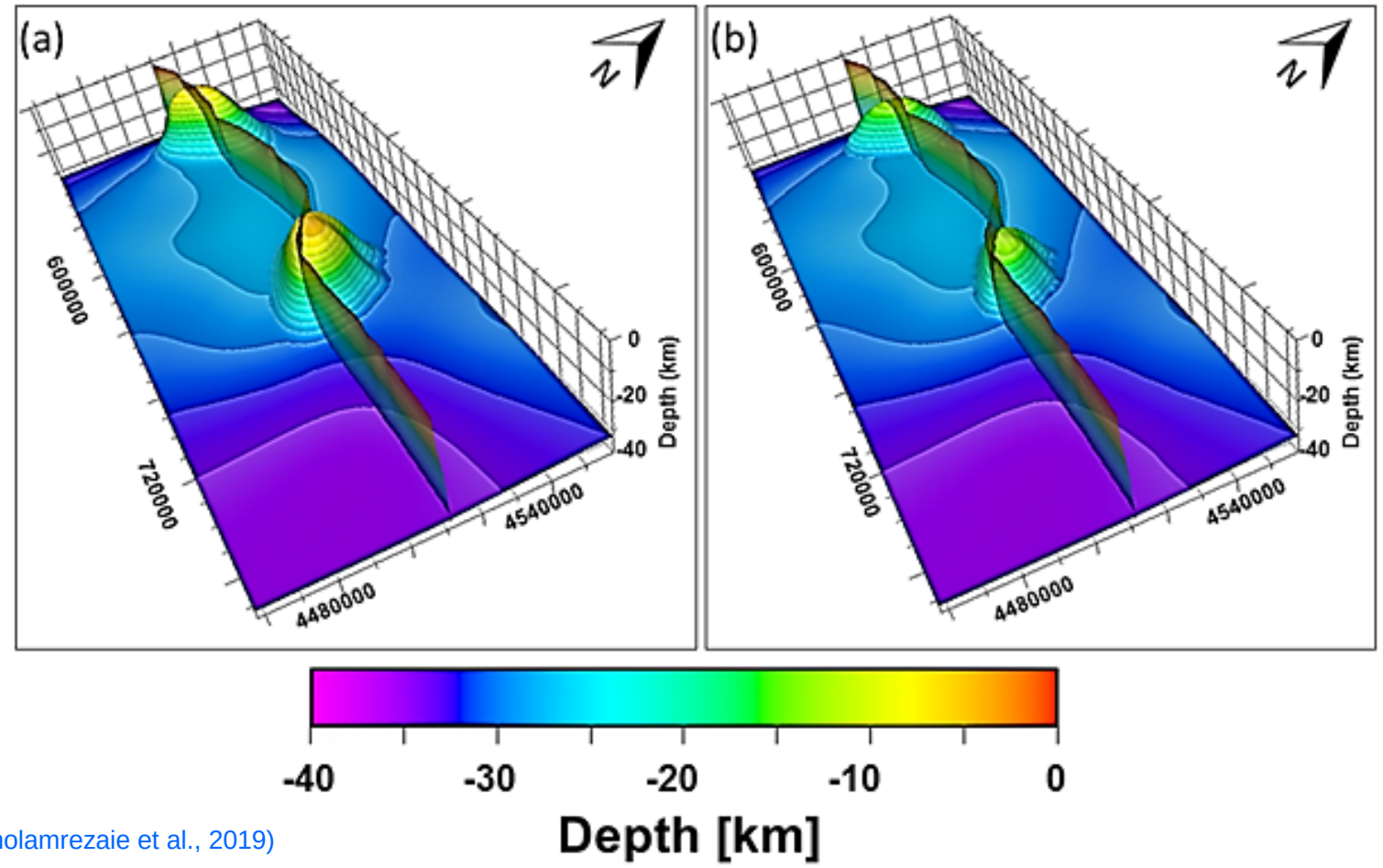


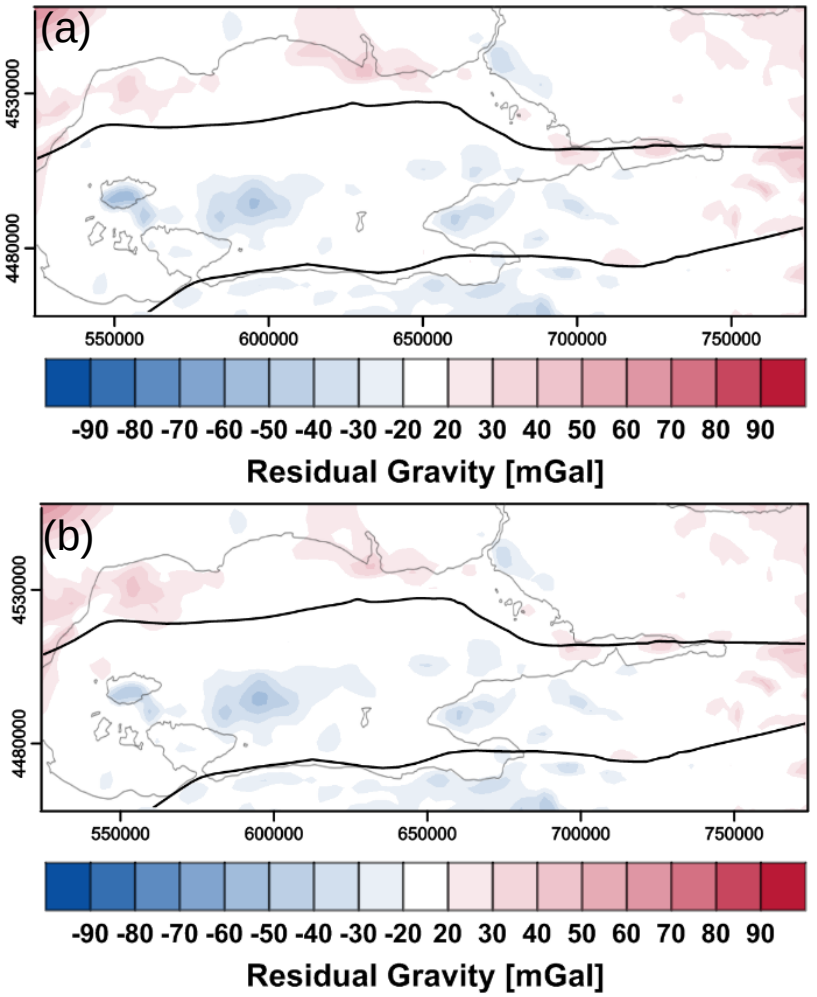
(Gholamrezaie et al., 2019)

- **The main finding of the gravity modeling is two high-density bodies that spatially correlate with major bends along the MMF.**
- **These bodies cause lateral crustal heterogeneities and may represent mechanical segment of the MMF.**

High-density bodies in 3-D

$\rho \approx 2900\ kg.m^{-3}$ $\rho \approx 3150\ kg.m^{-3}$





(Gholamrezaie et al., 2019)

Rheology Modelling

- First results from the rheology modelling indicate that:
  - ➢ The Lithospheric strength below the Sea of Marmara spatially correlates with the crustal thinning.
  - ➢ The high-density bodies are stronger than surrounding crustal rocks and may represent locked segments of the MMF.
  - ➢ These results support the hypothesis that the MMF is mechanically segmented.

Related Publication

Solid Earth, 10, 785–807, 2019
https://doi.org/10.5194/se-10-785-2019

SE | Volume 10, issue 3

Research article

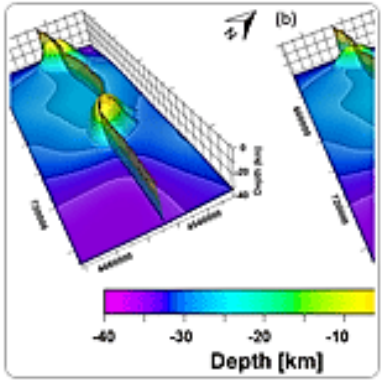
13 Jun 2019

3-D crustal density model of the Sea of Marmara

Ershad Gholamrezaie[1,2], Magdalena Scheck-Wenderoth[1,3], Judith Bott[1], Oliver Heidbach[1], and Manfred R. Strecker[2]

[1]GFZ German Research Centre for Geosciences, Telegrafenberg, Potsdam, Germany
[2]Institute of Earth and Environmental Science, University of Potsdam, Potsdam, Germany
[3]Faculty of Georesources and Materials Engineering, RWTH Aachen, Aachen, Germany

Correspondence: Ershad Gholamrezaie (ershad@gfz-potsdam.de)



Received: 14 Oct 2018 – Discussion started: 22 Oct 2018 – Revised: 12 Apr 2019 – Accepted: 23 Apr 2019 – Published: 13 Jun 2019