Impact of Satellite Gravity Data on Resistivity Models of the North-Western USA

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1 Introduction

We jointly invert magntotelluric and satellite gravity data to obtain a consistent density and conductivity model of the Northwestern USA.

We also demonstrate how station coverage impacts the MT inversion results. Satellite data may be beneficial when ground based data is only sparsely available.

2 Datasets

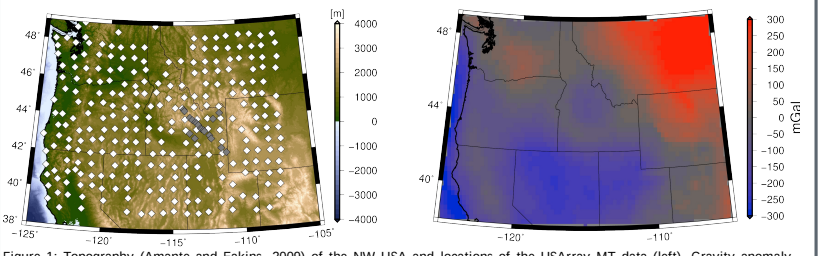


Figure 1: Topography (Amante and Eakins, 2009) of the NW USA and locations of the USArray MT data (left). Gravity anomaly over the NW USA from the XGM2016 (Pail et al., 2018) model (right). The gravity effect of the topography and a Moho model (Szwillus et al., 2019) have been subtracted from the free-air anomaly.

3 Inversion Results

We do a full 3D inversion of the MT impedance tensor and the processed gravity signal. The box-shaped model is discretized into 15 x 15 km cells with increasing vertical extensions with depth. While the joint inversion has not yet reached the same RMS as the single method inversions, distinct changes from the single method inversions can be seen, e.g. density anomalies have larger amplitudes at depths and do not tend to stick as much to the surface of the model in the joint inversion.

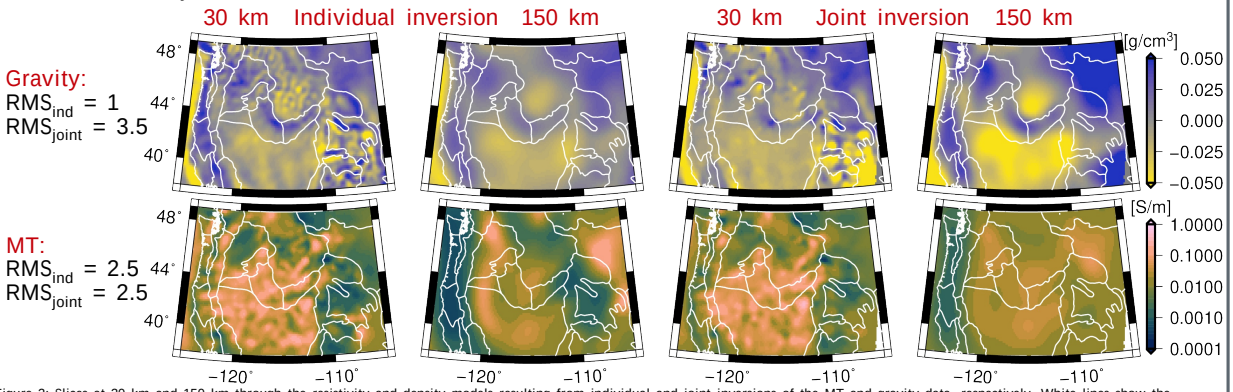
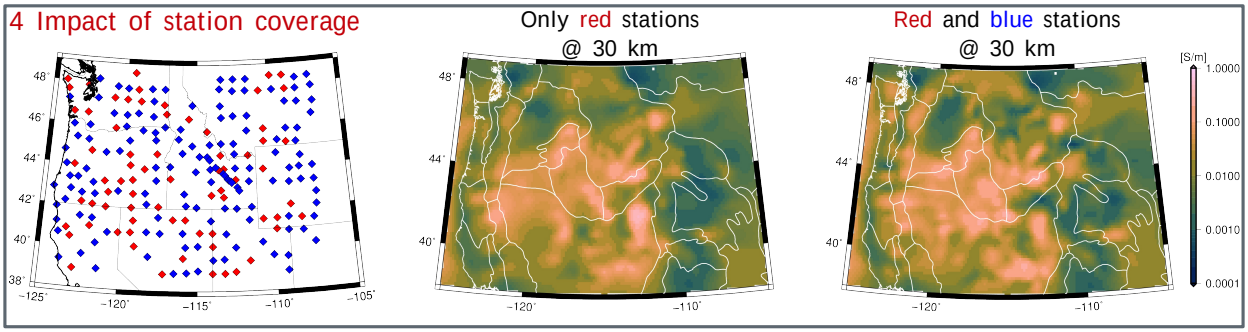


Figure 2: Slices at 30 km and 150 km through the resistivity and density models resulting from individual and joint inversions of the MT and gravity data, respectively. White lines show the physiographic provinces of the NW USA.

4 Impact of station coverage



Conclusions

- MT & satellite gravity joint inversion on a large scale is feasable.
- Joint inversion has positive effect especially on density model.
- Station coverage has large impact on MT inversion results.

References

- Amante, C., and B. W. Eakins. "ETOPO 1 Arc-Minute Global Relief Model: Procedure." Data Source and Analysis, National Oceanic and Atmospheric Administration NOAA (2009).
- Pail, R., T. Fecher, D. Barnes, J. F. Factor, S. A. Holmes, T. Gruber, and P. Zingerle. "Short note: the experimental geopotential model XGM2016." Journal of Geodesy 92, no. 4 (2018): 443-451.
- Szwillus, W., J. C. Afonso, J. Ebbing, and W. D. Mooney. "Global crustal thickness and velocity structure•from geostatistical analysis of seismic data." Journal of Geophysical Research: Solid Earth (2019).

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3D Earth Website -->

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