

Joint inversion of seismic and magnetotelluric data in the region of West Bohemia, Czech Republic, using a variation of information constraint

Y. Wei¹, A. Platz², U. Weckmann^{2,3} and M. Moorkamp¹

¹Department of Earth and Environmental Sciences, Ludwig-Maximilians-Universität, Munich, Germany.

Yunong.Wei@lmu.de, Max.Moorkamp@lmu.de

²GFZ, German Research Centre for Geosciences, Potsdam, Germany. aplatz@gfz-potsdam.de,
Ute.Weckmann@gfz-potsdam.de

³University of Potsdam, Institute of Earth and Environmental Science, Potsdam, Germany

SUMMARY

Positioned at the junction of the Saxothuringian, Tepla-Barrandian, and Moldanubian Units, the region in the Czech Republic known as West Bohemia/Vogtland is characterized by large-scale CO₂ emissions, recurrent earthquake swarms, and Quaternary volcanism. Mousavi et al (2015) utilized local earthquake tomography to image a steep channel characterized by high Vp/Vs values. This channel is believed to serve as a conduit for fluids migrating from the earthquake swarm focal zone towards the Bublák/Hartoušov mofette fields on the surface. Additionally, they identified a heterogeneous intrusive structure with elevated Vp/Vs ratios in the middle crust situated beneath and north of the earthquake swarm focal zone. Coincidentally, a recent magnetotelluric (MT) study has also revealed conductive anomalies in the lower to mid-crust, with prominent pathways ascending to the mofette fields (Platz et al, 2022). However, due to different modeling configurations and heterogeneous subsurface structures, the spatial correlation between the resistivity and velocity anomalies remains uncertain. Moreover, while qualitative comparisons of resistivity and velocity features could suggest the presence of fluids, they may not offer quantitative explanations of their origins and compositions (such as melt or aqueous fluid).

In this study, we use the joint inversion framework jif3D, which incorporates the variation of information criterion (VI) (Moorkamp et al, 2011; Moorkamp, 2021), to perform joint inversions of seismic and MT data in the West Bohemia region. This VI approach improves the correlations between velocity and resistivity properties, thereby increasing the structural similarity (Haber and Holtzman Gazit, 2013). By examining correlated velocity and resistivity models at similar scales and resolutions, we conduct an initial investigation of the multiphysics relationships beneath the earthquake swarm area and estimate the composition fractions.

Keywords: Joint inversion, seismic, magnetotelluric, West Bohemia, variation of information constraint

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