EGU26-23038, updated on 24 Apr 2026
https://doi.org/10.5194/egusphere-egu26-23038
EGU General Assembly 2026

Travel time tomography of Aluto-Langano Geothermal field in the Main Ethiopian Rift

Tesfahiwet Yemane, John Michael Kendall, and Petros Bogiatzis
Department of Earth Sciences, University of Oxford, Oxford, UK

Understanding the structure of the crust and subsurface fluid distribution in volcanic systems is critical for geothermal energy development, volcanic hazard monitoring and mineral exploration. Seismic travel time tomography provides high-resolution images of the subsurface by mapping variations in P- and S-wave velocity structures and their ratio (Vp/Vs), offering insights into the internal structure of the volcano. In this study, we apply local earthquake travel time tomography at Aluto volcano, located in the central Main Ethiopian Rift (MER), and Ethiopia's first pilot site for geothermal energy development.

We analyse seismic data recorded between January 2012 and January 2014, identifying 2,393 local earthquakes mainly along the central part of the caldera and the Wonji Fault Belt (WFB) using non-linear location methods. We selected events with low spatial errors and a signal-to-noise ratio threshold of three or higher for the 3D travel time tomography. By resolving P- and S-wave velocity variations, as well as Vp/Vs anomalies, we aim to delineate zones of fluid saturation and structural heterogeneity. We compute the complete model resolution matrix using direct sparse methods, enabling us to assess the reliability of the tomographic model.

The results of this study are compared with previous studies on the attenuation and conductivity structure of Aluto, collectively providing new insights into the magmatic-hydrothermal system of the Aluto volcano. This study will help to refine geothermal exploration strategies and enhance our understanding of subsurface processes beneath the volcano.