EGU22-1578
https://doi.org/10.5194/egusphere-egu22-1578
EGU General Assembly 2022

S-wave velocity structure in Kenyan potential geothermal fields inferred from ambient seismic noise data analysis

Chanmaly Chhun[1], Takeshi Tsuji[1,2], and Tatsunori Ikeda[1,2]

[1]Department of Earth Resources Engineering, Kyushu University , Japan (chanmaly_chhun91@mine.kyushu-u.ac.jp)

[2]International Institute for Carbon-Neutral Energy Research (I2CNER), Kyushu University, Japan

To reveal the seismic velocity structure and anisotropy in potential geothermal fields, Kenya, we analyzed ambient noise data from nine vertical components of broadband seismometer stations. Our analysis is based on the cross-correlation of ambient noise data by extracting phase velocity dispersion curves via the zero-crossing method and then applying surface-wave inversion to estimate S-wave velocity structures. The results for both phase velocity and S-wave velocity structures show a clear velocity contrast in volcanic systems (i.e., Korosi-Paka-Silali) in the Kenyan Great Rift (KGR). The phase velocity structure (i.e., 1400 - 2200 km/s) significantly drops in the Silali trachytic shield volcano and the Pleistocene Paka shield volcano. Such velocity contrasts are also observed where they are parallel and perpendicular to the geological structure of the KGR. Most decreasing seismic velocities are normal to abundant faults and fractures in the inner trough of the KGR. This direction is aligned with local extension direction, linked to divergent plate boundaries. The resulting S-wave velocity structures further disclose the anomaly features that can indicate permeable or non-permeable layers. Permeable layers are extensively existing that can provide potential geothermal fluid accumulations. Most potential areas are below the rift floor between the Paka and Silali volcanoes, involved in intense faulting/fractures and young porous rocks (i.e., intercalated pyroclastic, trachyte, and basalt lavas). The lithocap zones are mostly less than 1 km. The magma heat sources are most likely deeper than 3 km at Paka and 4 km at Silali. Therefore, geothermal reservoirs can be relatively interconnected due to shallow magma-volcanic systems, existing groundwater, porous volcanic rocks (i.e., pumice) and intensive fractures controlled by main graben faults in the KGR, regardless of impermeable volcanic rocks or (ore) mineralization in this study area. This work was supported by Leading Enhanced Notable Geothermal Optimization (LENGO) of SATREPS (JICA-JST), Japan.

Keywords: ambient noise, S-wave velocity, seismic anisotropy, shallow magma-reservoir systems, rifting and volcanism