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Seismic earthquake tomography imaging of the Los Humeros geothermal field, Mexico: first results

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Between September 2017 and September 2018, a seismic network consisting of 23 broadband and 22 short period station was deployed to monitor the currently exploited Los Humeros (Mexico) geothermal field. This experiment, in addition to several geophysical, geological, and geochemical surveys, has been conducted in the framework of the European H2020 project GEMex for a better understanding of the structures and behavior of the geothermal reservoir under current exploitation, and for investigating future development areas. The Los Humeros geothermal field is located in the eastern part of the Trans Mexican Volcanic Belt (TMVB) forming the northern boundary of the Serdán-Oriental basin. It is one of the largest geothermal fields in Mexico with around 40 wells operated by the Federal Electric Comission (CFE, by its Spanish acronym).

In this work, we first filtered the continuous seismic records to detect local micro-seismic events occurring in the geothermal field, mostly associated to the exploitation activities. Processing includes a STA-LTA detection routine, followed by manual picking. As a result, a seismic catalog consisting of about 500 local earthquakes that are mainly clustered around injection wells is obtained. Focal depths range between 1 and 3.5 km and correspond to the known reservoir interval. We located the earthquakes using a non-linear localization technique, as a priori information for deriving a 1D velocity model. We then computed a 3D velocity model by joint inversion of each earthquake's location and velocity lateral anomalies using the derived 1D model. P- and S-wave velocities (V_p and V_s , respectively), as well as the V_p/V_s ratio models can aid in locating variations in geothermal reservoirs due to fluid composition, rock porosity and temperature.