Seismic models of the Los Humeros caldera (Mexico) using the GEMEX project data

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In the framework of the GEMEX project (cooperation between Europe and Mexico for geothermal development), a dense network of 45 stations was deployed in 2017-2018 in the Los Humeros caldera, Mexico.

Thanks to this network an intense local seismic activity has been recorded in the geothermal field and surroundings, from which it has been possible to identify high-frequency Volcano-Tectonic events (VT, >10 Hz) and Long-Period events (LP, 1-8 Hz). The former set of events is mainly associated with the local tectonics and power plant activities; while the latter has been generally recorded after strong earthquakes (Mw>7) occurred in Mexico.

Consequently, we adapted and applied two tomographic techniques to generate highly resolved seismic models; 1) the Enhanced Seismic Tomography (EST) method using the travel times of local seismic events. The method incorporates the Double Difference tomography and the post-processing Weighted Average Method to generate Vp and Vs models, and 2) the surface wave tomography method based on ambient noise analysis. In this case, we generated 3D anisotropic models of phase and group velocities of the Rayleigh and Love waves from Green functions retrieved by cross-correlation of the continuous records.

Thanks to the severe pre-processing of the whole seismic database that allowed to correct several errors on the data, and to the methods applied, we were able to obtain reliable and highly resolved models with both techniques.

Finally, the two sets of events (VT and LP) have been relocated using the 3D seismic velocity models of the region in order to better characterize the structure of the geothermal field and identify regions where the fluids could have a role on the triggering of the LP seismic activity observed.

This work is performed in the framework of the Mexican European consortium GeMex.
(Cooperation in Geothermal energy research Europe-Mexico, PT5.2 N: 267084 funded by CONACyT-SENER: S0019, 2015-04, and Horizon 2020, grant agreement No. 727550).