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Analysis of an Unusual Seismic Activity of a Geothermal Reservoir in Ayvacık, Çanakkale, Northwestern Turkey

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An unusually high seismic activity initiated in the first few days of 2017 in a geothermal reservoir area called Tuzla (Ayvacik), Canakkale, Northwestern Turkey. After more than a month of continuous activity, between February 6 and February 12, 2017, 4 earthquakes of Mw$\geq$5 have occurred. In total, 45 earthquakes larger than Mw3.5 occurred in the first two months of 2017. In this study, we attempt to understand the nature of faulting and how it relates to the geothermal nature of the region.

We relocated the 1st month of the seismic activity using manually picked arrival times and performed a cluster analysis for the year before the largest event (on 2007/02/06) using a seismic station that is several km away from the high seismic activity area. In addition, we studied the mechanisms of earthquakes Mw>4 using regional waveforms.

Both focal mechanisms and refined earthquake locations show that the activity occurred on a southwest dipping normal fault. Moreover, the earthquake relocations show that the activity occurred on a listric fault flattening below 10 km of depth. The activity extends 10 to 15 km laterally consistent with the strike direction obtained from earthquake mechanisms. Majority of the focal mechanisms show a dip angle between 50° and 60°.

In order to better understand the initiation of this seismic activity, we performed a cluster analysis for the year before the largest event (on 2007/02/06). The cluster analysis shows that the seismicity before the main activity time frame is clustered both spatially and temporally. The duration of clustered activity varies from 1 day to 1 month. In addition we detected several long term repeating earthquakes in the year prior to the unusual activity. We attempt to analyze the long term swarms, repeaters and their relation to the high activity crisis and their relation to changes in pore pressure.