EGU21-13438
https://doi.org/10.5194/egusphere-egu21-13438
EGU General Assembly 2021

Analysis of non-double-couple source mechanisms in an area of induced seismicity, West Texas (USA).

Savvaidis Alexandros[1] and Roselli Pamela[2]
[1]University of Texas at Austin, Jackson School of Geoscience, Bureau of Economic Geology, Austin, United States of America (alexandros.savvaidis@beg.utexas.edu)
[2]Istituto Nazionale di Geofisica e Vulcanologia, Via di Vigna Murata 605, 00143 Rome, Italy (pamela.roselli@ingv.it)

In the scope to investigate the possible interactions between injected fluids, subsurface geology, stress field and triggering earthquakes, we investigate seismic source parameters related to the seismicity in West Texas (USA). The analysis of seismic moment tensor is an excellent tool to understand earthquake source process kinematics; moreover, changes in the fluid volume during faulting leads to existence of non-double-couple (NDC) components (Frohlich, 1994; Julian et al., 1998; Miller et al., 1998). The NDC percentage in the source constitutes the sum of absolute ISO and CLVD components so that %NDC= % ISO + %CLVD and %ISO+%CLVD+%DC=100%. It is currently known that the presence of NDC implies more complex sources (mixed shear-tensile earthquakes) correlated to fluid injections, geothermal systems and volcano-seismology where induced and triggered seismicity is observed.

With this hypothesis, we analyze the micro-earthquakes (M <2 .7) recorded by the Texas Seismological Network (TexNet) and a temporary network constituted by 40 seismic stations (equipped by either broadband or 3 component geophones). Our study area is characterized by Northwest-Southeast faults that follow the local stress/field (SH_{max}) and the geological characteristic of the shallow basin structure of the study area. After a selection based on signal-to-noise ratio, we filter (1-50 Hz) the seismograms and estimate P-wave pulse polarities and the first P-wave ground displacement pulse in time domain. Then, we perform the full moment tensor analysis by using hybridMT technique (Andersen, 2001; Kwiatek et al., 2016) with a detailed 1D velocity model. The key parameter is the polarity/area of the first P-wave ground displacement pulse in time domain. Uncertainties of estimated moment tensors are expressed by normalized root-mean-square (RMS errors) between theoretical and estimated amplitudes (Vavricuk et al., 2014). We also evaluate the quality of the seismic moment tensors by bootstrap and resampling. In our preliminary results we obtain NDC percentage (in terms of %ISO and %CLVD components), Mw, seismic moment, P, T and B axes orientation for each source inverted.