



Seismological mechanism analysis of 2015 Luanxian swarm, Hebei province, China

Yipei Tan, Xu Liao, Hongsheng Ma, Longquan Zhou, and Xingzhou Wang
Earthquake Administration of Tianjin Municipality, Tianjin, China (fzkjxydl@163.com)

The seismological mechanism of an earthquake swarm, a kind of seismic burst activity, means the physical and dynamic process in earthquakes triggering in the swarm. Here we focus on the seismological mechanism of 2015 Luanxian swarm in Hebei province, China. The process of digital seismic waveform data processing is divided into four steps. (1) Choose the three components waveform of earthquakes in the catalog as templates, and detect missing earthquakes by scanning the continues waveforms with matched filter technique. (2) Recalibrate P and S-wave phase arrival time using waveform cross-correlation phase detection technique to eliminate the artificial error in phase picking in the observation report made by Hebei seismic network, and then we obtain a more complete catalog and a more precise seismic phase report. (3) Relocate the earthquakes in the swarm using hypoDD based on phase arrival time we recalibrated, and analyze the characteristics of swarm epicenter migration based on the earthquake relocation result. (4) Detect whether there are repeating earthquakes activity using both waveform cross-correlation standard and whether rupture areas can overlapped. We finally detect 106 missing earthquakes in the swarm, 66 of them have the magnitude greater than $ML0.0$, include 2 greater than $ML1.0$. Relocation result shows that the epicenters of earthquakes in the swarm have a strip distribution in NE-SW direction, which indicates the seismogenic structure may be a NE-SW trending fault. The spatial-temporal distribution variation of epicenters in the swarm shows a kind of two stages linear migration characteristics, in which the first stage has appeared with a higher migration velocity as 1.2 km per day, and the velocity of the second step is 0.0024 km per day. According to the three basic models to explain the seismological mechanism of earthquake swarms: cascade model, slow slip model and fluid diffusion model, repeating earthquakes activity is difficult to explain by previous earthquakes stress triggering, however, it can be explained by continuing stress loading at the same asperity from fault slow slip. The phenomena of linear migration is more fitting slow slip model than the migration characteristics of fluid diffusion which satisfied diffusion equation. Comparing the phenomena we observed and the seismological mechanism models, we find that the Luanxian earthquake swarm may be associated with fault slow slip. Fault slow slip may play a role in Luanxian earthquake swarm triggering and sustained activity.