

Source parameters of earthquake in Katav-Ivanovsk on September 4, 2018 according to instrumental and macroseismic data

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Earthquake in Katav-Ivanovsk (South Urals) which occurred on September 4, 2018 at 22:58:19, is registered by hundreds of stations worldwide and in fact it became the strongest instrumentally recorded earthquake in the Urals (mb 5.4) and the most sensible in the territory of Russia in 2018 (I0=6 points of MSK-64).

Epicenter coordinates (N54.793,E58.002), calculated from data of 57 seismic stations of teleseismic and regional networks, is situated near the northern outskirts of the Karaulovka. The error of location of epicenter is 8.4 km. The configuration of regional seismic network does not allow to determine depth rather precisely as the nearest seismic stations are located at distance of 150-180 km. Discrepancies between measured and theoretical arrival times are minimal when the depth of the source solution is at 9.5 km, a standard deviation of the depth equals 7.2 km. Alternative solution for the source depth is obtained with new approach based on calculation of the function of phase spectral matching for onsets intervals on records of 36 stations (Epifanskiy et al.,2018). The approach gives comparable estimates of depth – 11.25 ± 0.29 km.

The most intensive shaking from earthquake was observed in Katav-Ivanovsk city that is in several kilometers from the source. The zone of 5-point shaking covered Ust-Katav, Yuryuzan', Sim. 4-point shaking reached Asha, Minyar, Bakal, Satka. The zone of 3-point shaking extended to Ufa, Beloretsk, Zlatoust, Miass. Collected macroseismic data allowed to determine macroseismic epicenter (in 8 km to the East from the instrumental epicenter) and to receive alternative estimations of the depth – 20 ± 10 km.

The source mechanism is calculated from signs of wave onsets of 57 stations that are in the range of distances $1.35-89.63^\circ$ and round the source rather uniformly. The maximum azimuthal gap from the South does not exceed 80° . According to the obtained source solution the compression axis direction is South-South-East oriented ($az147^\circ$) and tension axis direction is West-South-West oriented ($az249^\circ$). The strike of the first nodal plane (NP1) is North-North-East ($az19^\circ$), the strike of the second nodal plane (NP2) is West-North-West ($az285^\circ$). In the first case the event is left-lateral strike slip / reverse fault, in the second case it is right-lateral strike slip with small reverse fault component. The source mechanism is in good agreement with a tectonic situation of the region. The principal axes directions are practically coincide with those received by alternative methods in the area (Tevelev et al.,2019), and the NP1 parameters coincide with ruptures orientation (azimuth, dip and slip) of the Bakal-Satka fault zone.