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Source parameters of the major earthquakes in Alaska (2025) from surface wave records

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For two major M ≥ 7.0 earthquakes in Alaska (i.e., the July 16, 2025, M7.3 earthquake and the December 6, 2025, M7.0 earthquake), the study considers analysis of surface wave records to construct source parameters. For each of the seismic events under study, records of Rayleigh and Love waves were filtered and their amplitude spectra were calculated using a frequency-time analysis procedure [1]. Considering the source of an earthquake in approximation of an instant point, we determine the source depth and focal mechanism (in terms of strike, dip, and slip angles) by systematic exploration of 4D parametric space, as well as seismic moment by minimizing the residual between the observed and calculated long period surface wave amplitude spectra [2]. As it is well known, the focal mechanism cannot be uniquely determined from the surface waves’ amplitude spectra. To constrain a unique solution of an earthquake focal mechanism, additional data were used, such as P-wave first-motion polarities or surface wave phase spectra.

Then, we moved on to consider the source in approximation of a plane elliptical dislocation with a finite duration [3]. For this purpose, we analyzed surface waves over shorter periods. Using these data, we determined integral estimates of the length of the source major and minor axes, its duration. Unfortunately, the resolution of the other three dislocation parameters (modulus of the axis average value of the instant centroid velocity, and two angles: the angle between the strike axis and major axis and the angle between the strike axis and instant centroid velocity axis) was poor and did not allow us to accurately estimate them.

Our results were compared with the data by seismological agencies and available geological and geophysical information about the considered region. Finally, we analyzed them together with our previous results on the strongest earthquakes occurred in this region since 2016 [4, 5].

References

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