Variations of the spectral composition of the layer of annual temperature variations during earthquakes in various permafrost-seismic regions of Eastern Siberia

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The relationship between the parameters of temperature and geophysical fields associated with the annual variations in the spectral composition of the ground surface motions during earthquakes is considered. The research results are presented on the example of multi-year data from records of earthquakes recorded in various seismic-climatic zones of the Baikal region. The consideration includes the influence of the most dynamic zone due to exogenous processes occurring in the area of influence of annual temperature variations.

The Baikal region is located within Eastern Siberia, which is included in the temperate and cold climate zone and in the region of a sharply continental climate with high seismic activity. The average annual temperature can fall below -10°. An important role is played by data on the periodic change in the spectral composition of oscillations during earthquakes in various seismic-climatic zones of the region.

The main indicators of the considered changes were selected spectra of earthquakes recorded by a permanent network of seismic stations of the Baikal region and the frequency characteristics of motions of the upper section. The cases for seismic stations located in areas with contrasting permafrost conditions are considered in most detail. Further, they are supplemented by the results of similar studies for seismic stations located in different permafrost conditions of the region.

According to the amplitude level, the spectra can differ by 2-4 orders, which corresponds to the interval of change of magnitudes, epicentral distances and other parameters of the foci of selected earthquakes. One can also note the frequency range of the spectra at the level of 0.7 from their maximum, which plays a significant role in the assessment of the energy level of earthquakes. It can vary from 2 to 14 Hz.

Analysis of the composition of the annual variations of motions according to the calculated frequency characteristics is more reliable. Iit was found that over the entire frequency range under consideration (up to 20 Hz), they are most significant at relatively high frequencies. At the level of standard deviations, the ranges of the effect of seasonal temperature changes on the amplitude-frequency composition of oscillations are identified, for each seismic station. They mainly appear at frequencies above 4-6 Hz and depend on the soil features of the bases on which the seismic receivers are installed. This refers to both continuous and island zones of permafrost. But the differences in amplitude composition are significant for the island zone of permafrost propagation, especially at frequencies of more than 8-10 Hz. At frequencies of 16-18 Hz in the summer period, the maximum frequency response can reach 6-10, and in periods of maximum freezing they are close to one.

Studies using more than 200 three-component earthquake records recorded at permanent seismic stations of the BF GS SB RAS confirm the existence of a general pattern related to the relative level of increase or decrease in the intensity of seismic vibrations of the subsurface sediment layer, which are correlated with periodic annual temperature fluctuations for different permafrost conditions of the Baikal region.