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Periodicity in the spatial-temporal earthquake distributions for the Pacific region: observation and modeling.

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In the course of the last century a cyclic increasing and decreasing of the Earth's seismic activity (SA) was marked. The variations of the SA for the events with M>=7.0 from 1900 up to date were under study. The two subsets of the worldwide NEIC (USGS) catalog were used: USGS/NEIC from 1973 to 2012 and catalog of the significant worldwide earthquakes (2150 B.C. - 1994 A.D.), compiled by USGS/NEIC from the NOAA agency. The preliminary standardization of magnitudes and elimination of aftershocks from list of events was performed. The entire period of observations was subdivided into 5-year intervals. The temporal distributions of the earthquake (EQ) density and released energy density were calculated separately for the Southern hemisphere (SH), and for the Northern hemisphere (NH) and for eighteen latitudinal belts: 90°-80°N, 80°-70°N, 70°-60°N, 60°-50°N and so on (the size of each belt is equal to 10°). The periods of the SA was compared for different latitudinal belts of the Earth. The peaks and decays of the seismicity do not coincide in time for different latitudinal belts and especially for the belts located in NH and SH. The peaks and decays of the SA for the events (with M>=8) were marked in the temporal distributions of the EQ for all studied latitudinal belts. The two-dimension distributions (over latitudes and over time) of the EQ density and released energy density highlighted that the periods of amplification of the SA are equal to 30-35 years approximately.
Next, we check the existence of a non-random component in the EQ occurrence between the NH and the SH. All events were related to the time axis according to their origin time. We take into consideration the set of the EQs in the studied catalog as the sequence of events if each event may have only one of two possible outcome (occurrence in the NH or in the SH). A nonparametric run test was used for testing of hypothesis about an existence the nonrandom component in the examined sequence of events. The statistical value Z was calculated. The confidence interval for a=1% (significance value) defined by the condition |Zcrit|<2.58. If |Z|>=|Zcrit| then given sample may contain non-random components. The Z values for all magnitude ranges exceeded |Zcrit| in several times, thus a periodic transfer of the seismic activity between the Northern Hemisphere and the Southern Hemispheres is confirmed.
The digital model (superposition of the random processes and the periodic process) was proposed. It was shown that statistical validity of the periodic component according to run test depends on: the frequency of the periodic function, and the duration of the observation period, and the probability of random component occurrence (P1) as function of time and the probability of the periodic component occurrence (P2) as function of time. The digital model enables to comprehend some particular features of the observation data.