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Earthquake effects in thermal neutron variations at the high–altitude station of Northern

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Results of study of thermal neutron variations under various space and geophysical conditions on the basis of measurements on stationary installations with high statistical accuracy are presented. Installations are located close to the fault of the earth′s crust at the high-altitude station of cosmic rays (3340 m above sea level, 43.02 N, 76.56 E, 20 km from Almaty) in the mountains of Northern Tien-Shan. Responses of the most effective gelio- and geophysical events (variations of atmospheric pressure, coronal mass ejections, earthquakes) has consistently considered in the variations of the thermal neutron flux and compared with variations of high-energy neutrons (standard monitor 18NM64) of galactic origin during these periods. Coefficients of correlation were calculated between data of thermal neutron detectors and data of the neutron monitor, recording the intensity of high-energy particles. High correlation coefficients and similarity of responses to changes of space and geophysical conditions are obtained, that confirms the conclusion of the genetic connection of thermal neutrons with high-energy neutrons of galactic origin and suggests same sources of disturbances in the absence of seismic activity.
Observations and analysis of experimental data during the activation of seismic activity in the vicinity of Almaty showed the frequent breakdown of the correlation between the intensity of thermal and high-energy neutrons and the absence of similarity between variations during these periods. We suppose that the additional thermal neutron flux of the lithospheric origin appears under these conditions. Method of separating of thermal neutron flux variations of the lithospheric origin from neutrons variations generated in the atmosphere by subtracting the normalized data is proposed, taking into account the conclusion that variations caused with the atmospheric and interplanetary origins in thermal neutron detectors are similar to variations of high-energy neutrons, and the probability of detecting by 18NM64 monitor of thermal neutrons is extremely low (less than 0, 01). We used it for analysis variations of thermal neutrons during earthquakes 2006-2015.
The catalog of earthquakes in the vicinity of Almaty with intensity $\geq$ 3b, including 25 events, is composed on the basis of observations of the Kazakhstan National Data center. Experimental data of registration of thermal and high-energy neutrons ($\geq$ 200 MeV) with duration not less than 14 days are prepared for an each event. The main statistical characteristics of experimental data are calculated and the normalization is carried out. The increase of thermal neutrons flux of the lithospheric origin during of seismic processes activation is observed for $\sim$ 60% of events. However, before the earthquake the increase of thermal neutron flux is observed only for $\sim$ 30-35% of events. It is shown that the amplitude of the additional thermal neutron flux from the Earth's crust is equal to 5-7% of the background level. Sometimes it reaches values of 10-12%.
We propose to employ method of allocating the thermal neutron flux of the lithospheric origin for short-term prediction of earthquakes in seismoactive regions.