ON THE POSSIBLE MECHANISMS OF THE EFFECTS OF SOLAR ACTIVITY ON THE SEISMICITY OF THE EARTH

Tarasov N.T.

Schmidt Institute of Physics of the Earth, Russian Academy of Sciences, Moscow, Russia

e-mail: tarasov@ifz.ru

The effects of geomagnetic storms (MS) and bursts of intensity of electromagnetic ionizing radiation (ER) from the Sun on the global seismicity of the Earth has been studied. It is shown that ER, as well as MS, cause a statistically significant decrease in the total number of earthquakes on Earth. After ER, a statistically significant decrease in the total energy of earthquakes occurs, and after MS, its increase is observed. This is mainly due to an increase in the number of the strongest earthquakes with MS > 7 after MS and a decrease in the number of such earthquakes after ER.

The obtained results show, that the processes occurring on the Sun effect the seismicity of the Earth and, consequently, the state of its lithosphere. However, the picture of their interaction is very complex. Factors of different physical nature, generated by solar activity, can effect the Earth's lithosphere and its seismicity in different directions. The impact of bursts of ER leads to a decrease in the probability of catastrophic earthquakes by almost two times, and MS, on the contrary, to an increase in this probability by almost a third. But it increases most strongly, more than twofold, after magnetic storms, before the onset of which, during a three-day interval, bursts of ER were recorded. Consequently, the results of the impact of these factors on the state of the lithosphere and its seismicity can vary depending on their combination.

The suppression of seismicity is observed after ER without a noticeable delay, and its activation after MS occurs after 2-5 days only. The latter circumstance was noted earlier during artificial irradiation of the earth's crust with powerful electromagnetic pulses, after which the activation of seismicity also occurred with a delay of 2-5 days. Irradiation caused an increase in the rate of seismotectonic strain, which contribute to the process of quasi-plastic deformation of the crust that accelerated the relaxation of elastic stresses accumulated in it.

ER bursts cause an increase in ionization of the ionosphere, which affects the parameters of the global electrical circuit, leads to a change in the activity of world thunderstorm centers, and worsen the conditions for the propagation of radio waves from natural and man-made sources. This reduces the intensity of the electromagnetic background over vast areas, which can cause suppression of seismicity due to a decrease in the triggering effect of electromagnetic fields. In turn, this can slow down the relaxation of elastic stresses in the crust.

Propagation of radio waves deteriorates during the MS too. However, they have a stronger triggering effect on areas in which strong earthquakes are prepared. Telluric currents induced in the crust by changes in the geomagnetic field can initiate strong earthquakes in unstable areas of the earth's crust. Another reason can be the phenomenon of magnetoplastics. The rate of plastic flow of rock bulk can change with a change in the geomagnetic field, which can also have a trigger effect on unstable areas of the earth's crust.