Weak Seismicity and Strongest Earthquakes Against the Background of S-wave Attenuation Field Variations

Aptikaeva O.I.

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

e-mail: aptikaevaoi@mail.ru

The paper considers the role of relatively weak earthquakes as a tool for studying the environment, including of strong earthquake process. The spatial structure of the attenuation field of several seismically active regions (of the Garm prognostic polygon in Tajikistan, Altai, the Caucasus, Eastern Anatolia, the Western Tien Shan), as well as the epicentral regions of a number of strong earthquakes, and the confinement of deepened seismicity to it are considered. It is shown that the attenuation field obtained from the short-period code of weak earthquakes in seismically active regions is inhomogeneous and consists of blocks with a high Q factor and weakened zones of strong attenuation. An uneven distribution of deepened earthquakes is noted. It is associated with the block structure: in weakened zones, their share is greater than in blocks with a high Q factor. Examples of variations in the of deepened seismic activity in weakened zones are demonstrated. It varies over time, increasing before strong earthquakes. Facts are presented that testify to the existence of a relationship between the Earth's rotation rate and the activity of deepened seismicity. Examples are given of the activization of weak seismicity in the form of seismic swarms (series of weak earthquakes concentrated in space and time) in connection with strong events. A characteristic feature of these swarm series is the isometry of the earthquake localization areas in plan view and vertical elongation. As a rule, they coincide with weakened zones of strong absorption of S-waves. Intense localized seismicity, confined to one-dimensional volumes, is most likely associated with increased conductivity channels through which deep fluids migrate.

The activization of swarm series is the result of active migration of deep fluids and an increase in fluid saturation of weakened zones. Fluids, in turn, are a catalyst for processes that lead to a decrease in the strength of rocks and the destruction of blocks in epicentral zones. In this case, the clusters to which the swarm series belong can be considered as local seismogenic zones.

The appearance of compact isometric in plan and nearly vertical in section clusters of weak seismicity is often observed outside the epicentral zones of strong earthquakes. Such zones may simply be indicators of the seismotectonic situation in the region as a whole.

It is assumed that a sharp change in the dynamics of atmospheric pressure during the preparation of a strong earthquake at hydrometeorological stations located in such areas is a consequence of the intergeospheric interaction of the lithosphere and atmosphere. Deep degassing seems to be one of the main mechanisms of the anomalous behavior of atmospheric pressure during the implementation of strong events. It is most active in weakened zones. The mechanisms of the impact of deep degassing on the outer geospheres remain the subject of discussion.