

# Preliminary results of the diagnosis of the SSS massif during an earthquake near the Katav-Ivanovsk city

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The seismicity of the Ural Region is characterized by a large number of small-focus events with a magnitude of 2-3. In September 2018, a series of earthquakes with magnitudes 4.2 - 4.5 occurred in the Southern Urals. The epicenter of earthquakes was 7 km. northwest of Katav-Ivanovsk at a depth of 10 km.

Previously, geodynamic studies in the Urals were carried out mainly by geophysical methods, permanent deformation measurements are carried out at the only IGS station ARTU. The geodynamic studies of the Northern and Middle Urals according to GPS data were carried out under the guidance of V.I.Outkin (IGPh UB RAS) in 2009-2010. When redefining the coordinates of points of geodetic networks, the change in the stress-strain state (SSS) of the array was determined.

Conclusions are made:

- The Ufa protrusion of the East European Plate is a tectonic formation, which in modern times continues to move slowly to the east, wedging into the Ural structure.
- The movement of the Ufa ledge will inevitably occur in the future time and lead to the accumulation of elastic stresses at the boundaries of the ledge, which, when depleted, can cause quite strong earthquakes.
- The necessity of organizing for the purpose of possible forecasting of the next major tectonic event of detailed geodynamic monitoring in the area of the Ufa projection of the East European Plate was noted.

The Institute of Mining conducted research with regional geodynamics using baseline data from the permanently operating GNSS stations of the Urals. The calculation of their coordinates from IGS points, the determination of velocities in the ITRF-2014 system, the construction of displacement and deformation fields by the difference of the velocities was performed.

An experiment was conducted in which 9 permanently operating GNSS stations of the Southern Urals were involved. The size of the study area was 280 x 250 km.

Sampling of the initial data for the period from 08/15/2018 to 10/15/2018 was made, for fixing movements and deformations before and after an earthquake.

The program of the experiment included:

- determination of absolute coordinates and their changes along the axes of coordinates daily, in the ITRF-2014 system;
- processing and adjustment of the GNSS network, to study trend movements.

As a result, the following were identified:

- daily amplitudes of changes of coordinates along three axes of coordinates, amplitude and trend components before and after earthquakes.
- horizontal displacements and deformations of the rock mass in the region in the form of displacements to the east with amplitudes of 7-10 mm.

An azimuth-diagram of displacements along all possible  $\Delta X$ ,  $\Delta Y$ ,  $\Delta H$ , 2D, and 3D between the GNSS network points is also constructed. Both conformity and discrepancy in the main directions of the prevailing fault orientations in the Ural region according to S.N. Tagiltsev (URSMU) has been established.

Conclusions about the need to expand the GNSS network to 25-30 points due to the inclusion of additional stations on the external contour.