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Study of temporal variations of seismoacoustic emission and electromagnetic radiation in boreholes exposed to natural deformation processes.

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The investigation of the correlation between the deformation processes, seismoacoustic emission and electromagnetic radiation of the geo-environment is a timely problem due to many reasons. It is related to the discovery of the modulation effect of the high-frequency noise by the long-period deformation processes [1]. The possibility appeared to distinguish similar periods in the variations of the amplitude level of the seismic acoustic emission (SAE) and electromagnetic radiation (EMR) based on the known periodicities of the deformation processes.
The investigation of the deformation processes is a complicated problem because the majority of currently applied methods give us information about deformations in the surface layer. In the conditions of the hierarchical block structure of the Earth's crust; such observations do not sufficiently reveal the distribution of deformations related to the accumulation and relaxation of stresses in the internal points of the medium. Therefore, the spatiotemporal distribution of the SAE and EMR in the boreholes carries significant information about the deformation processes in the Earth's crust directly reflecting the actual stresses and the structure of the investigated rock massive [2].
Geodynamical active zones along boreholes are characterized by anomalous (maximum) SAE and EMR values, moreover they change in time [3]. Simultaneous operational measurements of seismic acoustic emission and electromagnetic radiation were carried out in wells Kamchatskiy geodynamic testing ground and the Urals region. An analysis of amplitude-frequency spectra obtained by synchronous uninterrupted SAE and EMR measurements in boreholes allowed identifying latent periodicity of SAE and EMR signals and evaluating its connection with well-known deformation processes. As a result of realized investigations it was shown that simultaneous measurements of SAE and EMR in boreholes contain information on manifestation of deformation processes in fields of different physical nature and thus allow to identify zones of high strain sensitivity in a borehole favorable to reveal modulation effects of seismoacoustic and electromagnetic emission.
Investigations were carried out with the equipment developed at the Institute of geophysics UB of RAS [4]. The equipment simultaneously measures three vector components of acceleration experienced by a borehole instrument under the influence of external forces over the frequency range of 100-5000 Hz and electromagnetic signals at frequencies of 45, 70, 120 kHz.
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