# Investigation of Telluric and Planetary Processes Mitigation in High Frequency Microseisms Structure for Geophysical Monitoring Problems

Elena Pavlyukova, Alexey Nikolaev, Vyacheslav Lavrov, Askold Belyakov
Schmidt Institute of Physics of the Earth Russian Academy of Sciences, Moscow, Russia, http://www.ifz.ru

## Extended Abstract

Investigation of the Earth crust deep structure, deep geodynamic processes, nonlinear interaction of physical fields, is one of the most actual problems of present science in the World. This is due to the fact that at present all the planet's geophysical processes (earthquakes, tsunami, volcanic eruptions) activated and became an increasing threat to the citizens living in traditionally populated areas, and potentially dangerous industrial facilities. Most industrialized countries, like Russia, USA, Canada, Japan and India, have special national programs for monitoring and forecasting of dangerous seismic events. In addition, over the past decade, the earthquakes became more frequent in areas traditionally considered having no seismic hazard (for example, the earthquake of 2004 in the region of Kaliningrad (Russia) with a magnitude of 5.5 unusually high for the Baltic region, resulting in the destruction of buildings and railroad tracks) [1,2].

Investigation of seismic-acoustic noise by the Earth and manifestations of the telluric and planetary processes of different nature related to the movement of the Sun, Earth and Moon, in the high frequency microseism structure allows to develop new approaches for solving of the problems regarding geophysical monitoring and forecasting of dangerous seismic events.
Most actual investigations of microseisms and high-frequency seismic noise, both in Russia and other countries are limited by classical concepts, by that the observed processes can be not always explained, in particular, variations in level and spectral characteristics of the recorded signals. The present state of world-class investigation level in seismoacoustics in great majority cases is hardly limited by the actual top frequency of the applied sensors (velocimeters - 110 Hz and accelerometers - 500 Hz), that does not allow to detect high frequency natural geoacoustic noises having low amplitude.

Research by the authors are executed using the original magnetoelastic sensor that measures velocity of displacement acceleration. The sensor has a unique characteristic, namely low self-noise level, that allows to realize a wide band of frequencies, from unities up to several thousand Hertz. This feature increases sharply with increasing of the frequency that compensates decrease in the amplitude by the natural acoustic noise in the Earth's crust and allows to the authors make research at sufficiently high frequencies for the Earth's crust (up to 5 kHz) with good amplitude resolution (up to 10-15 m). Using of the new digital recording apparatus allows registration of seismic acoustic signals in a wide frequency band up to 8 kHz [3].

Variations in the level of high frequency microseisms due to Earth tides, mainly its solar and lunar components, as well as variations in high frequency microseisms in boreholes at the horizons of consolidated rocks natural deposits were detected by executed research. There were detected and investigated the differences of microseismic signals, characterizing the influence by telluric and planetary processes impact in various frequency bands (These differences have their own characteristics, depending on the geological conditions and the depth of the station installation). Due to the measurements in a wide band analysis (up to 2 kHz), the authors firstly studied fine temporal structure of individual pulses by high frequency microseisms, including the phase of preparation and development. High frequency microseisms structure changes under Winter and Summer solstices, the days of the vernal and autumnal equinox as well as high-frequency endogenous micro seism field variations around large cities, initiated by the daily fluctuations in the intensity of anthropogenic impacts, were detected. Original approach proposed and developed by the authors, that based on geodynamic monitoring of impedance measurements in a compact system of generator-ground-receiver and the significant (hugely more) change in data signal parameters at the moments of the impact by exogenous factors of planetary scale. In particular, a correlation of the changes with solar flare activity was detected [4].

As a result of the research, based on astrometric, tidal and seismic data, the authors obtained new data on nonlinear interactions of physical fields, deep geodynamic processes, telluric and planetary rhythms in seismic processes. Obtained results allow to develop actual methods for geophysical monitoring, for solving the problems regarding seismic hazard forecasting (catastrophic earthquakes, tsunami, rock bumps, etc.).

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