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Nonlinear seismology and acoustics – what is this?

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NONLINEARITY OF EARTH: ASTONISHING DIVERSITY AND WIDE PROSPECTS

Astonishing diversity of nonlinearity of seismic waves, fields and processes really have many peculiarities which in common are similary nonlinear effects of other scientific division. Only a seismic acoustic emission and the modulation of high frequency seismic noise are belonging for seismology. Therefore description of its is general and other direction will be shortly mention.

1. **THE SEISMIC-ACOUSTIC EMISSION AND MODULATION**. The modulation of high frequency seismic noise (15-300 Hz) by long-time deformation processes of the Earth are being studied experimentally from the very moment of its discovery in 1975 till present. A method of a narrow band filtration and singling out an envelope curve for recording some noise characteristics has been first grounded and applied by Khavroshkin and Tsyplakov. According to definition and characteristics of an enveloping curve variations of the accidental process at the output of narrow-band filter the data of registration of envelope amplitude give information about process intensity and its low-frequency changes. The relation of these variations (a modulation effect) of regional noise level to the processes which deform the Earth's lithosphere: the lunar-solar tides, the Earth's proper oscillations, microseism storms and wave packets from earthquakes and explosions has been found and studied. A qualitative mechanism of generation of a part of high frequency noise has been considered. A model of a local distraction and/or reconstruction of various scale defects of the deformed stressed geophysical media has been used. The concept of a seismic acoustic emission (SAE), analogue of acoustic emission has been introduced. Long-duration research revealed that usually the anomalous variations of SAE relate tectonic activity growth (earthquakes) in specific form. These SAE anomalies were found to exceed considerably the variations resulting from the other known regional noise effects (like tides, changes of meteorological and fluid-dynamic conditions). Tectonic activity of region is adequately represented by SAE envelope.

2. Seismic self-oscillations; self-chaotic and self-order of vibroseismic signals.
3. Solitary sign and peculiarity of seismic waves and fields.
4. Seismic waves interraction; conversion of seismic wave front.
5. Applied and fundamental using of seismic nonlinearity.
6. Cosmogonic nonlinearity.

Seismic lunar nonlinearity: peculiarities and Moon as mega detector.The moon as the cosmogonic and astrophysical mega detector has given essentially new information which initial form is received through seismicity (Nakamura Catalogue). Deeper understanding of lunar seismicity gives the analysis of time characteristics of last and integrated parameter of nonlinearity of the Moon as heavenly body as a whole. The parameter of nonlinearity was defined as the relation of squares of amplitudes determined on each year interval of the second tidal harmonic to the basic. The seismic factor of filling of intervals of breakdown of the Catalogue and parameter of nonlinearity are entered, the analysis of their numbers (series) with use of testing signals - solar - terrestrial tides and their harmonics is carried out and others. It has been found that dust-gas plasma of meteoroid streams and solar wind are modulated by Sun free oscillations. Simple estimation for nongravitational effects on the Moon: assessments of integral pressure to the Moon by solar wind (under undisturbed Sun and Sun burst) and gas-dust component of meteoroid streams have been made. Energy of these disturbances (under Sun bursts or its maximum stream density) is enough for free Moon oscillations initiation and recording lunar seismic events.