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Earthquake forecasting using a new theory concerning the anomalous behavior of precursory weak high frequency seismic waves

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ABSTRACT

A discovery of characteristic precursory anomalous changes of weak high frequency seismic waves enables more reliable earthquake forecasting and correct determination of focal coordinates and intensities. This previously unknown behavior of microseisms has been accorded the status of Scientific Discovery of a new physical phenomenon by the USSR State Committee for Discoveries and Inventions in March 1988, with priority from May 1979 with the description: "Previously unknown regularity of changes in microseisms before an earthquake has been established, which stipulates that at distances that exceed the size of the epicentral zone a multistage increase in the intensity of microseisms occurs, with simultaneous decrease of their main frequency. Along with this, there are also characteristic recurring impulses (zugs) of oscillations that increase in intensity and decrease in time between their appearances, which are polarized in the direction of the epicenter of the future earthquake".

This discovery also explains the origin of many other natural processes associated with earthquakes, and serves as the basis for a nonlinear theory of the relation of weak seismic signals with the medium in which they occur. The latter theory has many beneficial applications: earthquake forecasting, specifying the stress state of a medium, modeling the effects of induced seismicity, ecological control of large industrial activity, and enabling the creation of unified seismological and geophysical monitoring systems.

The requirements for a semiological observation network set up to monitor strong seismic events like earthquakes and explosions, and for a network for recording weak precursory signals with intensity close to the Earth's natural background seismicity at the point of observation are different. Which explains why so little progress has been made in earthquake prediction: existing seismological networks do not meet these criteria.

The former should be set up on basement rock with a minimum thickness of sedimentary column as this arrangement significantly absorbs the intensity of strong signals. Seismic networks set up for forecasting earthquakes conversely must be placed in regions with thick sedimentary column which are natural amplifiers of weak signals.

The seismic and gravity fields interactions study suggests that the gravitation force could be explained not only by the mass of one body, but also by its stressed state and vibration processes.

We have also reviewed the conventional approaches to earthquake prediction that measure multiple geophysical fields, requiring that one precursory field observation must be confirmed by changes in other fields. We have shown that they cannot all appear at the same time. The decrease of the dominant frequency of anomalous microseisms over various periods of time is a major factor which activates one or more of the precursory events in other geophysical fields. A change in one geophysical field suggests when an abnormal change will happen in another field, predicting a chain of precursory of events, and even changes that have taken place already but were not recorded. The more the delay between these changes in various geophysical fields, the bigger the ensuing earthquake, with the time of its main shock being related to the time delays.

Key words: prediction, precursors, networks, methodology.