EARTHQUAKE PHENOMENA AS COSMOLOGICAL MANIFESTATION

(Letter to the Editor)

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Abstract. In this paper the irregularities of the dilatation function, in terms of which the occurrence of the gravitational field was interpreted by Selak (1978), were taken to be a cause of the earthquake phenomena. On this basis we attempted to support an empirical relation of Tsubokawa (stated by Rikitake, 1972) expressing the way in which the time-interval of anomalous land deformation depends on the magnitude of the earthquake. Besides this, we suggest a way in which the earthquake prediction could be performed.

1. Introduction

In the previous paper (Selak, 1978) we attempted to find a physical interpretation of the perturbations of the metric tensor components of Minkowski space–time, assuming that the dilatation of the whole galactical system will have repercussions on the formulation of basic physical laws in our surroundings. The process governing the increase of dimensions of all physical objects in nature was held to be responsible for the changes of the time and length ‘standards’ in our world. Consequently we discerned there the meaning of time in two ways: (a) the ‘time’ based on the reading of clocks which suffer dilatation and (b) the time as it is accepted in special relativity. In order to obtain reproduction of the ‘fixed’ unit of time $U_T$ relating to the world which would not suffer dilatation, we introduced a certain space–time function $\xi(x)$: this one transforms an interval of proper time $\Delta t$ into our ‘information’ on time according to

$$\Delta t' = \frac{\Delta t}{\xi(x)}, \quad (1.1)$$

where we had

$$\xi(x) = 1 + \varepsilon(x). \quad (1.2)$$

In Equation (1.2) the function $\varepsilon(x)$ was called the dilatation function. So, considering that an observer in our world knows nothing of the aperiodicity of atomic oscillations which ‘determine’ the unit of time, we assumed that our ‘information’ on time is not followed by the proper time.

In this paper we put the following suggestion: earthquake phenomena appear as a consequence of irregularities in behaviour of functions which were held to be responsible
for the reproductions of the time and length ‘standards’ in our world. As was shown, these functions determine the perturbations of the metric tensor components of Minkowski space–time and describe the occurrence of the gravitational field. Now, instead of (1.2) we have

\[ \xi(x) = 1 + \xi(x), \quad \hat{\epsilon}(x) = \epsilon(x) + \delta\epsilon(x) \quad (1.2)' \]

and \( \delta\epsilon(x) \) accompanies occurrence of earthquake phenomena.

Starting from such concepts our aim will be to support the following empirical relation of Tsubokawa (stated by Rikitake, 1972)

\[ \log \Delta t = 0.75M - 4.27, \quad (1.3) \]

where \( \Delta t \) (in the sense of our comprehension this is \( \Delta t' \)) is the time-interval (measured in years) between the detection of anomalous land-deformation and an earthquake occurrence and \( M \) the magnitude of the quake concerned. Then we shall give the proposal in which ways predictions of earthquake phenomena would be performed.

### 2. On the Relation of Tsubokawa

We assume here that the magnitude of an earthquake depends on our ‘information’ on time starting from the instant when irregularities of the dilatation function take place to the instant of the earthquake occurrence. On the other hand, we know, according to Gutenberg (see Bullen, 1959), that the damping effect may be represented by the presence of a factor of the form \( q^{-kD} \), where \( D \) is the distance travelled by a wave and \( k \) is of the order of \( 10^{-4} \text{ km}^{-1} \). The time-interval in which \( P \)-waves travel to \( k^{-1} \) is

\[ \tau = \frac{k^{-1}}{\alpha} = \frac{k^{-1}}{[(\lambda + 2\mu)/\rho]^{1/2}}, \quad (2.1) \]

where \( \alpha \) is the velocity of \( P \)-waves, \( \rho \) the mass-density and \( \lambda, \mu \) elastic parameters. The magnitude of an earthquake will be supposed also to depend on \( \tau \) and defined as

\[ M = \chi \ln \frac{\Delta t'}{\tau}, \quad (2.2) \]

where \( \chi \) is a certain constant. As (1.2)' can be the first approximation of \( q^{\hat{\epsilon}(x)} \), we shall express (2.2) as

\[ M = \chi \ln \frac{\Delta t \cdot q^{\hat{\epsilon}(x)}}{\tau}. \quad (2.3) \]

By taking logarithms of (1.1), in this case we get

\[ \ln \Delta t' = \ln \Delta t - \epsilon(x). \quad (2.4) \]