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The Model of Own Seismoelectromagnetic Oscillations of LAI System

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Very low frequency (VLF) electromagnetic radiation (in diapason 1 kHz – 1MHz) in atmosphere, generated during earthquake preparation period, may be connected with linear size, characterizing incoming earthquake source. In order to argue this hypothesis very simple quasi-electrostatic model is used: local VLF radiation may be the manifestation of own electromagnetic oscillations of concrete seismoactive segments of lithosphere-atmosphere system. This model explains qualitatively well-known precursor effects of earthquakes. At the same time, it will be principally possible to forecast expected earthquake with certain precision if we use this model after diagnosing existed data.

As physical basis of working hypothesis is atmospheric effect of polarization charges occurred in surface layer of the Earth, it is possible to test the below constructed model in medium, where reasons of polarization charge generation may be different from piezoelectric mechanism, for example, due to electrolytic hydration.

It is known that in the period of earthquake preparation piezo-electric effect, caused by mechanical stresses, is observed in rocks. Generally, polarization charge should be distributed on a surface, which should be either limited by fault or formed along faults.

According to the model, in source area of incoming earthquake, at the final stage of its preparation, against a background of numerous fractures, definite, linear size main fault is being formed. So it can be represented as linear wire, the length of which considerably exceeds characteristic size of its section. Conductor of the same size but with opposite polarity should occur in the atmosphere by induction. It is obvious that such model is inverse or it can be assumed that initial conductor is in the atmosphere and secondary or induced one is in the lithosphere.

When electromagnetic dissipation is disregarded, circuit's (contour's) own oscillation frequency is defined by well-known Tompson's formula:

$$\omega^2 = \frac{1}{L \cdot C} \tag{1}$$

Let's say that the length of horizontal, opposite polarity conductors is l, characteristic quantity conductor's section is a, distance between conductors is h. It is known that inter capacity of conductors, when $h >> a$,is:

$$C \approx \frac{\pi\varepsilon_0}{\ln\left(\frac{h}{a}\right)} l$$

and mutual induction of conductors $L \approx \frac{\mu_0}{\pi} \ln\left(\frac{h}{a}\right) l$ (it is assumed that relative electric and magnetic constants $\varepsilon = \mu = 1$).

Thus, from (1) formula of circuit's own electromagnetic oscillations we'll have

$$\omega = \left(\varepsilon_0 \mu_0 l^2\right)^{-\frac{1}{2}} = \frac{c}{l} \tag{2}$$

where c is velocity of light. Let's assume that l changes in (1-100) km interval, which corresponds to change diapason of characteristic scale of earthquake source. From (1) we'll receive that change diapason of analogous circuit's own electromagnetic oscillation frequency is ω=3 (10^3 - 10^5) Hz. So it is obvious quantitative agreement with often recorded very low frequency atmospheric electromagnetic radiation spectrum in earthquake preparation period.

Quasi-electrostatic model presented by us, may become as physical basis of electromagnetic coupling into LAI system. It vary simply explains qualitatively possible results of induction effects in the lithosphere, as well as in the atmosphere and the ionosphere during earthquake preparation process.