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Effects in the ULF electromagnetic field induced by seismic activity

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While searching for the electromagnetic phenomena in an environment during seismic activity using data from the observatories Borok (latitude = 58.06°, longitude = 38.23°) and College (latitude = 64.9°, longitude = 212.0°) the following effects were detected:
(1) impulsive electromagnetic signals in the 0-5 Hz frequency range, which commencements concurred with the earthquakes or were very close to them;
(2) effects in a regime of geomagnetic pulsations of the different types, concurred with the above electromagnetic impulses.
Signals were observed in steadily allocated and close time vicinity of earthquakes as single pulses (75 %), or pair pulses (25 %), following one after another with an interval from 40 to 150 s. With respect to the earthquake, they were either advanced (70%) or delayed signals (30%). The advancing or delay was between 0 and 5 minutes. The analysis of these observations has not revealed any quantitative relationship between the intensity of electromagnetic pulses and the parameters of earthquakes in the range of magnitudes M between 3 and 8 and in the range of depths from 0 to 600 km. Typical values of the amplitudes of signals were a few tens of pT, their duration varied in an interval of 40-80 seconds.
Effects in geomagnetic pulsations were observed as abnormal changes in a regime of the continuous and irregular oscillations. These changes were closely connected in time to electromagnetic impulses (if they were present) and occurred in the first few seconds after them. For regular pulsations of 1 type (pearls) the following important regularity was found: if pearl series already existed before earthquake the emergence of electromagnetic impulse connected to the earthquake, always broke a natural mode of radiation and could lead to either the abrupt breakdown (or rapid decay) of Pc1 oscillations or, on the contrary, to their abrupt intensification.
Along with the effects of Pc1 abnormal changes in the behavior of specific type oscillations Ipdp (pulsations of diminishing periods) and impulsive noise bursts, or Pi1B, were found. These pulsations belong to a class of irregular oscillations and they are observed at the increased geomagnetic activity in evening and before midnight. In some cases Ipdp fluctuations unexpectedly appeared in absence of magnetic storms and, thus, not always in characteristic time for them. When compared with seismic events, it was found that all cases of abnormal Ipdp occurrence coincided or were close in time to the moment of this or that earthquake. Similar connection with earthquakes was marked as well for Pi1B bursts which owe their origin to the injection of charged particles into the ionosphere.
On the basis of the results obtained and known properties of pulsations we hypothesize about existence of earthquake connected specific mechanism of the seismo-magnetosphere–ionosphere coupling caused by the abrupt ULF electromagnetic impulse of the lithospheric origin.
Within the framework of this hypothesis the effects of pulsations are explained by change of resonant properties of the ionosphere as a result of the charged particles injection caused by impact of ULF electromagnetic impulse to the Earth's radiation belt.