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Enchancement of the Ionosphere Alfvén Resonance caused by earthquake: experiment and model

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Analysis of geomagnetic and telluric data, measured at the station PRK (Parkfield, ULF flux-gate 3-axial magnetometer) 1 week before (including) the day of major EQ (EarthQuake, Ms=6.0, 28-SEP-2004, 17:15:24) near Parkfield, California, USA, are presented. Spectral analysis reveals enhancement the IAR (Ionosphere Alfvén Resonance) modes, localized in the frequency range 0.25-1 Hz, observed the day before the event, Sep 27, at 15:00-20:00 by UT, and at the day of the EQ, Sep 28, at 11:00-19:00 (9 hours before the event). Estimations of the amplitudes of the signals give following values: up to 20 pT for the magnetic channels and 1.5 mkV/km for the telluric ones. Observed phenomena occurs under quiet geomagnetic conditions (|Dst|< 20 nT).
We have calculated the efficiency of the modulation of the Alfvén wave at frequencies f = 0.1 – 10 Hz, which passes from the magnetosphere (z > 600 km) to the ionosphere and the to the Earth´s surface and the lithosphere. The set of equations for the both magnetic and electric field components has been solved numerically. It has been obtained that the 20% modulation of the concentration of the ion and electron concentrations (which is also observed experimentally) at the heights z = 200 km can lead to the same (or higher) modulation of the amplitude of the variable magnetic field at the Earth´s surface (z = 0) at f = 0.1 – 10 Hz. Moreover, the effect depends weakly on the conductivity of the lithosphere. Therefore, an influence of the coupling mechanisms on the F-layer of the ionosphere could lead to observable effects at the Earth´s surface.