# Modification of the Ionosphere by Precursors of Strong Earthquakes

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Data measured by the DEMETER satellite in a vicinity of 8400 strong earthquakes (magnitude > 5.5) reveal decrease in the intensity of natural VLF (~1.7 kHz) waves within 440 km of the epicenters. We explain this decrease by the modification of the ionospheric parameters due to the earthquake preparation. Results from the numerical model of the ionosphere modification over the region of the earthquake preparation presented by *Kuo et al* [2011] demonstrate, in particular, that above the ionospheric F2-peak the electron density increases on the east side of the epicenter and decreases on the west side. The electron temperature in the ionosphere changes in the opposite way.

In this paper we report the results from applying this model to the observations performed by the DMETER satellite above the strong earthquake (M =7.7) occurred in the Sea of Okhotsk on July 5, 2008. During this event the DEMETER orbit passes near the epicenter on June 22 (13 days before the earthquake), July 5 (9 hours after the earthquake) and July 18 (13 days after the event). The DEMETER data show that the electron density was increased on July 5 compared with density values on June 22 on the east side of the epicenter and was decreased on the west side. The electron temperature behaves in the opposite way.

The DEMETER data allow us to recognize the ionosphere modification due to strong earthquake, but they do not allow to determine the date of the commencement of the modification because of the rarity of the satellite passes over the earthquake region. Such information could be obtained by the ground ionosonde installed in the place shifted from the epicenter of the future event by taking into account the inclination of the geomagnetic field lines.

On the shift of the modified ionosphere region in respect to the area of earthquake preparation indicate also data of the Intercomos-19 satellite measured above the strong earthquake «Irpinia» (23.11.1980, M=6.9). Analysis of data collected by 50 GPS stations during M=4.8 earthquake occurred in Kaliningrad region on 21.09.2004 also showed the shift of the anomaly in the Total Electron Content relative to the epicenter.

In that case, if the region of the strong earthquake preparation is determined, and the time period of the future earthquake occurrence is predicted (in the range of several years), then it will be reasonable to install the net of ionosondes to monitor the modification of ionospheric parameters near the magnetic force tube mapping on the ground to the expected epicenter. The data from such monitoring will help to identify ionospheric precursors of the earthquake.