



## **Using measurements of navigating system GPS for investigation of preseismic ionospheric effects**

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In this paper the analysis of the ionospheric total electron content (TEC) variations obtained by using the GPS (Global Positioning System) measurements before earthquakes is presented. There are the summary results of investigation of the anomaly ionosphere modification revealed for more than 30 strong earthquakes occurred during 1999-2006 in European and Japanese regions. For this analysis we used both the TEC data from the nearest to the epicenter GPS stations (diurnal TEC variations over station and TEC variations along the individual satellite flights) and TEC maps (global maps at the IONEX format and regional maps with high spatial-temporal resolution). The general peculiarities of the observed effects are described.

The pre-seismic behavior of TEC was detected within several days before the main event. Anomaly appeared as the local TEC enhancement (plasma cloud) located in the vicinity of the forthcoming earthquake epicenter. These structures are generated in the ionosphere for several days prior to the main shock. During the process of the earthquake approach the amplitude of plasma modification increases, and it has reached the value of 35-55% relative to the non-disturbed level. The ionosphere region of strong positive disturbance has extended larger than 1300-1800 km in latitudes and 3500-4000 km in longitudes. Besides, it was detected that for 10-30 hours prior to the main shock the local decrease of electron concentration in comparison with the previous day's situation might be observed. The amplitude of the negative deviation can reach the 30% level relative to the non-disturbed conditions.

The analysis has allowed to make the conclusion, that in the ionosphere during the

earthquake preparation time there is a local increase of ionosphere electron content for 2-3 day prior to the shock moment and for one day before the earthquake the relative minimum of electron concentration above epicenter area might be manifested.