

Dynamics of total electron content distribution during strong geomagnetic storms

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We worked out a new method of mapping of total electron content (TEC) equal lines displacement velocity. The method is based on the technique of global absolute “vertical” TEC value mapping (Global Ionospheric Maps technique, GIM). GIM with 2-hours’ time resolution are available from Internet (<ftp://cddisa.gsfc.nasa.gov/>) in standard IONEX-files format. We determine the displacement velocity absolute value as well as its wave vector orientation from increments of TEC x, y derivatives and TEC time derivative for each standard GIM cell (5° in longitude to 2.5° in latitude). Thus, we observe global traveling of TEC equal lines but we also can estimate the velocity of these line traveling.

Using the new method we observed anomalous rapid accumulation of the ionosphere plasma at some confined area due to the depletion of the ionization at the other spacious territories. During the main phase of the geomagnetic storm on 29-30 October, 2003 very large TEC enhancements appeared in the southwest of North America. TEC value in that area reached up to 200 TECU ($1 \text{ TECU} = 10^{16} \text{ m}^{-2}$). It was found that maximal velocity of TEC equal lines motion exceeded 1500 m/s, and the mean value of the velocity was about 400 m/s. Azimuth of wave vectors of TEC equal lines were orientated toward the center of region with anomaly high values of TEC (the southwest of North America). It should be noted that maximal TEC values during geomagnetically quiet conditions is about 60-80 TECU; the value of TEC equal lines displacement velocity does not exceed velocity of ones due to solar terminator motion ($< 400 \text{ m/s}$).

Such redistributions of the ionospheric plasma were observed also during the strong geomagnetic storms occurred in 2000-2004 years.